INITIATION AND GENERALIZATION OF SELF-INSTRUCTIONAL SKILLS

by

KATHERINE ALMAND SMITH

(Under the Direction of Kevin Ayres)

ABSTRACT

This study evaluated the effects of progressive time delay (PTD) to teach four participants how to initiate self-instruction in the presence of a task direction for an untrained task. Participants were taught to navigate to videos on an iPhone in history training, and all participants were screened for imitating video models prior to the study. A combination multiple probe across participants and multiple probe across settings design was used to evaluate the effects of PTD on initiation of self-instruction. All participants learned to self-instruct. Two participants generalized self-instruction learned in one setting to two additional settings without instruction. Two participants required instruction in two settings before generalizing to the third. Three participants generalized self-instruction in the presence of a task direction from the researcher to a task direction from their classroom teacher in all three settings. One participant generalized to a task direction presented by the classroom teacher in one setting, but not in the other two. All participants maintained self-instruction when probed one week after all participants met criteria in all settings. Self-instruction using videos or other supports on a mobile device is a pivotal skill and can increase independence for individuals with disabilities by decreasing a need for adult supports.

INDEX WORDS: Video modeling, Self-instruction, Autism, Daily living skills, Vocational skills

INITIATION AND GENERALIZATION OF SELF-INSTRUCTIONAL SKILLS

by

KATHERINE ALMAND SMITH

B.S.Ed., University of Georgia, 2007

M.Ed., University of Georgia, 2009

A Dissertation Submitted to the Graduate Faculty of The University of Georgia in Partial Fulfillment of the Requirements for the Degree

DOCTOR OF PHILOSOPHY

ATHENS, GEORGIA

2014

INITIATION AND GENERALIZATION OF SELF-INSTRUCTIONAL SKILLS

by

KATHERINE ALMAND SMITH

Major Professor: Kevin Ayres

Committee: Anne Marcotte
Alicia Davis
Jennifer Ledford
Scott Ardoin

Electronic Version Approved:

Julie Coffield
Interim Dean of the Graduate School
The University of Georgia
August 2014

DEDICATION

This is dedicated to Zach and to Bay, my favorite people in the whole world. To Zach, thanks for being the most supportive husband. There is no one I'd rather do life with. To Bay, you are simply the best. I cannot wait to have more time to spend with you.

ACKNOWLEDGEMENTS

Thank you to Kevin Ayres for being my advisor and for allowing me to work with you on your grant. Thank you for your support and feedback throughout the program and throughout the dissertation process and for all of the valuable opportunities you provided. Thank you to Jennifer Ledford, Anne Marcotte, and Alicia Davis for your feedback and support on my dissertation. Thank you to Sally Shepley for being an expert videographer for the videos used in my study and for helping to make school so much fun. I loved getting to work with you! Thank you to Jennifer Alexander for being the first person I go to for ideas, brainstorming, and feedback. I know it is rare to work this well and this easily with someone, and I'm thankful for you. Thanks for shooting videos, collecting reliability data, and for reading and re-reading everything I have ever written. You are by far my favorite person to work with, and I look forward to many more years of working together! Thank you to Mimi, Big Man, Grandmother, Grandaddy, and Beth for all of the time you spent with Bay to help me get where I am now. Without all of you, this would not have been possible. Lastly, thank you to the four students who participated in this study.

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER 1

INTRODUCTION AND LITERATURE REVIEW

Employment, independent living, and social involvement are all critical measures of post-school (i.e., measured for individuals who have aged out of the public school system) outcomes for individuals with and without disabilities (Bouck, 2012; Newman et al., 2011). Obtaining and maintaining employment is important because it can lead to increased financial independence (Newman et al., 2011), increased self-esteem (Newman et al., 2011), potential healthcare benefits, and opportunities to engage with other employees (Smith, see Appendix A). Living independently, defined as: "on their own or with a spouse, partner, or roommate" (Newman et al., p. 111) or semi-independently, defined as "living in a college dormitory, military housing, or group home" (Newman et al., p. 112) is important for individuals with disabilities after high school. Such living arrangements are an important consideration because individuals with disabilities may outlive their parents or caregivers on whom they rely for assistance. Also, Janus (2009) reported other issues that may occur when individuals with disabilities rely on caregivers or others for personal assistance in living situations including issues with confidentiality, sexual abuse, and caregivers who ignore the wishes of the individual. While independent living is important for many individuals, it is also important to consider the wishes of the individual with a disability, as some individuals may prefer to live with parents or other caregivers rather than alone or with a roommate. Lastly, social engagement of individuals with disabilities is another way in which successful transition into post-school settings is measured (Newman et al., 2011) and may be assessed by looking at factors such as friendship interactions and participation in group or community activities. Social engagement is important because it is associated with overall emotional health (Newman et al., 2011). Individuals with disabilities who are enrolled in public schools until their 22nd birthday have daily opportunities for social interaction. After high school, if these individuals are living at home, not engaged in post-secondary education, and unemployed, the quantity and quality of social engagement may be limited. As researchers have identified these factors (i.e., employment, independent living, social interaction) as important correlates with post-school outcomes for individuals with disabilities, further attention has been placed on the assessment and intervention on factors thought to influence post-school outcomes.

The National Longitudinal Transition Study 2 (NLTS2) reported data on post-school outcomes for individuals with disabilities (Newman et al., 2011). The NLTS2 includes information obtained through interview from individuals' with disabilities and their caregivers up to eight years after exiting high school. Specifically, researchers collected data on post-secondary education, employment, productive engagement in work or preparation for work, independent living, and social or community involvement (Newman et al., 2011). Only 37.2% of individuals with autism and 38.8% of individuals with intellectual disability (ID) were employed at the time of the interview. Additionally, 63.2% of individuals with autism and 76.2% of individuals with ID were temporarily employed at some time since high school. At the time of the interview, 17% of individuals with autism and 36.3% of individuals with ID lived independently, and 3.4% of individuals with autism and 0.2% of individuals with ID lived semi-independently. Equally as important, 45.8% of individuals with autism and 76.7% of individuals with ID living independently or semi-independently reported satisfaction with their current living arrangement. In terms of community involvement, Sanford et al. (2011) reported that only 48%

of individuals with autism and 62% of individuals with ID saw friends at least weekly outside of school or work.

Many of the statistics regarding outcomes for individuals with disabilities, specifically individuals with ID and/or autism are discouraging. Many of these individuals are struggling to obtain and/or maintain employment, do not have financial independence or health benefits through a full-time job, live dependent on the care of parents or others who may not be available in the future to provide the necessary assistance, or are not happy with their current living situations. Additionally, many individuals included in these statistics are not engaging regularly with others outside of the home, potentially negatively influencing their emotional health. With a reliance on others in many aspects of life, this adversely affects both the individuals with disabilities and the community around them. If post-school outcomes in any of these areas improved (e.g., more individuals employed, living independently, or engaging with others in the community), individuals with disabilities would be more independent of supports from others, and would possibly be more productive members of society.

Current Practices in Education for Individuals with Autism and ID

As employment, independent living, and social engagement are important indicators of post-school success, many practitioners teaching in middle and high school instruct in skills across these domains. According to the Individuals with Disabilities Education Act (2004), teachers are required to implement instruction using "research-based intervention, curriculum, and practices" (p. 2787). Many researchers have evaluated what interventions they consider "evidence-based." Odom, Collett-Klingenberg, Rogers, and Hatton (2010) identified 24 evidence-based practices (EBP) for instructing individuals with autism, and the National Secondary Transition Technical Assistance Center (NSTTAC) identified EBP for instructing individuals with disabilities in transition related skills (Test, Cease-Cook, Fowler, & Bartholomew, 2011). Odom et al. categorized EBP into interventions proven to be successful with academic skills, behavior, communication, play skills, social skills, and transitions. NSTTAC categorized EBP for teaching individuals a variety of skills including academic, safety, money, social, food preparation, and cooking skills (Test et al., 2011). While teachers' use of EBP for instruction of skills to be used in post-school settings (e.g., vocational skills, daily living skills, social skills) is important, it is also important to note that the use of EBP may end when instruction ends in the public school system as it is no longer required by law for practitioners to implement EBP. Time in public school settings is limited (i.e., until 22nd birthday); therefore, selecting efficient instructional strategies and selecting the most important skills to be taught are critical in this setting. While some debate exists whether this time should be spent teaching academic skills/core curriculum or focusing solely on functional and daily living skills (e.g., Ayres, Lowrey, Douglas, & Sievers, 2011), Bouck (2012) reported low rates for independent living and employment outcomes for individuals with moderate or severe ID despite curriculum used (i.e., academic or functional).

In addition to focusing heavily on specific skill selection and effective and efficient instructional strategies for individuals with disabilities, there is a need for researchers and practitioners to program for and frequently assess generalization of learned behaviors across novel settings, people, and materials (Stokes & Baer, 1977). Additionally, assessment of maintenance of behavior change over time is critical. If changes in behavior do not occur in the presence of differing conditions, and do not maintain over time, this does not result in a meaningful outcome for the individuals with whom the intervention was implemented. For example, if an instructor teaches an individual to pay for groceries in the classroom, and the individual learns the skill in only 3 sessions, but cannot use the skill in a real grocery store or without the teacher present, it is important to teach the skill in a different way. Despite the importance of generalization, many researchers using single-case design do not measure generalization (see Smith, Appendix B), and generalization and maintenance data are not factored into indicators evaluating studies to determine EBPs. In addition, many researchers do not program for generalization, and if they do, it is often by using "train and hope" methods (Stokes & Baer, 1977). Therefore, rather than continuing to focus solely on EBP to teach specific skills (academic or functional), or focusing on only acquisition of behaviors, researchers must begin evaluating instructional strategies to teach pivotal skills that lead to increased generalization across people, settings, stimuli, and time.

A pivotal skill is a skill that, once trained, will produce collateral effects in many areas (Koegel, Koegel, Harrower, & Carter, 1999). Frequently, individuals with autism require explicit instruction on a wide range of behaviors (Koegel & Frea, 1993) due to deficits in a number of areas including social, communicative (Koegel, Koegel, & McNerney, 2001), and often times adaptive behavior. To mediate this, practitioners can begin instructing on pivotal behaviors and increase efficiency in instruction, as collateral changes will occur in a number of areas as a result of the acquisition of a pivotal behavior. An example of a pivotal skill reported by Koegel et al. is initiating verbal interaction with peers or instructors. By initiating verbal interaction with peers or others, individuals with disabilities will have increased opportunities for social engagement and increased opportunities to learn new skills from others. One example of a pivotal behavior that may benefit individuals for post-school transition is the ability to self-instruct when presented with an untrained task.

Self-Instruction and Video-Based Instruction

One way to promote efficient instruction as students prepare for transition is to teach them to access self-instructional materials to learn new skills. Self-instruction has been defined as “The use of self-talk, printed instructions, or other materials that are used by the person alone rather than provided by the teacher. These instructions ‘set the occasion’ (i.e. are discriminative stimuli for the target behavior)“ (Browder & Shapiro, 1985, p. 204). Self-instruction is not limited to use by individuals with disabilities. Typically developing adolescents and adults use a variety of supports in the natural environment to self-instruct on a daily basis. Reading recipes from a cookbook, finding directions to a local restaurant on a handheld device, and watching an online video about how change the oil in your car are all examples of how people regularly self-instruct. One can Google “how to” and find a plethora of websites devoted to instructing through articles and videos with topics ranging from home and garden, finance and business, and sports and fitness. These self-instructional materials enhance individual’s daily lives and make people capable of completing tasks that they would otherwise not know how to complete (see Smith, Appendix A). Self-instructional materials for individuals with disabilities can reduce the need for intervention from an instructor while still providing the necessary information on how to complete multi-step tasks.

Researchers are continually evaluating ways to increase efficiency of instruction. Although there are a variety of instructional strategies to teach individuals with disabilities novel skills (e.g., constant time delay, system of least prompts, most to least prompting; Wolery, Ault, & Doyle, 1992), researchers continuously pursue other methods that may be more cost and/or time efficient while ensuring acquisition of skills. Researchers have found video-based instruction (VBI) to be an effective instructional strategy for teaching new skills to individuals with disabilities (for reviews see Ayres & Langone, 2005; Bellini & Akullian, 2007; Mason et al., 2012). In pursuit of efficiency, researchers began to compare VBI, such as video modeling, to other strategies (e.g., Charlop-Christy, Le, & Freeman, 2000; Cihak, Alberto, Taber-Doughty, & Gama, 2006). Charlop-Christy et al. (2000) reported that when comparing video modeling to in vivo modeling, video modeling was more efficient. Additionally, Mason et al. (2012) stated that even if outcomes between in vivo instruction and VBI were the same, there were instructional benefits to using video which included time and cost.

Video-based instruction has been used both as an instructor-delivered intervention and as a self-instructional tool. As previously mentioned, self-instruction can increase efficiency by providing an opportunity for individuals to learn new skills without intervention from an instructor. For example, when instructors teach individuals a task-specific skill (e.g., making the bed) without teaching them to self-instruct, the individual can complete that specific skill (e.g., make the bed) and can possibly generalize to novel materials, settings, or people. Alternatively, if the individual learns to use a handheld device to view and imitate videos (i.e., of functional skills such as making the bed), the individual can learn a self-instructional skill that may lead to him or her learning a variety of other skills independent of instructor intervention. Therefore, an instructor has a choice between spending time teaching an individual task-specific skills (e.g., making the bed), or how and when to self-instruct, which will ultimately have collateral effects on other areas of the individual's life. Video-based instruction may be a valuable tool for self-instruction.

Video-based instruction (including video modeling and video prompting) has been used to teach a daily living skills (e.g., Bereznak, Ayres, Mechling, & Alexander, 2012; Mechling, Gast, & Fields, 2008) and social skills (e.g., Buggey, Hoomes, Sherberger, & Williams, 2011) to individuals with ID and/or autism. Researchers have presented video modeling and video prompting on televisions (e.g., Haring, Kennedy, Adams, & Pitts-Conway, 1987), computers (e.g., Mechling, Pridgen, & Cronin, 2005), and handheld devices (e.g., Bereznak et al., 2012; Smith, Ayres, Mechling, & Smith, 2013). While using handheld devices increases the environments in which one can use VBI (e.g., it can be taken with you into the community), handheld devices were once considered extremely expensive, and therefore, an impractical tool for instruction. In recent years, researchers have increasingly used handheld devices when working with individuals with disabilities (Mechling, 2011). In a review of the literature from 2000-2010, Mechling (2011) identified 21 studies using portable or handheld electronic devices with individuals with developmental disabilities. Mechling noted that with the increasing availability and decreasing expense of portable devices such as cell phones/smart phones, they may be a highly accessible tool for individuals with disabilities with a number of uses in addition to VBI (e.g., making phone calls, sending text messages, using maps features to find nearby locations, etc.). While Mechling reported that there are still barriers to access of handheld devices (including cost for some individuals) the frequency with which they are being used is increasing.

Most research using VBI has focused on instructor-delivered VBI (e.g., Hammond, Whatley, Ayres, & Gast, 2010; Mechling & Ayres, 2012). Many researchers have recently shifted towards increasing participant involvement in using handheld devices as materials with which to self-prompt or self-instruct with video (e.g., Bereznak et al., 2012; Burke et al., 2013; Mechling, Gast, & Seid, 2010; Mechling & Savidge, 2011; Mechling & Seid, 2011; Payne, Cannella-Malone, Tullis, & Sabielny, 2012; Taber-Doughty, Miller, Shurr, & Wiles, 2013). In most of these studies, researchers taught participants to self-instruct or self-prompt in history training and then measured a daily living or multi-step task. Procedurally, the handheld device was unavailable in baseline and then available in intervention (e.g., Bereznak et al., 2012; Burke et al. 2013; Taber-Doughty et al., 2013). Other researchers waited until intervention to introduce and instruct participants on the use of the handheld devices (e.g., Cannella-Malone, Brooks, & Tullis, 2013; Payne et al., 2012). Data were only provided in a handful of studies on the participants' self-instruction (e.g., Cannella-Malone et al., 2013; Payne et al., 2012). In the majority of the studies, researchers only provided data related to the completion of steps within the daily living or vocational skills when participants viewed video models or prompts.

Despite the fact that greater independence from instructor supports is the terminal goal of teaching self-instruction, in all available studies teaching individuals to self-instruct or self-prompt, researcher instruction was a component present in every session of each study. Most of the time, the handheld device was given to the participants while the task direction was provided, making it impossible to ascertain whether or not the participant would independently locate the handheld device in the presence of an unknown skill (e.g., Cannella-Malone et al., 2013; Mechling & Seid, 2011; Payne et al., 2012; Taber-Doughty et al., 2013). In many studies, the participants were verbally instructed to use the handheld device when provided the task direction, raising the question of whether or not individuals would independently self-instruct without verbal instructions when presented with an unknown task (e.g., Cannella-Malone et al., 2013 Payne et al., 2012). Most researchers turned on the handheld devices and set it to the correct screen so the participant only had to push the button to advance the slide to the next screen. Without requiring the participant to navigate to the correct video, researchers are unable to report if they could locate the correct videos in the presence of an unknown task (e.g., Mechling, Gast, & Seid, 2010; Taber-Doughty et al., 2013). Lastly, some researchers evaluated methods for teaching participants a task specific skill (e.g., making popcorn), and then evaluated participants' use of self-instruction for the same task they previously learned (e.g., making popcorn; e.g., Payne et al., 2012, Cannella-Malone, 2012). Therefore, the participants learned to self-instruct on skills already in their repertoires. This poses a problem as the terminal goal is for participants to self-instruct for unknown or partially known tasks, rather than self-instructing on skills already in their repertoire.

Purpose of Study

The purpose of the current study was to fill gaps in the literature (e.g., lack of learner independence in instruction, lack of generalization of self-instruction) related to identifying effective ways to teach individuals with disabilities a pivotal skill that may increase access to employment, independent living, or social opportunities. That is, for individuals with ID and/or autism, this study is designed to evaluate the effects of progressive time delay (PTD) on the initiation of self-instruction when presented with untrained vocational, daily living, or social tasks. Progressive time delay is an evidence-based response prompting procedure, which has been used to teach a variety of tasks to individuals with disabilities (Odom et al., 2010; see Walker, 2008 for studies using PTD). The acquisition of the pivotal skill of self-instruction for individuals with disabilities has the potential to create meaningful outcomes in their lives. In this study, self-instruction was defined as the participant independently (a) initiating the removal of the iPhone from his pocket, (b) engaging in the task analysis for navigating to the correct video model, and (c) completing more of the daily living or vocational skill than he did in the last session with that skill. The initiation of self-instruction was defined only as the participant removing the iPhone from his pocket following a task direction.

CHAPTER 2

METHOD

Research Questions

The research questions were as follows: (a) Will PTD be effective in teaching participants to initiate self-instruction by independently accessing the iPhone? (b) If participants acquire initiation of self-instruction, will they independently and correctly navigate to and view the video model? (c) Will the acquired self-instructional response (including both initiation of self-instruction and navigating to, viewing the correct video, and improving performance on the daily living or vocational skill) in one setting generalize to another setting without instruction in the second setting? (d) If participants acquire self-instruction with a task direction provided by one instructor, will the response generalize to self-instruction when another instructor provides a task direction? And (e) Will participants acquire untrained daily living and vocational skills after viewing video models?

Participants

Participants included four high school students receiving special education services in a self-contained classroom for students with autism in a public school within a large public school system. Participants met the following inclusion criteria according to teacher report, file review, or direct assessment to participate in the study: (a) ability to attend to a task for 5 minutes, (b) fine motor ability to navigate an iPhone, (c) fine motor ability to complete each individual step of task analyses for vocational and daily living skills, (d) ability to imitate a video model, (e) have individualized education program (IEP) goals related to acquisition of vocational and/or daily living skills, (f) adequate vision and hearing (as assessed through school evaluation), and (g) inability to initiate the use of self-instruction on an iPhone which was assessed in the screening process.

Three of four participants received special education services under dual eligibilities of autism and speech language impairment, while one participant's eligibility was autism. The participants ranged in age from 15 years 7 months to 19 years 2 months. Table 1 displays individual information about participants' scores for cognitive ability, adaptive behavior, and autism ratings.

Alex and Jeremy had previous experience playing games on both an iPhone and iPad, and John had experience playing games on his parents' iPhone at home. Dan did not have experience using an iPhone or iPad prior to the study. No participant had previously received instruction using video modeling or PTD.

Settings and Instructional Arrangement

Sessions in screening, baseline, intervention, generalization, and maintenance occurred in one of three settings within the public school participants attended: (a) an outside courtyard, (b) kitchen area of daily living center, or (c) an office area in the daily living center. Each setting provided participants an opportunity to complete a variety of vocational or daily living skills. The courtyard was located directly outside the participants' classroom. Students had the opportunity to eat lunch and socialize in the courtyard. This area included approximately 15 tables with attached benches on all sides of square tables and two sides of rectangular tables. The participants' classroom included two sections set apart by room dividers. One half of the classroom included tables, desks, and other materials used for functional academic instruction. The second half of the classroom contained the daily living center with a fully functional kitchen.

Both the kitchen setting and office setting were in the second part of the classroom, the daily living center. The area included one rectangular table with two chairs, three stoves, three sinks, a refrigerator, a microwave, and a toaster oven. See Figure 1 for a diagram of the layout of the daily living center. History training occurred in the daily living center at the rectangular table. Any participants not engaged in the study were unable to hear or see what the engaged participant was doing as all other participants remained in the part of the classroom used for functional academics.

