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An Exploration of Task Independence for High School Students in a Self-Contained Classroom Using Structured Work Systems

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An Exploration of Task Independence for High School Students in a Self-Contained Classroom Using Structured Work Systems

by
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Approval Page

This applied dissertation was submitted by Lorinda Otto under the direction of the persons listed below. It was submitted to the Abraham S. Fischler College of Education and School of Criminal Justice and approved in partial fulfillment of the requirements for the degree of Doctor of Education at Nova Southeastern University.

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Abstract

An Exploration of Task Independence for High School Students in a Self-Contained Classroom Using Structured Work Systems. Lorinda Otto, 2020: Applied Dissertation, Nova Southeastern University, Abraham S. Fischler College of Education and School of Criminal Justice. Keywords: autism, intellectual disabilities, structured work system, independent work system, teaching strategies

This study investigated the effects of a method to support higher levels of independent performance and generalization of skills using a structured work system with a visual schedule when teaching online task completion skills to high school students with ASD and intellectual disabilities. Students with ASD and intellectual disabilities are typically deficient in independent skills. They often struggle to initiate and complete tasks on their own. By learning to complete tasks independently, high school students with ASD and intellectual disabilities gain essential life skills needed for employment. Structured work systems, along with visual schedules, have shown to be useful in teaching sequence, independence, and generalization of skills.

The researcher examined a structured work system strategy adapted from the Treatment and Education of Autistic and related Communication Handicapped Children and Adults (TEACCH®) approach. The structured work system combines several strategies that include visual schedules, structured work systems, and a structured environment and organized materials, and applied behavior analysis (ABA) strategies (prompts and reinforcers) that make up the structured teaching approach. This approach is followed at the TEACCH® centers and adapted by therapists and educators who work with students who lack the skills to work independently. A multiple-baseline design across participants explored if a structured work system, along with a visual schedule, can increase task completion while reducing the need for constant adult support.

The researcher examined the data results and determined that the combination of strategies significantly increased three self-contained high school students' level independence when completing multiple-step tasks. The increase in independence task completion occurred after introducing the structured work system. The structured work system decreased their need for adult prompting, and the participants demonstrated generalization skills across settings, persons, and tasks. Participants maintained their independent levels of accurately completing the tasks with minimal levels of prompting needed three weeks post-treatment. The structured work system is individualized to meet student needs and easily implemented by educators, parents, and other interventionists in a variety of settings.

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Chapter 1: Introduction

Statement of the Problem

Completing multiple-step tasks is difficult for high school students with Autism Spectrum Disorders (ASD) and intellectual disabilities who learn in self-contained adult supported classrooms (Blosser & Neidecker, 2002). Despite the implementation of individualized education programs (IEPs) to address their needs, reliance on adult prompting continues to occur (American Psychiatric Association [APA], 2013; Dalien, 2016; Hume & Reynolds, 2010; McClannahan & Krantz, 2010; Palmer & Wehmeyer, 2003; Public School Review, 2016). This problem has negatively affected these students' ability to be functionally independent at school, and their ability to work independently at a job because they must rely on adults to show them what to do (Carnahan, Hume, Clarke, & Borders, 2009; Maguire, 2005).

This problem may be a combination of the characteristics of their disability, along with a lack of attained skills. The researcher investigated a structured work system method (a.k.a., independent work system), which began as part of structured teaching at the TEACCH® research clinic. Division TEACCH® is a research facility and currently offers ASD testing, diagnosis, and paid therapy services. The researcher investigated a structured teaching method developed initially through research by TEACCH®, which is not part of their current paid services. The researcher used a single-subject multiple-baseline design using the structured work system method to determine if students with ASD and intellectual disabilities can improve independent task completion by using a structured work system with a visual activity schedule.

The research problem. The problem to be addressed in this applied dissertation is the lack of independent task completion skills of students with ASD and intellectual disabilities in a self-contained classroom. The researcher used a structured work system along with a visual activity schedule and computer tasks that may or may not help the students with the acquisition of independent computer skills commonly needed to complete employment-related activities such as data entry or online job applications.

The phenomenon of interest. ASD is a neurological developmental disorder (National Institute of Mental Health [NIMH], 2016). ASD is a spectrum disorder because of the all-encompassing variations in the abilities and needs of those diagnosed (Sam & AFIRM Team, 2015b). Children identified with ASD usually start to exhibit developmental delays as toddlers (APA, 2013). Diagnoses can be determined as early as two years of age; however, most children get diagnosed after age 4 (Baio et al., 2018). ASD affects an estimate of more than 3.5 million Americans (Hartwell-Walker, 2016). The Center for Disease Control (CDC) established a network called the Autism and Developmental Disabilities Monitoring (ADDM) Network in 2000 to collect data and furnish estimates of the prevalence of ASD (Baio et al., 2018). The CDC's ADDM Network research data indicated that 1 in 59 of children in the United States has a diagnosis of ASD (Baio et al., 2018). It is not entirely known why the number of people diagnosed with ASD is on the rise. However, increased identification could be because of better training and awareness of the distinctive behavioral characteristics associated with ASD.

Autism spectrum disorder (ASD) is identified by diagnostic criteria that include a social communication deficiency, along with developing, keeping, and understanding

relationships due to their lack of social interaction (Greenspan, 2006; NIMH, 2016). Children with more severe characteristics of ASD may have delays in or absence of speech and language development (APA, 2013). Individuals diagnosed with ASD may exhibit restrictive or repetitive patterns of behavior, restricted interests, and activities such as a need for nonfunctional routines or rituals, repetitive motor movements, and a preoccupation with objects (APA, 2013; Baio et al., 2018). Thus, many children with ASD have limited independent ability to communicate their needs, feelings, and interests despite their age (Carnahan et al., 2009; Maguire, 2005).

The 2012 ADDM Network data have shown that around one-third of youth with ASD had intelligence quotient (IQ) results in the intellectual disability range, with an IQ of ≤ 70 (APA, 2013; Baio et al., 2018). Along with low cognitive functioning, people with intellectual disabilities also have deficits in adaptive behavior, personal independence, communication, and academic or occupational functioning (APA, 2013). Having an intellectual disability can compound ASD with impairments of adaptive functioning in personal independence, social communication, and academic or occupational functioning (APA, 2013). For example, a typical student with ASD and intellectual disability in a high school setting may struggle to communicate his or her need to use the bathroom. Children with ASD and intellectual disabilities may experience significant social challenges and limited independence throughout their lives (Palmer & Wehmeyer, 2003). Students with ASD and intellectual disabilities struggle to learn at the same pace as their peers academically and, therefore, need specialized instruction (Public School Review, 2016).

The National Center for Education Statistics (NCES) shows data indicating that 14% of students receiving special education services spent more than 60% of their day in self-contained classrooms in 2015 (National Center for Education Statistics [NCES], 2018). Students with ASD and intellectual disabilities may receive instruction in a self-contained classroom with part-time instruction in general education classes or could be in self-contained full-time where they receive all their academic instruction (APA, 2013; Hume & Reynolds, 2010; Office of Special Education Programs [OSEP], 2018). Self-contained classrooms focus on a smaller group of students who usually need a more supportive environment for individualized learning (Blosser & Neidecker, 2002; Dalien, 2016). Highly qualified special education educators and paraprofessionals provide specialized instruction with an individualized curriculum (Dalien, 2016).

Background and justification. Students diagnosed with ASD and intellectual disabilities need to become proficient at independent task completion before they can be successful at school and on a job (Roux, Shattuck, Rast, Rava, & Anderson, 2015). However, many high school students with ASD and intellectual disabilities have not developed independent task completion skills or necessary technology skills; therefore, they do not have the skills they need for the job market.

Employment. Students served in self-contained classrooms are less likely to obtain employment than their typical peers (Roux et al., 2015). The National Center for Special Education Research monitored the progress of special education students with ASD to see how they performed after high school through a study titled the National Longitudinal Transition Study-2 (NLTS2, 2003). The U.S. Department of Education sponsored the NTLS2 study, which documented the experiences of special education

students 13 to 16 years of age as they transitioned to adulthood (NLTS2, 2003; Wagner, Newman, Cameto, Levine, & Marder, 2007). The NTLS2 study and the pathways survey of youth with developmental, physical, mental, and behavioral disorders showed that 58% of individuals with ASD found employment. In comparison, 74% with intellectual disabilities, and 95% with other learning disabilities were employed after high school (NLTS2, 2003; Singh, 2015). The NTLS2 study also showed that 96% scored below the mean on independent behavior, and 80% still lived at home (NLTS2, 2003; Wagner et al., 2007).

The United States uses a survey called the Current Population Survey (CPS) as the primary source of labor force statistics. The U.S. Census Bureau, alongside with the U.S. Bureau of Labor Statistics, sponsored the survey (U.S. Census Bureau, 2019). Data collected from the CPS showed the annual average employment-population ratio for persons with a disability age 16 to 65 increased from 17.9 percent in 2016 to 18.7 percent in 2017 (ODEP, 2019). The CPS examined everyone who was employed or seeking employment within the previous four weeks of the survey but found that 79.4% of individuals with disabilities were not seeking employment, and 1.9% were jobless in 2017(ODEP, 2019). In summary of the two different surveys, the data from the NTLS2 study showed that an extremely high percentage of adolescents with ASD lacked independent job skills and were less likely to live on their own or find employment than those with other disabilities. The data from the Department of Labor's Office of Disability Employment Policy showed a rise in employment rates for those with disabilities. However, the data showed that most people with disabilities are less likely to even be in the labor force because they lack the adaptive skills needed and learn at a

much slower rate than their non-disabled peers (APA, 2013; Carnahan et al., 2009; Maguire, 2005; Public School Review, 2016). We can ascertain from the data that transition planning services are needed to prepare students with disabilities for post-secondary life.

Post School Transition Planning. The U.S. Department of Education (2010) stated that transition planning refers to a set of activities based on student interests, preferences, skills, and needs that prepare students with disabilities for adult life. The Individuals with Disabilities Education Act (IDEA) requires states to develop performance plans based on twenty indicators. The thirteenth indicator focuses on transition services in independent living, vocational training, and employment (U.S. Department of Education, 2010).

IDEA requires transition statements to be included in the student's individual education plans (IEP) by age 14 but must have a plan in place at age 16 that relates directly to the student's needs beyond secondary education (U.S. Department of Education, 2010). For example, a student interested in cabinetry might have a goal for taking woodworking classes, while another student's transition services might connect employment interests with independent task completion training skills. Transition planning can begin earlier; however, only 58% of students with ASD had a transition plan by age 14 (Singh, 2015). Even though laws are in place, many high school students diagnosed with ASD are not prepared to transition.

According to the U.S. census, over a half-million students with ASD turn 18 over the next decade (U.S. Census Bureau, 2019). More research is necessary to

successfully prepare students with ASD and intellectual disabilities for transitioning to adulthood with job-related skills (Browder, Wood, Thompson, & Ribuffo, 2014).

Independently completing required tasks is an essential skill for job success, yet some high school students in self-contained classrooms have deficits in demonstrating task completion skills without adult assistance (Pelios, MacDuff, & Axelrod, 2003). It is crucial to identify the best strategies and procedures to teach independent task completion, maintain the skill successfully, and then be able to generalize the skill to the workplace successfully (Pelios et al., 2003). Hume and Carnahan (2008b) demonstrated that students with ASD and intellectual disabilities could learn to sequence and generalize independent task completion using a method initially developed by TEACCH® called a structured work system. Previous research has shown that structured work systems have helped with the development of independent skills in high school students with ASD; therefore, structured work systems can also support the transition services requirement of IDEA (Carnahan et al., 2009; Hume & Odom, 2007).

Deficiencies in the evidence. Many interventions exist for ASD; however, research has shown that only a few of these interventions are effective. Prior research using structured work systems has shown that children with ASD and intellectual disabilities could learn sequencing, independence, and generalization using TEACCH® structured work systems (Hume, Plavnick, & Odom, 2012). However, the National Professional Development Center for Autism (NPDC) removed structured work systems as considered evidence-based practice due to more rigorous criteria requirements, and the limited pool of studies available.

The research that is available using structured work systems shows that they are effective overall; however, there is more research needed in this area due to the limited pool of studies available that support the TEACCH® method. There is also a need to do more research on the individual components (i.e., prompting, reinforcement, visual, and environmental support) and the overall effectiveness of a structured work system using a single case design to isolate specific strategies that are effective for specific behaviors (Mesibov & Shea, 2011). Most of the available research results using a structured work system with workbox tasks such as matching and sorting that did show an increase in independent task completion; however, a gap in research remains for using computer technology tasks. The use of laptops with students identified with ASD and intellectual disabilities has not been extensively explored (Ramdoss et al., 2012). Future research is necessary using technology to prepare students with ASD for transitioning to adulthood with job-related skills (Browder et al., 2014). Activities such as using a laptop computer for lesson completion could prove to be highly motivating and generalize online task completion to the workplace more successfully.

Audience. This applied dissertation topic provides valuable information about using a structured work system for independent task completion to clinicians and educators who work with individuals with ASD, and researchers in the field of instructional strategies for those diagnosed with ASD and intellectual disabilities to develop independent task completion skills and generalization of those skills. Special Educators and Job coaches find value in this study through the adaptation of the strategies and procedures for generalization to new tasks or work sites. After the student or client has learned the structured work system, they can perform other tasks without the need for

adult prompting. The use of the structured work system allows the Educator or job coach time to work with other individuals who still need assistance.

Purpose of the Study

The purpose of this study was to determine whether a structured work system and visual schedule could improve task completion independence using computers for three high school students with ASD and intellectual disabilities in a self-contained classroom, by observing student behavior during the completion of mastered skills. Structured work systems increase independence while reducing the need for prompts from an educator (Hume, 2009). This research method involved a single-subject multiple-baseline design that used a series of units of AB in which the move from baseline (A) condition to intervention (B) condition was staggered (Byiers, Reichle, & Symons, 2012).

Researcher's Role and Feasibility

The researcher is the special educator of the students that took part in the study. Data collection and observations began after the study was approved, and the consents were signed. The approval process included receiving formal permission from the school district, allowing the researcher to conduct the research. Next came the submission to the institutional review board (IRB) board for final approval. After the IRB granted final approval and signed informed consent was received from both the participants and their parents, the researcher began the study.

Definition of Terms

Applied Behavior Analysis (ABA) is an approach that changes behavior using a collection of different strategies, such as environmental changes, prompting, and reinforcement (Cooper, Heron, & Heward, 2007).

Autism Spectrum Disorders (ASD) is a developmental disability usually evident by age 3, with deficits in social interaction and communication, and skills in developing and maintaining relationships that adversely affect an individual's educational performance. Characteristics associated with ASD also include engaging in repetitive patterns of behavior, resistance to environmental change or a change in daily routines, and unusual responses to sensory experiences (APA, 2013).

Community-Based Instruction (CBI) refers to instruction and experiences that take place in the community. CBI volunteer experience provides students with work skills in actual environments like those on a job (Beakley, Yoder, & West, 2003).

Functional Independence is the ability to initiate and complete an activity without prompting (Hume & Odom, 2007).

Fluency refers to the quickness and accuracy that a student completes a specific skill or behavior. It contributes to the ease with which students can access the necessary skills to complete tasks (Cooper et al., 2007).

Generalization is the ability to perform a task taught under specific classroom conditions in new situations such as different environments using dissimilar materials, with alternate questioning, multiple authorities, and times of the day. Response generalization is the level to which a participant's natural responses are equivalent to the instructed response. Setting/situation generalization is the level to which a participant produces the target behavior in a different setting from the instructional environment (Cooper et al., 2007).

Independence means to start and complete an activity without the need for adult support (Riffel, Wehmeyer, & Turnbull, 2005).

Independent Task Completion refers to completing an assigned structured task during an independent work session per classroom instructions within a given timeframe by the educator (Riffel et al., 2005). Students who do not initiate tasks currently need prompting to work. The intent is to use less prompting once the student learns to work independently.