All sessions occurred in a 1:1 arrangement with the participant and either the researcher or the classroom teacher. The researcher conducted screening, history training, baseline, intervention, and maintenance sessions while the classroom teacher conducted generalization sessions. A second observer was present in some sessions to collect reliability data. The researcher was present in the room (for sessions in the daily living center or office) or in the courtyard (for sessions taking place outside) for all conditions, but stood as far away as possible from the participant while still being able to view the iPhone for reliability purposes in generalization sessions where the classroom teacher served as the instructor.

Materials

Self-instructional materials. Participants used a white iPhone4s to access video models. The iPhone had a total of 20 application icons on the first screen, including one labeled "videos" where all video models were located. The icon for videos was in the top right corner of the iPhone screen and remained in the same location throughout the duration of the study. A graduate student filmed each of the daily living or vocational skills using a Canon – EOS Rebel DSLR camera with video capabilities. The graduate student shot all videos using point-of-view perspective (i.e., the videos were shot from the perspective of the participant and only the actor's hands/arms were in frame), while the author acted in each of the videos; only hands/arms were visible. Each video lasted no more than 45 s. The author edited all videos using iMovie software. Each step of the skills depicted in the videos included audio narration describing the target behavior (e.g., "Open lemonade packet"). To create this, during editing, the researcher paused the video for 1 s permitting enough time for narration of each step. The researcher instructed each participant to place the iPhone in his pocket before beginning each session. The purpose of this was to replicate what would occur in typical environments outside of the research study (i.e., many people carry an iPhone in their pockets and remove it when they need information).

In history training, the researcher provided participants with printed thumbnail images paired with written words describing each task used to represent each video model on the iPhone. The researcher created thumbnail images by taking screen shots or freeze frames from the videos shot of each individual skill. The thumbnail images included all of the materials present for the task (i.e., all materials listed in Table 2 for any individual skill). The researcher printed, cut out, and glued each image to 3 in. x 5 in. notecards. The name of the skill was placed next to each image, identical to images in the video application on the iPhone (see Figure 2 for sample image). The researcher placed notecards on the table so she could assess (and instruct if needed) participants' receptive identification of pictures and words representing the different skills.

Daily living and vocational skill materials. Each video model loaded on the iPhone had corresponding materials used for completing the individual tasks. In screening, baseline, intervention, maintenance, and generalization sessions, the materials necessary to complete the daily living or vocational skill were present in the environment, and the participant was oriented towards materials before the task direction was provided. Additional distractor materials present in the setting included materials in a typical environment in which the participant would use the skills. That is, when a participant walks into a kitchen in his home, the materials for making lemonade are not typically alone on the counter (e.g., materials to make lemonade may be stored in cabinets, or they may be on the counter next to mail, canisters, a coffee maker, or other materials often found in kitchens). Table 2 provides a list of the skills and corresponding materials (some tasks were adapted from Smith et al., 2013).

Data collection materials. Data were collected on researcher-created data sheets (see Appendix C). The researcher kept all data sheets in a research binder. The researcher used individual data sheets created for each condition. In addition, video recordings of select sessions occurred for reliability purposes. The researcher recorded sessions with an iPhone5.

Response Definitions and Recording Procedures

Data collection occurred in each of the three settings for screening, baseline, intervention, generalization, and maintenance. For history training, data collection occurred in the daily living center only. The primary dependent measure in the study was independent initiation of self-instruction (i.e., removing iPhone from pocket) contingent on the researcher providing a task direction for an untrained skill.

Data collection occurred for three measures in baseline, intervention, generalization, and maintenance: independently accessing the iPhone, navigating to the correct video, and the completion of correct steps on each vocational and daily living skill. In screening, data collection occurred on independent identification of pictures of thumbnail images, independently accessing the iPhone, navigating to the correct video, and independent completion of daily living and vocational skills. The researcher served as primary data collector in screening, baseline, intervention, maintenance, and post-generalization conditions and stood directly to the left of the participant (i.e., within 3 feet) to ensure she could view the iPhone screen as the participant navigated to the correct video. In the generalization conditions, the classroom teacher served as the primary data collector standing directly to the left of the participant, and the researcher stood away from the session but within view to help the classroom teacher if necessary.

Identifying pictures of thumbnails. In screening, data collection occurred on participant's receptive identification of pictures of thumbnail images paired with written words describing each task when given task directions related to each skill. Correct responses occurred when participants touched or picked up the correct picture within 10 s of the task direction. Participants identified each image correctly for two trials before viewing that video in baseline, intervention, generalization, or maintenance conditions.

Initiation of self-instruction. The primary dependent measure for this study was initiation of self-instruction by accessing the iPhone within 5 s of the presentation of a task direction. Assessment of this response occurred once for each participant in screening, and multiple times in each setting during baseline, intervention, generalization, and maintenance conditions. Initiation of self-instruction occurred when the participant removed the iPhone from his pocket within 5 s (or within allotted delay interval during intervention) of a task direction. There were five possible responses recorded for the initiation component of self-instruction: (a) unprompted correct, (b) prompted correct, (c) unprompted incorrect, (d) prompted incorrect, and (e) no response. See Table 3 for definitions and the conditions in which the response may have occurred. Only unprompted correct responses counted toward criterion and were graphed. Instruction in intervention (i.e., PTD) occurred solely on the use of self-instruction.

Navigating the iPhone. After removing the iPhone from his pocket, the participant had to navigate to the correct video in order for self-instruction to occur. Data collection occurred for the percent of steps completed correctly for navigating to and playing the correct video on the iPhone (see Table 4 for task analysis). Participants learned this skill before baseline sessions, but as this skill is critical to self-instruction, the researcher monitored performance to ensure that remediation was unnecessary. Each of the five steps in the task analysis was correct if the participant independently completed the steps within 50 s of removing the iPhone from his pocket.

Daily living and vocational skills. In screening, intervention, generalization post-test, and maintenance, data were collected on the percent of steps completed correctly on untrained daily living and vocational skills (see Table 2 for examples of task analyses of daily living and vocational skills). Steps completed within 30 s of the completion of the video model were correct and could occur in any order (i.e., if it did not deter from the final product). Data were summarized as the percent of steps completed correctly.

Experimental Design

A multiple probe design across settings embedded in a multiple probe across participants (Gast & Ledford, 2010) was used to evaluate the effectiveness of PTD to teach participants to self-instruct on untrained daily living and vocational skills (see Figure 3 and Figure 4). The multiple probe design across settings allowed for monitoring of generalization across settings but also allowed documentation of experimental control. The multiple probe design across participants allowed for evaluation of a functional relation between PTD and self-initiation. In order to determine if instruction was necessary for a given daily living or vocational skill, the participant had to demonstrate that it was not in his repertoire. Therefore, in each session, the daily living or vocational skill targeted was one in which the participant completed 50% or less of total steps during screening or previous sessions. That is, the same skill could be used multiple times if the participant did not demonstrate that he could complete over 50% of the steps without instruction from the researcher. The order of settings in which intervention occurred was counterbalanced across participants (see Table 5).

Baseline data collection occurred on each participant's initiation of self-instruction for different skills across three settings. When a zero-celerating trend occurred for at least three sessions for initiation of self-instruction, intervention began with the first participant for initiation of self-instruction in Setting 1. No data collection occurred in Settings 2 or 3 for the first participant, nor for any setting for the second, third, and fourth participant, until the first participant met mastery criteria in Setting 1 for self-instruction. Mastery criteria included independently initiating, navigating to, and viewing the correct video model as well as increasing performance on the daily living or vocational skill from previous sessions for at least three sessions. When the first participant met criteria for self-instruction in Setting 1, baseline probes occurred for all participants in all three settings, and then intervention began for the second participant in Setting 1 while the third and fourth participant remained in baseline. If a participant generalized the self-instructional response to a setting in which instruction did not occur (i.e., while the researcher was the instructor), instruction did not occur in that setting. If the participant generalized self-instruction to one untrained setting but not the other, intervention occurred for the setting in which generalization did not occur. If a participant did not generalize to Settings 2 and 3 after instruction in Setting 1, intervention occurred for initiation of self-instruction in Setting 2. Following mastery of self-instruction in any setting during intervention, probes were conducted in Settings 1, 2, and 3 to assess for maintenance of already acquired settings and generalization of untrained settings.

The study was designed to evaluate methods for teaching individuals to independently self-instruct, rather than the researcher providing instruction or the researcher telling participants to self-instruct in every session. That is, the removal of the iPhone from the participant's pocket was critical to his long-term independence with self-instruction. Although initiation may have been the most important component, one cannot determine that an individual has self-instructed unless he or she viewed the correct video model. Therefore, mastery criteria for the study included initiating a self-instructional response, viewing the correct video model, and improved performance on the daily living or vocational skill from previous sessions. It was also critical that the self-instruction was effective in order for the intervention to be meaningful for the participant; therefore, data collection occurred on the percent of steps completed correctly for each daily living and vocational skill the participant completes. So, while PTD specifically targeted the initiation component of self-instruction, navigating to the correct video and improving performance on the daily living or vocational skill by at least one step were components of mastery of the skill.

Procedures

Before beginning any procedures described herein, the researcher spent three 1-hour periods in the participants' classroom to minimize adaptation threats to internal validity. Sessions were conducted 1-2 times per day for 3-4 days each week. Sessions in the same setting conducted within the same day occurred at least 1 hour apart. Sessions occurred between 12:00 PM and 2:00 PM due to scheduling needs of the classroom teacher. The researcher video recorded select sessions for reliability data collection. Table 6 shows the order of conditions. In baseline, intervention, and maintenance conditions, the researcher provided a task direction for an untrained daily living or vocational skill in each session (see list of skills in Table 1). The researcher randomly selected the skill in each session from skills the participant had completed with 50% or less accuracy in a previous session (i.e., in any condition). If the participant previously completed the skill with more than 50% accuracy, that daily living skill was not presented in subsequent sessions. If the researcher presented a skill and the participant did not engage in a response (e.g., the participant did not self-instruct and therefore did not engage with the daily living or vocational skill materials) or completed less than 50% of the steps correctly, the researcher could present the same daily living skill during a subsequent session.

Screening. The primary researcher conducted screening on both the vocational and daily living skills, which participants later viewed in video models and initiation of self-instruction.

Screening for vocational and daily living skills. The purpose of screening vocational and daily living skills was to identify a variety of skills not currently in the participant's repertoire. That is, instruction would not be necessary unless the participants could not independently perform the skills. If they could already perform the skills, it would be inefficient to view a video model of the skill before engaging in the task. Therefore, screening occurred for each of the vocational or daily living skills that might have been instructed through video modeling. The researcher assessed participant's performance on a minimum of 30 skills (i.e., 10 for each setting). Each skill was screened in the environment in which it would be used (e.g., screening for making lemonade occurred in the kitchen area of the daily living center and screening for addressing an envelope occurred in the office area of the daily living center). The researcher provided materials necessary for completing each task along with distractor materials. The researcher provided a task direction related specifically to the skill being probed (e.g., "Address an envelope") and the participant had 30 s to interact with materials for each skill. All correct responses during the 30 s time period were recorded. After 30 s, the researcher ended the probe session and told the participant "good job" regardless of performance. Only skills in which a participant completed 50% or less of steps correctly were used in baseline, intervention, maintenance, and generalization sessions. Therefore, participants were taught different skills based on their performance in screening.

Screening for initiation of self-instruction. Screening occurred to ensure that participants did not already have the initiation of self-instruction in their repertoire. The researcher asked each participant to engage in a daily living or vocational skill that he was unable to complete as identified through the screening of daily living and vocational skills. The purpose of this was to ensure that the participant needed instruction to complete the given response. First, the researcher met with the participant and asked him to put the iPhone in his pocket. The researcher then told the participant to continue whatever activity in which he was previously engaged. The purpose of this was to represent typical environments (outside of school) where the participant would have an iPhone already in his pocket before engaging with untrained tasks that may require self-instruction. After a minimum of 3 min and no more than 10 min, the researcher asked the participant to come to the selected location (e.g., daily living center). If at any time between the participant putting the iPhone in his pocket and beginning the session he took the phone out of his pocket, the researcher verbally instructed him to place it back in his pocket, and then the 3 min minimum restarted. Once in the screening location, the researcher oriented the participant towards the materials necessary for completing the daily living or vocational skill. The researcher provided the task direction related only to the vocational or daily living skill response (e.g., “Make lemonade”), without mentioning the use of the iPhone and waited 5 s for the participant to initiate self-instruction. In order to participate in the remainder of the study, the participant could not independently initiate the self-instructional response within 5 s of the task direction. If the participant did not engage in this response, the session was ended and the participant was included in the remainder of the study. If the participant began to interact with the materials for the daily living or vocational skill, the researcher immediately interrupted, recorded that the participant did not initiate the use of self-instruction, and ended the session.

History training. The purpose of this condition was to ensure that each participant had the necessary prerequisite skills to participate in the study. In history training, participants were assessed on their ability to independently navigate to videos on an iPhone and on their ability to match verbal task directions (e.g., "Make lemonade") to pictures of corresponding video thumbnails (e.g., picture of lemonade pitcher and cup) paired with words describing the task. To assess for proficiency at navigating to videos, the researcher provided the participant with an iPhone and provided a task direction (e.g., "Watch a video about setting up a board game"). The researcher waited 50 s (10 s for each of 5 steps) for the participant to complete the response. If he did not complete the response within 50 s, training was provided. To assess for the ability to independently match task directions to pictures of video thumbnail images paired with words, an array of 10 thumbnail images glued to notecards with words describing the task glued next to the pictures were placed on a table. The researcher assessed for receptive identification by providing a task direction (e.g., "Find making lemonade") and waiting 10 s for the participant to select a picture. Training occurred for each image until the participant correctly identified the picture from an array of 10 for two sessions. If a participant was already proficient at navigating to videos on an iPhone and/or could independently match task directions to pictures of video thumbnails paired with words, history training did not occur for that skill for that participant. If a participant could not complete either of these two skills, history training occurred for whichever skills were not in his repertoire.

To teach participants to use an iPhone to navigate to video models, a system of least prompts procedure was used. History training sessions began by handing the iPhone to the participant and providing a task direction (e.g., "Watch a video about making coffee"). If the participant engaged in a correct response within 10 s of the task direction, the researcher provided a general praise statement (e.g., "Good job") and waited 10 s for the participant to initiate the next step of the task analysis. If the participant engaged in an error or did not respond within 10 s of the task direction, the researcher provided a verbal prompt (e.g., "Push home button"). If the participant completed the step within 10 s of the verbal prompt, the researcher waited 10 s for the participant to initiate the next step in the task analysis. If the participant engaged in an error or non-response within 10 s of the verbal prompt, a full physical prompt was used to ensure correct responding. Praise was provided to the participant contingent on each independent response (i.e., FR1) and once at the end of the session. After one session of 100% correct responding on all steps, the researcher provided praise for every other independent response (i.e., FR2) and once at the end of the session. After one session at 100% independent responding on a FR2 schedule of reinforcement, the researcher provided praise only at the end of the task analysis (e.g., FR5).

For identifying thumbnail images, all images were first probed to assess which responses were already in each participant's repertoire. For images the participant did not independently identify, one 0 s delay trial was conducted. In the following trials, the researcher provided the task direction and waited 10 s for the participant to select the correct picture. If the participant did not respond or engaged in an error, a gesture prompt was provided to the correct picture. After meeting criteria for identification of images (i.e., correct identification for 2 consecutive trials from a field of 10) and for navigating to the correct video (100% on FR5 schedule of reinforcement for 1 session with 3 consecutive sessions at 100%), the participant proceeded to baseline.

Baseline. The purpose of the baseline condition was to provide a condition with which to compare the intervention condition. Baseline sessions were conducted in each of the three settings for each participant. At least 3 min and no longer than 10 min prior to starting each session, the researcher asked the participant to place the iPhone in his pocket. The session began after the participant and researcher arrived in the assigned location. To begin, the researcher oriented the participant towards the materials and provided a task direction related to the untrained skill (e.g., "Make lemonade"). The participant was given 5 s to initiate self-instruction by removing the iPhone from his pocket. If the participant completed the initiation response, the participant had an opportunity (i.e., 10 s for each of 5 steps) to navigate to the correct video and complete the daily living or vocational skill. Participants were not expected to independently initiate self-instruction in baseline because screening occurred for this same response before baseline began. If the participant did not initiate the use of self-instruction by leaving the iPhone in his pocket for 5 s after the task direction, the researcher immediately ended the session and provided general praise (e.g., "Good job working with me today").

Baseline sessions were conducted for all three settings, so when the participant did not remove the iPhone from his pocket, the researcher asked the participant to follow her to the next location. The order of baseline sessions in each setting was randomized. The researcher allowed for at least 3 min between sessions across locations in which a participant removed the iPhone from his pocket (to allow for 3 to 10 min with the iPhone in his pocket before a task direction is provided). After the last baseline probe session was conducted for that day, the researcher asked the participant to return the phone and escorted him back to class. Baseline sessions were conducted for a minimum of three sessions without initiation of self-instruction before intervention was introduced to the first participant in the first setting.

Progressive time delay. Before beginning each session, the participant placed the iPhone in his pocket (see baseline procedures for additional details) and was brought to the setting in which instruction would occur. Progressive time delay was used in which the delay interval gradually increased in one second increments from 0 s to 5 s. For 0 s delay sessions, the researcher provided a task direction for a skill (e.g., "Make lemonade"), and then immediately provided the controlling prompt; a verbal prompt (i.e., "Get your phone out and watch a video about how to make lemonade"). If the participant removed the phone within 5 s of the prompt, the researcher allowed the participant 50 s to navigate to the correct video. If the participant responded incorrectly after the verbal prompt (i.e., error or non-response within 5 s), the session was ended and the next PTD session remained at a 0 s delay. If the participant responded correctly within 5 s of the verbal prompt, the delay interval for the next PTD session increased to 1 s.

For 1 s, 2 s, 3 s, 4 s, and 5 s delay sessions, the iPhone was placed in the participant's pocket as described in baseline procedures. For 1 s delay sessions, the participant was given a task direction related to an untrained daily living or vocational skill (e.g., "Make lemonade"), and the researcher waited 1 s to provide the verbal prompt. If the participant initiated a correct response within 1 s of the task direction, the researcher allowed the participant 50 s to navigate to the correct video. If the participant did not respond to the task direction by removing the phone from his pocket within 1 s, a verbal prompt was provided and the researcher waited 5 s for the participant to remove the iPhone from his pocket. If the participant responded correctly to the verbal prompt to remove his phone, the participant was given 50 s to navigate to the correct video. If the participant did not respond correctly within 5 s of the verbal prompt to remove his phone, the session ended and the participant did not have an opportunity to navigate to the correct video or to engage in the daily living or vocational skill. If the participant engaged in an error before the prompt, the researcher immediately delivered the verbal prompt. If the participant engaged in a prompted or unprompted correct response (without first engaging in an error) for initiation of self-instruction, the delay interval for the following session increased by 1 s. All 2 s, 3 s, 4 s, and 5 s delay trials occurred with the same procedures, with the only difference being the delay interval. This continued until a 5 s delay was reached or the participant met mastery criteria. Mastery criteria was set at 3 sessions (at least 2 consecutive) with (a) unprompted correct initiation of self-instruction, (b) 100% correct navigation to the correct video model, and (c) improved performance on the daily living or vocational skill by at least one step.

Generalization. Generalization assessment occurred in two ways. Generalization across settings was assessed through the experimental design by using a multiple probe across both participants and settings. The second way generalization was assessed was across instructors. For generalization across settings, training occurred in only one setting at a time. After mastery of the self-instruction in one setting (i.e., initiation, navigation, and improving performance on daily living or vocational skill), the researcher probed responding in all settings. This allowed the researcher to assess if generalization across settings occurred without instruction, and additionally, to provide instruction if it did not.

In addition to assessing for generalization across settings, generalization across instructors was assessed in a pre-post test using untrained daily living and vocational skills. The purpose of assessing generalization across instructors was that the researcher was not the typical instructor in the participant's environments and, after completion of the study, would not be present with the students on a daily basis. Without assessment for generalization to a familiar person, it is possible that the researcher may have become the discriminative stimulus for self-instruction rather than the task direction for an untrained skill from anyone in their environment. Therefore, generalization across instructors was assessed with the participant's classroom teacher once before baseline and once after the participant acquired initiation across all three settings. Generalization across instructor sessions were identical to baseline sessions except that the classroom teacher was standing to the left of the participant to provide the task direction and have a view of the iPhone screen.

Maintenance. Maintenance sessions occurred for previously mastered settings and were identical to baseline sessions. The researcher continued to probe maintenance for each setting when the participant or other participants mastered skills in intervention until all settings were in the maintenance condition (see Table 4). A maintenance probe also occurred once at the end of the study (one week after all participants met criteria in all settings).

Interobserver Agreement

Interobserver agreement (IOA) was collected and reported for a minimum of 20% of sessions across baseline, intervention, generalization, and maintenance conditions for all participants. Interobserver agreement was calculated and reported individually for initiation of self-instruction, percent of steps independently completed for navigating to the correct video, and percent of steps independently completed of the untrained daily living or vocational skill for each participant. Interobserver agreement was calculated using point-by-point agreement by taking the total number of agreements and dividing by the total number of agreements plus disagreements and multiplying by 100 (Ayres & Gast, 2010). Because the response for initiation of self-instruction was recorded as a yes or no, IOA for each session for that skill was 0% or 100%.

Procedural Fidelity

Procedural fidelity data were collected and reported for a minimum of 20% of sessions across baseline, intervention, generalization, and maintenance conditions for all participants. Procedural fidelity data were calculated by dividing the number of correct researcher or teacher behaviors by the total number of expected researcher or teacher behaviors and multiplying by 100 (Ayres & Gast, 2010). Procedural fidelity data were recorded for the following researcher or teacher behaviors in baseline, generalization, and maintenance conditions: (a) correct materials for daily living and vocational skills were available and in view of participant, (b) iPhone was available and set up correctly (i.e., the phone is turned on, the home screen is locked, correct videos were loaded on phone), (c) iPhone was in participant's pocket 3 min and no more than 10 min prior to the session beginning, (d) the correct task direction was provided, (e) no prompting was provided by the researcher/classroom teacher throughout the session, (f) the participant was given 5 s to initiate self-instruction by removing the phone from his pocket, (g) if the participant did not remove the phone from his pocket, the session is ended and all subsequent steps for procedural fidelity were be scored as not applicable (NA), (h) if the participant removed the iPhone from his pocket, he was given 50 s (i.e., 10 s for each step) to access and play the correct video (and additional time to view the selected video), (i) if the participant viewed the correct video, he was given 30 s to complete the vocational or daily living skill, and (j) the participant was provided general praise at the end of the session regardless of performance.

Procedural fidelity data were recorded for the following researcher behaviors in intervention: (a) correct materials for daily living and vocational skills were available and in view of the participant, (b) iPhone was available and set up correctly (i.e., the phone was turned on, the home screen was locked, correct videos were loaded), (c) iPhone was placed in the pocket of the participant at least 3 min and no more than 10 min prior to the session beginning, (d) the correct task direction was provided, (e) prompt was provided on the correct delay interval if the participant made an error or engaged in a non-response, (f) no prompting was provided if the participant engaged in a correct response within the allotted delay interval, (g) if the participant removed the iPhone from his or her pocket with or without prompting, the researcher allowed 50 s to access and play the correct video, (h) if the participant did not independently access the correct video, (i) when the participant viewed the correct video, he was given 30 s to complete the vocational or daily living skill, and (j) participants were provided general praise at the end of the session regardless of performance.

Table 1

Participant Information

Participant	Age	Eligibilities	IQ	Adaptive Behavior Scale	Autism Rating Scale
Jeremy	17 yr 3 mo	ASD; SLI	72 (WISC-IV)	69 (Vineland-II-teacher) 59 (Vineland-II-parent)	20 (CARS-teacher) 39 (CARS-parent)
John	19 y 2 mo	ASD	43 (WISC-IV)	65 (ABAS-II-teacher) 87 (ABAS-II-parent)	33.5 (CARS)
Dan	17 yr 10 mo	ASD; SLI	62 (WISC-IV)	44 (ABAS-II-teacher) 50 (ABAS-II-parent)	64 (GARS-teacher)
Alex	15 yr 7 mo	ASD; SLI	44 (SB5)	57 (Vineland-II)	111 (GARS-teacher) 74 (GARS-parent)

Table 2

Daily Living and Vocational Skills and Corresponding Materials

Courtyard		Kitchen		Office	
Task	Materials	Task	Materials	Task	Materials
Set up board game 1. Open box 2. Put game board flat on table 3. Put stack of cards on game board 4. Put 1 player piece on board 5. Put 2nd player piece on board	• Board game	**Prepare a potato for baking** 1. Place potato on foil square 2. Cover potato with foil 3. Use fork to put holes in potato 4. Use fork to put holes in potato again	• Potato • Foil • Fork	**Collate and Staple** 1. Pick up first paper 2. Place second paper behind first paper 3. Place third paper behind second paper 4. Stack papers 5. Staple papers in top left corner	• 3 pieces of numbered papers • Stapler with staples
Hang up streamer 1. Tear off streamer 2. Get 1 piece of tape 3. Tape 1 side of streamer to table 4. Get a second piece of tape 5. Tape other side of streamer to table	• Streamer • Tape	**Put salsa in bowl** 1. Twist off top 2. Pour salsa in bowl 3. Put top on salsa	• Salsa • Bowl	**Address an envelope** 1. Take off address label 2. Put in middle of stuffed envelope 3. Take off stamp 4. Put in top right corner of stuffed envelope	• Stuffed and sealed envelope • Stamps • Address labels
Set up tablecloth 1. Open bag 2. Take out tablecloth 3. Shake out tablecloth 4. Lay tablecloth flat on table	• Table cloth in ziplock bag	**Make lemonade** 1. Turn on water 2. Fill cup between ½ and ¾ full 3. Turn off water 4. Open lemonade packet 5. Pour packet in cup 6. Stir	• Cup • Spoon • Sink/faucet • Lemonade packet	**Prepare a Letter** 1. Fold paper 1/3 down 2. Fold paper 1/3 up 3. Put paper in envelope 4. Take top off glue 5. Wet seal of envelope 6. Close envelope	• Paper • Envelope • Glue stick
Prepare a place setting 1. Put plate on table 2. Put napkin on table to the left side of the plate 3. Put fork on napkin 4. Put spoon on right side of the plate	• Plate • Fork • Spoon • Napkin	**Grease a pan** 1. Take top off cooking spray 2. Shake can 3. Spray bottom of pan 4. Spray sides of pan 5. Put top back on cooking spray	• Cooking spray • Baking pan	**Organize the binder** 1. Put 2 pieces of paper in hole punch 2. Punch holes in paper 3. Open binder 4. Open rings 5. Put papers in binder 6. Close rings	• Binder • Paper • Hole punch
Put out name cards 1. Put name card on plate 1 2. Put name card on plate 2 3. Put name card on plate 3	• 3 name cards • 3 plates	**Get 1 cup of water** 1. Turn on water 2. Put 1 cup under water 3. Fill cup to top 4. Turn off water after filling correct amount	• Measuring cups • Sink/faucet	**File notecards** 1. Open box 2. Put first card in correct location 3. Put second card in correct location 4. Put third card in the correct location	• 3 note cards • Note card box with alphabetizing cards

Courtyard		Kitchen		Office	
Task	Materials	Task	Materials	Task	Materials
Set up flowers 1. Pour water in vase 2. Put flowers in vase 3. Put vase in the middle of the table	• Flowers • Vase • Pitcher of water	**Prepare soup** 1. Pull up tab 2. Pull back tab to open can 3. Pour soup in bowl	• Soup can • Bowl	**Sort paperwork** 1. Put first flyer in corresponding stack 2. Put second flyer in corresponding stack 3. Put third binder in corresponding stack	• 3 stacks of 3 different flyers
Set up BINGO 1. Set out card 1 2. Set out card 2 3. Put chips next to card 1 4. Put chips next to card 2	• 2 BINGO cards • pile of 20 chips	**Put popcorn in microwave** 1. Take popcorn out of plastic 2. Unfold popcorn bag 3. Walk to microwave 4. Open microwave 5. Place popcorn in microwave 6. Close microwave	• Microwave • Microwaveable popcorn package	**Put staples in stapler** 1. Open stapler 2. Open box 3. Take staples out of box 4. Put staples in stapler 5. Close stapler	• Staples • Stapler
Serve drinks 1. Open 2-liter drink 2. Pour into cup 1 3. Put cup by plate 1 4. Pour into cup 2 5. Put cup by plate 2	• 2-liter drink • 2 cups • 2 plates	**Make chocolate milk** 1. Open milk 2. Pour milk in cup 3. Open chocolate syrup 4. Squeeze chocolate syrup in cup for 1-5 seconds 5. Stir with spoon **6.** Put top back on milk	• Milk • Cup • Chocolate Syrup • Spoon	**Sort office supplies** 1. Put paper clips in paperclip bin 2. Put rubber bands in rubber band bin 3. Put binder clips in binder clip bin	• Rubber bands • Binder clips • Paper clips • Bins to store each item
Prepare a gift 1. Open bag 2. Put necklace in bag 3. Get 1 piece of tissue paper 4. Put tissue paper in bag	• Gift bag • Necklace • Tissue paper	**Brush zucchini with olive oil** 1. Open top to olive oil 2. Pour olive oil in bowl 3. Dip brush in olive oil 4. Use brush to rub olive oil on zucchini 5. Put top on olive oil	• Sliced zucchini • Olive oil • Basting Brush	**Put papers in covers** 1. Open binder 2. Put paper in first slip 3. Turn page 4. Put paper in second slip 5. Close binder	• Binder with protective slips • 2 pieces of paper
Hang up happy birthday sign 1. Get 1 piece of tape 2. Tape "H" to table 3. Get a second piece of tape 4. Tape "Y" in Birthday to table	• Happy Birthday sign • Tape	**Coat the chicken** 1. Take top off bread crumbs 2. Pour bread crumbs in bowl 3. Dip chicken in egg 4. Dip chicken in bread crumbs 5. Put breaded chicken on plate	• Bread crumbs • Bowl • Chicken • Plate • Beaten egg in bowl	**Prepare package** 1. Put check in package 2. Peel off strip 3. Close package	• Packing envelope • Check •
		Clean the plate 1. Turn on water 2. Put plate under water 3. Open soap 4. Put soap on plate 5. Scrub with sponge 6. Rinse	• Dirty plate • Sponge • Dish soap • Sink/faucet		

Courtyard		Kitchen		Office	
Task	Materials	Task	Materials	Task	Materials
		Make pudding 1. Open box 2. Take out package 3. Open package 4. Pour in bowl 5. Pour in cup of milk 6. Stir with whisk	• Bowl • Pudding package • Whisk • Cup of milk		
		Make Cereal 1. Open cereal box 2. Open bag 3. Pour into bowl 4. Take top off milk 5. Pour milk into cereal 6. Put top on milk	• Cereal • Milk • Bowl		

Table 3

Response Definitions

Response	Definition	Conditions in which the Response May Occur
Unprompted correct	Participant removes iPhone from pocket within 5s (or within allotted delay interval during intervention) of task direction	Screening, baseline, generalization, maintenance, intervention
Prompted correct	Participant removes iPhone from pocket within 5s of verbal prompt	Intervention
Unprompted incorrect	Participant either does not remove iPhone from pocket within 5s (or within allotted delay interval during intervention) of task direction	Screening, baseline, generalization, maintenance intervention
Prompted incorrect	Participant does not remove iPhone from pocket within 5s of verbal prompt	Intervention
No response	Participant does not respond within 5s of task direction (or within 5s of verbal prompt)	Screening, baseline, generalization, maintenance, intervention

Table 4

Task Analysis For Navigating to Video Model

Navigating to the Correct Video
1. Push home button
2. Slide to unlock
3. Push home button
4. Select videos application
5. Select correct video

Table 5

Counterbalancing of Setting Order

Participant	Setting 1	Setting 2	Setting 3
Jeremy	Kitchen	Office	Outside
John	Office	Outside	Kitchen
Dan	Kitchen	Office	Outside
Alex	Outside	Kitchen	Office

Table 6

Condition Order

Participant	Setting													
Jeremy	1	BL	PTD	M		M		M		M		M		M
	2	BL		G		M		M		M		M		M
	3	BL		G		M		M		M		M		M
John	1	BL		BL	PTD	M		M		M		M		M
	2	BL		BL		BL	PTD	M		M		M		M
	3	BL		BL		BL		G		M		M		M
Dan	1	BL		BL		BL	PTD	M		M		M		M
	2	BL		BL		BL		G		M		M		M
	3	BL		BL		BL		G		BL		M		M
Alex	1	BL		BL		BL		BL	PTD	M		M		M
	2	BL		BL		BL		BL		BL	PTD	M		M
	3	BL		BL		BL		BL		BL		G		M

Note. BL=Baseline, PTD=Progressive Time Delay, G=Generalization, and M=Maintenance. If after intervention occurred in one setting, participants generalized in another setting, that condition is represented by a G for generalization.

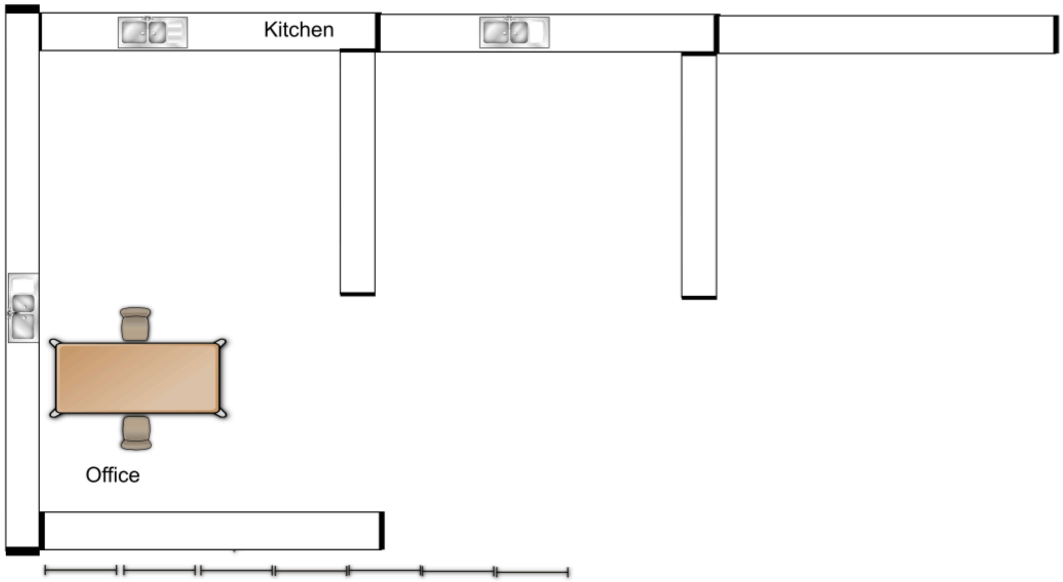

Figure 1. Daily living center. This figure shows the layout of the daily living center including two settings used in the study: the kitchen and office.

Put staples in stapler

Figure 2. Sample thumbnail image and description.

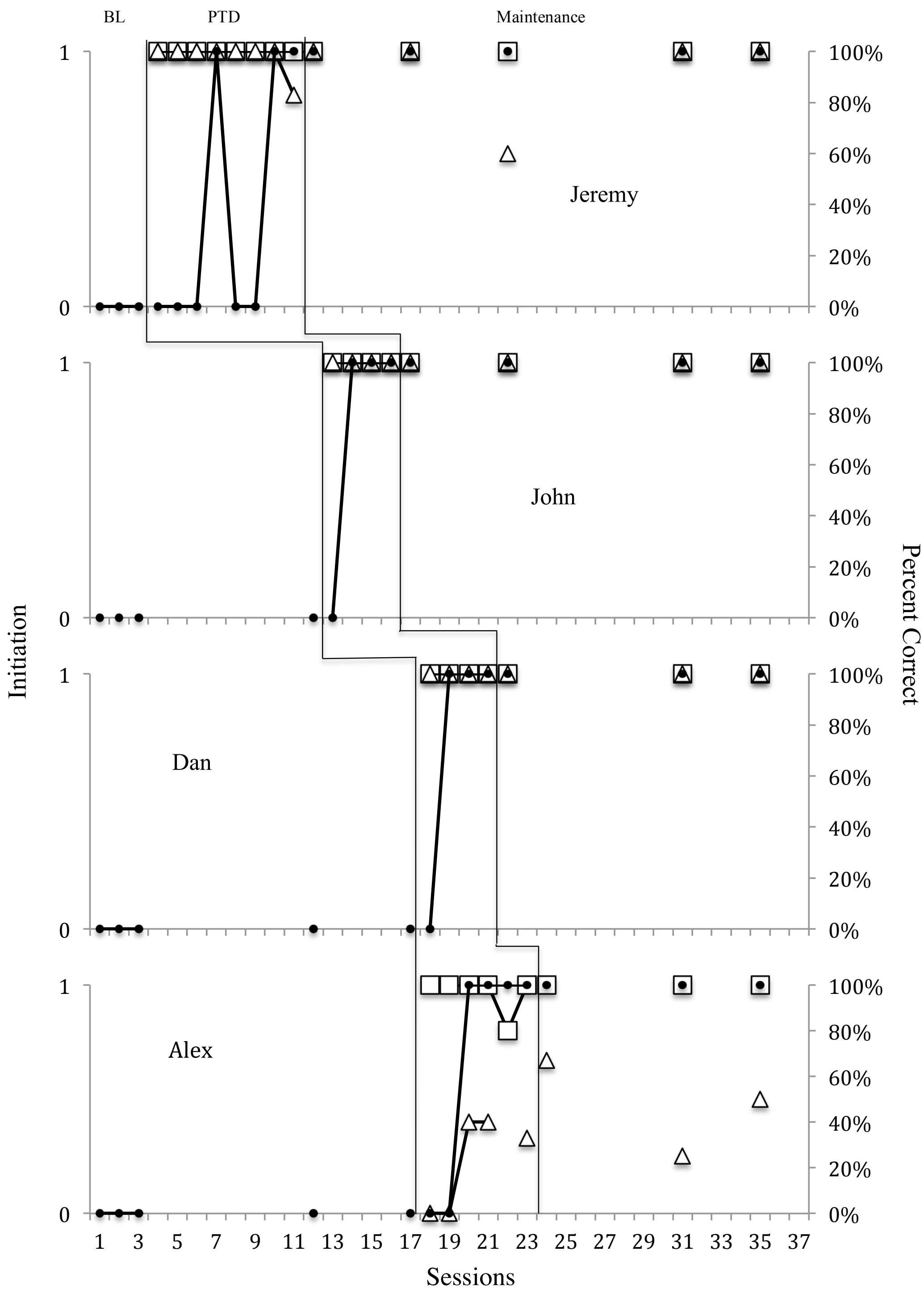

Figure 3. Self-instruction data from Setting 1. The closed circle represents initiation, the open square represents navigation to correct video, and the open triangle represents percent correct on daily living/vocational skill. BL=baseline, PTD=Progressive Time Delay.

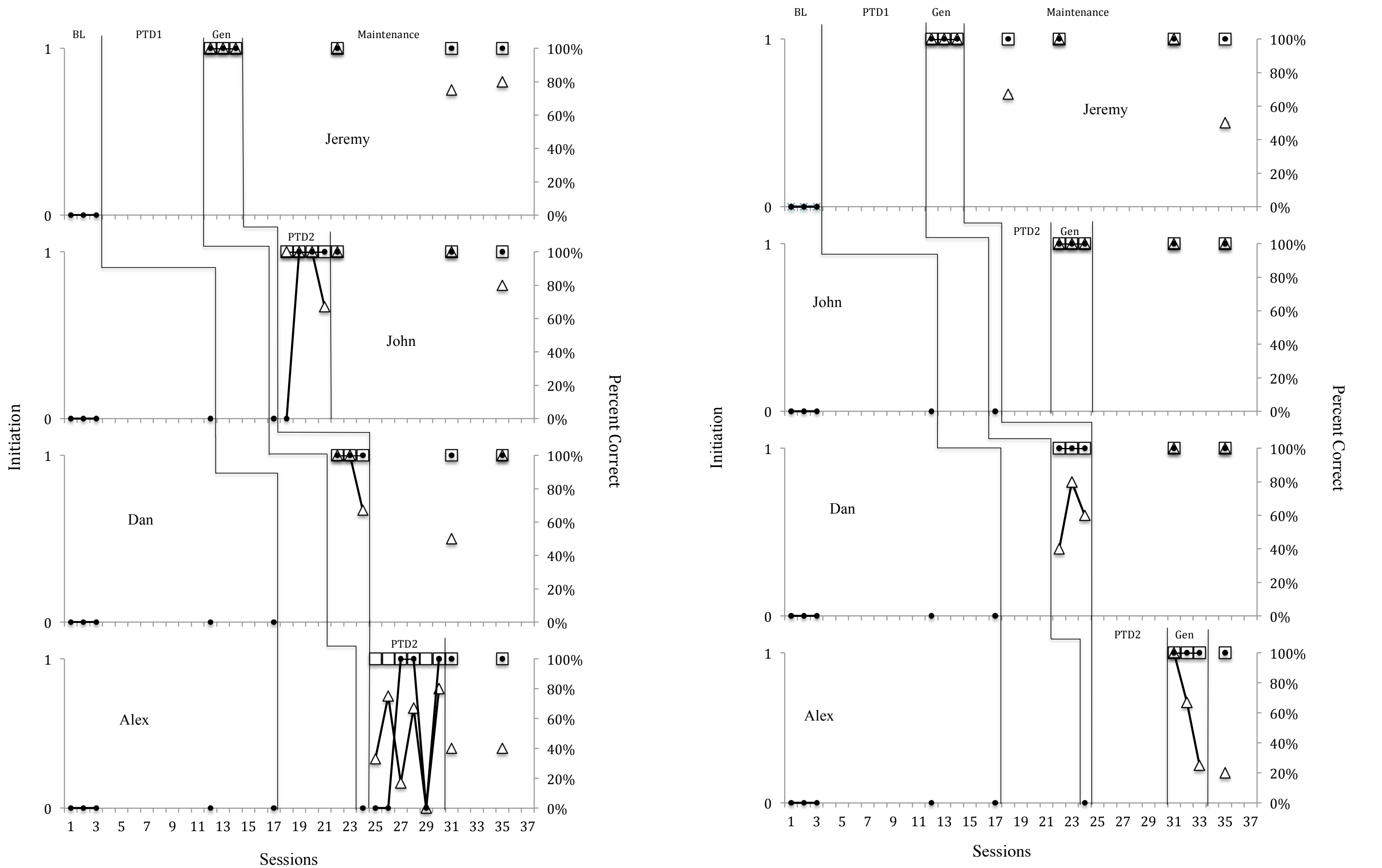

Figure 4. Self-instruction data from Setting 2 (left panel) and Setting 3 (right panel). The closed circle represents initiation, the open square represents navigation to correct video, and the open triangle represents percent correct on daily living/vocational skill. BL=baseline, PTD1=Progressive Time Delay in Setting 1, PTD2=Progressive Time Delay in Setting 2. Gen=Generalization

CHAPTER 3

RESULTS

Interobserver agreement and Procedural Fidelity

Interobserver agreement and procedural fidelity data were calculated for 32% of baseline sessions, 28% of intervention sessions, 30% of maintenance sessions, and 50% of generalization sessions. Interobserver agreement was 100% for initiation of self-instruction, 100% for navigation to the correct video, and 100% for steps performed correctly on daily living or vocational skills. Procedural fidelity was 100% in all conditions for all participants.