Independent Task Transition refers to moving from a previous activity to the next one within the time allocated by the educator (Riffel et al., 2005).

Intellectual Disability defined as an IQ of ≤ 70 on a psychometric assessment. Categorized according to International Classification of Disease, Ninth Edition, Clinical Modification (ICD-9-CM): mild (i.e., IQ of 50-70), moderate (i.e., IQ of 35-49), severe (i.e., IQ of 20-34), and profound (i.e., IQ of ≤ 20) (Metropolitan Atlanta Developmental Disabilities Surveillance Program [MADDSP], 2017).

Maintenance is **t**he ability to perform a skill or recall knowledge or behavior over time without the need for reteaching (Secan, Egel, & Tilley, 1989). Response maintenance refers to the level to which a participant continues to complete a task after all the intervention responsible for the initial change in behavior is removed (Cooper et al., 2007).

Positive Reinforcement includes the presentation of a stimulus, such as toys or praise, immediately after the desired behavior to increase similar responses in the future (Cooper et al., 2007).

Prompts are defined as stimuli to evoke a desired response at the appropriate time. These levels of prompt assistance start from the least-to-most intrusive (Cooper et al., 2007).

Prompt dependency occurs when individuals respond to verbal prompts instead of responding to visual cues to evoke the target behavior (Cameron, Ainsleigh, & Bird, 1992) and that a more intrusive prompt may be needed to evoke correct independent responses (Fisher, Kodak, & Moore, 2007).

Reinforcement refers to a stimulus that follows a behavior that increases the likelihood of that behavior occurring once more. This process is a central principle of ABA teaching strategies (Cooper et al., 2007).

Response Latency is the elapsed time or time allowed for a student to respond without assistance after the educator gives an instructional prompt or cue (Cooper et al., 2007).

Self-contained classrooms are separate classrooms for students who more than spend less than 40% of the school day in the general education classroom (NCES, 2018; OSEP, 2018). In this type of service delivery model, a highly qualified special educator delivers instruction in the classroom to students with disabilities (Blosser & Neidecker, 2002).

Self-monitoring refers to a procedure in which an individual student systematically observes his or her behavior for assessing and producing behavior change (Cooper et al., 2007).

Skill Acquisition is the process of learning a skill (Secan et al., 1989).

Independent Work System is the same as a structured work system that refers to a system that encompasses several to show the user how to complete work independently. The student learns to use the system in a manner that shows the user how to complete previously mastered activities in a sequence (Hume & Carnahan, 2008b). The visual

structure of the materials shows the user how to complete the work using visual organization and visual instruction (Taylor, & Preece, 2010).

Structured Systematic Instruction is a method of teaching; using the same methods are used when teaching a specific skill (Carnahan et al., 2009). Project TEACCH® was the first public school program for students with autism and remains one of the most popular intervention models today. TEACCH® emphasizes using structured teaching and a clear visual organization of activities called a structured work system (Hume, 2009).

The TEACCH® Structured Work System is a method designed to focus on four areas: (1) physical structure, organized left to right to identify the activity area and reduce distractions, (2) communication of the sequence of activities (i.e., visual schedule), (3) organization of tasks; and (4) linking individual tasks together to complete and multi-step activity (Mesibov & Shea, 2010). Structured work systems should only use previously mastered tasks. The structured work system began as part of structured teaching at the TEACCH® research clinic and is now used to accommodate students with ASD complete tasks (O'Hara & Hall, 2014).

Transition Services include a set of activities for a student with disabilities that helps with the transition from school to post-school activities in the areas of postsecondary, vocational, employment, adult education and services, independent living, or community participation. Activities should meet the individual student's needs and interests through instruction, therapy, community experiences, employment development, along with post-school objectives, and when appropriate, the attainment of independent living goals and vocational assessment (U.S. Department of Education, 2010).

Visual schedules are pictures or word schedules that convey what activities follow and in what sequence (Davies, 2008). Visual schedules can accommodate for deficits in verbal instructions, environment organization, and focusing attention on-task (Hodgdon, 1995). Visual Schedules are sometimes called activity schedules, task schedules, and daily schedules, or mini schedules, which use a set of pictures that show steps in specific activities or tasks to communicate when and how much work needs to be completed (Jamieson, 2004).

Visual Support defined as teaching strategies that use symbols, photographs, written words, or objects (Jamieson, 2004).

Chapter 2: Literature Review

Although there is no cure for ASD, researchers are continuing to discover methods and techniques that can capitalize on the abilities and strengths of people with ASD to help improve their lives. The literature review begins with the significance of independence, and the impact of having to be dependent on adults has on individuals with ASD and intellectual disabilities. Next, the researcher investigated evidence-based teaching strategies (i.e., prompting, reinforcement, and visual supports) that address the need for independent task initiation, accuracy, and completion for students with ASD and intellectual disabilities. The TEACCH® approach program combined several strategies as components in a structured work system developed for individuals with autism spectrum disorder (Mesibov, Shea, & Schopler, 2005). The researcher highlights current research trends on the use of structured work systems constructed from the evidence-based components that are an integral part of the study.

The Significance of Independence

This section describes the need for achieving independence, particularly for those with ASD and intellectual disabilities due to their learning disadvantages. It is typical for children to have a desire to become independent. Independence begins in the adolescent years due to a person's ability to function through independent decision making without the need for constant supervision (Palmer & Wehmeyer, 2003; Zimmer-Gembeck & Collins, 2003). Zimmer-Gembeck and Collins (2003) stated that students learn personal decision making through opportunities to practice. There is a big difference between the independence to make one's own decisions to do what one wants and having functional independence (Hume & Odom, 2007; Palmer & Wehmeyer, 2003). Still, both behaviors

convey the ability to complete tasks without supervision from adults (Zimmer-Gembeck & Collins, 2003). Independent task completion is essential for all students since post-school outcomes indicate there is a clear association between successful learning in school and a student's future ability to gain employment and become productive members of society (Palmer & Wehmeyer, 2003). Students who achieve greater independence and ability to self-govern their behavior during high school have a higher chance of finding employment after graduating than students who are reliant on staff (Palmer & Wehmeyer, 2003). High school prepares all students to demonstrate their independent skills by completing assignments on time. Independence and self-regulation are crucial to successful post-high school outcomes (Carnahan et al., 2009).

Barriers to Independence. Children with ASD also have a desire for independence; however, reaching independence is more difficult for them. Students with ASD and intellectual disabilities require explicitly taught skills to help them become functionally independent. To be functionally independent, the individual with ASD and intellectual disabilities must have the ability to complete required tasks without the supervision of an adult. Functional independence is difficult for students with ASD and intellectual disabilities because they learn at a much slower pace than their nondisabled peers (APA, 2013; Carnahan et al., 2009; Maguire, 2005; Public School Review, 2016).

Students with ASD and intellectual disabilities struggle to complete tasks independently without specialized instruction (Carnahan et al., 2009) because of their learning deficits that make it challenging. When children begin to complete tasks their own, they feel a sense of accomplishment and competence. Gaining independence is a

primary concern for all, yet for children with ASD, independence can make a dramatic difference with social inclusion and employment.

ASD Learning Disadvantages. Children with ASD and intellectual disabilities face many challenges when developing independent skills. They usually have low adaptive behaviors with deficits in communication, socialization, executive functioning, and generalization skills that interfere with developing independence skills (APA, 2013; Carnahan et al., 2009; Hume & Reynolds, 2010; Maguire, 2005). Children with ASD struggle with sequencing and organizational demands, initiating and completing assignments, abstract thinking, cannot generalize learned skills to new situations using dissimilar materials, or in a slightly different manner (Greenspan, 2006; Rao & Gagie, 2006). Also, people with ASD and intellectual disabilities may exhibit restricted interests and activities and require unusual sensory responses such as nonfunctional routines or rituals, or have repetitive motor movements, and preoccupation with objects (APA, 2013). Furthermore, interfering behaviors may result in the need for continuous adult prompting due to missed cues, missed instruction, and not being able to prioritize visual and auditory information due to off-task behavior, and classroom distractions (Martella, Nelson, Marchand-Martella, & O' Reilly, 2012). Slow acquisition rates may contribute to interfering behaviors and a lack of skills to achieve independence (McClannahan & Krantz, 2010; Public School Review, 2016). •

Structured Work Systems to Increase Independence

This section examines the history of the structured work system and why to use this strategy for teaching independent task completion. Structured work systems include visual schedules, independent, and a structured environment (O'Hara & Hall, 2014).

Structured work systems are systematic and organized presentations of tasks and materials that visually communicate information to individuals with ASD who have difficulty structuring their environment (Carnahan, 2008; Mesibov & Shea, 2011; Schopler, Mesibov, & Hearsey, 1995). Structured work systems promote independence for individuals with ASD by organizing task jobs, and assignments in a visually structured sequence. Structured work systems provide opportunities to practice previously taught skills (Schopler et al., 1995).

Structured work systems began as part of structured teaching from TEACCH® (O'Hara & Hall, 2014). The structured work system is just one of the methods the TEACCH® approach uses to develop independence for children with ASD (O'Hara & Hall, 2014). The TEACCH® approach was created at the University of North Carolina (UNC) at Chapel Hill by Eric Schopler (Mesibov et al., 2005). A study by Keel, Mesibov, and Woods (1997) presented important information on the history of Division TEACCH® which began in the mid-1960s and expanded to a statewide program (Keel et al., 1997) through a federally funded research grant for clinical research with children with ASD in the early 1970s (Mesibov et al., 2005). Division TEACCH® began by providing services in several areas, including diagnosis and assessment, treatment and training, and consultation services to parents and educators in educational or residential settings (Keel et al., 1997). The theory behind the TEACCH® approach is structured teaching, based on a belief that individuals with ASD share similar neuropsychological deficiencies and strengths (Mesibov et al., 2005). The TEACCH® group wanted to develop a unified way of focusing on the strengths, and interests of children with ASD, compensating for their sensory obstacles (Rao & Gagie, 2006; Taylor & Preece, 2010).

The structured work system compensates for an individual's lack of organization, sequencing, initiation, and generalization skills using a visually organized area to complete their assigned tasks (Carnahan et al., 2009; Hume et al., 2012; Taylor, & Preece, 2010). This predictability can decrease the anxiety that individuals with ASD feel when presented with task demands.

Students with ASD and intellectual disabilities who attend public schools benefit from structured instruction since these students usually do not know where to begin or how to proceed on assignments. Students with ASD and intellectual disabilities have difficulty knowing what to complete first, or next, while at the same time trying to understand the relationship between each step (Carnahan et al., 2009). Many students with ASD focus on parts and not the big picture, thus they have a lack of understanding of how an independent routine fits into their school day (Carnahan et al., 2009). The TEACCH® structured work system helps lessen anxiety because tasks that are organized in an easy to understand predictable order with all the necessary information for independent task completion (Hume & Odom, 2007; Hume & Reynolds, 2010; Mesibov & Shea, 2011; Rao & Gagie, 2006; Taylor & Preece, 2010).

Structured work systems can help paraprofessionals learn to teach and monitor academic tasks for on-task behaviors and independent performance (Hume & Reynolds, 2010; Reeve & Kabot, 2012). The structured work system teaches the student to attend to the visual cues rather than verbal prompts when completing tasks, which helps decrease prompt dependency (Cameron et al., 1992). The structured work system shows a student what to do, and the visual schedule indicates the sequential order for completing tasks independently (Hume & Reynolds, 2010). Structured work systems are considered

evidence-based practices for students with ASD under the category of visual supports (Kucharczyk, Schaefer, & Mrla, 2019). The components or strategies that make up the structured work system are broad principles successfully used with individuals with ASD rather than a specific curriculum; therefore, these strategies can be individualized based on the individual's age and functioning level. For example, interventions using structured teaching adapts well for both concrete learners who benefit from visual information, and abstract learners who learn best from using spoken and written language more meaningful (Mesibov & Shea, 2010). If it takes continual adult prompting for the implementation of a structured work system, then tasks are probably not mastered, and additional training may be necessary to master the tasks before placing them in the structured work system (Carnahan, 2008).

There are three main types of structured work systems, a matching work system, a left-to-right work system, and a checklist work system (Hume & Carnahan, 2008c). Depending on which type of structured work system used, the tasks might be in the form of a sorting type workbox tasks with a finished basket, or worksheets placed left to right for completed work in a folder (Reeve & Kabot, 2012). Previous research used structured work systems with children who are in preschool and elementary age for initiating in play activities, life skills routines, task organization, and completing math assignments. Bennett, Reichow, and Wolery (2011) completed research using structured work systems with three preschool children. Two of the children had a diagnosis of ASD. The researchers found that all the children completed tasks, were more engaged in the activities, needed less adult prompting, and completed the activities more fluent after

implementing the structured work system. The children also demonstrated less maladaptive behaviors when using the structured work system (Bennett et al., 2011).

Hume (2009) examined the efficacy of TEACCH® structured work system with three seven-year-old children to investigate if the strategy would change on-task behavior, task completion duration, and generalize to other conditions. They used multiple-probe-across-participants design. Hume (2009) found that all participants showed an increase in independent play activities during the intervention condition, which decreased when the structured work system treatment stopped. Also, work systems decreased the amount of prompting from adults. However, it was uncertain which of the components of the work systems contributed to participant improvements.

Mavropoulou, Papadopoulou, and Kakana (2011) investigated the effects of task organization using the structured work of students with ASD. The study focused on teaching play types of behaviors and used an ABAB design with two 7-year-old elementary boys as participants. The boys were both educated primarily in a self-contained classroom in a public school. The organization of tasks followed the TEACCH® guidelines. The intervention comprised of two steps: (a) training and (b) treatment using a left to right work system with a visual activity schedule. Mavropoulou et al. (2011) performed ten treatment sessions lasting 15 minutes each with individual participants before returning to baseline again. The baseline consisted of five 15-minute sessions. The researchers used momentary time sampling using partial interval recording for on-task and off-task behaviors and prompting, and event recording for scoring task completion and performance. The research findings showed wide-ranging success with the two students. One participant showed more independence with his on-task completion

abilities and a reduced number of adult prompts; however, only slight improvement resulted in the other student. Both students in the study were more accurate in their task completion, but only one participant met statistical significance (Mavropoulou et al., 2011). The study data found that structured work systems can increase on-task behavior, task accuracy, and task completion independence, although the level of improvement may vary for each participant. Further research is needed to understand why one participant only had marginal improvement.

Pelios et al. (2003) used a visual schedule and a structured work system for academic learning. The researchers examined the effects of a treatment method to develop independent academic skills of three children with ASD. Pelios et al. (2003) used a multiple probe design across all conditions, which included the use of delayed reinforcement, prompt fading, and contingent response cost for off-task responding. The researchers used pictorial and textual cues to develop on-task responding behavior. The treatment took place in a small room with no windows. The educator placed the dependent variable activities in folders on a long table in the order on their left to right schedule strip. The schedule was in a binder with textual cues such as Math to indicate what activity was next. The researchers used a 15-second partial interval procedure to record on-task, off-task responding. If the participant was engaged in the activity and was next on his schedule, scored as on-schedule. If the participant was engaged in an activity that was not next on his schedule, scored as off-schedule. The independent variables included least-to-most prompting. The researchers provided physical, verbal, and gestural prompts as needed for completing the activities.

The sessions lasted for 15 minutes each and were limited to two data collection sessions a day. The baseline condition consisted of verbal directions from the educator, who stated: “do your schedule.” The educator then left the room, and the student was alone while working. This data showed very little "on task" behavior. During the intervention condition, the educator stayed in the room and supplied physical prompting with immediate reinforcement. The researcher observed an increase in performance with on-task and on-schedule behavior during the intervention. The participants continued to maintain their task-completion skills and received a reinforcement of their choice at the end. The treatment relied heavily on reinforcement. Structured work system research by Pelios et al. (2003) showed an increase in independence, reduced need for prompts, task accuracy, and generalized with a visual schedule.

Another study that successfully used reinforcement in combination with a structured work system was by Kucharczyk et al. (2019). The researchers used a multiple baseline design across routines and examined the effectiveness of structured work systems implemented by a parent on skill independence for a 7-year-old Caucasian girl named Lilly, who has ASD and functional blindness. Lilly receives special education services in a self-contained classroom. Lilly has minimal functional communication except through object exchange during snack with her mother (e.g., cookies, chips, fruit, juice). A workstation was set up in the bedroom, bathroom, and kitchen. The parent provided a verbal prompt (e.g., “time to play,” “time to wash hands,” “time for a snack”) to begin the routine. Then data was collected baseline and treatment by the parent across three routines on Lilly’s engagement with the workstation materials. Later the parent conducted maintenance and generalization probes.

The researchers found that the parent-implemented structured work system was effective across three routines, Lilly maintained for up to 3 weeks, and generalized with another parent using new workstations (Kucharczyk et al., 2019). This study demonstrated that a structured work system could be implemented by a parent successfully for independent task completion of home routines for a 7-year-old with ASD and functional blindness.

Hume et al. (2012) studied the effect of individual work systems on task accuracy across educational settings. The researchers used a multiple-probe-across-participants design to evaluate the effects of individual work system accuracy, level of prompting needed, and generalization of skills. The participants were three first grade students with the diagnoses of ASD. The materials used included two bookshelves and a basket marked "finished," along with 12 multiple-step tasks (Hume et al., 2012). Participants one and two were to place letters to form words. Participant three had to sort or classify objects or photos by their attributes. The researchers administered five baseline probes for each participant. The baseline and intervention took place in the special education classroom, while generalization probes collected in the general education setting (Hume et al., 2012). During the experimental condition, the visual schedules helped direct students to their work system. The investigator recorded treatment integrity data from the videos using a checklist that visually defined the steps participants were required to complete. Results indicated that the treatment produced an increase in accuracy while reducing the need for prompts. The treatment also generalized into the general education setting because the participants maintained the behaviors for four weeks following the study with low levels of prompting (Hume et al., 2012). The research data by Hume et al. (2012) demonstrated

that structured work systems in conjunction with prompting, and visual schedules increased independence, accuracy, and generalized to other classrooms.

Employment Work Systems. Structured work systems can also be used in a variety of environments to increase task completion independence. Research using structured work systems for independence on the job is expanding. Structured work systems apply structure, teach systems that ensure completion of vocational tasks, and develop independence on the job site (Reeve & Kabot, 2012). The following research demonstrated that structured work systems could be successful with young children as well as implemented in a library setting during job training to increase work independence, fluency, and amount of work completed, along with generalization of job skills. Hume and Odom (2007) used an individualized work system based on TEACCH® principles to improve the independent work skills of 3 individuals with ASD (ages 6, 7, and 20 years) in self-contained classrooms. The researchers used an ABAB single-subject withdrawal of treatment design. The two young students showed increases in on-task behavior and a reduction of adult prompting.

For the 20-year-old, the baseline and intervention took place at a library, and the job coach was told to prompt as needed (Hume & Odom, 2007). During the experimental condition, the researchers gave the participant a number-matching work system that contained number-cards with matching numbers on the trays used to complete tasks (Hume & Odom, 2007). The participant received a written schedule with picture cues and a file box that had the words “finished” written on it. Collection of data used 10-second interval recordings of on-task, off-task behavior in 10-minute sessions. The researchers used momentary time sampling for on-task and off-task behavior at the end of each

interval. The researchers used partial interval recording to provide evidence for job coach prompting, and event recording to document task completion data. Results showed that the participant increased on-task behavior and needed less prompting by the job coach, which also increased independence and the number of activities completed. The data also showed that the participant maintained his skills at the end of four weeks. The structured work system, along with prompting methods and visual schedules, worked together to increase independence.

Research by Carnahan et al. (2009) also took place in a library setting. The researchers chose to investigate if using a structured work system would be beneficial for improving independent task completion for a student who was employed by a public library. Carnahan et al. (2009) examined a high school student who was able to punch in on the time clock but relied on the job coach to prompt him to get started on each task (Carnahan et al., 2009). The educator set up a written to-do list work system for the student. When using the to-do list, the student was able to initiate each task and complete them in order. By implementing an ABAB withdrawal of treatment design across three participants, results of the data collected showed that using the work system resulted in higher levels of independent functioning, measured by increased on-task behavior and a decrease in adult prompting (Carnahan et al., 2009). This research is an asset to this study because the results showed that employees with ASD could initiate tasks independently and generalize more successfully when work systems are in place.

Prior research has proven using structured work systems with visual schedules increase in task independence, accuracy, and fluency, and decrease challenging behaviors (Hume, & Reynolds, 2010). When individualizing and combining evidenced-based

strategies, structured work systems can provide the best possible outcome for independent task completion with students who have ASD and intellectual disabilities.

Visual Schedules to Increase Independence

Visual supports may help individuals with ASD process information faster by using their visual processing strengths (Carnahan et al., 2009; Hodgdon, 1995; Kimball, Kinney, Taylor, & Stromer, 2004; Reeve & Kabot, 2012; Sam & AFIRM Team, 2015c). Temple Grandin (1995), a well-known author with ASD, stated that she visually processes information by viewing images in her mind (p. 30). More recently, a study by Samson, Mottron, Soulières, and Zeffiro (2012) demonstrated that individuals with ASD allocated more thinking power to the regions of the brain associated with visual processing than did individuals without an ASD diagnosis. The participants of the study showed an enhanced ability to interpret information and were more engaged when using a visual Schedule (Samson et al., 2012). There are different levels of visual supports for individuals with different functioning levels. The lowest level starts with matching an object to an object, then an object to a picture, picture to picture. Next, use a colored picture, then a black-and-white picture, move on to the use of the written word for visual support.

A visual schedule is a broad term that refers to the use of any visual support that uses written to-do lists, symbols, drawings or photographs on paper, laminated cards, or displayed on an electronic device (Bryans-Bongey, 2018; Jamieson, 2004; Maguire, 2005; Reeve & Kabot, 2012). There are visual supports used for different purposes. They can offer choices (i.e., choice board), used to create visual schedules that show blocks of time (i.e., bell schedule), or sequential steps in a task (i.e., task schedule). Visual

schedules are informative task lists that reduce anxiety and accommodate for difficulties in auditory processing, attention, sequencing, and organization (Hodgdon, 1995; Maguire, 2005; Odom, Collet-Klingenberg, Rogers, & Hatton, 2010**)** by providing predictability (Jamieson, 2004) and increasing on-task behavior and independent schedule-following (McClannahan, & Krantz, 2010; O'Hara & Hall, 2014; Stromer, Kimball, Kinney, & Taylor, 2006). Visual schedules use ABA task analysis by breaking down a complex task into a sequence of smaller steps that are easy to make and applied to existing routines with minimal effort (Banda, Grimmett, & Hart, 2009; Dettmer, Simpson, Myles, & Ganz, 2000; Kimball, Kinney, Taylor, & Stromer, 2003; McClannahan, & Krantz, 2010; Pierce, Spriggs, Gast, & Luscre, 2013).

The following studies examine using visual schedules to assist elementary-age students with ASD in transitioning between tasks and activities. Dettmer et al. (2000) analyzed the effects of visual schedules in aiding two elementary boys, 5 and 7, with ASD to transition from one activity to another. The researchers assessed the effectiveness of the visual schedule using a single-subject reversal design (ABAB), through withdrawal and replacement of the intervention. The strategies used during baseline condition include least-to-most prompts, and proximity control, and added a picture schedule made of laminated paper during the intervention condition. Throughout the baseline and intervention conditions, the researchers had a verbal prompt to transition delivered after one 1-minute following noncompliance with the instruction. After another minute of noncompliance, the participant received a second verbal prompt, this time paired with a picture of the next activity. If the participant was still not compliant, the participant was guided to the designated activity. During the sessions, the observers used frequency

counts to score the number of prompts given. Dettmer et al. (2000) used a stopwatch to collect latency data by starting the stopwatch with a visual or verbal prompt and stopping when the participant complied. The intervention showed a significant decrease in the latency and educator-delivered prompts needed for transitions. The Dettmer et al. (2000) study data findings showed that visual schedules increase independent task completion and initiation time.

Pierce et al. (2013) also used an ABAB design study to evaluate the usefulness of visual schedules for independent transitioning within the classroom. The researchers collected data before the treatment to determine if the generalization of a visual schedule was possible from one center to another (Pierce et al., 2013). The four participants diagnosed with ASD ranged in age from 9 to 11 years old. The researchers used a laminated picture schedule to see if there were an increase in independent transitions between centers and if independent transitions would generalize to novel pictures and materials. The generalization condition assessed the participants' use of the visual schedule with tasks. The tasks included sorting, puzzles, computer games, and cutting and gluing worksheets (Pierce et al., 2013). In the baseline, the visual schedules were present; however, no direction on how to use them. The researchers collected data on the percentage of independent transitions. When the participants became familiar with the visual schedule, the treatment continued until the participants consistently transitioned independently for three sessions or more at 90% or above (Pierce et al., 2013). The researchers used event recording during participants' transitioning behaviors. The transition counted as an independent transition if the students moved within 5 seconds without the need for a prompt. Participants took a pretest and a posttest to show

generalization skills at different centers in the same classroom. The effectiveness of the use of a visual schedule with the least-to-most prompting method showed an increase in independent transition behavior and generalization across centers (Pierce et al., 2013).

According to Watson and DiCarlo (2016), visual schedules can increase independence and multi-step task completion. The researchers conducted a single-subject multiple-baseline design that examined whether a laminated picture activity schedule could aid a student in completing housekeeping routines independently in a typical kindergarten classroom. The class included 22 students ranging in age from 5 through 7 years of age. The participant of this study was a 6-year-old boy who was attending the class for seven months, yet he still had a difficult time following the multi-step routines. The morning time tasks included putting their coats up on a hook, taking out any papers or notes from their bookbag and setting them on their desks, then begin reading.

The other students could complete their daily tasks independently; however, the participant needed help to complete the same tasks (Watson & DiCarlo, 2016). The researchers recorded the participant's on-task behavior across three daily routines. The researchers took observation data using a checklist before and during the picture activity schedule treatment and compared the percentages. Observation sessions lasted 5 minutes to record the number of independently completed tasks and the amount of prompting provided by the educator. After baseline data collection, the educator trained the student on how to use an activity schedule. The schedule was a three-picture activity schedule for each routine. The schedules for each routine in this study were adapted from research by Banda et al. (2009) using the story strip and labeled picture model. The schedules illustrated the steps of the housekeeping routine with pictures and sentences. During the

treatment condition, data collection procedures were identical to the baseline. Interobserver data scored 94% accuracy, which shows reliability.

The data results showed that the picture activity schedule treatment increased independent completion of tasks within each of the three routines, while also reducing the need for adult prompting. The study by Watson and DiCarlo (2016) was an excellent example of single-subject multiple baseline research that staggered the application of the treatment across routines. Although the study did not include latency or maintenance data, it showed that visual schedules combined with a structured environment reduced the level of prompting and indicated an increase in transitioning independence. (Watson & DiCarlo, 2016).

Electronic Visual Schedules. According to Kimball et al. (2004), technology was an underestimated educational resource for children with ASD more than a decade ago. The usefulness of technology for children with ASD intensified when Ramdoss et al. (2012) explored the use of technology for students with ASD. They examined 12 different studies using technology with 330 students with ASD. The types of skills targeted for dependent variables included social competence skills, social interaction skills, spontaneous verbal greetings skills, identification of emotions in faces and voices. The types of technological devices used included computers and iPads. The software included Microsoft PowerPoint, Adobe Photoshop, Hyperstudio, Emotion Trainer, and Mind Reading. The skills related studies showed positive results.

The following research combined visual schedules and technology in the form of electronic checklists, programs, PowerPoints, and videos and then as personal devices such as PDAs, IPads, and Apple Watches to make visual schedules more convenient

more and accessible. Bouck, Savage, Meyer, Taber-Doughty, and Hunley (2014) compared the use of iPads with paper schedules in an experimental design. They investigated if iPads could assist students with ASD in independent task completion and if a difference existed in levels of task independence when completing steps in food preparation. Three students were selected based upon their ability to self-monitor using a paper to-do list and an iPad. The investigators scored the data on the participant's ability to follow multistep formats. Bouck et al. (2014) stated that both interventions reduced prompting and increased independence equally. However, all three participants preferred the iPad over the paper to-do list.

Computer-based interventions improve technological supports learning for students with ASD (Ramdoss et al., 2012). However, before application software existed, educators adapted available technology. The subsequent researchers developed their programs or used Microsoft Word and PowerPoint to design their visual schedules for students with ASD. For example, Cramer, Hirano, Tentori, Yeganyan, and Hayes (2011) designed an interactive program using visual schedules. The researchers called it vSked and incorporated known strategies that work, such as paper-based visual schedules, choice boards, and a token rewards system into the program. Cramer et al. (2011), wanted to see if the program could increase independence and reduce prompting. Participants in the study included a classroom of 16 students using the system for over a school year and were between the ages of 6 and 10 and had been diagnosed with moderate to severe ASD and exhibited limited verbal communication skills (Cramer et al., 2011). The findings from the study showed that electronic schedules decreased the number of prompts given by educators and aides. Cramer et al. (2011) used their vSked program to decrease

prompt dependence during task completion. However, vSked did not show a significant improvement and was not user-friendly. It was not as flexible as paper schedules and designed to display all schedules on a big screen at one time, which was overwhelming for the students (Cramer et al., 2011). vSked reduced prompting but not significantly, which was more than likely due to a lack of individual display of the schedules.

Bryans-Bongey (2018) used examined using technology-based visual support approaches for learning with college students with ASD. The researcher used Universal Design Learning with the use of electronic visual activity checklists and comic strip creations, to see if these would provide visual support for the learners. She also used these visual approaches with preservice educators, and they, in turn, were to implement these approaches with special education students. Bryans-Bongey (2018) instructed college students with ASD at Nevada State College. She taught a Universal Design for learning approach using online platforms (e.g., Moodle, Blackboard, and Canvas). Each module had an activity checklist to assist in completing the course requirements. Bryans-Bongey (2018) stated that college students with ASD could access content before and after class sessions for understanding. The researcher collected data through observation and surveys (Bryans-Bongey, 2018). The survey used a Likert-scale on the use of the visual supports for opportunities for engagement, and ways to express knowledge. The survey and observation findings showed that college students with ASD were highly receptive to the use of the on-screen computerized task lists and a picture comic strip task schedules. The study could have been more reliable if Bryans-Bongey (2018) had had not combined survey results of the participants with ASD with the English language learners,

and preservice educators. However, the study data findings showed that electronic visual supports increase engagement for individuals with ASD (Bryans-Bongey, 2018).

Kimball et al., (2004) examined utilizing PowerPoint program to examine computer-cued activity schedules for young children with ASD, and whether activity schedules could be presented in a multimedia format to capitalize on the natural appeal of computers by children. The research used the single-subject method with a multiple-probe design. The researchers used observation of baseline and treatment data to evaluate the effectiveness of the PowerPoint video schedule. In the baseline, they collected data for on-task, off-task behavior while initiating activities. Next, the researchers introduced the PowerPoint schedule with the embedded a video.

The first slide contained the picture of the activity, and the second slide contained the cue to play. The picture was a cue for the participant to start the activity, the researchers included the third slide for written text explaining how to begin the activity and the fourth slide with a photograph of the participant's preferred reinforcer he would earn upon completing the schedule. Kimball et al. (2004) taught the participant how to move the slides with the embedded videos for viewing. The participant received a prompt to watch one PowerPoint video per day and then use the information to initiate playtime with his peers. The first activity used for observational data collection involved the participants playing in a pop-up play tunnel. The next probe involved playing with a parachute. The last activity probe involved initiating game playing. When he was on task using the video, he would receive verbal cues for support. When he was off task, he would not receive any verbal cues. Participant-initiated play during the tunnel play activity but did not initiate as much with the parachute and game activities (Kimball et

al., 2004). The results showed that the participant in the study increased independent play initiation at the tunnel using the PowerPoint schedule, verbal prompting, and reinforcers (Kimball et al., 2004). However, the participant had not consistently increased initiating play with the parachute or game activities when the researcher discontinued the PowerPoint treatment.