Acquisition of Initiation of Self-Instruction

The primary dependent variable was initiation of self-instruction (define as a participant removing the iPhone from his pocket) in the presence of a task direction for an untrained task (see Figure 3 and Figure 4). No participant independently initiated self-instruction in the presence of a task direction for an untrained task from the researcher in baseline in any of the locations. After three consecutive baseline data points without initiation of self-instruction, intervention began in Setting 1 for Jeremy. Table 5 provides information about which settings were assigned in which order for each participant.

Jeremy. Jeremy did not immediately begin initiating self-instruction upon the introduction of PTD. In three of eight sessions, Jeremy engaged in an error by attempting to access the materials to complete the daily living skill contingent on the task direction. In two of eight sessions, Jeremy waited for a prompt before removing the iPhone from his pocket. After eight sessions, Jeremy mastered initiation of self-instruction in Setting 1. When probed in all settings after mastering self-instruction in Setting 1, Jeremy generalized performance to settings 2 and 3; therefore, instruction was unnecessary in those settings. When Jeremy met criteria for initiation of self-instruction in Setting 1, one baseline session occurred for all participants in all settings.

John. With stable performance from John in baseline (i.e., a lack of initiation of self-instruction), he began intervention. After one 0 s delay sessions, John began independently initiating self-instruction by removing the iPhone from his pocket in the presence of a task direction to complete an untrained task. John mastered initiation of self-instruction in Setting 1 in four sessions. When John met criteria in Setting 1, one baseline probe occurred for Dan and Alex and a maintenance probe occurred for Jeremy. When John was probed in all settings following mastery, he did not generalize to Setting 2 or 3 and therefore instruction for initiation of self-instruction began for John in Setting 2. He mastered self-instruction in Setting 2 in only four sessions. He was then probed across setting again, and responding generalized to Setting 3. Therefore, instruction did not occur on initiation of self-instruction in Setting 3 for John. Upon mastery of self-instruction in Setting 1 for John, intervention began in Setting 1 for both Dan and Alex.

Dan. After one 0 s delay session for Dan in Setting 1, he began to independently initiate and mastered self-instruction of Setting 1 in four sessions. Dan generalized self-instruction to Setting 2 and 3; therefore, instruction on initiation only occurred in Setting 1.

Alex. Alex began to independently initiate self-instruction on the third session for Setting 1, but required an additional session to meet mastery criteria, as he did not locate the correct video in one of the four sessions in which he initiated. Alex mastered self-instruction in Setting 1 in six sessions. Alex did not generalize the use of self-instruction to Setting 2 or 3 after intervention in Setting 1; therefore, intervention began in Setting 2. Alex again initiated self-instruction during the third session of intervention in Setting 2. On the fifth session, Alex did not initiate self-instruction. This session followed the temporary removal of lunch contingent on problem behavior. After mastering self-instruction in six sessions, self-instruction generalized to the third setting; therefore, intervention did not occur in Setting 3 for Alex.

Navigating to the Correct Video

All participants learned to navigate to videos on the iPhone during history training using system of least prompts in between 7 to 10 sessions (see Figure 5). During intervention, maintenance, and generalization sessions, there was only one session in which a participant initiated self-instruction (with or without prompting) and did not navigate to the correct video. After history training, no additional prompting was provided on navigating to the correct video, even for the participant who did not navigate correctly in one session.

Generalization Across Settings

Before and after acquisition of self-instruction in Setting 1, the researcher assessed self-instruction in Settings 2 and 3. Figure 4 depicts generalization data for Settings 2 and 3. The researcher assessed generalization using a combination multiple probe design, but specifically assessed response generalization to additional settings within the multiple probe across settings design for each individual participant. Any responses that did not generalize to Settings 2 and 3 were trained in those settings. Two participants, Jeremy and Dan, learned to self-instruct in Setting 1 before generalizing to Settings 2 and 3. Two participants, John and Alex, required instruction in Setting 1 and 2 before generalizing to Setting 3. All participants met criteria in settings to which they generalized self-instruction in three sessions.

Generalization to a Familiar Adult

To evaluate the fourth research question assessing generalization across instructors, a pre-post test was used (see Table 7). Before intervention began in any setting for any participant, the classroom teacher conducted one session in each setting for each participant in which she provided the task direction to participants for an untrained task. In the pre-test, no participant initiated self-instruction. After all participants met criteria in all settings, the classroom teacher conducted a generalization post-test in the same manner.

Jeremy, John, and Dan generalized self-instruction to a task direction from the researcher to their classroom teacher in all three settings. All three participants independently initiated self-instruction within 5 s, navigated to the correct video, and increased performance on daily living or vocational skills (see Table 7).

In Alex's first generalization post-test session in the kitchen (i.e., target setting), he did not initiate self-instruction by removing the iPhone from his pocket and therefore did not have the opportunity to navigate to the video or attempt the daily living or vocational task. Alex's second generalization session occurred in the office. In this setting, Alex initiated self-instruction and navigated to the correct video, but did not complete any steps of the daily living or vocational skill correctly. In Alex's last generalization session, which occurred outside, he initiated self-instruction, navigated to the correct video, and completed 50% of the task correctly, which was improved performance on the skill.

Acquisition of Daily Living and Vocational Skills

Self-instruction involves both initiating the self-instructional response and viewing the correct video. Additionally, for self-instruction to have both taken place and been effective, the participants had to increase performance on the daily living skill from previous sessions. As mastery criteria included all three components before moving to the next condition, all participants completed a portion of daily living and vocational skills that were not in their repertoire in screening and/or previous sessions. Participants only had the opportunity to complete the daily living or vocational skills if they initiated self-instruction (prompted or unprompted) and navigated to the correct video. The number of sessions in which participants had exposure to daily living and vocational skills varied by participant.

Jeremy. Jeremy initiated (prompted or unprompted) and navigated to the correct video in 30 total sessions. His performance on daily living or vocational skills in these sessions was at a mean of 93% correct responding (range: 50-100%). Jeremy correctly completed 100% of tasks in 23 sessions. In the seven sessions where he did not complete 100% of tasks, two occurred outside in the courtyard, one was in the kitchen, and three were in the office. The length of the tasks varied (range: 3-5 steps).

John. John had the opportunity to attempt daily living and vocational tasks in a total of 23 sessions. His mean percent correct on these tasks was 99% (range: 67-100%). There was only one session where John did not complete 100% of steps correctly which occurred outside, and the task was only three steps.

Dan. Dan had the opportunity to attempt daily living and vocational tasks in a total of 20 sessions. His mean percent correct on these tasks was 85% (range: 33-100%). He completed 100% correct responding in 13 sessions. For sessions in which he did not complete 100% responding, three were in the office and four occurred outside in the courtyard. Task length ranged from 3-5 steps.

Alex. Alex had the opportunity to engage with materials for the daily living or vocational tasks in 25 sessions. His mean percent correct on these tasks was 41% (range: 0-100%). Alex completed 100% correct on only two tasks throughout the entire study, which occurred in the office and in the courtyard. Both of the tasks on which he completed 100% correct were only three steps in length.

Table 7

Generalization to a Familiar Adult

		Initiation of Self-Instruction		Navigation to Correct Video	Daily Living Skill
Participant	Setting	Pre	Post	Post	Post
Jeremy	Kitchen	0	1	100%	100%
	Office	0	1	100%	80%
	Outside	0	1	100%	100%
John	Office	0	1	100%	100%
	Outside	0	1	100%	100%
	Kitchen	0	1	100%	100%
Dan	Kitchen	0	1	100%	100%
	Office	0	1	100%	40%
	Outside	0	1	100%	75%
Alex	Outside	0	1	100%	50%
	Kitchen	0	0	NA	NA
	Office	0	1	100%	0%

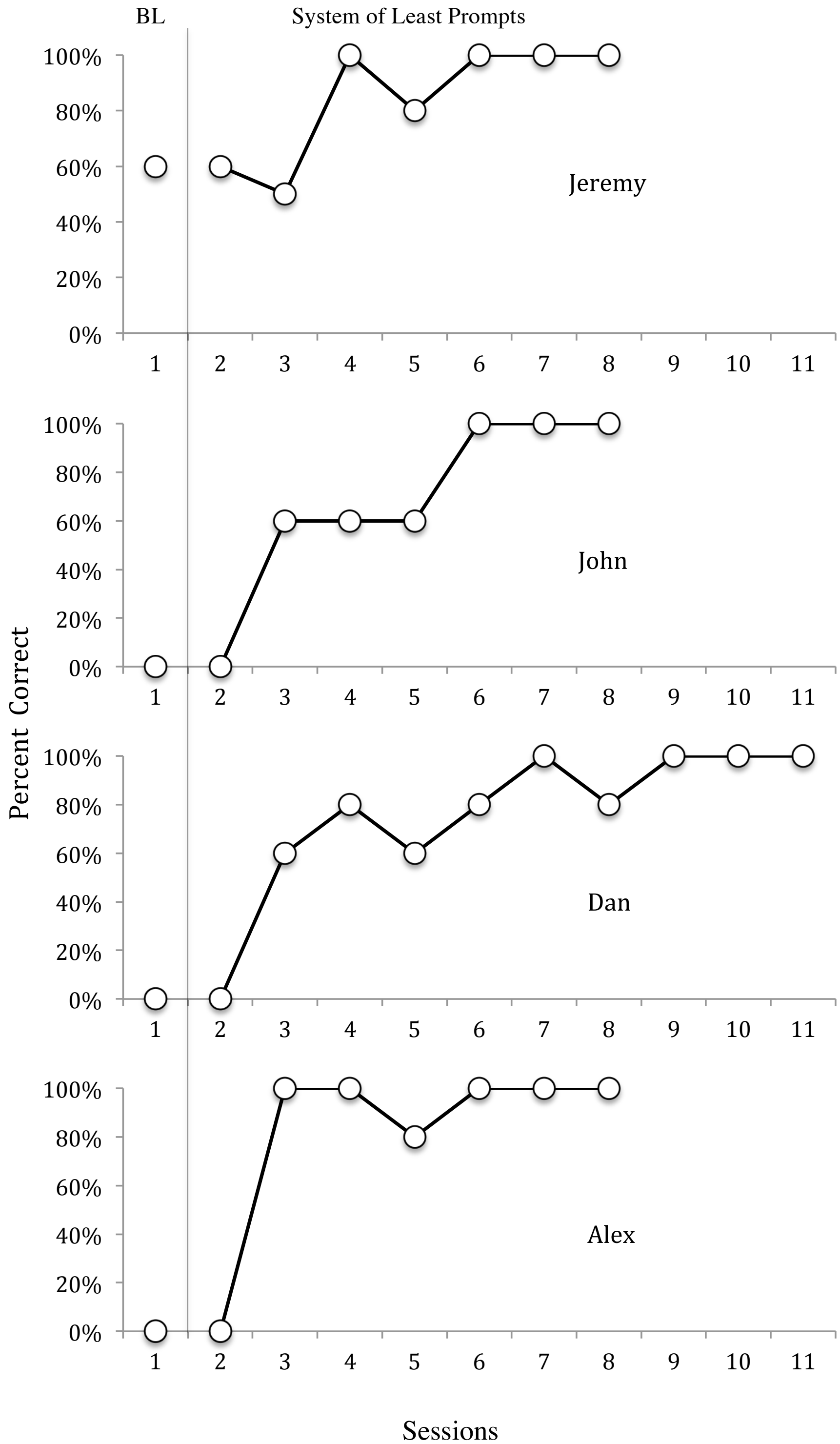

Figure 5. Navigation to video on iPhone. This data depicts the percent correct for each participant on navigating to the correct video on an iPhone in history training

CHAPTER 4

DISCUSSION

This study demonstrated the effectiveness of PTD on the initiation of self-instruction using an iPhone. A functional relation was demonstrated within a multiple probe across participants design where the introduction of PTD was staggered across participants. Participants all learned to initiate self-instruction in three settings and generalized to at least one setting without adult instruction in that setting. Additionally, three of four participants generalized self-instruction to the presentation of a task direction from their classroom teacher in all three settings, while one participant met criteria in one setting in a generalization post-test. The results of this study are important because as participants increase self-instruction with technology and learn to independently use video supports to acquire previously untrained skills, the need for adult support decreases. Being self-reliant may increase access to new environments. Additionally, with an ability to self-instruct with supports in their environment (e.g., video models) rather than with support from adults, the participants may have an opportunity to learn more skills as adult instruction is not required for each skill. All participants acquired the initiation response with the use of PTD, but participants learned to navigate to correct videos during history training. After mastering navigation in history training, no participant required remediation as they maintained the response throughout intervention, maintenance, and generalization.

One of the most important parts of the current study was the assessment of generalization of a skill taught in one setting to another setting without instruction. Often, when studies include video-based instruction within the context of single-case design, researchers do not assess for generalization. If researchers assess for generalization, they often do so in a pre-post test; if participants do not generalize, instruction does not occur in the generalization conditions (see Smith, Appendix B). This study occurred in the context of a multiple probe across participants and settings design so the researchers could assess generalization across settings. For participants for whom generalization did not occur, the researcher had an opportunity to provide instruction in that setting. Additionally, the experimental design included three settings. So, for participants who did not generalize to other settings after receiving instruction in only one setting, instruction could be provided in Setting 2. After instruction in two settings, it was still possible to assess for generalization as there was a third setting in which intervention had not yet taken place. Two participants (i.e., Jeremy and Dan) received instruction in Setting 1 before generalizing to the additional two settings. Two participants (i.e., John and Alex) did not generalize to Setting 2 and 3 after instruction in only Setting 1, but did generalize to Setting 3 after instruction occurred in both Setting 1 and Setting 2. Individual participant differences may have contributed to generalization or a lack of generalization after intervention in Setting 1. Jeremy and Dan, who generalized after instruction in only Setting 1, had higher IQ scores than John and Alex. Jeremy also had a more expansive vocabulary and was working on higher level functional academic skills than other participants.

All participants except Alex generalized self-instruction to a task direction presented by their classroom teacher. In the generalization probe for the kitchen, in which Alex did not initiate self-instruction and therefore did not have an opportunity to complete the remainder of the steps of self-instruction, his teacher stated that he was upset about a classroom issue involving his lunch. This may have contributed to a lack of responding.

All participants learned a portion of the daily living or vocational skills viewed on video models through self-instruction, but participants used videos differently from one another. Video modeling literature includes different ways participants view videos and interact with materials including participants viewing video models and then completing the task (Smith, Ayres, Mechling, & Smith, 2013) and participants completing tasks while watching a video (Mechling, Ayres, Purrazella, & Purrazella, 2014). Although participants in Mechling et al. (2014) had the opportunity to view the video multiple times in a row, the concept is similar in that participants completed steps as they viewed the video. The current study did not require participants to view the video first or complete the steps while viewing the video. Participants accessed videos independently and were in control of the iPhone resulting in differential use of the videos. John viewed the entire video before ever accessing materials. He then imitated the video exactly in the order that the actor completed steps. For example, in the video for collating and stapling papers, there were three numbered sheets of paper. In the video, the actor pointed to the number in the top right corner of the page to signal how to order the papers, although pointing was not a step of the task analysis. John is the only participant that pointed to each number on the page imitating exactly what was viewed in the video. Jeremy viewed the video while completing the task in each session. As the video paused to narrate the directions for the next step, Jeremy collected the needed materials and began engaging with the materials to complete the task. Dan viewed the entire video before completing the task near the beginning of the study, and about halfway through, he began to complete the tasks while watching the videos. Alex sometimes viewed the entire video before completing the task and sometimes completed the task while watching the video. Alex is the only participant who accessed correct videos in some sessions without completing any correct steps of daily living or vocational skills. Although there are no data on attending to the video, anecdotal observations of Alex's sessions revealed that his eyes were often not oriented to the entire video. The only two sessions in which Alex completed 100% of correct responding were each only three steps and 22 s long. The longest videos were six steps and 45 s long, so there is a possibility that Alex could only attend to shorter videos.

Limitations

There were several limitations to the current study related to generalization, phone storage, video length, and a lack of discrimination between trained and untrained tasks. The purpose of assessing generalization to a familiar adult was to see if participants could generalize to a task direction from the classroom teacher, and to ensure that the discriminative stimulus for self-instruction was the presence of a task direction for an untrained skill, not the presence of a task direction from the researcher specifically. One limitation related to this is that the researcher was still in the environment in order to collect data during all generalization sessions. Although the classroom teacher provided the task direction, the presence of the researcher alone could have influenced performance. Secondly, the researchers planned that for any participants who did not generalize self-instruction to the classroom teacher in all settings, instruction would occur with the classroom teacher. The purpose of instructing in that setting is that for this skill to be meaningful to the participants in their lives, the participants must be able to access videos to learn skills in the presence of instructors who are typically in their environment. Because of the end of the school year, it was not possible to instruct Alex on self-instruction with the classroom teacher present.

Another limitation in the current study is that although the participants wore pants with pockets nearly every day where a phone is typically carried, there was one day the researcher arrived and Alex was not wearing pants with pockets. The researcher was unable to conduct a session with Alex on that day. If the study included either participants who did not wear pants with pockets regularly or did not like holding a phone in their pocket, the researcher would need to teach a different response.

Another consideration is that Alex only responded with 100% correct on the tasks shortest in both number of steps and video length. The current study did not control for number of steps and video length across videos used in the study and screening related to the ability to imitate videos only included a task that was three steps long. This is a limitation as some skills were much longer and it was not assessed before the study if participants could imitate longer videos.

Lastly, in the current study, while the expected response was that after being exposed to intervention, each participant would self-instruct when provided a task direction for an untrained skill, it is possible that the participants may overgeneralize and begin to also independently view video models for already learned skills (i.e., in environments outside of the research study). While future studies should evaluate methods for teaching individuals who have acquired self-instruction of untrained skills to discriminate between when self-instruction is necessary and when a skill is already learned, the current study did not address this concern. While this is a limitation, even if the participant views videos of both known and untrained skills, the participant will still be more independent of instructor supports as an end result.

Future Directions for Research

There are several directions of future research that may come as a result of the current study. One direction for future research is to teach participants to discriminate between known and untrained tasks, so participants can determine when to view videos and when not to view videos before engaging in a task. Also, although the current study provided the participants with greater independence in comparison to adult delivered instruction to complete daily living and vocational tasks, the researcher created each video and loaded them onto the participant's iPhone. Future research should consider teaching participants to access videos from online video libraries (e.g., iSkills, YouTube), or to create their own videos for skills specific to them (e.g., a job skill at a specific restaurant). Either of these directions would again decrease assistance from adults in that participants would not only be able to learn the skills that had been pre-loaded onto their device. Researchers should continue to assess how VBI can be independently accessed in meaningful ways that promote generalization. Lastly, researchers should continue to evaluate how pivotal skills related and unrelated to VBI may provide individuals with disabilities access to a greater number of environments.

Implications for Practice

While video-based instruction is becoming a more widely used instructional strategy, there is much of room for growth in the area of teaching independence in accessing these videos. This study evaluated the use of PTD, a commonly used prompting procedure, to teach participants to become more independent. With adult-delivered instruction (without technology), the adult must be present in each session to teach participants a new task. With adult-delivered instruction with video modeling, the adult is still present in each session to teach participants a new task. With the current study, although the adult is present, instruction is not required to complete the task after a task direction is provided. An adult could, essentially, create a library of videos to be loaded on several different participants' phones, and then provide a task direction to one participant to complete a skill in the kitchen, to another participant in the office, and another participant in the classroom simultaneously. On a job site, if three to four employees were working on different tasks and each had access to technology, the employer could provide several different task directions and not stand with the participant as they complete the task because supports are in place to teach the participant the task without an adult. Learning to rely on supports from their environment results in a decreased need for adult support and increases independence for these individuals. The implications of this practice can have profound effects as this means potential access to more environments and the possibility of learning more skills.

In addition to learning new skills, the ability to access a video independently when one recognizes that remediation on a once learned skill is needed is a pivotal skill for maintenance of already learned tasks. That is, if a participant learns to make coffee at his or her place of employment, but take a one week vacation and when arriving back at work, did not maintain all steps of the TA, adult instruction would not be required again. Many typically developing individuals use technology everyday as support to complete tasks that are either untrained or have not maintained from previous acquisition. A continued focus on pivotal skills for individuals with disabilities is critical so that time spent in instruction can be the most effective and efficient, and therefore, meaningful for each individual.

Considering how pervasive mobile technology has become in the past few years, the potential for self-support and self-instruction using this technology has greatly increased. Most people with a mobile device have familiarity with using Google to look up an answer to a question or get directions. Teaching individuals with disability these similar skills for self support and self-instruction creates opportunities for them to live more independently and integrate more fully into their communities. Rather than secondary instruction focusing on adult instruction of a lengthy list of functional life skills (Ayres et al., 2012) or Common Core Standards (Courtade, Spooner, Browder, & Jiminez, 2012), if educators focused on pivotal skills such as problem solving and self-instruction, this will increase the skills individuals can learn on their own and the environments they can access without constant adult support.