On-screen schedules are successful when displayed on PDAs Smartphones or iPads (Reeve & Kabot, 2012). iPads and Smartphones appeal to people of all ages and abilities. A national survey used by the Pew Foundation stated 78% of the people who responded between age 12 and 17 years old had a smartphone, and 95 % were using the internet through different forms of technology (Madden, Lenhart, Duggan, Cortesi, & Gasser, 2013). The following studies utilized personal technology devices along with animated visual schedules to demonstrate the steps using a video to model the steps involved in multiple step tasks. Mechling and Savidge (2011) stated that students might be able to complete more steps independently when using video prompting compared to static picture prompts. Mechling and Savidge (2011) examined using a PDA with multiple prompt levels to increase task box completion and to increase transitioning between tasks. The researchers compared the PDA to a paper picture-based task strip and used a multiple probe design across a series of task boxes and replicated this design with three different middle school students.

Two students were male, and the other was a female who had a diagnosis of ASD. The PDA device was programmed to provide a multi-level picture and video activity schedule. Mechling and Savidge (2011) placed a photo of a known stimulus preference reinforcer as the first thing the participants saw on the PDA. The picture alone was the

lowest-level prompt. The picture with verbal directions as the next level, and a video modeling completing the task as the highest-level prompt. When the participant scrolled to the next picture, he or she could click on the verbal directions or the video if he or she needed it to complete the task. The results showed that two of the students performed better with task completion as compared to the baseline condition using the picture-based task schedule. All students completed a higher number of transitions using the PDA than the picture task schedule. The students performed multiple-step task completion equally as well using both the PDA and picture task schedule. One student self-faded need for higher prompts. Mechling and Savidge (2011) established that interactive visual schedules, in combination with reinforcement and reinforcers, could decrease prompting during task completion. As described by Koegel and Mentis (1985), the reinforcer may have also kept the student motivated to work longer.

Gentry, Kriner, Sima, Mcdonough, and Wehman (2015) also used PDA's; alternatively, this study examined using PDA electronic schedules on the job to see if employees could benefit from a visual schedule for helping complete tasks. The researchers compared two groups of adults with ASD to examine whether an Apple iPod Touch PDA could improve independent work performance at a job site in a delayed randomized controlled trial. The treatment included an assistive technology assessment, Apple iPod Touch training to accommodate the participant in the workplace, and follow-along and fading of OT and job coach support. Gentry et al. (2015) collected baseline data on 50 adults with ASD who were placed in vocational settings and supported by a job coach. Randomly chosen participants received PDA-use training upon starting their employment for group one, and after working 12 weeks without the PDA for group two.

The results indicated that personnel who received PDA training at the start of their employment in group one required significantly fewer hours of job coaching support than those who did not receive the intervention in group two. After the 12 weeks when both groups used the PDA for assistance, data indicated that the need for job coach support also decreased in group two. Gentry et al. (2015) were able to reduce the cost of job coach hours by increasing independent task completion through self-prompting.

The O'Brien et al. (2016) study is like the Kimball et al., (2004) PowerPoint Schedule in that it used static pictures and videos for increasing independent responding. O'Brien et al. (2016) used the latest technology, such as an Apple Watch, instead of a PowerPoint. O'Brien et al. (2016) explored whether visual cues (e.g., photos, video clips) delivered via an Apple Watch would enable children with ASD to apply directives they could not implement with verbal cues alone. The researchers examined visual cues as an optional modality and spoken-only cues by comparing each response condition in a within-subjects design. The researchers provided visual scene cues on an as-needed or just-in-time (JIT) support basis rather than using immediately when the participant did not understand the spoken input, the staff supply a scene cue (O'Brien et al., 2016).

Five participants with a diagnosis of ASD, between 6 and 17 years old, were chosen to participate in the study. The participants had to have passed vision and hearing screenings. They had to be able to match photos on an iPad successfully to participate. Each participant had to complete ten directives in spoken form, and the participant had 10 seconds to carry out the instructions with the objects provided on the tabletop. For example: ‘‘block in cup,’’ or ‘‘dog on car.’’ If the participant was unable to perform the skill with auditory direction alone, he or she was then shown a static scene cue on the

Apple Watch of a block in a cup (O'Brien et al., 2016). Each participant was shown the picture up to three times if needed. When the participants failed to complete the tasks, they were shown the dynamic scene cue video on the Apple Watch of someone placing the block in the cup. The five participants could watch the video up to three times if needed, while given motivational cues along the way. This task completion skill was performed for ten different directives by all five of the participants.

The researchers considered the responses as correct if the participants carried out the instruction with the correct objects on the table within 10 seconds of the spoken instruction. If the participants took longer than 10 seconds to process, the staff would have considered that as incorrect and moved to the next prompt. Results indicated that the hierarchical JIT supports enabled all five participants with ASD to carry out most of the directives. The small display size of the Apple Watch did not seem to impede participants from acquiring information from visual supports. O'Brien et al. (2016), demonstrated that using Apple Watches for interactive schedules could assist with increasing independent task completion.

The prior research demonstrated that the use of visual schedules, both paper and multi-media formats, along with the use of prompts and reinforcement, have shown a definite increase in task engagement and task completion independence. The use of a visual schedule reduces the amount of prompting needed from an adult (O'Hara & Hall, 2014). Students with ASD display fewer maladaptive behaviors and increased cooperation with the use of visual supports to convey the task expectations (Hodgdon, 1995). Furthermore, visual supports are easy to use in many different environments (Dettmer et al., 2000). Clinicians and educators should continue to create opportunities to

integrate technology for individuals with ASD to increase their independent task completion abilities (King-Sears, Swanson, & Mainzer, 2011).

ABA Strategies to Increase Independence

The principles of applied behavior analysis (ABA) use evidence-based strategies and techniques that help individuals who have ASD and intellectual disabilities acquire new skills, increase communication, increase independence when responding and competing tasks. Prompting, fading, and reinforcement are components of ABA.

Prompting. Prompts minimize errors and increase the probability that the correct response occurs (Cooper et al., 2007). Prompting increases the attainment and the generalization of target skills for people with ASD (Sam & AFIRM Team, 2015a). Prompts are cues used during teaching to help the student to associate the correct response with the delivery of the reinforcer (Cooper et al., 2007). Prompts are a supplemental stimulus that is an additional cue that is paired with instruction to help the student respond appropriately. They are necessary when the teaching cue is not enough to cause the student to initiate a response. For example, when someone greets a student by gesturing with his or her knuckles for a fist bump, but it was not a high enough prompt to get a return fist bump greeting, adding a verbal prompt, “fist bump” and the student now responds by giving a fist bump. Prompts, ranked by hierarchy, are based on the level of intrusiveness by progressing from verbal to non-verbal prompts until the target response occurs (Fisher et al., 2007). For instance, Cooper et al. (2007) explained the effects of prompting hierarchies. A prompting hierarchy may include; independent (i.e., no prompt), a gestural prompt (e.g., cueing for a fist bump, or pointing or nodding), a verbal prompt (i.e., one-step instruction), then a visual prompt (i.e., picture of the activity), and

the most intrusive level is a physical prompt (i.e., physically guiding student to start the activity).

Prompt Fading. Independent initiation can also be tough during multi-step activities and require prompts to initiate each step of the task. Prompts are essential for teaching the initiation of tasks, however, fading the prompts are essential for independence, yet, sometimes they develop prompt dependence (Fisher et al., 2007; McClannahan & Krantz, 2010). Prompt dependence occurs when the student with ASD and intellectual disabilities focus on the wrong cues and have difficulty processing (Rao & Gagie, 2006). Students with ASD and intellectual disabilities have difficulty picking out cues in their environment.

Consequently, they come to depend on the prompt for their every move, instead of the natural cues to cue their skills or behavior (Rao & Gagie, 2006). For example, a student may learn to hang up his or her book bag, but only if someone physically guides his or her arm to pick up the bookbag and cues a verbal prompt, "hang up" each time. If the child does not learn to hang up his or her bookbag independently (i.e., without the prompts), they become prompt dependent**.** Over-reliance on prompts can be problematic if not faded when instructing students with ASD and intellectual disabilities (Banda et al., 2009; Fisher et al., 2007; McClannahan & Krantz, 2010).

Prompt fading is the gradual removal of a prompt over time until the stimulus (i.e., instruction) evokes the response, and the student can respond accurately and independently to the instruction. Prompt fading is used for the fading of response prompts. Effectively teaching prompt fading can avoid prompt dependence. Educators must explicitly teach prompt fading strategies to reduce prompt dependency and increase

skill acquisition. Planning to fade prompts from the beginning is an integral part of the intervention (Cooper et al., 2007; Fisher et al., 2007). There are two different procedures for fading prompts, which include using a most-to-least prompting method or the least-to-most prompting method.

The most-to-least prompting starts with the most intrusive prompt, such as physical hand-over-hand and gradually decreases as correct responses occur (Cooper et al., 2007; Sabielny, & Cannella-Malone, 2014). This procedure is applied when teaching a new skill for errorless learning. Sabielny and Cannella-Malone (2014) examined a prompting method in an experimental design to provide support for the acquisition of skills, the decrease of errors, and the prevention of prompt dependency. To decrease mistakes, the researchers chose a form of the "most-to-least" prompting method that begins with a physical prompt and later moves toward independence. The researchers compared two different prompting techniques to see which would be more successful; physical prompting and praise versus physical prompting accompanied by verbal prompting and praise. Sabielny and Cannella-Malone (2014) used an alternating treatment design with two young adult participants who had intellectual disabilities. The tasks included folding a shirt and pair of pants using each strategy. Both levels of prompting strategies were successful for one participant; however, the physical prompting only was more useful for the second participant. The prompting treatment data in this study showed a reduction in errors during skill acquisition. The Sabielny and Cannella-Malone (2014) study revealed that using the "most-to-least" prompting method can successfully achieve the acquisition of skills and increase task accuracy, which can easily be replicated in the classroom or at home. The most-to-least procedure is

appropriate for the acquisition of the skills; however, the least-to most prompt method is fitting for building independence.

The least-to-most prompting strategy slowly increases the level of prompt until the students respond correctly. If the student makes an error, the weakest possible prompt is given and continues to increase the strength of the prompt until the student is successful (Cooper et al., 2007; Fisher et al., 2007; Sabielny, & Cannella-Malone, 2014). This prompt fading procedure is used to promote the highest level of independence and helps to avoid prompt dependency. Fisher et al. (2007) compared using a least-to-most prompting method with an identity matching condition with no-reinforcement control condition within a multi-element experimental design to increase attending. The two participants included a 12-year-old girl and a 10-year-old boy with ASD. Fisher et al. (2007) collected data on both prompted and unprompted responses that were correct through sessions conducted in their classroom. The participant received a score of correct unprompted response when they pointed to the correct comparison stimulus, in the 5 second window time frame. Participants received a score of prompted response if they pointed to the correct comparison stimulus within the 5-seconds of the modeled prompt. Each condition included 16 trials using four pictures through pointing. The pictures included household items (i.e., cup, soap, chair, book), and familiar people (i.e., Alex, Kim, Mark, Stella).

In the least-to-most prompting condition, correct responding resulted in access to a preferred reinforcement item. Incorrect responding resulted in a modeled prompt. Correct responding to the prompt implied the start of the next trial. Incorrect responding to the prompt indicated the need for repeated direction from the therapist, who physically

guided the student to the correct response (Fisher et al., 2007). The identity matching condition was the same as the least-to-most prompting condition except that the identity-matching task replaced the modeled prompt. The correct responding to the identity-matching prompt resulted in moving to the next trial. The incorrect response resulted in the therapist repeating the request (Fisher et al., 2007). The least-to-most prompting condition used modeled prompting with a reinforcer, where the identity-matching condition used visual prompting with no reinforcer. The results for both participants showed that the identity-matching condition produced a little better response. The Fisher et al. (2007) study data findings showed prompting methods with and without reinforcement produced successful responding and prompting methods and schedules of reinforcement work together to produce responding.

Reinforcement. Reinforcement is the action or process of reinforcing or strengthening the likelihood a person performs the skill or behavior in the future (Cooper et al., 2007). Effective intervention programs include reinforcement for responding (Koegel & Mentis, 1985; Sam & AFIRM Team, 2015b). The student can earn the reinforcer once he or she responds or completes the task accurately. To further support their independence, the student can choose their preferred reinforcer (Koegel, & Mentis, 1985). Examples of commonly preferred reinforcers include playing with favorite toys, listening to music, high fives, verbal praise, or food.

Donohue, Casey, Bicard, and Bicard (2012) used reinforcement to decrease latency in responding and compliance. The researchers used an experimental design with a treatment consisting of a successive changing criterion design. The participant was a 17-year-old male student with ASD and intellectual disabilities. Before each session, the

researchers conducted a preference assessment of two choices, including the baseline condition. The researchers conducted two sessions a day for three days per week in the participant's classroom and later his home. The baseline condition included 25 questions. When the participant responded accurately within the preset criterion 10 second timeframe, he received the reinforcement (Donohue et al., 2012). The researchers collected data through direct observation, starting with a preference assessment, recorded as correct, incorrect, or non-compliant.

In the intervention condition, Donohue et al. (2012) used differential reinforcement (praise or preferred stimulus item) if the response fell below pre-set criteria for accuracy. Once the participant responded correctly for three consecutive sessions, the time limit decreased by 1 second. The intervention condition ended after the completion of all 25 questions (Donohue et al., 2012). Results showed that response latency reduced by half the time (i.e., moved from an average of 4.6 seconds to an average of 2.4 seconds). The data showed positive results for differential reinforcement of short latencies that resulted in a reduction of latency in response and a significant increase in compliance (Donohue et al., 2012). However, during the intervention condition, the participant increased his incorrect responses, which Donohue et al. (2012) stated, could have been a result of rapid responding to seek the reinforcement. Overall, this study proved that responding time and compliance can increase with the use of reinforcement for students with ASD and Intellectual disabilities.

Implications for Research and Practice

Researchers, clinicians, educators, and job coaches can use structured work systems and visual schedules based on TEACCH® principles to develop task completion

independence strategies for students with ASD and intellectual disabilities with success. Structured work systems can also be individualized and expanded upon for developing independent life skills in the home, independent academic goal completion at school, and for job skill development independence and generalization. Structured work systems can be individualized based on student need and setting (Mesibov & Shea, 2011).

Gaps in Literature

Based on the literature reviewed, structured work systems, along with visual supports, prompting hierarchies, and reinforcements are successful in supporting independence in students with ASD and intellectual disabilities but has primarily focused on children who are elementary age (Wong et al., 2014). There is limited research with adolescents with ASD with the use of technology for task completion lessons and worksheets online. Research performed in this area could especially benefit older students, as well as younger students in school districts that are using 1:1 laptop distribution and going paperless to prepare students for 21st-century job requirements. Research for skill acquisition and task completion has involved sorting and matching workbox container tasks. With the increasing need for technology skills for most jobs, students with ASD and intellectual disabilities may need to use computers for academic online task completion at school and to prepare for the workplace (King-Sears et al., 2011).

This study examined if a structured work system can foster independence in the classroom using online mastered tasks and generalize to a different environment using different tasks with consistency.

Research Questions

The study addressed improving independent skills using a multiple-baseline design with students diagnosed with ASD and intellectual disabilities to answer the following research questions:

1. How does the use of a structured work system with a visual schedule using online tasks affect the level of independent performance of task-related skills of students with ASD and intellectual disabilities?

2. Can the structured work system with a visual schedule be implemented in the classroom and generalized with consistency for a small selection of students with ASD and intellectual disabilities?

Chapter 3: Methodology

Participants

The target population for this study was high school students with ASD and intellectual disabilities. The subset group for this study consisted of three participants between the ages of 14-16-years old taught in a self-contained classroom in a public high school in Alabama. All three participants were following the Alabama achievement standards pathway. All three participants were male, one participant was Caucasian, and the other two participants were African American. All 3 participants are in their first year of high school.

The parents of the participants learned about the purpose and procedure of this study through the information on the required oral recruitment script approved by Nova Southeastern University Institute Review Board. After parents indicated an interest in their child's participation in the study, the researcher then met with the students to discuss the study and answer any questions that they had. Once the students agreed to participate, parents and students received the parent and child forms to sign the consent to participate in the study with the understanding that at any point, they could withdraw from the study.

Selection criteria. The researcher used a nonprobability purposive sampling (a sample of convenience) included participants who met predetermined criteria for ASD and intellectual disability. Previous autism assessment scores > 85 demonstrated a high probability of autism, and an IQ of < 55 demonstrated a moderate intellectual disability. Participants were also chosen based on their verbal ability to express their basic wants and needs and reports by the special education educator, indicating that the participants

struggle with task completion and or prompt dependence. Participants had to be available to complete the study before school, and able to physically perform tasks such as log onto a laptop computer and type in their passwords, website addresses, and have functional vision and hearing as evidenced through special education records. Eleven students receive special education services in the self-contained classroom. Four students had ASD and intellectual disabilities. Out of those four students, only three students met the criteria for this study. The students in the study were special education students in a self-contained high school class designed to instruct students with intellectual disabilities. The participants received related services for speech therapy and occupational therapy.

Participant 1 was the youngest at 14-years-old African American male and with a diagnosis of autism and intellectual disabilities. He had a diagnosis of attention deficit hyperactivity disorder (ADHD) with a moderate level of anxiety, which impeded his learning. He had trouble focusing on tasks and was preoccupied with food, drawing, or listening to music, or playing video games on his phone with earbuds. He had eczema on his arms, and he continually scratched. All the above contribute to off-task behavior and the need for repeated adult prompting.

Participant 2 was a 16-year-old Caucasian male with autism and intellectual disabilities. Participant 2 had a speech impediment, which impeded his communication with others. He has ADHD, oppositional defiant disorder (ODD), which causes him to be off task. Sometimes he became non-compliant and put his head in his hands and yell or hit himself in the head out of frustration. He is preoccupied with drawing airplanes, playing a computer game called Minecraft, and his Lego helicopter he takes with him everywhere he goes. Lego helicopter occasionally gets bumped or dropped and falls into

pieces. He must put it back together before he can focus on classwork. All this contributes to his off-task behavior and the need for repeated adult prompting.

Participant 3 is a 15-year old African American male with a diagnosis of ASD and intellectual disabilities. He has severe verbal communication deficits. For example, he jumped up and down when he needed to go to the bathroom or shouted in the adult's face, "bathroom!" He has said when asked to use a sentence, "I need to go to the bathroom." However, he only said sentences when prompted. He has a LAMP communication iPad, but he only used it when prompted to do so. He did not understand personal space boundaries and got up to touch other students' and adults' faces. If they do not let him, he gets upset, jumps up and down, cries tears, and makes a loud shrieking sound. Participant 3 also has a medical diagnosis of ADHD, along with trouble with initiating and completing tasks. He developed a prompt dependency. He did not stay seated at his desk if an adult is not sitting right beside him and reading every question aloud to him and keeping him focused. Before he answers the question, he points at the correct answer and looks at the adult for approval. He did not circle the answer or click on the answer without reinforcement and reassurance. Participant 3 wears glasses and deafening sound headphones for sensory issues.

Research Setting

The study took place in an urban Alabama school district. The district provided laptops to each student in grades 3-12 to develop learning opportunities and meet the workforce needs of the community. The Alabama public school district included 37 schools: six high schools, five junior high schools, six P-8 schools, and 20 elementary schools that educate over 24,000 students. Within the six high schools, there were ten

self-contained classrooms with varying numbers of students in each classroom. Self-contained students spend less than 40% of their day learning in the general education environment (NCES, 2018). The classes included specialized instruction for students in grades 9-12, where typically developing peers were enrolled to serve as peer helpers to the students with specialized needs. Participants in this study learned in a self-contained classroom in this school system. The classroom chosen by the researcher accommodated eleven students who require more intense small group instruction and taught using a modified curriculum using the Alabama achievement standards (AAS). These students receive a high school diploma once they have met the AAS pathway criteria for graduation.

This study took place before school started in the morning. The participants typically arrived 30 minutes before school started. The participants were seated at a table with chairs facing the wall to prepare for the structured work system to reduce distractions, and to organize the physical environment component of the structured work system. The chairs and tables were at appropriate heights and had plenty of room for each student to open and use their laptops. The classroom used for generalization skills was a nearby classroom used for various purposes (e.g., meetings, work experience activities). The students were not using a structured work system before the study.

Data Collection Instrument

This section includes information regarding data collection instruments used during the study. The use of the same data collection instrument provided consistency and reliability for this study. The instrument used in the study was a data collection sheet that recorded the scores through observation probes. The established instrument scored

the level of independence for task completion (i.e., non-completion, physical prompts, gestural prompts, visual prompts, or independence) before and after the treatment. It is an adapted structured work system data sheet, as seen in Appendix B from the book; *Building Independence: How to Create and Use Structured Work Systems*. (Reeve & Kabot, 2012). This technique and data collection instrument were chosen as the data collection instrument for this study because the data collection sheet had validity through successful use in classrooms by educators. An expert in the field, Dr. Reeve, who is a board-certified behavior analyst (BCBA), and a consultant, designed the instrument specifically to collect data on independence based on the required steps to complete a structured work system. Dr. Reeve granted permission to use her data collection sheet for this study, as seen in Appendix A.

Procedures

The following procedures describe the experimental methods used in this study. The procedures include the experimental design, the analysis of the conditions of the experiment, the type of measurement instrument, and the treatment reliability.

Design. Single-subject research designs support documenting the causal relationships between the variables. There are five types of experimental designs. These include A-B single-subject design, A-B-A-B reversal, changing criterion designs, multiple baselines across participants, and alternating treatment designs (Zhan & Ottenbacher, 2001). The AB design is the basic single-subject design that uses a planned comparison. The “A” represents the baseline (i.e., non-treatment) condition, and “B” represents the intervention condition (Zhan & Ottenbacher, 2001). However, the AB design is the building block of single-subject designs. The AB design assumes that if the

treatment had not occurred, the baseline pattern would have continued. The AB design was not as robust of a design as the multiple baseline design for this study. For example, if the participants all start the baseline at the same time, and the intervention (i.e., treatment) condition at the same time, the participants might observe and copy the other participants, which could skew the results.

The repeated measurement in the ABAB reversal design baseline allows for two separate instances of replication; however, it cannot rule out possible carryover effects on internal validity (Cooper et al., 2007). A carryover effect is an effect that remains from one experimental condition to another and could weaken the validity of the treatment results. For example, if the participants return to the baseline condition, they have some carryover effect of remembering using the earlier intervention condition. The changing criterion design uses an initial baseline condition followed by a series of intervention conditions consisting of successive and gradually changing criteria. The changing criterion design is for evaluating a single target behavior in a series of distinct stages of changes. For example, to increase reading fluency in increments. The reversal ABA designs also did not meet the criteria for this study because it is better to end on the intervention condition rather than withdrawing the potentially effective treatment and is a minimal type arrangement for establishing experimental control. The alternating treatment design is better used when implementing multiple intervention conditions to test the function of a behavior.

This researcher chose to examine the structured work system method using the multiple-baseline design that is applied when answering research questions about the effects of an independent variable across three or more individuals (Byiers et al., 2012).

Multiple-baseline designs use a series of two or more separate AB groups over the same period in which the switch from baseline (A) condition to experimental (B) condition occurs at staggered times (Byiers et al., 2012). The three different types of multiple baseline designs include; multiple baselines across different behaviors of the same participant, multiple baselines across the same behavior of different participants, and multiple baselines of the same behavior of one participant across different settings (Cooper et al., 2007). The researcher for this study chose to use multiple baselines across three different participants.

The multiple-baseline design demonstrates experimental control by staggering the intervention condition start times, which eliminates any outside influences, such as participants copying other participants, which could skew their data (Byiers et al., 2012). For example, the condition change made to participant 1 started on week two, while participant 2 and participant 3 stayed in the baseline condition. Then the condition change for participant 2 started a week before participant 3. The baseline is the standard against which the researcher measured changes implemented by the treatment. The differential changes that occurred to each participant at separate times helped to strengthen the AB design for this study.

The advantages of using the multiple baseline design are that this design does not require the removal of an effective intervention. The multiple baseline design is well-matched with the data collection tool and the steps of data analysis for evaluating the effect of instruction on skill sequences, especially when it might be questionable that the participant independently completes steps without prompting (Cooper et al., 2007). The multiple baseline design also molds the research question asked about implementation in

the classroom because the other advantages of this design are that the implementation of the treatment resembles practices used by educators; therefore, it would be relatively easy for educators to implement in this study (Cooper et al., 2007). The design also allows for direct observation of generalization of behavior change, and the assessment of maintenance of acquired skill levels.

Independent Variable. The independent variable in this study used a structured work system with a visual schedule for visual cues that informed the participant about what activities to complete in sequence, and when the participant finished. The tasks used with the structured work system include activities that also met goals in the participants' individual education plans (IEP).

Dependent Variable. The dependent variable in this study included each student completing a set of tasks. The on-target completion was measured by each participant following the visual schedule in the correct sequence and completing tasks with a measured level of independence.

Experiment Procedure. After Nova Southeastern University Institute Review Board granted approval and consents were signed, the study began. The participants in the study were distinguished using numbers (e.g., Participant 1, Participant 2, and Participant 3). The study began with each participant entering the baseline condition at the same time. The three sessions per week received scores.

During the baseline condition, the participants were given a preference assessment for the preferred item of choice when finished. Next, verbal directions stated to retrieve their laptops, and on log on to two websites and open activity for each website. The students had previously mastered each of these tasks before the study began. After

the study began, observation of the participants continued three times per week to establish a stable baseline for each participant before moving to the intervention condition. The stable baseline happened when the data points from different session observations fell within a tight score range (Cooper et al., 2007). The stable baseline proved that any changes after the intervention condition began were the result of the treatment. As seen in the flow chart in Appendix C, the conditions are staggered for each participant. The Staggered Multiple Baseline Schedule for this study is as follows:

Week One: Three participants enter the baseline condition.

Week Two: The experimental condition started for participant one. The other two participants remained in the baseline condition.

Week Three: Participant one began the second week in the experimental condition. Participant two started the experimental condition. Participant three remained in the baseline condition.

Week Four: Participant one started the third week in the experimental condition. Participant two started the second week in the experimental condition. Participant three started in the experimental condition.

Week Five: Participant one started the fourth week in the experimental condition, while participant two started the third week in the experimental condition. Participant three started the second week in the experimental condition.

Week Six: Participant one started generalization condition, while participant two started the fourth week in the experimental condition. Participant three started the third week in the experimental condition.

Week Seven: Participant one started a two-week break from the study. Participant two started the generalization condition. Participant three started the fourth week in the experimental condition.

Week Eight: Participant one in a two-week break from the study.

Participant two started their first week in a two-week break from the study. Participant three started the generalization condition.

Week Nine: Participant one started the maintenance condition, while participant two is in a two-week break. Participant three started their first week in a two-week break.

Week Ten: Participant one completed the study. Participant two started the maintenance condition. Participant three started their second week of the break.

Week Eleven: Participant two completed the research study. Participant three started the maintenance condition. Once participant three completed the maintenance stage at the end of week 11, Participant three completed the research study, which concluded all data collection for all three participants.

The research observer recorded the level of independence (0-4) for each task completed and continued to collect data three times per week on all three-participants' independent task completion skills.

Tasks. Each task contains multiple steps for completion, using online programs containing reading and math review activities. Before each session, the participants received a preference assessment using a picture choice board in Appendix G. The board had picture choices for a treat (cookies, chips, popcorn), playing basketball, time in the sensory room, or playing a favorite video game. The students consistently chose to play their favorite video games as their reward. In the baseline condition, the participants

received the following information: What tasks, when the task is complete, and what to do next (e.g., reinforcer). The difference between the baseline and the treatment was that during the treatment had the use of a visual task schedule showing the tasks with websites' names and pictures.

The participants received the visual task schedule at the beginning of the intervention condition. The participants had a choice of which style of visual schedule they preferred before the study. These two different task schedules contained the same information as seen in Appendix F. Participants 1 and 2 chose the top to bottom to-do list visual schedule, whereas Participant 3 chose the left-to-right style visual schedule that focuses more on the pictures. The task schedule provided visual information for the organization of the tasks and what to do next after they completed all the tasks. The schedule also linked individual tasks into a sequence of activities used for the structured work system. The pre-chosen reinforcer was attached to the bottom of their task schedule. As seen in Appendix F, a detailed picture with text schedule for which includes: The visual schedule conveyed the following information to the participant:

Task One: (Step 1) open the laptop (Step 2) plugin laptop (Step 3) power-up.

Task Two: (Step 1) type username (Step 2) type password (Step 3) click enter.

Task Three: (Step 1) type Prodigy.com (Step 2) username (Step 3) password, click enter.

Task Four: (Step 1) type ABCYA.com (Step 2) username (Step 3) password, click enter.

What Comes Next? (The participants previously chose their favorite activity).

M**easurement**. The intent is for the participants to complete the task independently during the sessions. Data collection occurred three times per week across all four conditions. The trained research observer collected the data. Each participants'

scores were from observations of prompt levels recorded on the adapted structured work system data sheet. The researcher observed the level of prompt and scored the data collection sheet as seen in Appendix B. The structured work system data sheet included levels: non-completion (score of 0), physical prompting (score of 1), verbal prompting (score of 2), gestural prompting (score of 3), or independently (score of 4).

The participant received a non-completion score if he did not complete the task even with prompting provided. The physical prompt used hand-over-hand guidance, with verbal instruction for correct responding (Cooper et al., 2007). The need for a physical prompt happened when the gestural and verbal prompts alone were not enough to produce the correct response. The verbal prompt provided an auditory cue used to increase participant task initiation and completion (Cooper et al., 2007). This prompt level is needed when the gestural prompt is not enough to evoke the target behavior. A gestural prompt is a non-verbal prompt that provides information about the task using gestures such as pointing or touching the laptop or the visual schedule. This level prompt is least intrusive and more natural to fade than a verbal prompt. A gestural prompt is needed when the participant is not initiating the tasks independently after given directions. Independent task completion refers to completing a task independently during the session within a given timeframe after instructions (Riffel et al., 2005). The initiation of a task step is counted as independent if the participant initiated within 5 seconds.

Each participants' scores were observations of prompting levels needed and recorded on the adapted structured work system data sheet. The data was analyzed from each condition and displayed in a graph for each participant. The analysis of the graph

determined whether the use of the structured work system with a visual schedule improved task completion independence.

Generalization. Generalization difficulties are also a potential hindrance to independence. Generalization is the ability to transfer learned skills and concepts to a variety of settings and situations (Secan et al., 1989). People with ASD may perform a task independently in one setting but then have difficulty in applying the task in a different setting. The expectations were the same for the participant; however, the environment and tasks were different from the original setting (Riffel et al., 2005).

Once the participants became knowledgeable about using the structured work system in the classroom setting for four weeks, they transitioned to the generalization condition. The participants were familiar with both the environment and the previously mastered tasks. The participants had a visually structured environment in the other classroom, a different but similar visual schedule, as seen in Appendix F, along with a different adult for prompting if needed. The generalization condition included a similar visual schedule; however, the websites, usernames, and passwords were different. The researcher and assistant recorded the participant's independent task completion skills in a different setting. Data were collected using the structured work system with a visual schedule to see if the participant decreased his need for prompting. After participants completed their tasks on the visual schedule, the schedule directed the participant to go to their reinforcer picture, in this case, their favorite online game. If the participant completed the different tasks with the same or less prompting than the intervention condition, then the participant generalized task completion skills using the structured work system.