REFERENCES

Ayres, K. & Gast, D. L. (2010). Dependent measures and measurement procedures. In D. L. Gast (Ed.), *Single subject research methodology in behavioral sciences* (pp. 129-165). New York: Routledge.

Ayres, K. M., & Langone, J. (2005). Intervention and instruction with video for students with autism: A review of the literature. *Education and Training in Developmental Disabilities, 40*, 183-196.

Ayres, K. M., Lowrey, K. A., Douglas, K. H., & Sievers, C. (2012). The question still remains: What happens when the curricular focus for students with severe disabilities shifts? A reply to Courtade, Spooner, Browder, and Jiminez (2012). *Education and Training in Autism and Developmental Disabilities, 47*, 14-22.

Bellini, S., & Akullian, J. (2007). A meta-analysis of video modeling and video self-modeling interventions for children and adolescents with autism spectrum disorders. *Exceptional Children, 73*, 264-287.

Bereznak, S., Ayres, K. M., Mechling, L. C., & Alexander, J. L. (2012). Video self-prompting and mobile technology to increase daily living and vocational independence for students with autism spectrum disorders. *Journal of Developmental and Physical Disabilities, 24,* 269-285.

Bouck, E. C. (2012). Secondary students with moderate/severe intellectual disability: Considerations of curriculum and post-school outcomes from the national longitudinal transition study-2. *Journal of Intellectual Disability Research, 56*, 1175-1186.

Browder, D. M., & Shapiro, E. S. (1985). Applications of self-management to individuals with severe handicaps: A review. *Journal of the Association for Persons with Severe Handicaps, 10*, 200-208.

Buggey, T., Hoomes, G., Sherberger, M. E., & Williams, S. (2011). Facilitating social initiations of preschoolers with autism spectrum disorders using video self-modeling. *Foc us on Autism and Other Disabilities, 26*, 25-36.

Burke, R. V., Allen, K. D., Howard, M. R., Downey, D., Matz, M., & Bowen, S. L. (2013). Tablet-based video modeling and prompting in the workplace for individuals with autism. *Journal of Vocational Rehabilitation, 38*, 1-14.

Cannella-Malone, H. I., Brooks, D. G., & Tullis, C. A. (2013). Using self-directed video prompting to teach students with intellectual disabilities. *Journal of Behavioral Education, 22*, 169-189.

Charlop-Christy, M. H., Le, L., & Freeman, K. A. (2000). A comparison of video modeling with in vivo modeling for teaching children with autism. *Journal of Autism and Developmental Disorders, 6*, 537-552.

Cihak, D., Alberto, P. A., Taber-Doughty, T., & Gama. A comparison of static picture prompting and video prompting simulation strategies using group instructional procedures. *Focus on Autism and Other Developmental Disabilities, 21*, 89-99.

Courtade, G., Spooner, F., Browder, D., & Jiminez, B. (2012). Seven reasons to promote standards-based instruction for students with severe disabilities: A reply to Ayres, Lowrey, Douglas, & Sievers (2011). *Education and Training in Autism and Developmental Disabilities, 47,* 3-13.

Gast, D. L., & Ledford, J. R. (2010). Variations of multiple baseline designs and combination designs. In D. L. Gast (Ed.) Single subject research in behavioral sciences (pp. 382-416). New York: Routledge.

Hammond, D. L., Whatley, A. D., Ayres, K. M., & Gast, D. L. (2010). Effectiveness of video modeling to teach iPod use to students with moderate intellectual disabilities. *Education and Training in Autism and Developmental Disabilities, 45*, 525-538.

Haring, T. G., Kennedy, C. H., Adams, M. J., & Pitts-Conway, V. (1987). Teaching generalization of purchasing skills across community settings to autistic youth using videotape modeling. *Journal of Applied Behavior Analysis, 20*, 89-96.

Individuals With Disabilities Education Act, 20 U.S.C. § 1400 (2004).

Janus, A. L. (2009). Disability and the transition to adulthood. *Social Forces, 88*, 99-120.

Koegel, R. L., & Frea, W. D. (1993). Treatment of social behavior in autism through the modification of pivotal social skills. *Journal of Applied Behavior Analysis, 26,* 369-377.

Koegel, L. K., Koegel, R. L., Harrower, J. K., & Carter, C. M. (1999). Pivotal response intervention I: Overview of approach. *Journal of the Association of Persons with Severe Handicaps, 24*, 174-185.

Koegel, R. L., Koegel, L. K., & McNerney, E. K. (2001). Pivotal areas in intervention for autism. *Journal of Clinical Child Psychology, 30*, 19-32.

Mason, R. A., Ganz, J. B., Parker, R. I., Boles, M. B., Davis, H. S., & Rispoli, M. J. (2012). Video-based modeling. Differential effects due to treatment protocol. *Research in Autism Spectrum Disorders, 7,* 120-131.

Mechling, L. C. (2011). Review of twenty-first century portable electronic devices for persons with moderate intellectual disabilities and autism spectrum disorders. *Education and Training in Autism and Developmental Disabilities, 46*, 479-498.

Mechling, L. C., & Ayres, K. M. (2012). A comparative study: Completion of fine motor office related tasks by high school students with autism using video models on large and small screen sizes. *Journal of Autism and Developmental Disorders, 42*, 2364-2373.

Mechling, L. C., Gast, D. L., & Fields, E. A. (2008). Evaluation of a portable DVD player and system of least prompts to self-prompt cooking task completion by young adults with moderate intellectual disabilities. *The Journal of Special Education, 42*, 179-190.

Mechling, L. C., Gast, D. L. & Seid, N. H. (2010). Evaluation of a personal digital assistant as a self-prompting device for increasing multi-step task completion by students with moderate intellectual disabilities. *Education and Training in Autism and Developmental Disabilities, 45*, 422-439.

Mechling, L. C., Pridgen, L. S., & Cronin, B. A. (2005). Computer-based video instruction to teach students with intellectual disabilities to verbally respond to questions and make purchases in fast food restaurants. *Education and Training in Developmental Disabilities, 40*, 47-59.

Mechling, L. C., & Savidge, E. J. (2011). Using a personal digital assistant to increase completion of novel tasks and independent transitioning by students with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 41*, 687-704.

Mechling, L. C., & Seid, N. H. (2011). Use of a hand-held personal digital assistant (PDA) to self-prompt pedestrian travel by young adults with moderate intellectual disabilities. *Education and Training in Autism and Developmental Disabilities, 46*, 220-237.

Newman, L., Wagner, M., Knokey, A. M., Marder, C., Nagle, K. . . & Schwarting, M. (2011). *The post-high school outcomes of young adults with disabilities up to 8 years after high school. A report from the national longitudinal transition study-2 (NLTS2)* (NCSER 2011-3005). Melo Park, CA: SRI International.

Odom, S. L., Collet-Klingenberg, L., Rogers, S. J., & Hatton, D. D. (2010). Evidence-based practices in interventions for children and youth with autism spectrum disorders. *Preventing School Failure, 54*, 275-282.

Payne, D., Cannella-Malone, H. J., Tullis, C. A., & Sabielny, L. M. (2012). The effects of self-directed video prompting with two students with intellectual and developmental disabilities. *Journal of Developmental and Physical Disabilities, 24*, 617-634.

Sanford, C., Newman, L., Wagner, M., Cameto, R., Knokey, A. M., & Shaver, D. (2011). *The post-high school outcomes of young adults with disabilities up to 6 years after high school. Key findings from the National Longitudinal Transition Study-2 (NLTS2*). Menlo Park, CA: SRI International.

Smith, M., Ayres, K., Mechling, L., & Smith, K. (2013). Comparison of the effects of video modeling with narration vs. video modeling on the functional skill acquisition of adolescents with autism. *Education and Training in Autism and Developmental Disabilities, 48,* 164-178.

Stokes, T. F., & Baer, D. M. (1977). An implicit technology of generalization. *Journal of Applied Behavior Analysis, 10*, 349-367.

Taber-Doughty, T., Miller, B., Shurr, J., & Wiles, B. (2013). Portable and accessible video modeling: Teaching a series of novel skills within school and community settings. *Education and Training in Autism and Developmental Disabilities, 48*, 147-163.

Test, D. W., Cease-Cook, J., Fowler, C. H., & Bartholomew, A. (2011). *Tool for College and Career Ready Standards and Secondary Transition Planning for Students with Disabilities: 101.* National Secondary Transition Technical Assistance Center.

Walker, G. (2008). Constant and progressive time delay procedures for teaching children with autism: A literature review. *Journal of Autism and Developmental Disorders, 38*, 261-275.

Wolery, M. Ault, M. J., & Doyle, P. M. (1992). *Teaching students with moderate to severe disabilities: Use of response prompting strategies*. Whiteplains, NY: Longman.

APPENDICES

Appendix A

A Review of the Literature on Self-Instruction

The Independent Use of Self-Instructions for the Acquisition of Untrained Multi-step Tasks: A Review of the Literature

Katie A. Smith

The University of Georgia

Abstract

Systematic instruction on multi-step tasks (e.g., cooking, vocational skills, personal hygiene) is common in classrooms for individuals with intellectual disabilities. Unfortunately, when individuals with disabilities turn 22, they no longer receive services in the public school system and the systematic instruction often ends. If individuals do not receive instruction, they are unlikely to acquire new skills and may be less likely to maintain previously acquired skills. Rather than using instructional time to focus on adult-delivered training on the acquisition of multi-step tasks, teaching individuals with disabilities a pivotal skill, such as how to use self-instructional materials, may be a better use of time. With the acquisition of self-instructional skills and specific focus on programming for generalization, individuals with disabilities can have the opportunity to continue acquisition of novel multi-step tasks in post-secondary settings and will have a strategy for remediating skills that are lost over time. The purpose of this review was to synthesize research related to generalized self-instruction to learn multi-step tasks. Information is provided about the types of self-instructional materials used and the ways in which participants were trained to use them. Recommendations for future research are provided.

Keywords: self-instruction, self-prompting, student-directed

The Independent Use of Self-Instructions for the Acquisition of Untrained Multi-step Tasks: A Review of the Literature

An increasing number of individuals with autism and/or intellectual disabilities (ID) transition out of secondary settings each year (Boyle et al., 2011). As the number of individuals with disabilities entering into post-secondary settings increases, practitioners must be more efficient with how instructional time is spent programming for independence, generalization, and overall success of individuals with ID and/or autism. Specific focus in educational planning is often put on independence in post-secondary settings, including employment and independent living, but the outcomes remain poor.

Employment is important for individuals with disabilities for a variety of reasons, and specifically has been associated with financial independence and higher self-esteem (Newman et al., 2011). Gaining and maintaining employment is a crucial part of successful adult outcomes for many individuals with disabilities, yet according to the National Longitudinal Transition Study 2 (NLTS2), only 38.8% of transition-age youth with ID and 37.2% with autism were employed at the time of interview after leaving high school (Newman et al., 2011). The focus of many transition plans for students with disabilities is on employment related skills, but often individuals do not obtain similar jobs as those practiced in secondary settings. This causes reliance on job coaches or other adults in post-secondary settings to train necessary skills to gain and/or maintain employment.

In addition to a need for improving outcomes for youth with disabilities related to post-secondary employment, many individuals with disabilities do not have the necessary skills to live independently (defined as living with a spouse, partner, roommate, or alone) or semi-independently (defined as living in a college dorm, military housing, or group home) (Newman et al., 2011). According to the NLTS2, 36.3% of individuals with ID had lived independently since high school and .2% lived semi-independently. Seventeen percent of individuals with autism lived independently since leaving high school and 3.4% lived semi-independently (Newman et al., 2011). Skills necessary to live independently or semi-independently post-high school include home living, community living, safety, social, advocacy, and health-related skills. A high-priority should be placed on teaching these skills, which will affect individuals in multiple ways in post-secondary settings. In addition to poor employment and independent living outcomes, according to the NLTS2, only 46.7% percent of individuals with ID and 61.1% of individuals with autism engage in social interaction (including lessons or classes, volunteer or community service activities or community groups such as sports, hobbies, and religious groups) each week after leaving high school (Newman et al., 2011). Increased opportunities for employment, independent/semi-independent living, and inclusion in the community may provide an additional opportunity for social engagement for these individuals, but an inability to complete tasks in these settings may preclude individuals with disabilities from accessing these environments.

In employment settings, at home, in the community, and in all areas of our daily lives, we complete a large number of multi-step tasks (e.g., getting dressed, brushing teeth, making coffee, making a copy, checking out at the grocery store, washing hands, etc.). The overall level of support necessary for completion of these multi-step tasks will influence an individual's ability to be independent in post-secondary settings. Increasing the number of tasks an individual can independently complete reduces the level of support required by caregivers, job coaches, and other adults. Many instructional strategies have been used to increase multi-step tasks (e.g., vocational and daily living skills) including simultaneous prompting (e.g., Fetko, Schuster, Harley, & Collins, 1999), time delay (e.g., Snell, 1982), and video-based instruction (e.g., Van Laarhoven & Van Laarhoven-Myers, 2006). While these strategies have been effective, they require 1:1 or small group instruction. With a large number of tasks to learn across settings and a need for less reliance on adult supports (for both efficiency of instruction and staffing ratios in secondary and post-secondary settings), it is important to begin shifting the focus of instruction from task-specific instruction to pivotal skills instruction.

A pivotal skill is a skill that once trained will produce collateral effects in many other areas (Koegel, Koegel, Harrower, & Carter, 1999). In this case, acquired pivotal skills will enable an individual to learn a variety of novel or untrained skills independent of adult instruction. For example, when taught to do laundry (task-specific) using a least-to-most prompting procedure, an individual will be able to do his or her own laundry. When taught to independently navigate a handheld device (e.g., smart phone; pivotal skill) to view and imitate videos of functional skills, vocational skills, and daily living skills (including laundry, brushing teeth, making coffee, making a copy, etc.) an individual has learned a pivotal self-instructional or self-prompting skill (navigating the handheld device). This can lead to the individual teaching him or herself a variety of other tasks (e.g., brushing teeth, making coffee, making a copy). The individual may have required training to use the handheld device to acquire the laundry task, but he or she now has an opportunity to learn additional untrained skills without adult instruction. Even if instruction on using the handheld device to do laundry is less efficient than a least-to-most prompting procedure, one must consider the amount of time the individual would have spent in 1:1 or small group training for additional skills. Now the individual can complete tasks without adult instruction and can use these tools if previously acquired skills are not maintained over time. Rather than seeking adult assistance in the workplace or the home, individuals would have a reference for how to complete a specific task and could continue to self-instruct.

Self-instruction has been defined as "the use of self-talk, printed instructions, or other materials that are used by the person alone rather than provided by the teacher. These instructions 'set the occasion' (i.e. are a discriminative stimuli for the target behavior)" (Browder & Shapiro, 1985, p.204). Self-instructional materials (including written task analyses, picture task analyses, video models/prompts, auditory prompts, and any combination of these prompts) reduce the need for adult instruction while still providing the necessary information for how to complete multi-step tasks. The focus of this review was on the use of self-instructional materials only and did not include the use of self-talk. The purpose of excluding self-talk was that the focus was on generalized use of self-instructional materials and when taught to self-talk, the individual does not learn a skill that will help him or her acquire new skills or maintain previously taught skills, rather an adult would need to provide training in task-specific self-talk for each new skill. The purpose of this review was to systematically identify, summarize, and synthesize research studies teaching generalized use of self-instructional materials to learn multi-step tasks by individuals with ID and individuals with ID and autism. Recommendations for future research are provided.

Method

An electronic search of PsychInfo and ERIC databases was conducted with the following search terms: self-instruction or self-prompting or student-directed and disability or intellectual disability or autism. An initial search identified 224 studies, and a total of 48 studies were selected from reviewing abstracts alone. After reviewing full articles, 8 of 48 studies met criteria for inclusion. An additional 10 studies were identified from ancestral searches of both the 8 included studies and other studies/literature reviews found in the original search. A total of 18 studies were included for review. Criteria for inclusion in the current review included: (a) publication in a peer-reviewed journal between the years of 1980-2013, (b) written in English, (c) inclusion of at least one participant with ID (d) use of a research design that included a baseline condition, and (e) measurement of at least two multi-step tasks per included participant with the purpose of probing at least one task without adult-delivered instruction.

Results

All studies identified were single-case design (SCD) studies published between 1983 and 2012. The studies employed a variety of research designs including ABAB (n=1), multiple probe across behaviors (n=13), adapted alternating treatments (n=1), and multiple baseline across participants and behaviors (n=3). The research question and/or purpose of the study in many identified studies was specifically related to generalization (e.g., To evaluate the effects of picture prompts on the acquisition of vocational behavior and the effects of picture prompts on the generalization and maintenance of performance; Wacker & Berg, 1983). Other studies reported a research question and or/purpose targeted focused on a different goal (e.g., To compare student's ability to independently complete multi-step cooking tasks when using (a) static pictures in a cookbook format and (b) video prompting using a portable DVD player; Mechling & Stephens, 2009). Although the purpose of some studies was not to assess generalized use of a self-instructional tool across two or more multi-step tasks, the study also presented this information, therefore the studies were included for review.

Participants

The 18 studies reviewed included a total of 56 participants. Participants were included based on an IQ score below 75 or if IQ was not reported, a participant was included based on a reported ID. Eight participants were identified as having an IQ score below 35, 18 were identified as having an IQ score between 35-49, 29 were identified as having an IQ score between 50-75, and one participant's IQ score was not reported. Thirty-two participants were reported to have ID, eight participants had ASD and ID, three participants were reported to have a visual impairment and ID, and disability categories were not reported for 13 participants. Twenty-two participants were female, 18 were male, and sex was not reported for 16 participants. Participants ranged in age from 10-48 years. Forty-one participants were between the ages of 10-19, 11 participants were between the ages of 20-29, one participant was between the ages of 30-39, and three participants were between the ages of 40-48. Table 1 provides information on age, IQ, and disability category for individual participants.

Independent Variables

Presentation of self-instructional materials. Fifteen studies introduced self-instructional materials between baseline and intervention and measured a change in performance on multi-step tasks. In three studies, the self-instructional materials were available during baseline and intervention (e.g., photo books with picture prompts were available in all conditions), but participants were trained to use the materials after baseline (Johnson & Miltenberger, 1996; Trask-Tyler et al., 1994; Steed & Lutzker, 1987). The type of prompts and type of presentation of prompts varied between studies.

Type of prompt. Studies included for review spanned a 29 year period, therefore as technology evolved, the type of prompting used has also evolved. Six studies attempted to teach participants to self-instruct with picture prompts (published between 1983 and 1997). Three studies used auditory prompting alone (published between 1990 and 1999). One study compared picture prompts to video prompts (including audio; 2009), and three studies used video prompting (including audio; 2007 and 2012). Additionally, five studies used combinations of prompting including picture and auditory prompts (1997) or picture, picture and auditory, and video prompts (published between 2009 and 2011) (See Table 2).

Presentation of prompt. As technology has evolved, the types of presentation of prompting has also evolved. The earliest identified study and four additional studies used photo books between 1983 and 1997. Cassette players with and without headphones were used in three studies (published between 1990 and 1999), and a 12-picture communication device was used in one study (published in 1997). Two studies used portable DVD players (published between 2008 and 2009) and one study also compared the use of picture books to video prompts on a portable DVD player in 2009. Most recently, six studies used handheld devices to present varying types of prompts (published between 2007 and 2012) (see Table 2).

Training to use self-instruction. Training participants to self-instruct with provided materials occurred in two ways: history training (with an additional multi-step task not targeted in the study) and training within the intervention condition on a target task or between baseline and intervention condition on a target task.

History training. History training occurred in 10 studies. In eight studies, history training occurred before baseline and in two studies it occurred directly after baseline. In history training, participants were taught how to use self-instructional materials with an additional multi-step task not targeted for instruction. One study used verbal prompting to teach two participants to provide video self-prompting on an iPhone (Bereznak et al., 2012), and five studies used least-to-most prompting to instruct participants to use a 12-picture communication device (Mechling & Gast, 1997), a portable DVD player (Mechling et al., 2008), and a handheld device (Mechling et al., 2010; Mechling & Savidge, 2011; Mechling & Seid, 2011). Four additional studies provided history training, but specific information about prompting procedures was not provided (Briggs et al., 1990; Cihak et al., 2007; Mechling et al., 2009; Mechling & Stephens, 2009). Criteria for completion of history training varied across studies but generally ranged from one to three sessions with 100% correct responding on self-instructional skill, although history training data was not provided.

Training within design. Training occurred within the context of a SCD for eight studies. Data were reported for training in some studies, and in other studies, it was reported that training occurred between baseline and post-intervention, but no data were reported during training. Three studies did not include training data, but taught participant to use self-instructional materials using modeling and/or verbal instructions and corrective feedback (Steed & Lutzker, 1997; Steed & Lutzker, 1999; Wacker & Berg, 1984). The difference between studies where training occurred within the context of SCD without reported data and history training was that instruction occurred on the use of the self-instructional tool with a multi-step task targeted for intervention. Five of eight studies presented data on completion of the multi-step task with the use of self-instructional materials in training (Frank et al., 1985; Johnson & Miltenberger, 1996; Trask-Tyler et al., 1994; Wacker & Berg, 1983; Wacker et al., 1985). Two studies trained in three phases: Training to use the materials included modeling and corrective feedback to turn pages in the picture book (phase 1), to match appropriate materials to the pictures (phase 2), and using skills from phase 1 and phase 2 to complete the steps of the multi-step task (phase 3), but data were reported for phase 3 alone. Trask-Tyler et al. (1994) and Frank et al. (1985) used verbal instructions and/or corrective feedback to train the use of self-instructional materials while Johnson & Miltenberger (1996) used modeling, behavioral rehearsal, praise and corrective feedback.