Maintenance. After a two-week break from the study, the participants received the original visual schedule and observations scored. The skill is maintained when the observation scores are about equal with intervention condition after the break from the study. The participants completed the same tasks they did in the experimental condition utilizing the same structured work system structured and visual schedule as in Appendix F. The maintenance of task completion skills was probed two weeks after the generalization condition. This probe showed if the independence level maintained after a long break in routine. The maintenance observations occurred for one week, across three sessions. The structured work system data sheet (Adapted from Reeve & Kabot, 2012), as seen in Appendix B, was used to collect data in all four conditions. The structured work system data sheet measured the occurrence or nonoccurrence of the participant completing the tasks independently. The purpose of keeping the visual schedule is to see if they maintained the skills to use the visual schedule to work independently.

Data analysis. After data collection in all four conditions was analyzed to indicate the mean level of independent performance of each participant for each condition of the research. The analysis report included descriptive data in detail as well as generated graphs using the data. Scoring the data was based on the level of independence and completion (i.e., non-completion, physical prompting, gestural prompting, with visual prompting, or independently). For example, if a participant refused to complete the task, he would have received a score of zero; for physical assistance, the participant received one point. If the participant needed a visual prompt to complete the task, he received two points and three points for a gestural prompt. If the participant completed the task independently, they received four points.

Fidelity, Reliability using Interobserver Agreement (IOA). Treatment with fidelity was conducted by using the Reliability Checklist: *Implementation Checklist for Structured Work Systems* developed by Hume and Carnahan (2008a). Treatment was implemented with 100% fidelity on (1) conducting a preference assessment (2) selecting the correct type of structured work system for the participants (3) providing the most minimally intrusive prompts possible, (4) using previously mastered skills, (5) reviewing participants work for accuracy (6) use of a data collection system to record participant behavior (Hume & Carnahan, 2008a).

Reliability is a measure of consistency that describes the extent to which a measurement procedure produces the same result when measuring the same variable over time (Cooper et al., 2007). IOA refers to the degree to which two independent observers report the same observed scores after measuring the same activities. It is a procedure used to ensure the reliability of data using two observers score data on the same event (Gast, 2010). The IOA consists of a number-recording formula. It describes how to record the level of tasks completed independently (Gast, 2010; Martella et al., 2012). The IOA requires the use of an event recording system when two observers record during the same session.

To ensure accurate data collection, protect internal validity, and reliability of the data, a second trained IOA observer recorded one-third of observed sessions in this study. The IOA observer recorded data for each participant during the baseline, experimental, generalization, and maintenance conditions as the fulfillment of interobserver agreement (IOA) checks that validated data collected by the researcher. The IOA observer was a special education educator who worked for the school system. She was trained on the

data collection procedures as well as how to record data using the structured work system data sheet. She was not blind to the experimental conditions. Both observers used the structured work system data sheet included in Appendix B. Both observers witnessed the participant's actions and simultaneously but independently collected data cued by the participant's response to initiate each task step. The researcher's and observer's data verified agreement.

As seen in Appendix D, the Interval by Interval IOA between the sessions was chosen for this study. Interval by Interval IOA is calculated by dividing the number of agreements by the total number of opportunities, then multiplying by 100% to get the total percent of agreement (Cooper et al., 2007; Gast, 2010; Martella et al., 2012).

The IOA data results averaged to 95.5% for baseline and 93.2% for treatment. The generalization and maintenance conditions averaged to 94% and 100%, respectively. The range of calculations for IOA across each condition of the study ranged between 88% to 100%. These percentages indicated a high rate of agreement.

Ethical Considerations

The observational data collection was concealed from the participants to avoid influence on their behavior during the baseline and intervention conditions. The data collection sheets were kept in 3-ring binders and secured in a locked filing cabinet when observation recording is not taking place.

Potential Research Bias

The selection results in this study used the purposive sampling of three students who meet the criteria for the study in the self-contained classroom. According to Black (2010), purposive sampling is a non-probability sampling method used when the

researcher needs to rely on personal judgment when choosing members of the population to participate in the study. This type of sampling can create difficulties in identifying possible researcher bias. However, purposive sampling is an appropriate method when there are a limited number of participants who can contribute to the study (Black, 2010).

Limitations

This study used a limited sample size of three students in a self-contained classroom at one school. The possibility of hidden variables affecting the outcome included noncompliance, and the frequent absences of participants, which affected their treatment time. Limitations of the multiple baseline design used in the study are that it is more of an evaluation of the independent variable's effectiveness (i.e., structured work system intervention) than an analysis of the behaviors (i.e., task completion). However, the two do coincide. Conducting the multiple baseline design experiment required a substantial time commitment (Cooper et al., 2007).

Chapter 4: Results

The purpose of this study was to examine whether a structured work system and visual schedule can improve task completion independence using online tasks with laptops for three high school students with ASD and intellectual disabilities in a self-contained classroom. Two research questions were addressed in this study:

Research Question 1. How does the use of a structured work system using online tasks affect the level of independent performance of task-related skills of students with ASD and intellectual disabilities?

Research Question 2. Can the structured work system with a visual schedule be implemented in the classroom and generalized with consistency for a small selection of students with ASD and intellectual disabilities?

Data Analysis of Independent Task Completion

After the analysis of the data collected on the baseline and treatment, the researcher calculated the changes in independence level. The less intrusive the prompt, the more significant the impact the treatment had on the target behavior, in this case, task completion independence (Gast, 2010). The hypothesis proposed that independent performance would increase using a structured work system with a visual schedule when teaching online task completion skills to high school students with ASD and intellectual disabilities.

It is clear from the stable baseline and subsequent changes in percent after introducing the structured work system with a visual schedule that the treatment was responsible for the change. The structured work system with a visual schedule increased all three participant's independent task completion skills while decreasing their need for

adult prompting. The participants demonstrated generalization skills across settings (i.e., completed tasks in a different classroom), persons (i.e., different adults), and tasks (i.e., different websites). The increases in the dependent variables occurred with the introduction of the treatment (i.e., independent variable) on separate sessions for each participant. The participant changes in performance indicate a functional or causal relationship between the implementation of structured work systems and changes in the dependent measures (Cooper et al., 2007).

Figure 1 shows the mean percentage of responses for tasks completed independently (i.e., no prompts needed to complete the task with accuracy) across baseline, intervention, generalization, and maintenance conditions. The higher the percentage, the more steps completed independently.

Participant 1 was 63.6% (range 50–75%). His independent task completion levels increased with the implementation of the treatment with mean levels of 75.2% (range 25–94%). The independent task completion level continued to rise for Participant 1 during the generalization condition, with a mean of 98% (range of 94–100%), which continued during the maintenance condition, with an average of 98% (range of 94–100%).

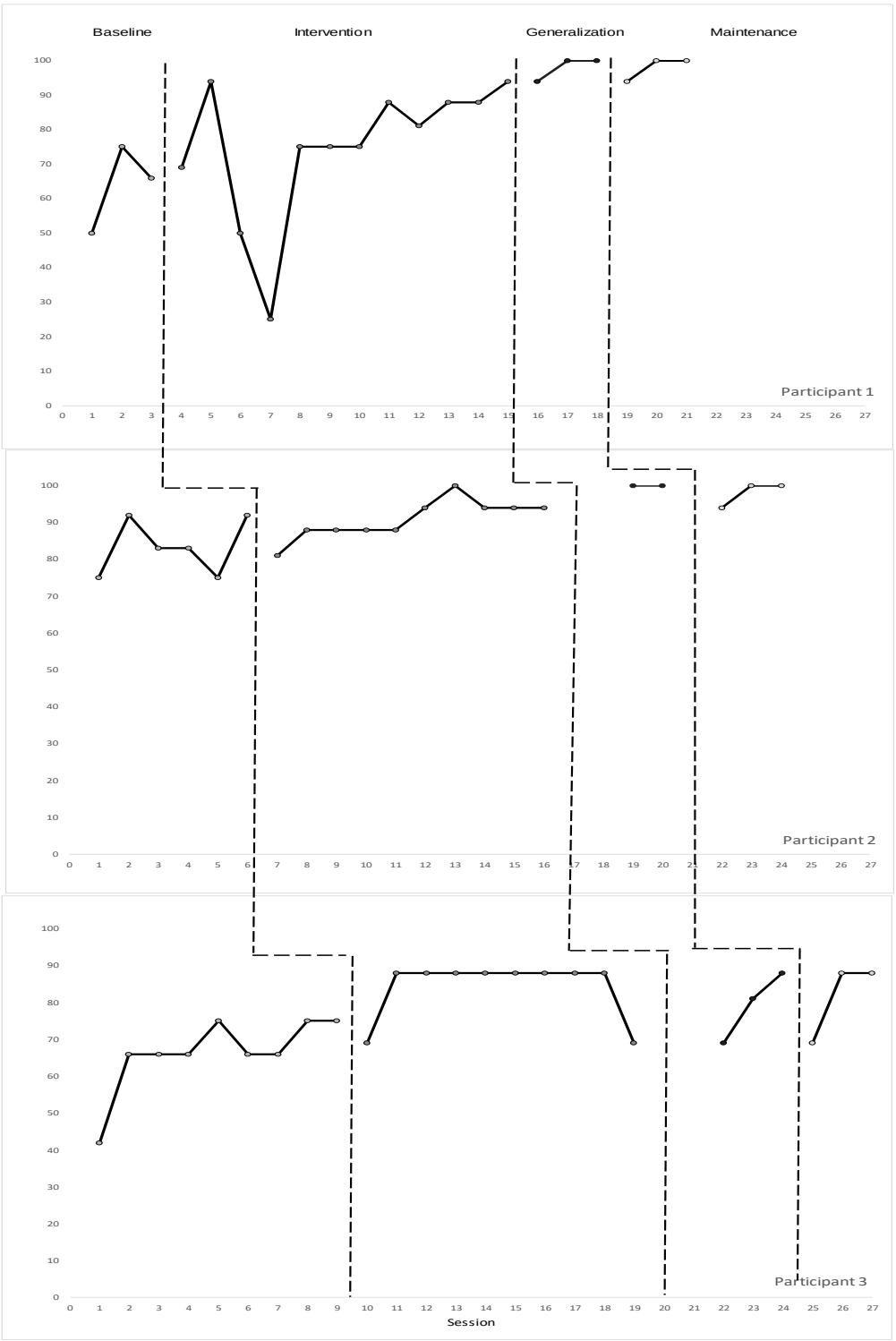

Figure 1. Percentage of Independent Responses in Task Completion.

Participant 2: The mean number for tasks completed independently and accurately during baseline averaged 80.5% (range 75–92%). Participant 2 was absent for 3 out of 12 of the sessions during the intervention condition and once during generalization. However, an immediate change in independence level was noted when the introduction of the treatment to participant 2. Even with his non-compliance and need for physical prompting around session 6, his independent task completion skills increased with a mean number of 91.2% (range 81–100%). His independent task completion skill level continued to rise during the generalization condition, with a mean of 100% (range of 100–100%), yet when probed after a two-week break, his skill level dropped slightly for the maintenance condition, with probes with a mean of 98% (range of 94–100%).

Participant 3: The baseline mean number averaged to 66.3% (range 42–75%). The independent task completion level for Participant 3 rose once with the introduced treatment with a mean number of 84.2% (range 69–88%) even with being absent during two treatment sessions and winter break. However, during the generalization condition, his independence level decreased slightly with a mean of 79.3% (range of 69–88%) but then improved after the break for the maintenance condition, with a mean number of 81.6% (range of 69–88%). Participant 3 was absent for 2 out of 12 of the sessions during the intervention condition but was in attendance for the generalization and maintenance observations

Adult Prompts. Figure 3 shows the mean number for the sessions that needed a prompt from the educator or staff member across participants, conditions, and settings. Participant 1: During the baseline condition, Participant 1 was prompted for a mean of 36% (range 25–50%). During the implementation of the treatment, the need for adult

prompting lessened with prompts occurring for a mean of 25.8% (range 6–75%). Much lower rates of prompting were needed in the generalization setting, with a mean of 2% (range 0–6%) and continued in the same in the maintenance condition with a mean of 2% (range 0–6%).

Participant 2 received prompts from adults for a mean of 16.7% (range 8–25%) in the baseline condition. During the treatment, participant 2 demonstrated that he could complete his tasks independently with a mean of 0% (range 0-19%). Participant 2 exhibited generalize independence with a prompt mean of 0% (range 0–0%). However, he did need a low-level prompt in maintenance with a mean of 2% (range 0–6%).

Participant 3 required a considerable amount of adult prompting in the baseline condition for an average of 33.1% (range 25–58%), however, during the intervention condition, prompting needs decreased slightly to a mean of 23.4% (range from 12 to 88%). Participant 3 had an increase in prompt levels around session 18, which was most likely due to his absences and winter break. During the generalization condition, his mean number fell to 20.7% (range from 12-31%). In the maintenance condition, the level of adult prompts needed for Participant 3 slightly reduced his prompting requirements to a mean of 18.3% (range from 12-31%).

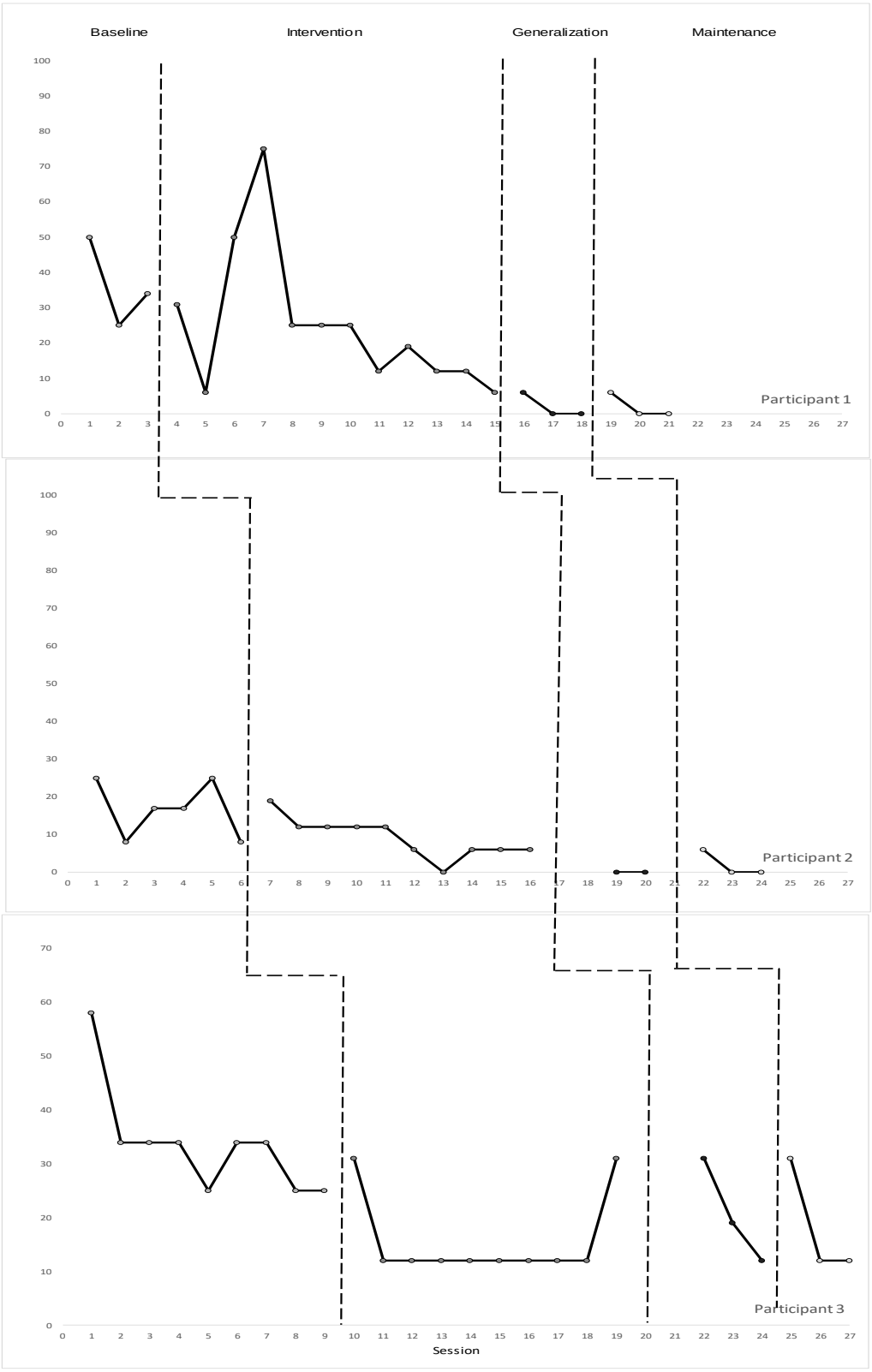

Figure 2. Percentage of Prompted Responses.

Prompt Intrusiveness. *Figure 4* shows the number of prompts that were needed to complete tasks. The least-to-most prompt started with independence, and then if needed, the prompt level moved to gestural (e.g., non-verbal pointing). If that did not yield task initiation, then a more intrusive prompt was provided, which included a verbal prompt or a physical prompt. Even though the least-to-most prompt fading strategy was applied, the data shows that Participant 3 needed more verbal prompts than participants 1 or 2. The data for participant 3 demonstrates he is prompt dependent on verbal prompts for task initiation and completion, which is that hardest prompt to fade (Fisher et al., 2007; McClannahan & Krantz, 2010).

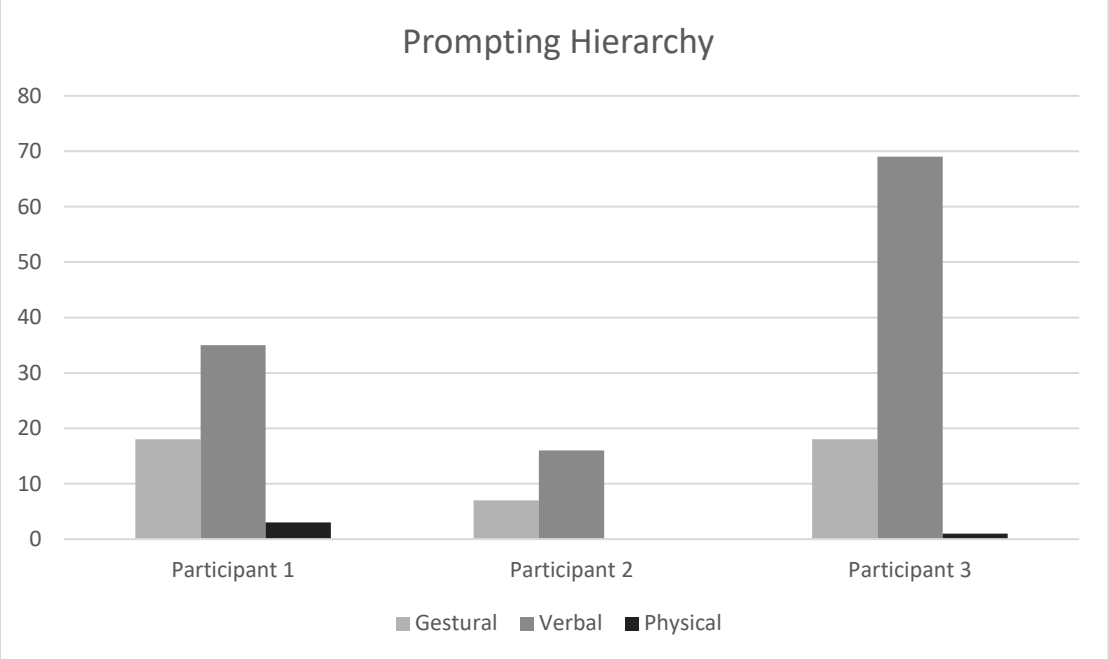

Figure 3. Number of Prompts Required for Task Completion.

Generalization of Skills. The hypothesis proposed that independent performance could be generalized with consistency using a structured work system with a visual schedule for students with ASD and intellectual disabilities. Generalization occurs when

the generalization condition almost reaches or exceeds the intervention condition. Generalization in this study included completing tasks independently in a different classroom, using different previously mastered tasks, with a different adult. In *Figure 4*, the data showed that the use of the structured work system supported task generalization across settings, tasks, and persons for each participant. Participants 1 and 2 performed more independently in the other setting compared to treatment on the self-contained classroom. Participant 3 had difficulty with transitioning to new activities; therefore, only a slight decrease was considered an accomplishment for this student. This study extends the research on structured work systems facilitating generalization.

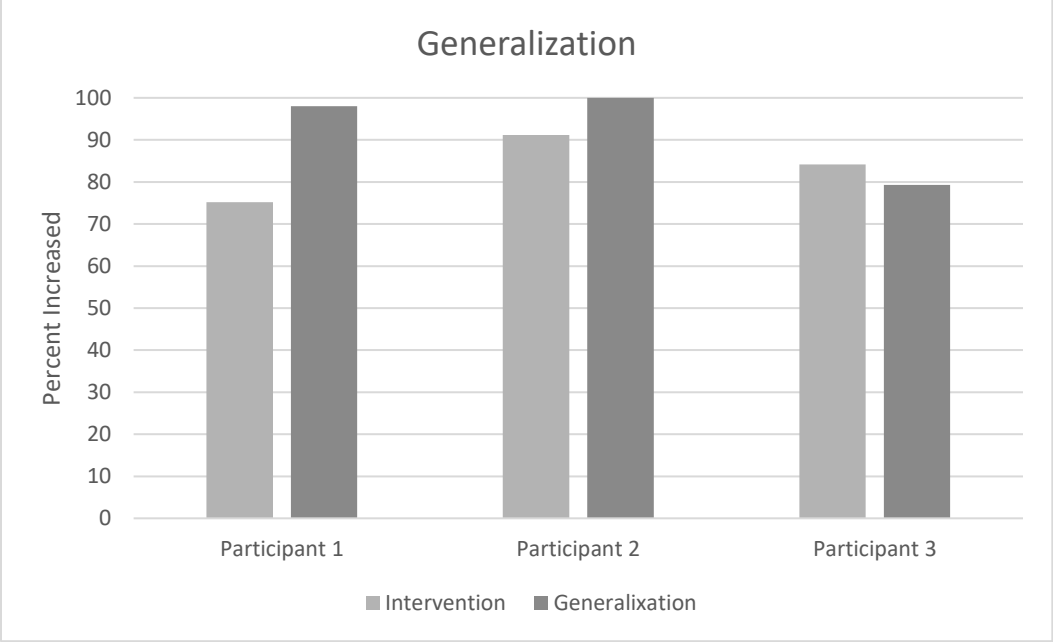

Figure 4. Generalization Across Settings, Tasks, and Persons.

Chapter 5: Discussion

This study investigated the effects of a method to support higher levels of independent performance and generalization of skills using a structured work system with a visual schedule when teaching online task completion skills to high school students with ASD and intellectual disabilities. The study demonstrated that the use of the structured work system intervention resulted in improved independent task completion skills for students with ASD and intellectual disabilities, with a decrease in adult prompting. The data showed that all three participants generalized the skills with consistency. Participants maintained their independent levels of accurately completing the tasks with minimal levels of prompting needed for up to three weeks post-treatment. Several factors may have played a part in this success.

Interpretation of Findings

Increased Independent Task Completion. Given the subsequent results established in previous research, the structured work system is a well-designed intervention to promote independent initiation, accuracy, and completion of previously mastered skills for students with ASD and intellectual disabilities (Bennett et al., 2011; Carnahan et al., 2009; Hume & Odom, 2007; Hume et al., 2012; Mavropoulou et al., 2011; Pelios et al., 2003). Therefore, this study extends the effectiveness of a structured work system using online tasks for independent task completion with high school students who have ASD and intellectual disabilities.

Visual Schedules. The visual task schedule assisted in the increased task completion and decreased the need for adult prompting. Prior research data has shown prompting levels decrease with the implementation of structured work systems (Bennett

et al., 2011; Carnahan et al., 2009; Hume & Odom, 2007; Hume et al., 2012; Mavropoulou et al., 2011; Pelios et al., 2003) along with the use of visual schedules to reduce the number of prompts needed from an adult (Bouck et al., 2014; Cramer et al., 2011; Gentry et al., 2015; Mechling & Savidge, 2011; O'Hara & Hall, 2014; Watson & DiCarlo, 2016). The structured work system with the visual schedule transferred stimulus control (i.e., the constant need for adult prompting to complete tasks) to an alternative stimulus (i.e., structured work system with visual schedule), which supplied the information (e.g., what tasks need completed, what to do next) previously provided by an adult in the baseline condition (Mesibov & Shea, 2010). Shifting stimulus control from adult prompts to an alternative stimulus (i.e., visual schedule) is a crucial component in increasing task completion independence for students with ASD and intellectual disabilities who need adult prompting to complete tasks (Mesibov & Shea, 2010).

Least-to-Most Prompt Fading. The least-to-most prompting procedure used in this study gradually increased the level of prompt until the participant responded correctly. When the participant did not respond or made an error, the weakest possible prompt level was given (i.e., gestural) and continued to increase the level of the prompt until the participant responded correctly. This method promoted the highest level of independence in this study (Cooper et al., 2007; Fisher et al., 2007; Sabielny & Cannella-Malone, 2014).

R**einforcement.** The three participants earned a reinforcer once they completed the task accurately. The delayed reinforcers were preferred activities previously chosen from the reinforcer choice board before the session. Appendix G shows an example of a picture of the choice of board participants used. The delayed reinforcement was the “what

do I do next' after all tasks are completed, which strengthened the likelihood the participant would complete the tasks (Cooper et al., 2007; Koegel & Mentis, 1985; Sam & AFIRM Team, 2015b).

Generalization of Skills. Generalization in this study included completing tasks independently in a different classroom, using different previously mastered tasks, with a different adult. The data showed that the use of the structured work system supported task generalization across settings, persons, and tasks for each participant. Participant performance improved considerably in the other classroom compared to when the structured work system was implemented in the self-contained classroom. The generalization of skills of all three participants in this study shows they are more likely to generalize independent task completion skills successfully in a workplace setting in the future.

The structured environment and or the visual schedule component may have supported the generalization of skills and reduced the level of adult prompts needed to complete the tasks. Another possible explanation for generalization was the ''what is next'' reinforcement of a preferred activity when finished. It is not known whether the visual schedule or the preference reinforcers affected generalization or if it was a combination of all the above; however, the present study provides evidence that structured work systems can be useful in promoting accurate and independent task completion that can be generalized for high school students with ASD and intellectual disabilities.

Context of Findings

The findings in this study follow the same trends of increased independent task completion, less prompting, generalization, and maintenance of skills as compared to the existing studies that used structured work system with students who have ASD (Hume, 2009; Kucharczyk et al., 2019; Pelios et al., 2003). This study was similar in the population of prior research which used two to three participants with ASD using structured works systems (Bennett et al., 2011; Hume, 2009; Kucharczyk et al., 2019; Mavropoulou et al., 2011; Pelios et al., 2003). This study also examined high school participants using a structured work system as with prior studies (Carnahan et al., 2009; Hume & Odom, 2007). This study used a multiple baseline research design with similar results as previous research (Kucharczyk et al., 2019; Pelios et al., 2003). However, their research used a structured work system with young children.

There were no contradictions noted with previous research using structured work systems to increase task independence, reduce prompting, and generalize to new tasks, persons, and places. However, it is still unknown which component or combinations of components of the structured work system with a visual schedule attribute to the increase in task completion independence and generalization. Could it have been the structured environment, the left-to-right organization of materials, the visual schedule that sequenced the tasks, the use of the least-to-most prompting, or the delayed reinforcement? We do know that the combination of components works together to cause the change. This research extends prior research because the results showed that high school students with ASD and intellectual disabilities could initiate and independently

complete online computerized tasks and generalize more effectively when structured work systems with a visual schedule are in place.

Implications of Findings

The findings are consistent with current theories in the field and contribute to the discussion about task completion independence development and generalization across tasks, people, and settings (Hume, 2009; Kucharczyk et al., 2019; Pelios et al., 2003). Structured work systems have the potential to serve as tools to accommodate students in settings beyond those where the treatment was implemented. The findings may also inspire parents, educators, and other professionals as they provide independent work for individuals throughout the school day or home training. The structured work system extends time on task and maintains mastered skills. Once the student can perform the steps in the structured work system, it is necessary to continually assess and consider how the system might be useful in other areas of the student's life. It is also important to continually adapt the structured work system and a visual schedule to meet the student's current needs (Carnahan, 2008).

Furthermore, the results indicate that educators and other interventionists who serve students with ASD and intellectual disabilities can increase student task completion independence across multiple people, tasks, and settings when implementing the structured work system. Results showed that a structured work system applied with online tasks produces independent task completion. These are notable outcomes that suggest the structured work system with a visual schedule has the potential to allow high school students with ASD and intellectual disabilities to work independently not only in the classroom but generalize skills to work independently in a workplace environment.

Businesses can use this information to better accommodate people with ASD by setting up a structured work system environment with checklists for task completion independence, and increased production of work completed.

Limitations of the Study

There were numerous limitations to this study. First, this study used a limited sample size of three students in a self-contained classroom at one school. Second, the study was limited to early morning sessions by the school district. However, this time of day may not have been the most effective time for implementing the treatment; as classmates were walking in talking, hanging up their coats and bookbags, and getting their laptops and supplies out during the study, which more than likely caused auditory distractions during the sessions. Generalization occurred when the participants produced similar target behaviors in a different setting from the instructional environment (Cooper et al., 2007). The different setting used in this study was a separate classroom on the same hall of the school which had fewer distractions in the environment and, therefore, could have contributed to participant higher generalization task completion scores.

Third, the multiple baseline design staggered the treatment start time for each participant to ensure experimental control (Byiers et al., 2012). To further protect internal validity and reliability of the data and to ensure accurate data collection, a second trained IOA observer recorded one-third of observed sessions using the same data collection instrument in Appendix B. Interval by Interval IOA between the sessions was chosen for this study. Interval by Interval, as seen in Appendix D was calculated by dividing the number of agreements by the total number of opportunities, then multiplying by 100% to get the total percent of agreement (Cooper et al., 2007; Gast, 2010; Martella et al., 2012).

The IOA results for the baseline condition averaged to 95.5%, intervention averaged 93.2%, and the generalization and maintenance conditions averaged 94% and 100% respectively across all three participants, which indicated a high rate of agreement.

The variables affecting the outcome of conditions included participant compliance issues and frequent absences. Participant 1 exhibited a fair amount of refusal to comply during the condition. Participant 1 walked away from the session to get a notebook out of his book bag and began drawing. He was verbally prompted with no response; therefore, a physical prompt was needed and illustrated in Figure 3. Even Though there was preference assessment conducted, the use of student chosen and valued reinforcers, it is possible that the appropriate establishing operations were not in place to motivate participant 1 to sit and comply during the sessions. Participants 2 and participant 3 missed several observational sessions due to illness, which could have affected their change in treatment percentages. Participant 2 was absent for two sessions during the intervention condition and once during generalization. Participant 3 was absent during two treatment sessions. Both participants did have an increase during the intervention and generalization; however, they might have had a higher gain if they had not missed the sessions. Independent task completion levels for Participant 3 were lower than those of Participant 1 and Participant 2. Though his independent task completion level increased markedly across conditions and settings and maintained a mean of 79-80%, however, it was 16.4% less than participant 1 and Participant 2. This difference may be attributable to his functioning level, or his prompt dependence noted previously. Prompt dependency is due to processing difficulties or focusing on the wrong cues (Rao & Gagie, 2006). Future

research examining the characteristics of individuals with ASD who may respond with various levels of independence is recommended to address this limitation.