Dependent Variables

Measurement of multi-step tasks. In all studies, participants were taught to use self-instructional materials to learn a multi-step task and then were assessed to determine if they could acquire an additional multi-step task with the self-instructional tool alone (i.e., without adult prompting or assistance). Multi-step tasks that were instructed via a self-instructional tool included: cooking, pedestrian travel, job boxes, daily living skills, vocational skills, and leisure skills. In some studies, participants learned only one type of skill (e.g., three cooking tasks), and in some studies participants learned more than one type of skill (e.g., one cooking task and two vocational tasks). All studies measured multi-step tasks using percent or number of independent and correct responses (see Table 3 for information on target task and dependent measure by study).

Measurement of use of self instructional materials. Thirteen studies reported data only on performance on the multi-step tasks, and five studies reported data on the participant's self-instructional behaviors (Johnson & Miltenberger, 1996; Mechling et al., 2008 Mechling et al., 2010; Mechling & Stephens, 2009; Wacker et al., 1985;). Three studies reported the overall percentage of adult prompts necessary to navigate the self-instructional tool throughout intervention. Mechling et al. (2008) reported that two participant's required prompting on all three tasks (range=1.8-6.4%), while one participant required prompting on two of three tasks (range=0-3.6%). Mechling et al. (2010) reported participants required zero prompting to navigate through prompt levels on a handheld device, and Mechling & Stephens (2009) reported that participants engaged in fewer errors when navigating a handheld device (mean=2.5%) than when navigating through a picture book (mean=4.9%). Two studies reported percentage of self-instruction for participants each session. Wacker et al. (1985) graphically depicted the percent of pages turned independently, while Johnson and Miltenberger (1996) showed the percent of independent picture pointing, picture looking, and verbal self-instructions in intervention.

Outcomes

Targeted multi-step tasks. In the 18 studies reviewed, 55 out of 56 participants acquired at least one multi-step task through self-instruction or a combination of self-instruction and adult delivered prompting (see Table 1). The one participant who did not acquire any multi-step tasks participated in a study where additional prompting on the use of the self-instructional materials or on the multi-step tasks was not provided. The participant was not able to independently generalize the use of the self-instructional materials from history training to novel tasks. Specific information about the participant included that he engaged in challenging behaviors and was only enrolled in a half day program at school due to this issue (Mechling & Savidge, 2011).

Generalization to multi-step tasks. Twenty-four participants independently generalized the use of self-instructional materials to an untrained multi-step task as measured in a SCD. A demonstration of effect of independent self-instruction was observed in one of two ways: acquisition of a multi-step task with the introduction of the independent variable with no adult instruction provided in the intervention condition or by achieving 100% correct responding in the first intervention condition for studies in which adult assistance was available in the first session. An additional 15 participants generalized a portion of the use of self-instructional materials to at least one multi-step task as observed through visual analysis of a significant absolute level change between baseline and intervention (determined by visual analysis alone). Only one study programmed for generalization by not including information about self-instructional materials in the task direction, requiring independent initiation of the self-instructional materials on a generalization task, and having generalization to an untrained task with the use of self-instructional materials alone for all included participants (Wacker & Berg, 1984).

Three clusters have been created to illustrate the ways in which studies assessed for generalization of self-instruction to untrained multi-step tasks: 1) in one of three SCDs (i.e., multiple probe/baseline across behaviors, ABAB design or AATD replicated across behaviors) in which all tiers were identical, 2) in a multiple probe/baseline across behaviors in which decisions to provide training in subsequent tiers depended on probe data with the self-prompting tool, and 3) studies where specific behaviors were selected as target tasks and other behaviors were selected as generalization tasks a priori. In addition to assessing for generalization in different ways, when generalization did not occur, some studies provided adult assistance to participants. Adult assistance has been classified into two types: additional prompting provided to complete self-instruction or additional prompting provided to complete the multi-step task.

Assessment of generalization for cluster 1. Ten studies assessed generalization within multiple probe, ABAB or AATD designs replicated across behaviors where all multi-step tasks received intervention in the same way (Bereznak et al., 2012; Briggs et al., 1990; Cihak et al., 2007; Mechling & Gast, 1997; Mechling & Savidge, 2011; Mechling & Seid, 2011; Mechling & Stephens, 2009; Mechling et al., 2008; Mechling et al., 2010). In the multiple probe designs, baseline data were taken for three behaviors concurrently, followed by the introduction of self-instructional materials for the first behavior while measuring the other two behaviors which remained in baseline condition. When criteria was met on behavior one, the self-prompting tool was introduced to behavior 2. With the introduction of the self-instructional materials, some studies also included other prompting procedures to assist participants in completion of self-instruction or in completion of the multi-step task. For the AATD and multiple probe designs where adult prompting and assistance was available to participants throughout intervention, generalization was noted by the absolute level change from baseline to intervention.

Results for cluster 1. Three of ten studies did not include adult instruction on the use of self-instructional materials or completion of multi-step tasks (Bereznak et al., 2012; Mechling & Gast, 1997; Mechling & Savidge, 2011). In seven studies, prompting was available from an adult/researcher on either self-instruction (e.g., directing students back to a handheld device to view a video prompt) (Mechling & Seid, 2011; Mechling & Stephens, 2009; Mechling et al., 2008; Mechling et al., 2009; Mechling et al., 2010) or on completion of a multi-step task (e.g., modeling a step of stocking milk in the grocery store) (Briggs et al., 1990; Cihak et al., 2007).

For studies in which no adult assistance was provided in intervention, data were analyzed by evaluating which behaviors reached criterion. Because participants received no additional prompting, one can be confident in attributing the change in participant's behavior from baseline to intervention to self-instruction. All participants in Bereznak et al. (2012) acquired multiple skills with self-prompting alone. Mechling and Gast (1997) used an ABAB design and criteria for changing conditions was set at 3 stable data points (i.e. within 10% of one another), and participants didn't remain in intervention with the device for more than three sessions at a time. Although specific criteria for mastery was not set, three of four participants responded with over 80% accuracy in the majority of sessions with the device present and all participants reached 100% for at least one of the two multi-step tasks with the use of self-instructional materials. Three of four participants in Mechling and Savidge (2010) acquired multiple tasks with the presentation of self-instructional materials.

For studies which employed some level of prompting on either the use of self-instruction or on completion of multi-step tasks, data were analyzed by looking at absolute level change between baseline and intervention. This was done because after the first data point in intervention, additional prompting occurred to assist the participant in self-instruction (which may lead to task completion) or task completion, therefore conclusions can no longer be made about self-instruction alone. Data from subsequent sessions are affected by additional treatment components on the use of self-prompting or on the multi-step task. Immediacy of effect typically means the change in level between the last three data points in one condition and the first three data points in the next. Because that is not a possibility here, absolute level change was observed. Kratochwill et al. (2010) state that the "more rapid the effect, the more convincing the inference that change in the outcome measure was due to manipulation of the independent variable" (p. 18), therefore this was used to analyze and report outcomes. Some participants reached 100% correct responding in the first session for at least one multi-step task meaning prompting from an adult was not required to self-instruct or for task completion.

Five studies prompted participants back to their self-instructional tool contingent upon errors or non-responses on multi-step tasks (Mechling & Seid, 2011; Mechling & Stephens, 2009; Mechling et al., 2008; Mechling et al., 2009; Mechling et al., 2010). The last data point in baseline and the first data point in intervention were compared to note the change in behavior with the introduction of the self-prompting system. From visual analysis, a significant change between baseline and intervention with the introduction of a handheld device (Mechling & Seid, 2011; Mechling et al, 2009; Mechling et al, 2010) or portable DVD player (Mechling et al., 2008) was observed for participants in four studies. One study compared video (with audio) to picture prompts and found more significant gains when using video prompting (Mechling & Stephens, 2009). Additionally, three participants reached 100% in the first session for at least one multi-step task, confirming that with the introduction of self-instructional materials alone, participants were able to prompt themselves through a multi-step task with no assistance from an adult (Mechling et al., 2008; Mechling et al., 2009).

Assessment of generalization for cluster 2. Three studies employed multiple probe/baseline across conditions where the adult assistance on multi-step tasks and on self-instruction in each tier differed based on responding from participants. This occurred in two different ways. Johnson and Miltenberger (1996) gave participants access to picture prompts in baseline and intervention and introduced training on how to use picture prompts in intervention for tier 1. For participants who did not reach mastery on the first behavior with adult prompting on self-instruction alone, task training occurred where participants were given adult assistance with the multi-step task. Because participants had access to picture prompts in tiers 2 and 3, training only occurred for behaviors that did not generalize independently. If the participants began to use self-instructional materials to prompt themselves through tasks in tiers 2 or 3, there was not a need for additional prompting from an adult. Wacker & Berg (1983) and Wacker et al. (1985) collected data in baseline on behaviors without the use of picture prompting. After introducing picture prompts and providing training on both the use of self-instructional materials and completion of the first multi-step task to criteria in tier 1, behaviors in tier 2 were probed with the use of picture prompts and no adult assistance for two to three sessions. If participants did not reach criteria in two to three probe sessions with self-instructional materials but no adult instruction, training occurred for tier 2 as it did in tier 1.

Results for cluster 2. One study provided no additional prompting to participants on at least one task (Johnson & Miltenberger, 1996), two studies provided prompting to some participants based on participant performance (Wacker & Berg, 1983; Wacker et al., 1985). In Johnson and Miltenberger (1996), all participant’s generalized the use of self-instructional materials to an untrained multi-step task and acquired that task. One participant required verbal training (i.e., prompting on self-instruction alone) and verbal and task training (i.e., prompting on self-instruction as well as prompting on the multi-step task) on one multi-step task and verbal training alone on a second multi-step task before generalizing to an untrained third multi-step task. One participant required verbal training alone on the first task before generalizing to two additional tasks with no training and the third participant required verbal training and task training on the first task before generalizing to two untrained tasks. Wacker and Berg (1983) trained individuals to use photo books/picture prompts to complete assembly and packaging tasks. After training on two multi-step tasks, two participants generalized to one untrained task, but still required adult instruction on a second generalization task. One participant mastered two untrained tasks with no adult instruction. Lastly, in Wacker et al. (1985), after training on one task, all three participants required additional adult instruction on two untrained multi-step tasks. Two of three participants also required additional training to self-instruct on both skills, while one participant required additional training to self-instruct on one of two skills.

Assessment of generalization for cluster 3. Five studies selected specific multi-step tasks for training and other multi-step tasks for generalization before the study began. Two studies provided self-instructional materials to participants for the generalization task, but did not train participants to use them while subsequently providing training to participants on another task with the same topography of self-instructional materials and observed at what point in training of other skills the participant used the materials to self-instruct on the generalization task (Steed & Lutzker, 1997; Steed & Lutzker, 1999). Three studies trained at least one behavior to criteria before probing the generalization task with the use of self-instructional materials (Frank et al., 1985; Trask-Tyler et al., 1994; Wacker & Berg, 1984).

Results of generalization for cluster 3. Four studies used no additional prompting from adults on either self-instruction or multi-step tasks (Steed & Lutzker, 1997; Steed & Lutzker, 1999; Trask-Tyler et al., 1994; Wacker & Berg, 1984) and one study provided training to some participants only after initial probes revealed a lack of generalization (Frank et al., 1985). For studies that targeted specific training behaviors and generalization behaviors, no additional prompting was provided to assist participants in completing self-instruction. For four of five studies, no additional prompting was provided to assist in completion of multi-step tasks. For three studies, all participants generalized the use of self-prompting tools to untrained tasks and required no additional training (Steed & Lutzker, 1999; Trask-Tyler et al., 1994; Wacker & Berg, 1984). Frank et al. (1985) taught participants to self-instruct to turn on, play, and turn off two computer programs. Two participants acquired the target skill during training and generalized to an untrained skill without training. For three participants, a significant level change was observed between baseline and the first probe session with self-instruction, but participants did not reach approach criteria within two sessions, therefore training was implemented on the generalization skills. The authors reported specific difficulty using the shift key for all participants on the generalization task. Some level of generalization did occur between baseline and treatment for untrained skills. Steed & Lutzker (1997) taught one participant to set the table, vacuum, and dust. Following training, the participant demonstrated setting generalization by dusting in another environment, but was unable to generalize to an untrained task (i.e., emptying the trash) without additional training.

When participants generalize the use of self-instructional tools to untrained tasks, this presents an invaluable opportunity to learn novel skills without adult assistance. Task generalization was assessed in two different ways. Some studies trained participants to use the self-instructional tool on one or more behaviors and then probed generalization to untrained tasks. Some studies used multiple probe/baseline across behaviors designs in which generalization (or lack thereof) was observed after training occurred in one tier and the independent variable was applied to the second or third tier.

Task Directions and Material Preparation

To promote independence with self-instructions, prompting participant's use of the self-instructional tool is typically faded over time. In some studies, participants were independent at using their self-instructional tool, but may not independently generalize that skill to a novel or untrained task because the task direction from the adult included information about the use of the self-instructional tool. For example, participants were told, "Use your picture book to make popcorn." An alternative way to present the task direction is by making it more natural to task directions presented across skills in the participant's environment (e.g., "Make popcorn") and teaching the participant to respond to the task direction by initiating the use of the SI tool. Nine studies identified included information about the self-instructional tool in the task direction, seven studies provided a task direction that did not include information about the self-instructional tool, and three studies did not provide information about the task direction.

In addition to the way the task directions are provided, the presentation of self-instructional materials is also extremely important in promoting independent generalization of self-instruction to untrained tasks. In fourteen studies, researchers gave the self-instructional materials to the participant when providing the task direction and set the self-instructional materials up to begin prompting for that specific task. For example, participants were handed an audio-cassette player with the correct tape inserted and told to use the cassette player to complete the task. When participants pushed play, the correct verbal prompting for that task was provided.

While this still promotes independence in learning for the participants, it does not teach participants to independently access and navigate a variety of prompts to learn untrained tasks or as reminders for already learned tasks. Rather than placing the materials in the hands of participants, some studies allowed the initiation of the tool by participants. Mechling and Savidge (2011) placed a handheld device at a work station for participants to initiate self-instruction with after the natural discriminative stimulus of checking his or her daily schedule and walking to the work station. Wacker and Berg (1984) placed the photo book with picture prompts on the counter next to the materials, but did not direct participants attention to it.

Inter-observer agreement and Procedural Fidelity

All studies collected inter-observer agreement (IOA) data between the researcher and an independent observer. Sixteen of 18 studies collected reliability data for at least 20% of sessions, one study reported data collection for less than 20% of sessions (Wacker & Berg, 1983), and one study did not report (Briggs et al., 1990). All 18 studies reported Mean IOA over 80%. Only nine of 18 studies collected and reported procedural fidelity (PF) data (Bereznak et al., 2012; Cihak et al., 2007; Mechling & Gast, 1997; Mechling & Seid, 2011; Mechling & Stephens, 2009; Mechling et al., 2008; Mechling et al., 2009; Mechling et al., 2010; Mechling & Savidge, 2011). In all nine studies, PF was collected in over 20% of sessions and mean PF was over 80%.

Discussion

The purpose of this review was to systematically identify, summarize, and synthesize research studies teaching generalized use of self-instructional materials to learn multi-step tasks by individuals with ID or ID and autism.

Implications for Practitioners

The way task directions and self-instructional materials were provided may greatly impact the external validity of many of the reviewed studies. Macduff, Krantz, and McClannahan (2001) in discussing programming for prompting and prompt fading, describe the need for researchers and practitioners to always ask the question “What stimuli should cue the person to engage in the target behavior?” (p.45). Sometimes in the natural environment, the cue will be someone telling the individual to complete a task (e.g., “Put away your laundry please”). Other times, the discriminative stimulus to begin engaging in a task does not involve another person at all. The cue to complete a task could be the completion of a previous task (e.g., getting out of bed in the morning for some people cues the individual to take a shower) or something else occurring in the individuals environment (e.g., the washer beeps when it is finished, signaling the individual to move the clothes to the dryer). Although it is sometimes necessary for adults to provide specific task directions (e.g., “Make popcorn”) when learning new skills, researchers and practitioners should continue to teach individuals with disabilities to respond to natural discriminative stimuli in their environments whenever possible.

In most studies reviewed, the participants were instructed to complete the task with the help of self-instructional materials (e.g., “Use the picture book to help you fold your laundry”). The discriminative stimulus for folding laundry became an adult telling the participant (1) what to do (e.g., fold laundry) and (2) how to do it (e.g., using the picture book). In other studies, participants were instructed only about what to do (e.g., fold laundry) but the researcher placed the self-instructional materials in the participant’s hands. Both of these situations create possible barriers to generalization as participants may require an adult to provide a task direction including information about both what to do and how to do it. Two studies provided more naturalistic discriminative stimuli for participants (Mechling and Savidge, 2011; Wacker and Berg, 1984). Self-instructional materials were placed on a desk or counter next to the materials the participant would be using to complete the multi-step task. Both studies required participants to initiate the use of the materials, but Mechling and Savidge (2011) had the handheld device turned to the correct slide and the participant simply had to push the first button to begin. The picture book in Wacker and Berg contained only pictures related to that specific task. Although these studies took great care in programming for generalization, barriers to independence on future untrained multi-step tasks still exist. For example, if an individual's mother always prepared his dinner, but he was hungry before she got home from work and wanted to make a sandwich but a picture book for making a sandwich was not sitting on the counter next to the materials to make a sandwich, the participant may still require adult assistance to learn that skill or locate the self-instructional materials. It is important to note that adult supports are still required to create the self-instructional materials, but time spent with adult instruction would not be required, decreasing overall dependence on adult supports.

In addition to teaching individuals with disabilities to respond to natural discriminative stimuli, or at the least, to respond to a task direction including information only about what to do rather than how to do it (e.g., "Wash your clothes), providing individuals with self-instructional materials they can navigate to engage in a variety of tasks is also critically important. If each time a teacher or caregiver wants an individual to self-instruct to learn an untrained multi-step task, the adult has to provide a photo book to the individual, this reduces the potential for future independence from adult assistance and dependence on other materials. Typically developing adolescents and adults use a variety of supports in the natural environment to self-instruct on a daily basis. Reading recipes from a cookbook, looking up directions on a handheld device, and watching an online video about how change the oil in your car are all examples of how individuals self-instruct. One can google “how to” and find a plethora of websites devoted to how-to articles and videos with topics ranging from home and garden to financial and business information, to sports and fitness which are available at the click of a button. These self-instructional materials enhance our daily lives and make us capable of completing multi-step tasks that we would otherwise not know how to complete. In order to truly provide individuals with disabilities with a pivotal skill, researchers and practitioners must focus on teaching individuals to use self-instructional materials such as handheld devices where the individual has the ability to select prompting (in the form of written task analyses, auditory prompting, pictures, or video) on one of many multi-step tasks.

Directions for Future Research

Although research exists on the generalized use of self-instructional materials across the last 30 years, much research remains to be done. Participants in the reviewed studies generalized between one and three multi-step tasks. Future research should assess generalization across a wider variety and larger number of tasks and across a larger number of settings to conclude the acquisition of a truly pivotal skill. Future research should also include teaching individuals to respond to natural discriminative stimuli. This includes removing information about self-instructional materials in provided task directions and teaching individuals to respond without task-directions from an adult. Additionally, future research should focus on the initiation of self-instruction without an adult providing the self-instructional materials. For example, rather than giving the participant self-instructional materials that are prepared on the correct slide so participants only have to press start, keep the materials in the participant’s desk or in his or her pocket and teach the participant to locate the materials, turn them on (if electronic), and independently navigate to the information about the skill they want to complete. With these directions in future research, adults would not provide instruction related to multi-step tasks, but they would still have to prepare the self-instructional materials. Because of this, additional research should explore teaching individuals with disabilities to create their own instructional materials. For example, participants could learn to video another person engaged in the task they want to complete (e.g., film a peer making popcorn), and use that video to self-instruct.

Limitations and Conclusions

Two main limitations of the studies reviewed were both related to a lack of reported data. One limitation was the lack of training data in studies that used history training. History training is a common way to introduce participants to the independent variable; although valuable, data on participant's acquisition of self-instructional behavior or information about participant's acquisition of the multi-step task learned in history training was not provided by any studies. This has practical implications as information is not provided on the level of prompting required or length of time participant's spent in history training so an instructor would not know if the procedures would be feasible in a school, vocational, or home environment. Valuable information is still gained by reports of history training including the types of prompting strategies required to instruct participants to engage in self-instruction with the provided materials.

A second limitation involved the lack of procedural fidelity data reported in half of the studies. Horner et al. (2005) states that single-case design studies "should provide adequate documentation that the practice was implemented with fidelity" (p.176). This becomes even more important when discussing the role of adult delivered prompting as a measure of independence for individuals with disabilities. In studies that did not report procedural fidelity data, it is possible researchers provided prompting outside the context of what was reported. In this case, participants were completing 100% of multi-step tasks correctly, but may not have been using self-instructional materials independently. This could cause readers to make false conclusions about the efficacy of an intervention and the outcomes displayed.

Self-instruction is a skill used by typically developing adolescents and adults every day. It is important to teach individuals with ID to self-instruct to acquire multi-step tasks, because an increase in daily living skills may create an opportunity to access additional post-secondary settings (e.g., employment). Also, when systematic instruction is no longer available (e.g., from the public school system), an opportunity to acquire novel tasks is still available.

References

Bereznak, S., Ayres, K. M., Mechling, L. C., & Alexander, J. L. (2012). Video self-prompting and mobile technology to increase daily living and vocational independence for students with autism spectrum disorders. *Journal of Developmental and Physical Disabilities, 24*, 269-285.

Boyle C.A, Boulet S, Schieve L, Cohen R.A, Blumberg S.J, Yeargin-Allsopp M, Visser S, & Kogan M.D. Trends in the Prevalence of Developmental Disabilities in US Children, 1997–2008. Pediatrics. 2011 [epub ahead of print].

Briggs, A., Alberto, P., Sharpton, W., Berlin, K., McKinley, C., & Ritts, C. (1990) Generalized use of a self-operated audio prompt system. *Education and Training in Mental Retardation, 25*, 381-389.

Browder, D. M., & Shapiro, E. S. (1985). Applications of self-management to individuals with severe handicaps: A review. *Journal of the Association for Persons with Severe Handicaps, 10*, 200-208.

Cihak, D. F., Kessler, K., & Alberto, P. (2007). Generalized use of a handheld prompting system. *Research in Developmental Disabilities, 28*, 397–408. doi:10.1016/j.ridd.2006.05.003.

Frank, A. R., Wacker, D. P., Berg, W. K., & McMahon, C. M. (1985). Teaching selected microcomputer skills to retarded students via picture prompts. *Journal of Applied Behavior Analysis, 18*, 179-185.

Fetko, K. S., Schuster, J. W., Harley, D. A., & Collins, B. C. (1999). Using simultaneous prompting to teach a chained vocational task to young adults with severe intellectual disabilities. *Education and Training in Mental Retardation and Developmental Disabilities, 34*, 318-329.

Horner, R. H., Carr, E. G., Halle, J. McGee, G., Odom, S. & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional Children, 71*, 165-179.

Johnson, R. R., & Miltenberger, R. G. (1996). The direct and generalized effects of self instructions and picture prompts on vocational task performance. *Behavioral Interventions, 11*, 19-34.

Koegel, L. K., Koegel, R. L., Harrower, J. K., & Carter, C. M. (1999). Pivotal response intervention I: Overview of approach. *Journal of the Association of Persons with Severe Handicaps, 24*, 174-185.

Kratochwill, T. R., Hitchcock, J., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M. & Shadish, W. R. (2010). Single-case designs technical documentation. Retrieved from What Works Clearinghouse website: http://ies.ed.gov/ncee/wwc/pdf/wwc_scd.pdf.

MacDuff, G. S., Krantz, P. J., & McClannahan, L. E. (2001). Prompts and prompt-fading strategies for people with autism. In C. Maurice, G. Green, & R. M. Foxx (Eds.), *Making a difference: Behavioral intervention for autism* (37- 50). Austin, TX: PRO-ED.

Mechling, L. C., & Gast, D. L. (1997). Combination audio/visual self-prompting system for teaching chained tasks to students with intellectual disabilities. *Education and Training in Mental Retardation and Developmental Disabilities, 32*, 138-153.

Mechling, L. C., & Seid, N. H. (2011). Use of a hand-held personal digital assistant (PDA) to self-prompt pedestrian travel by young adults with moderate intellectual disabilities. *Education and Treatment of Developmental Disabilities, 46*, 220-237.

Mechling, L. C., & Stephens, E. (2009). Comparison of self-prompting of cooking skills via picture-based cookbooks and video recipes. *Education and Training in Developmental Disabilities, 44*, 218-236.

Mechling, L. C., Gast, D. L., & Fields, E. A. (2008). Evaluation of a portable dvd player and system of least prompts to self-prompt cooking task completion by young adults with moderate intellectual disabilities. *Journal of Special Education, 42*, 179-190.

Mechling, L. C., Gast, D. L., & Seid, N. H. (2009). Using a personal digital assistant to increase independent task completion by students with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 39*, 1420-1434.

Mechling, L. C., Gast, D. L., Seid, N. H. (2010). Evaluation of a personal digital assistant as a self-prompting device for increasing multi-step task completion by students with moderate intellectual disabilities. *Education and Training in Autism and Developmental Disabilities, 45*, 422-439.

Mechling, L. M., & Savidge, E. J. (2011). Using a personal digital assistant to increase completion of novel tasks and independent transitioning by students with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 41*, 687-704.

Snell, M. E. (1982). Analysis of time delay procedures in teaching daily living skills to retarded adults. *Analysis and Intervention in Developmental Disabilities, 2*, 139-155.

Steed, S. E., & Lutzker, J. R. (1997). Using picture prompts to teach an adult with developmental disabilities to independently complete vocational tasks. *Journal of Developmental and Physical Disabilities, 9,* 117–133.

Steed, S. E., & Lutzker, J. R. (1999). Recorded audio prompts: A strategy to increase independent pre- vocational task completion in individuals with dual diagnosis. *Behavior Modification, 23,* 152–168.

Trask-Tyler, S. A., Grossi, T. A.,& Heward, W. L. (1994). Teaching young adults with developmental disabilities and visual impairments to use tape-recorded recipes: Acquisition, generalization, and maintenance of cooking skills. *Journal of Behavioral Education, 4*, 283-311.

Van Laarhoven, T., & Van Laarhoven-Myers, T. (2006). Comparison of three video-based instructional procedures for teaching daily living skills to persons with developmental disabilities. *Education and Training in Developmental Disabilities, 41*, 365-381.

Wacker, D. P., & Berg, W. K. (1983). Effects of picture prompts on the acquisition of complex vocational tasks by mentally retarded adolescents. *Journal of Applied Behavior Analysis, 16*, 417-433.

Wacker, D. P., & Berg, W. K. (1984). Training adolescents with severe handicaps to set up job tasks independently using picture prompts. *Analysis and Intervention in Developmental Disabilities, 4*, 353-365.

Wacker, D. P., Berg, W. K., Berrie, P., & Swatta, P. (1985). Generalization and maintenance of complex skills by severely handicapped adolescents following picture prompt training. *Journal of Applied Behavior Analysis, 18*, 329-336.

Table 1

Participant Demographics and Results

*Reference	Participants who met criteria	Age	Diagnoses	IQ	Sex	Acquired at Least One Multi-step Task	Generalized to at least One Multi-step Task with Zero Adult Instruction	Significant Absolute Level Change Before and After SI for at Least One Multi-step Task
Bereznak et al.	1	16	severe ASD; MID	68	M	X	X	NA
(2012)	2	15	NR; "possibly" range of ASD	40	M	X	X	NA
Briggs et al. (1990)	1	13-19	NR	30	F	X	-	X
	2	13-19	NR	54	M	X	-	-
	3	13-19	NR	36	F	X	-	X
	4	13-19	NR	53	M	X	X	X
Cihak et al. (2007)	1	19	NR	45	NR	X	-	-
	2	19	NR	50	NR	X	-	-
	3	18	NR	43	NR	X	-	-
	4	18	NR	40	NR	X	-	-
Frank et al. (1985)	1	13	NR	70	NR	X	-	NA
	2	11	NR	69	NR	X	X	NA
	3	11	NR	63	NR	X	-	NA
	4	11	NR	61	NR	X	-	NA
	5	11	NR	61	NR	X	-	NA
Johnson &	1	48	Down Syndrome	48	F	X	X	NA
Miltenberger (1996)	2	28	Down Syndrome	48	F	X	X	NA
	3	29	Sturge-Weber Syndrome	69	M	X	X	NA
Mechling & Gast	1	13	MOID	52	F	X	X	NA
(1997)	2	13	MOID	51	F	X	-	NA
	3	10	MOID	41	M	X	-	NA
	4	10	MOID	48	M	X	-	NA
Mechling & Seid	1	20	MOID	46	F	X	-	X
(2011)	2	21	MOID	57	F	X	-	X
	3	21	MOID	52	F	X	-	X
Mechling &	1	20	MOID	55	NR	X	-	X
Stephens (2009)	2	19	MOID	58	NR	X	-	X
	3	19	MOID	57	NR	X	-	X
	4	22	Williams Syndrome, MOID	55	NR	X	-	X
Mechling, Gast, &	1	20	Down Syndrome; MOID	53	F	X	X	X
Fields (2008)	2	22	MOID	40	M	X	-	X
	3	19	MOID	52	F	X	-	X
Mechling, Gast, &	1	17	mild ASD; MOID	51	M	x	-	X
Seid (2009)	2	16	mild ASD	75	M	X	X	X
	3	17	mod ASD; MOID	40	F	X	X	X
Mechling, Gast, &	1	15	Williams Syndrome; MOID	55	M	X	-	X
Seid (2010)	2	17	DS; MOID	51	F	X	-	X
	3	17	MOID	44	F	X	-	X
Mechling & Savidge	1	14	ASD; MOID	45	M	X	X	NA
(2011)	2	14	ASD; MOID	47	F	X	X	NA
	3	14	ASD; MOID	54	M	-	-	NA
Steed & Lutzker (1997)	1	40	Profound ID; atypical psychosis	NR	M	X	-	NA
Steed & Lutzker	1	48	MID; atypical psychosis,	50	F	X	X	NA
(1999)	2	37	MOID; undifferentiated	31	F	X	X	NA
Trask-Tyler et al.	1	21	visual impairmnt	72	F	X	X	NA
(1994)	2	20	visual impairment	64	M	X	X	NA
	3	17	visual impairment	72	M	X	X	NA
Wacker & Berg	1	18	severe ID	30	F	X	X	NA
(1983)	2	19	moderate-severe ID	34	F	X	X	NA
	3	19	moderate-severe ID	38	F	X	X	NA
Wacker & Berg	1	19	severe ID	36	NR	X	X	NA
(1984)	2	19	mod-severe ID	34	NR	X	X	NA
	3	19	mod-severe ID	38	NR	X	X	NA
Wacker et al. (1985)	1	13-19	severe or profound ID	<26	F	X	-	NA
	2	13-19	severe or profound ID	<26	M	X	-	NA
	3	13-19	severe or profound ID	<26	M	X	-	NA

*References are listed alphabetically; NR=Not reported; NA=Not applicable; SI=Self-Instruction; MID=Mild Intellectual Disability; MOID=Moderate Intellectual Disability; ASD=Autism Spectrum Disorder

Table 2

Self-Instructional Materials

*Reference	Type of Prompt			Presentation of Prompt						
	Picture	Auditory	Video with Audio	Poster-board	Photo Book	Cassette Recorder w/ Headphones	Cassette Recorder w/o Headphones	Portable DVD Player	12-Picture Communication System	Handheld Device
Wacker & Berg (1983)	X				X					
Wacker & Berg (1984)	X				X					
Wacker et al. (1985)	X				X					
Frank et al. (1985)	X				X					
Briggs et al. (1990)		X				X				
Trask-Tyler et al. (1994)		X					X			
Johnson & Miltenberger (1996)	X			X						
Mechling & Gast (1997)	X	X							X	
Steed & Lutzker (1997)	X				X					
Steed & Lutzker (1999)		X				X				
Cihak et al. (2007)			X							X
Mechling et al. (2008)			X					X		
Mechling & Stephens (2009)	O		O		O			O		
Mechling et al. (2009)	X	X	X							X
Mechling et al. (2010)	X	X	X							X
Mechling & Seid (2011)	X	X	X							X
Mechling & Savidge (2011)	X	X	X							X
Bereznak et al. (2012)			X							X

*References are listed in order of publication da

Table 3

Multi-Step Tasks and Dependent Measures

*Reference	Target & Generalization Tasks	Measured as % correct	Measured as # correct	Reference	Target & Generalization Tasks	Measured as % correct	Measured as # correct
Bereznak et al. (2012)	Making a copy, Making noodles, Using a washing machine	X		Mechling et al. (2008)	Grilled cheese, Hamburger Helper, Ham salad	X	
Briggs et al. (1990)	Operate washing machine, Operate a dryer, Clean the commode, Clean mirrors	X		Mechling et al. (2009)	Hamburger Helper, Individual size pizza, Ham & cheese sandwich	X	
Cihak et al. (2007)	Gathering carts, Stocking milk, Vacuuming, Making sub-rolls, Self-prepping, Preparing broccoli, Skewering shrimp, Preparing tea, Straightening mushrooms, Stocking bananas, Stocking pineapples, Cleaning a fitting room	X		Mechling et al. (2010)	Hamburger helper in microwave, Grilled ham and cheese on stove, Individual pizza in microwave	X	
Frank et al. (1985)	Spelling computer programs, Clock computer program	X		Steed & Lutzker (1997)	Setting table, Vacuuming, Dusting table, Dusting sofa, Emptying the trash	X	
Johnson & Miltenberger (1996)	Sorting, Packaging	X		Steed & Lutzker (1999)	Making coffee, Washing dishes, Washing windows, Watering garden	X	
Mechling & Gast (1997)	Sorting groceries or school supplies, Using dishwasher		X	Trask-Tyler et al. (1994)	Pizza, Coffee, Cheesecake, French fries, Popcorn, Tea, Pudding, Microwave brownie, Microwave cake		X
Mechling & Savidge (2011)	Sets of 4 task boxes (e.g., color match sequence, positive attraction, lacing, pencil packaging)		X	Wacker & Berg (1983)	Black valve assembly, Circuit board assembly, Double Red Valve Assembly, Packaging tasks	X	
Mechling & Seid (2011)	Landmarks and Final Destinations Reached	X		Wacker & Berg (1984)	Valve assembly set-up, Packaging task set-up	X	
Mechling & Stephens (2009)	Hot Chocolate, Ravioli, Broccoli, Chocolate, Pudding, Tuna, French Fries	X		Wacker et al. (1985)	Stuffing envelopes, Folding laundry, Dusting tables, Clean a window, Conduit-assembly, Laundry folding, Set up a board game	X	

*References are listed alphabetically

Appendix B

A Review of the Literature on Generalization and Video-Based Instruction

Generalization and Video-based Instruction: A Review of the Literature

Katie A. Smith

The University of Georgia

Abstract

Research was reviewed on assessment of generalization in studies using interventions including video-based instruction to teach multi-steps tasks to individuals with autism or intellectual disability. A total of 81 studies were identified for review. Studies were published between 1992 and 2013. Ten of eighty-one studies assessed a generalization response in at least a pre-/post-test design while also assessing an acquisition response in baseline and intervention and additional research questions were included regarding these studies. Types of generalization assessed (e.g., settings, materials, persons, skills) are discussed, and generalization outcomes are reported for each of ten studies. Future research should focus on experimentally evaluating generalized responding in research studies, and improving the quality of generalization probes by assessing behaviors under natural conditions, rather than just different conditions from acquisition.

Generalization and Video-based Instruction: A Review of the Literature

In 1978, Wolf described the importance of the analysis of interventions to problems of social importance and described applied behavior analysis as being “dedicated to helping people become better able to achieve their reinforcers” (p. 206). Prior to this paper, many in the field of applied behavior analysis were concerned with demonstrating control over behavior, but were less concerned about the social validity of the goals, procedures, or outcomes. Without high levels of social validity, it is unlikely a researcher, practitioner, parent, or other will continue to implement an intervention on the target behavior or other behaviors even if the target behavior change was significant. This paper created a push to be cognizant of social validity when examining the behaviors selected for change, the interventions and procedures implemented to change the behavior, and the effects of the intervention on the target behavior and/or other unintended outcomes or effects of the intervention or procedures on other behavior. Two components of the effects of an intervention and arguably the most important components are the change in behavior across time (i.e., maintenance) and the change in behavior across settings, materials, people, or skills (i.e., generalization).

In 1977, Stokes and Baer described the importance of not only assessing, but also programming for generalization. Stokes and Baer described the current state of research being that discrimination was considered an active process by which procedures were developed and practice occurred and generalization was “the natural result of failing to practice a discrimination technology adequately” (p. 349). The authors made a case that generalization was equally as important as discrimination and state that “A therapeutic behavioral change, to be effective, often (not always) must occur over time, persons, and settings and the effects of the change sometimes should spread to a variety of related behaviors” (p. 350). In this seminal work, Stokes and Baer defined generalization as the "occurrence of relevant behavior under different, non-training conditions (i.e., across subjects, settings, people, behaviors, and/or time) without the scheduling of the same events in those conditions as had been scheduled in the training conditions" (p. 350). They go on to describe the goal to be that the behavior will occur under natural conditions and be maintained by naturally occurring reinforcement.

In 1988, Stokes and Osnes discussed controversy with the previously provided definition of generalization in that it was not specific enough and provided an additional definition of generalization and maintenance as "obtaining widespread change across diverse stimulus conditions, responses, and time without comprehensive programming" (p .6). Additionally, the authors discuss the importance of determining both when and where generalization occurs and asking the question "Why?" to continue to program for change in behaviors of social significance that maintain over time and occur in a variety of settings, with a variety of people, and with a variety of materials. Additionally, if skills from acquisition of one response (e.g., packing a book bag) can generalize to an additional response (e.g., unpacking a book bag), instructional time that would have been spent on unpacking a book bag can be spent on an additional skill and instruction becomes more efficient.

The focus of this review was specifically on generalization of responses taught via video based instruction. Video-based instruction has been used to teach discrete and chained tasks to individuals with disabilities for over 25 years (Haring, Kennedy, Adams, & Pitts-Conway, 1987). Numerous reviews on video-based instruction have been published (e.g., Ayres & Langone, 2005; Mechling, 2005; Bellini & Akullian, 2007; Mason et al., 2012), and some researchers have reported that skills taught via video-based instruction generalize more effectively than skills taught via in vivo instruction (Charlop-Christy, Le, & Freeman, 2000). One specific type of video-based instruction, video modeling, has been identified as an evidence-based practice through a number of organizations. For example, the National Secondary Transition Technical Assistance Center (NSTTAC) has identified video modeling as an evidence-based practice with moderate levels of evidence for adolescents and adults for teaching food preparation, cooking, and home-maintenance skills (Test, Cease-Cook, Fowler, & Bartholomew, 2011). Also, the National Professional Development Center on Autism Spectrum Disorders (NPDC) has identified video modeling as an evidence-based practice for individuals with autism (Odom, Collet-Klingenberg, Rogers, & Hatton, 2010).

Criteria for meeting standards as an evidence-based practice through both of the evaluations included rigorous quality standards for single-case design. The NSTTAC criteria for meeting evidence standards includes having a number of high quality or acceptable quality studies from multiple research groups. Criteria for being identified as an evidence-based practice through the NPDC for single-case designs includes having at least five high quality studies without threats to internal validity that create confounds with three demonstrations of effect at three points in time from at least three different research groups. Neither organization includes any component of participants completing skills in the natural environment or generalizing acquired skills to natural environments to report the instructional strategy as an evidence-based practice.

The importance of generalization and maintenance for behaviors of social significance cannot be overlooked. Don Baer stated, “A behavior change—no matter how important initially—is of little value to the learner if it does not last over time, is not emitted in appropriate setting and situations, or occurs in restricted form when varied topographies are desired” (Cooper, Heward, & Heron, 2006, p. 653). Therefore, in order to better answer the questions when and where generalization occurs and why generalization occurs, the quality of assessment of generalization must improve. One purpose of this review was to determine if generalization was a goal in the each research study as identified through the research questions being asked by the researchers. A second purpose was to determine if generalization was being assessed in studies describing the implementation of video-based instruction on multi-step tasks. Lastly, for studies that did assess generalization, additional questions were asked to attempt to conclude why generalization did or did not occur. The specific research questions included the following: In studies teaching multi-step tasks to individuals with autism and/or intellectual disabilities, (a) What number/percentage of studies included a component of generalization in their research purpose or research question? and (b) Was generalization assessed in any way, and if so, when was generalization assessed in relation to instruction (e.g., pre-post, continuously)? For studies that assessed generalization using a minimum of a pre-/post-test for a generalization measure as well as collecting data on a separate acquisition response in baseline and intervention conditions, additional research questions were asked including the following: (c) What type of generalization was assessed (e.g., settings, people, materials, skills) and (d) What were the effects of the intervention on generalized responding?

Method

An electronic literature search was conducted using ERIC and Psychinfo with the following search terms: video modeling or video prompting or video-based instruction or videotape modeling or video technology or video and autism or intellectual disability or developmental disability or disability. Studies were included for review if they met the following criteria: (a) published in a peer-reviewed journal, (b) included only participants with autism and/or intellectual disability or data could be disaggregated for these participants, (c) at least one component of the independent variable included video-based instruction, (d) target behaviors were multi-step tasks measured using task analytic recording and were reported as percent or number of correct steps completed, and (e) involved the use of a research design that employed at least a baseline and intervention condition. Studies were excluded if they included multi-step tasks, but the tasks were not measured using task analytic recording (e.g., partial interval recording), or if the task was performed multiple times within a session and data were not disaggregated for each response chain (e.g., 3 identical trials of unloading dishwasher reported by one data point). Using the search terms listed above, 1,530 articles published between 1968 and 2013 were found. Of the articles located, 79 studies were selected based on inclusion criteria and two additional studies were located through an ancestral search for a total of 81 studies included for review. Results for the 81 articles are included in part one of the results section which is focused on the purpose or research questions included in the studies reviewed and how generalization has or has not been assessed. An additional focus of this review was to evaluate whether responses have generalized to additional settings, materials, people, etc. For this question, only studies that met a minimum criteria in how generalization was assessed were included in part two of the results.

A minimum criterion was set for quality of assessment of generalization within single-case designs. In order to state that a response has generalized as a result of acquisition, it is imperative that both an acquisition response and generalization response were measured before and during or after intervention. Therefore, to meet criteria for part two of the results section, studies must have assessed acquisition response and generalization response before or during baseline and at least during or after intervention. Studies in which instruction occurred during all generalization probe sessions during or after intervention were excluded.