Fourth, limitations of the multiple baseline design used in the study are that it is more of an evaluation of the independent variable's effectiveness (i.e., structured work system intervention) than an analysis of the behaviors (i.e., task completion). Conducting a multiple baseline design experiment required a considerable amount of time to complete (Cooper et al., 2007). Finally, a structured work system consists of several components that may have affected task initiation, accuracy, and completion. These include minimizing environmental distractions, visually sequencing the tasks, using left-to-right organization, and answering the questions: what to do first and what is next. Additionally, the work system was used in combination with other ABA strategies (e.g., least-to-most prompt fading procedures and delayed reinforcement). This method can be generalized to use with children and adults with ASD using beginner or more advanced designed structured work systems in a variety of environments using different tasks. A structured work system is appropriate for home, school, and work. Research by Kucharczyk et al. (2019) confirmed a 7-year-old could use a structured work system successfully for home life skills routines. Hume et al. (2012) used structured work systems for sorting and classifying photos with several first-grade students. Research by Hume and Odom (2007) demonstrated that the structured work system with a number matching schedule was successful for a 20-year-old for employment support.

Future Research Directions

Hartwell-Walker (2016) stated that more than 3.5 million Americans have ASD. The NTLS2 study also showed that 96% of people with ASD scored below the mean on

independent behavior, and only 58% found employment. With prior research showing that multi-media schedules are successful, more research is necessary using technology for both the schedule and the tasks to prepare students with ASD for independent task completion and employment (Browder et al., 2014).

Structured work systems combine evidence-based strategies for task initiation, accuracy, and task completion, as well as maintain and generalize mastered skills (Reeve & Kabot, 2012; Schopler et al., 1995; Taylor, & Preece, 2010). Structured work systems can be designed simple or complex, used across settings, and work time to match an individual's age and developmental level (Hume & Carnahan, 2008c; Mesibov & Shea, 2010). There are several types of successful interventions using prompting hierarchies, using reinforcers, and visual task schedules. Both paper and electronic-based schedules increase independent responding and task completion. When combined as the components of a structured work system, this method has documented data for increased in on-task behavior and increased independent task completion for students with ASD and intellectual disabilities.

This study extends the effectiveness of the structured work system method for increasing independent task completion, decreasing prompts, and generalization across environments, persons, and tasks with high school students. However, it was not possible to identify which specific components were responsible for behavioral increases since the strategies in the structured work system method are reliant upon each other. Future research should examine both the individual components of the structured work system TEACCH® approach and overall program effectiveness at various ages and developmental levels (Mesibov & Shea, 2010).

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Appendix A

Permission Received to Use Data Collection Instrument

Permission Received to Use Structured Work System Data Sheet

Gmail

Lori Otto <scubalori@gmail.com>

Permission to Adapt your Data Sheet for my Dissertation

Christine Reeve <reeve@nova.edu> Sun, Jan 6, 2019 at 7:46 PM
To: Lori Otto <scubalori@gmail.com>

You have my permission to use the Work System Data sheet for your dissertation.

Chris
Christine Reeve, Ph.D., BCBA-D
Reeve Autism Consulting, LLC

Appendix B

Data Collection Instrument

Appendix B

Structured Work System Data Sheet (Adapted from Reeve and Kabot, 2012)

Participant Number_____Scorers Initials_____Session Date:_____

Information provided:
__What Work? __How Much Work? __When Finished? __What is Next?

	Checks Schedule	Completes Step 1	Completes Step 2	Completes Step 3
TASK # 1	4 Independent	4 Independent	4 Independent	4 Independent
	3 Non-verbal	3 Non-verbal	3 Non-verbal	3 Non-verbal
	2 Verbal	2 Verbal	2 Verbal	2 Verbal
	1 Physical	1 Physical	1 Physical	1 Physical
	0 Refused	0 Refused	0 Refused	0 Refused

	Checks Schedule	Completes Step 1	Completes Step 2	Completes Step 3
TASK # 2	4 Independent	4 Independent	4 Independent	4 Independent
	3 Non-verbal	3 Non-verbal	3 Non-verbal	3 Non-verbal
	2 Verbal	2 Verbal	2 Verbal	2 Verbal
	1 Physical	1 Physical	1 Physical	1 Physical
	0 Refused	0 Refused	0 Refused	0 Refused

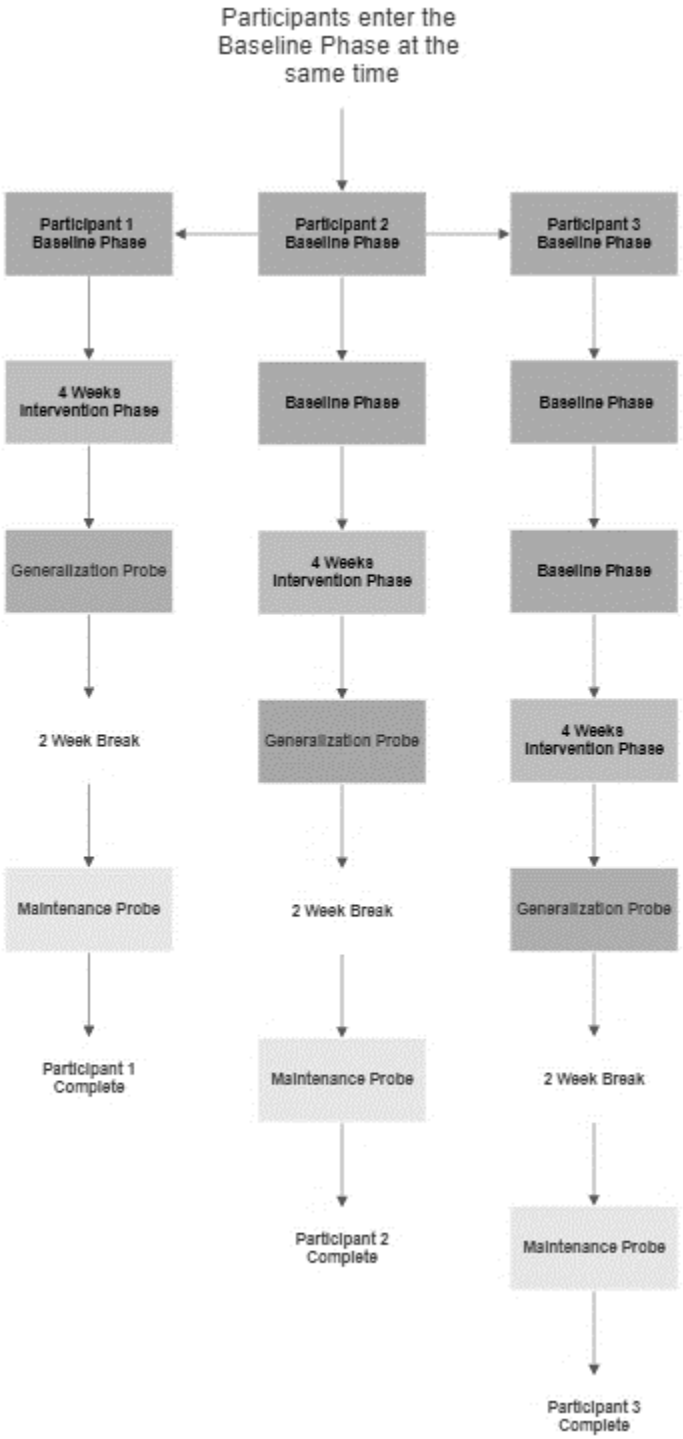
	Checks Schedule	Completes Step 1	Completes Step 2	Completes Step 3
TASK # 3	4 Independent	4 Independent	4 Independent	4 Independent
	3 Non-verbal	3 Non-verbal	3 Non-verbal	3 Non-verbal
	2 Verbal	2 Verbal	2 Verbal	2 Verbal
	1 Physical	1 Physical	1 Physical	1 Physical
	0 Refused	0 Refused	0 Refused	0 Refused

	Checks Schedule	Completes Step 1	Completes Step 2	Completes Step 3
TASK # 4	4 Independent	4 Independent	4 Independent	4 Independent
	3 Non-verbal	3 Non-verbal	3 Non-verbal	3 Non-verbal
	2 Verbal	2 Verbal	2 Verbal	2 Verbal
	1 Physical	1 Physical	1 Physical	1 Physical
	0 Refused	0 Refused	0 Refused	0 Refused

Appendix C

Multiple Baseline Design Flow Chart

Multiple Baseline Design Flow Chart



Appendix D

Sample Interobserver Agreement Calculation Form

Sample: Interval-by-Interval IOA Calculation Form

$$\frac{\text{\# of agreements}}{\text{\# of opportunities}} \times 100\% = \text{\% IOA}$$

Week 1

Week 1 Participant 1 Probe	Open laptop	Plug-In	Turn-On	Type Username	Type Password	Logon Desktop	Open browser Type Website	Type Password	Open Activity	Open browser Type Website	Type password	Open Activity
Observation 1	1	2	3	4	5	6	7	8	9	10	11	12
Observer 1 IOA												
Observer 2												

Baseline Condition Participant 1: __/12 = _____% IOA

Week 1 Participant 2 Probe	Open laptop	Plug-In	Turn-On	Type Username	Type Password	Logon Desktop	Open browser Type Website	Type Password	Open Activity	Open browser Type Website	Type password	Open Activity
Observation 1	1	2	3	4	5	6	7	8	9	10	11	12
Observer 1 IOA												
Observer 2												

Baseline Condition Participant 2: __/12 = _____% IOA

Week 1 Participant 3 Probe	Open laptop	Plug-In	Turn-On	Type Username	Type Password	Logon Desktop	Open browser Type Website	Type Password	Open Activity	Open browser Type Website	Type password	Open Activity
Observation 1	1	2	3	4	5	6	7	8	9	10	11	12
Observer 1 IOA												
Observer 2												

Baseline Condition Participant 3: __/12 = _____% IOA

Appendix E

Sample Work System Data Calculation Form

Sample: Work System Data Calculation Form

$$\frac{\text{\# of independent trials}}{\text{\# of opportunities}} \times 100\% = \%$$

Tracking Participant Independent Task Completion

Week 1 Baseline Condition

1.	Monday					Tuesday					Friday			
		1	2	3			1	2	3			1	2	3
1														
2														
3														
4														

Session 1: __/12 = _____%

Session 2: __/12 = _____%

Session 3: __/12 = _____%

Week 2 Intervention Condition

1	Monday					Tuesday					Friday			
	CS	1	2	3		CS	1	2	3		CS	1	2	3
1														
2														
3														
4														

Session 4: __/16 = _____%

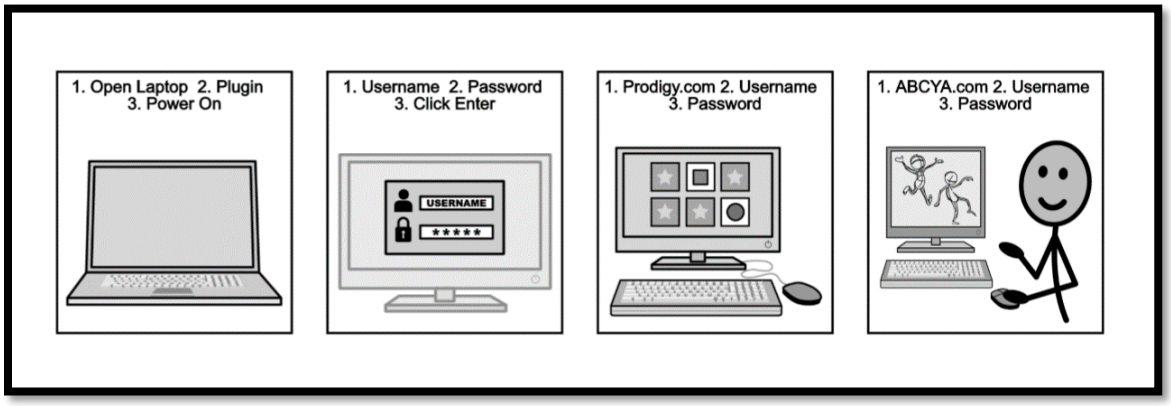
Session 5: __/16 = _____%

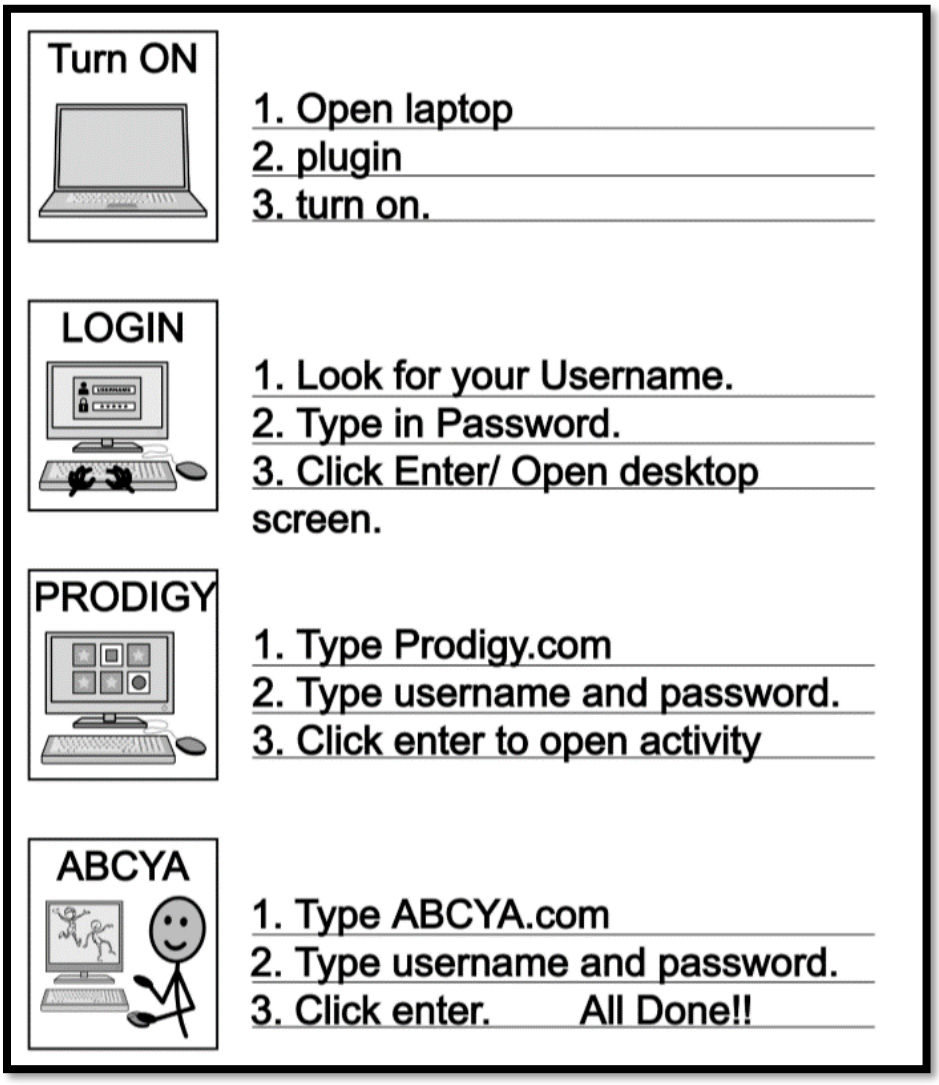
Session 6: __/16 = _____%

Appendix F

Sample of a Visual Task Schedule

Sample: Visual Task Schedules





Appendix G

Reinforcer Choice Board

Reinforcement Choice Board