Results

Part One

The 81 identified studies were published between 1992 and 2013 in 27 journals. Sixty-nine studies (85%) were published in the past 10 years (i.e., 2004-2013). The following journals included five or more publications: *Education and Training in Autism and Developmental Disabilities* (n=24, 29%), *Focus on Autism and Other Developmental Disabilities* (n=5, 6%), *Journal of Behavioral Education* (n=6, 7%), and *Journal of Developmental and Physical Disabilities* (n=5, 6%). All studies included for review employed the use of a single-case design to assess the effects of the independent variable(s) on multi-step task(s).

Research question. To identify the goals of each study, the specific research question(s) asked in each study were coded for inclusion or exclusion of at least one generalization component. If a research question was not stated, the purpose statement was coded. Research questions/purpose statements included generalization if the term generalization was used (e.g., Will any acquired skills generalize to children's classroom sensory activities and across untrained materials?; Hine & Wolery, 2006) or if generalization was described but the term was not explicitly stated (e.g., During postintervention phases 1 through 5, in the presence of similar but different stimuli ((i.e., the inclusion of novel math problems)), what are the effects of video self-modeling via an iPad on the percentage of correct responses?; Burton, Anderson, & Prater, 2013). Twenty-four studies (29%) included at least one research question or purpose statement related to generalization and fifty-seven studies (71%) did not.

A total of 10 studies were included in part two of the results section (i.e., minimum requirements met for generalization assessment) if data were reported on an acquisition response in baseline and intervention and at least a pre-/post-test was included for a generalization response. Because other studies included measures of generalization that did not meet these requirements, all studies (i.e., those that did or did not include a research question related to generalization) were coded for how generalization was or was not assessed within the context of the single case-designs in part one.

Studies including a generalization research question(s). Of the 24 studies including at least one research question (e.g., goal) related to generalization, two studies reported no formal data regarding generalization to other settings, materials, people, or skills (Ergenekon, 2012; Graves, Collins, & Schuster, 2005) and 22 studies reported some type of generalization data. One study was excluded from part two of the results because it provided instruction in what was referred to as generalization probes (Payne, Cannella-Malone, Tullis, & Sabielny, 2012) and one study reported generalization after response generalization occurred between tiers within the context of a multiple-probe design (Alcantara, 1994). Six studies measured a response in baseline, a different response in intervention, and the response from baseline post-intervention (Ayres, Langone, Boon, & Norman, 2006; Ayres, Maguire, & Mclimon, 2009; Ayres & Cihak, 2010, Mechling, Gast, & Barthold, 2003; Mechling, Gast, & Langone, 2002; Branham, Collins, & Schuster, 1999). For example, Ayres et al. (2009) measured baseline performance on setting the table, making soup, and making a sandwich in the school or home for three participants. Participants were then instructed to complete setting the table, making soup, and making a sandwich using computer-based video instruction including viewing a video model and completing a computer simulation response. Following criteria of computer simulation, in-vivo probes were again conducted in the home or community. No baseline data were collected on responses in computer simulation and at least one participant completed 100% correct responding on the first trial, therefore the response may have already been in the participant's repertoire prior to intervention. Because of a lack of baseline data on the target response trained in intervention, it is not possible to conclude that generalization occurred due to the acquisition of the computer simulation response.

Ten studies measured an acquisition response in baseline and intervention, but did not include baseline data on a generalization response (i.e., included only probes after intervention for a generalization response). Four studies that included a research question about generalization included at least one measure of generalization in at least a pre-/post-test and at least one target response measured in baseline and instructed in intervention and met criteria for part two of the results section (Charlop-Christy et al., 2000; Bidwell, & Rehfeldt, 2004; Hine & Wolery, 2006; Van Laarhoven & Van Laarhoven-Myers, 2006).

Studies not including a generalization research question(s). The majority of studies (n=57; 70%) did not include research questions or purpose statements related to generalization. Forty-four of these studies also reported no measures of generalization at all. Because this was not one of the stated goals of the study, generalization was not mentioned unless it was mentioned in the discussion section as a direction for future research or limitation. Of the 57 studies, although it was not included as a research question or goal, six studies met criteria for generalization assessment by assessing an acquisition response in baseline and intervention and a generalization response at least pre- and post-intervention. Additional studies partially assessed generalization. Three studies did not measure the generalization response in baseline, three studies measured what they considered to be a generalization response in baseline and post-intervention, but did not collect baseline data on the target behavior trained in intervention, one study applied the intervention to what was considered the generalization response, and one additional study did not provide enough information to differentiate generalization data from acquisition data.

Part Two

Ten of eighty-one articles measuring acquisition of a multi-step task and providing instruction using at least one component of video-based instruction met criteria for assessment of generalization. Four of ten studies included a research question related to generalization and six of ten did not.

Participants. Studies had a total of 29 participants. Twenty-three total participants met criteria for inclusion in the review. The remaining six participants did not have generalization assessments pre- and post-intervention, were being instructed on discrete tasks, or were being instructed on multi-step tasks measured by partial-interval recording or another measurement system not included in the review. Participants ranged in age from 2 to 72 years old and had diagnoses of autism, intellectual disability, intellectual disability and autism, or intellectual disability and Down syndrome. Diagnosis was not reported for one participant. Additional information about participants can be found in Table 2.

Setting and target behaviors. A total of 17 multi-step tasks were taught to participants in a variety of settings including therapy rooms, clinical settings, homes, and schools (see Table 3). Skills ranged in length from 3 to 23 steps. Eight tasks were daily living skills (e.g., fold laundry, brush teeth), eight were play skills (e.g., gardening play scheme, toy construction, aquatic play skills), and one was cooking and a social skill combined into one task analysis (e.g., making coffee and serving it to a peer).

Independent variable. Video-based instruction (e.g., video modeling/rehearsal, video prompting, or video chunking) was used as a part or the only intervention to teach target skills to the participants. For six studies, video-based instruction was the only component of intervention aside from the studies including reinforcement. Three studies included prompting such as prompting for on-task (n=1), system of least prompts procedure (n=1), or response blocking for consistent errors (n=1) in addition to video-based instruction in intervention. One study used video-based instruction and then transitioned to the use of live models within a backward chaining procedure. In addition to other treatment components, some studies used reinforcement within intervention. One study reported reinforcement for correct responding, three studies reported reinforcement regardless of correct responding, two studies reported no reinforcement, and four studies did not report whether reinforcement occurred or did not occur in intervention probes. Intervention probes occurred at different times in relation to video presentation across studies. Four studies used comparison designs to compare video modeling or prompting to additional independent variables. For example, Rosenberg, Schwartz, and Davis (2010) compared commercial video models to custom-made video models and Van Laarhoven, Kraus, Karpman, Nizzi, and Valentino (2010) compared video prompts to picture prompts. Two studies measured participant performance on target skills directly before videos were shown each session and four measured performance directly after viewing a video. For the studies that probed before watching the video, a practice session occurred directly after watching the video as well, but responses in practice sessions were not recorded towards acquisition criteria. For all studies including video prompting (n=3), participants were assessed on performance directly after viewing each video clip during the session. One study reported that intervention probes occurred at different times on different days (e.g., Charlop-Christy et al., 2000).

Experimental design. What Works Clearinghouse (WWC; 2011) design standards were used to evaluate the quality of the studies. Four studies did not meet evidence standards, three studies met evidence standards with reservations, and three studies met evidence standards without reservations (See Table 4). Like NSTTAC and NPDC, WWC standards do not include guidelines related to generalization.

Generalization assessment.

Types of generalization assessment. Eight studies assessed generalization across settings, five studies assessed generalization across materials, two studies assessed generalization across people, and one study assessed generalization across skills (See Table 5). Five studies included only one type of generalization assessment (e.g., setting only). One study conducted separate probes for two different types of generalization (e.g., one probe where everything remained constant except setting and one probe where everything remained constant except materials), and four studies assessed multiple types of generalization within each generalization probe (e.g., settings and people).

When generalization was assessed. Three studies assessed a generalization response for one session prior to intervention and one session after intervention was complete, five studies assessed generalization pre- and post-intervention with multiple sessions in baseline or post-intervention or until mastery post-intervention, and two studies measured generalization intermittently within baseline and intervention or continuously throughout baseline and intervention (see Table 5).

Maintenance assessment. Nine studies assessed responding in a maintenance condition and one did not (Charlop-Christy et al., 2000). Two studies did not report how long after intervention maintenance probes were conducted, but the remaining seven studies reported the last maintenance probes occurring seven to forty-two days after intervention. Rayner (2011) conducted maintenance probes only on generalization behaviors, and the remaining studies conducted maintenance probes on acquisition responses (see Table 6).

Outcomes.

Acquisition outcomes. Acquisition criteria were reported for eight of ten studies (not reported for Hine & Wolery, 2006; Rayner, 2010). Acquisition criteria ranged from 85-100% across one to five sessions. The number of steps in each task ranged from 3-23, and the sessions to criteria are reported for all studies in which an acquisition criteria was reported. Participants required between two and thirty-two sessions to meet criteria (See Table 6).

Generalization outcomes. Generalization outcomes are reported in Table 6. For studies that combined several types of generalization into one probe, only one percentage is reported per participant. For studies which separated generalization probes (e.g., one probe for setting, a different probe for materials), multiple percentages are reported. In addition to the percent of steps correct on the last generalization probe, the percent change from pre- to post-intervention is reported to better identify the change in performance resulting from instruction on the target behavior. The results of generalization are variable across studies ranging from 0% post-intervention to 100% post-intervention. The change reported from pre- to post-intervention ranged from 0%-100% as well.

Maintenance outcomes. Four of nine studies that assessed maintenance reported all participants to maintain all skills assessed at 100% correct responding. Additional percentages of correct responding can be viewed in Table 6.

Social validity assessment and outcomes. Five of ten studies included a social validity measure. For the purposes of this review, social validity included questionnaires, interviews, etc. and did not include components such as time and cost efficiency. Three studies included statements requiring responses in a likert-type scale (Hine & Wolery, 2006; Rayner, 2011; Rosenberg et al., 2010), one study conducted an informal interview (Van Laarhoven et al., 2010), and one study conducted an informal questionnaire (Yanardag, Akmanoglu, &Yilmaz, 2013). Social validity assessments were delivered to classroom teachers (Rayner, 2011; Rosenberg et al., 2010; Van Laarhoven et al., 2010), parents (Yanardag et al., 2013), graduate students (Hine & Wolery, 2006), and participants (Van Laarhoven et al., 2010). Results of social validity assessments were considered positive if there was an increase from pre- to post-test or if findings were more than neutral on a likert-scale. Positive findings were reported for four of five studies (Hine & Wolery, 2006; Rosenberg et al., 2010; Van Laarhoven et al., 2010; Yanardag et al., 2013).

Interobserver agreement and procedural fidelity. Interobserver agreement was calculated for all participants for at least 20% of sessions in each condition, and mean agreement was over 80% for seven studies (Charlop-Christy et al., 2000; Hine & Wolery, 2006; Rayner, 2010; Rosenberg et al., 2010; Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006; Yanardag et al., 2013). Two studies did not provide enough information to meet all criteria for IOA (Bidwell & Rehfeldt, 2004; Rayner, 2011), and one study did not meet requirements for IOA. Five studies collected procedural fidelity (PF) data on researcher behavior for all participants for at least 20% of sessions in each condition, and mean PF was over 95% (Hine & Wolery, 2006; Rosenberg et al., 2010; Van Laarhoven et al., 2010; Van Laarhoven & Van Laarhoven-Myers, 2006; Yanardag et al., 2013). One study did not meet requirements for procedural fidelity (Tereshko, MacDonald, & Ahearn, 2010) and the remaining studies did not provide enough information.

Discussion

Twenty-five years ago, Stokes and Osnes (1988) discussed then current issues in research in generalization programming. The authors stated, “The research literature itself is replete with examples in which generalization and maintenance are well documented, but in which the sophistication of the experimental analyses does not match the promise of the effects observed within the studies” (p. 16). They went on to discuss that experimental analysis of the variables associated with the when, where, and why of generalization must be conducted and generalization should be a major dependent variable in research. One could argue generalization must be a major dependent variable in all research, because if interventions are effective and efficient but acquired skills do not generalize into the most natural conditions, there is a lack of social validity in the outcomes. Although a conversation about generalization began over 35 years ago (Stokes & Baer, 1977) and continued ten years later (Stokes & Osnes, 1988), the same issues hold true today in that there is a lack of focus on generalization, and even when generalization is measured, the experimental analyses often do not match the promise of the effects.

The purpose of this review was to answer the following questions: In studies teaching multi-step tasks to individuals with autism and/or intellectual disabilities, (a) What number/percentage of studies included a component of generalization in their research purpose or research question, (b) Was generalization assessed in any way, and if so, when was generalization assessed in relation to instruction (e.g., pre-post, continuously)? For studies that assessed generalization using a minimum of a pre-/post-test for a generalization measure as well as collecting data on a separate acquisition response in baseline and intervention, additional research questions were asked including the following: (c) What type of generalization was assessed (e.g., settings, people, materials, skills) (d) What were the effects of the intervention on generalized responding?

Research questions (a) and (b) were written to determine the current state of generalization assessment in single-case design in this one area of video-based instruction to teach multi-step tasks to individuals with autism or intellectual disability. In 1978, Wolf posed the question: “Are the specific behavioral goals really what society wants?” (p. 207). The goals of the study and the behavior to be changed were identified through the research questions in each study. “What society really wants” is not a question that can be answered generically. One could assume, however, it is preferable to instruct on one target behavior that generalizes to a variety of novel conditions rather than a need for instruction on each specific response. Only 29% of studies in the current review identified a goal related to generalized responding. With that, only 12% of all 81 studies evaluated generalization in at least a pre-post assessment. The criteria for generalization assessment for this study was liberal in that with most of the pre-post assessment studies, it is still extremely difficult to determine when, where, and why generalization occurred (i.e., without continuous measurement of the generalization response). An additional 57 studies did not include a goal related to generalization and 44 of those studies did not assess a generalization response at all. While their stated purpose and assessment procedures may have been aligned, it is important to again consider the value of an intervention if it is unclear whether acquisition will lead to generalized responding.

Research questions (c) and (d) looked specifically at studies that completed a minimum criteria for generalization assessment to determine what types of generalization assessment were occurring and if there were positive effects in generalization outcomes. Table 6 reports individual participant outcomes related to generalization. Studies in which there was 100%

generalized responding post-intervention and a change of at least 50% from baseline were looked at more closely to begin to ask the question of “Why?”. The percentage of generalized responding was selected because with multi-step tasks (e.g., making pasta, washing the table, creating a toy structure), not completing even one step can completely alter the final product. For example, a participant cooks pasta and completes all steps correctly except turning on the stove; the participant will end the session with wet, uncooked pasta in a bowl. Tereshko et al. (2010) and Yanardag et al. (2013) each had nine reports of generalization at 100% with a 100% change from pre- to post-intervention. Additionally, Tereshko et al. reported an additional generalization response at 100% post-intervention with a 63% change. Yanardag et al. had only three steps per task, and Tereshko et al. had only eight steps per task. The two studies have in common that generalization was assessed across settings only (e.g., from one swimming pool to another swimming pool), and both studies had target behaviors that could be classified as play or leisure. While other studies taught play/leisure skills without the same generalization results (e.g., Hine &Wolery, 2006; Van Laarhoven & Van Laarhoven-Myers, 2006), there is great importance of teaching skills that will maintain in the future as a result of reinforcement contingencies in the natural environment. Although it is not certain that these specific target behaviors were preferred for these participants, it highlights the importance of preference assessment prior to skill selection in future research.

Bidwell & Rehfeldt (2004) also reported high levels of generalized responding (100% post-intervention with 55-75% change from pre-test). This studies differed from Tereshko et al. and Yanardag et al. in that the skill taught was making coffee and serving it to a peer, so it was not a play/leisure skill. Additionally, the task analysis and generalization assessments were more complex with 23 steps in the task analysis and generalization across settings, materials, and persons conducted within one generalization probe.

Recommendations for Future Research

In summarizing the research on video-based instruction to teach multi-step tasks to individuals with autism and/or intellectual disability, several directions for future research and questions about generalization moving forward have emerged. The first recommendation for future research is to continuously collect data on generalized responding throughout baseline, intervention, and maintenance conditions without initially instructing on those responses. Stokes & Osnes (1988) highlighted the importance of asking when generalization occurs, where it occurs, and why it occurs. Without making generalization a primary dependent variable, we will be unable to answer these questions, and this will create obstacles in programming for generalization in the future. By collecting continuous data, it can be evaluated at what point in instruction and acquisition a generalization response was acquired. This may lead to additional information about components of intervention necessary to ensure generalized responding.

Stokes and Baer (1978) urged researchers to consider the naturally maintaining contingencies in participants' environments and to thin contrived reinforcement, so that behaviors maintain with only the use of naturally occurring reinforcement. Naturally occurring reinforcement for making a peanut butter and jelly sandwich is often that one can eat the sandwich. It is important to consider preference assessment here in the selection of skills. If an individual does not prefer a peanut butter and jelly sandwich, it is unlikely that the response will maintain over time and across a variety of conditions. Therefore, conducting preference assessments to determine multi-step tasks of value to each individual participant is critical for generalization and maintenance of the skills.

The NSTTAC and NDCA provide recommendations about evidence-based practices to be used with individuals with autism and intellectual disability. While these recommendations are extremely helpful in that the quality of research designs used to evaluate the efficacy of interventions is high, it may be important to consider additional criteria regarding the maintenance and generalization of skills over time and across a variety of conditions. Stokes and Osnes (1988) state that to "conduct a treatment study and not analyze the generalization outcomes is the research equivalent of the practical risk involved in the generalization programming method of train and hope" (p. 16). They go on to say that post hoc analyses are not demonstrations of causality, but are "simply guesses" (p. 16). When determining interventions to use in classrooms, clinical settings, day treatment programs, homes, communities, etc. it is critical that evidence-based practices are identified, but equally as critical is that the interventions recommended lead to generalization whenever possible.

Lastly, researchers should continue to program for and assess generalization with the most natural conditions in mind. That is, some studies that measure generalization across settings simply teach a response in one classroom, carry the materials across the hall, and assess the response in an additional classroom. If, for example, a participant was learning to make coffee and acquired the response in the classroom and could perform the response in an additional classroom, what does this mean for the participant when he or she is required to make coffee at his or her job? Will the participant know to make coffee when the coffee pot is empty rather than only when being told explicitly, "Make coffee"? If the participant is required to make coffee when asked, will the participant understand other task directions than "Make coffee" such as "Will you please make me a cup of coffee?" While Stokes and Osnes (1988) state that any assessment of generalization should be applauded, it is important to continue thinking through how intervention will affect the individual's life outside the research study and what researchers can do to program for and ensure generalized responding in the natural environment that maintains over time.

References

Alcantara, P. R. (1994). Effects of videotape instructional package on purchasing skills of children with autism. *Exceptional Children, 61*, 40-55.

Avcioglu, H. (2013). Effectiveness of video modeling in training students with intellectual disabilities to greet people when they meet. *Kuram ve Uygulamada Egitim Bilimleri, 13*, 466-477.

Ayres, K. M., & Langone, J. (2005). Intervention and instruction with video for students with autism: A review of the literature. *Education and Training in Developmental Disabilities, 40*, 183-196.

Ayres, K. M., Langone, J., Boon, R. T., & Norman, A. (2006). Computer-based instruction for purchasing skills. *Education and Training in Developmental Disabilities, 41,* 253-263.

Ayres, K. M., Maguire, A., & McClimon, D. (2009). Acquisition and generalization of chained tasks taught with computer based video instruction to children with autism. *Education and Training in Developmental Disabilities, 44*, 493-508.

Ayres, K., & Cihak, D. (2010). Computer- and video-based instruction of food-preparation skills: Acquisition, generalization, and maintenance. *Intellectual and Developmental Disabilities, 48*, 195-208.

Bellini, S., & Akullian, J. (2007). A meta-analysis of video modeling and video self-modeling interventions for children and adolescents with autism spectrum disorders. *Exceptional Children, 73*, 264-287.

Bereznak, S., Ayres, K. M., Mechling, L. C., & Alexander, J. L. (2012). Video self-prompting and mobile technology to increase daily living and vocational independence for students with autism spectrum disorders. *Journal of Developmental and Physical Disabilities, 24*, 269-285.

Bidwell, M. A., & Rehfeldt, R. A. (2004). Using video modeling to teach a domestic skill with an embedded social skill to adults with severe mental retardation. *Behavioral Interventions, 19*, 263-274.

Boudreau, E., & D'Entremont, B. (2010). Improving the pretend play skills of preschoolers with autism spectrum disorders: The effects of video modeling. *Journal of Developmental and Physical Disabilities, 22*, 415-431.

Branham, R. S., Collins, B. C., Schuster, J. W. (1999). Teaching community skills to students with moderate disabilities: Comparing combined techniques of classroom simulation, videotape modeling, and community-based instruction. *Education and Training in Mental Retardation and Developmental Disabilities, 34*, 170-181.

Burke, R.V., Allen, K. D., Howard, M. R., Downey, D., Matz, M. G., & Bowen, S. L. (2013). Tablet-based video modeling and prompting in the workplace for individuals with autism. *Journal of Vocational Rehabilitation, 38*, 1-14

Burton, C. E., Anderson, D. H., Prater, M. A., & Dyches, T. T. (2013). Video self-modeling on an iPad to teach functional math skills to adolescents with autism and intellectual disability. *Focus on Autism and Developmental Disabilities, 28*, 67-77.

Cannella-Malone, H. I., Fleming, C., Chung, Y., Wheeler, G. M., Basbagill, A. R., & Singh, A. H. (2011). Teaching daily living skills to seven individuals with severe intellectual disabilities: A comparison of video prompting to video modeling. *Journal of Positive Behavior Interventions, 13*, 144-153.

Cannella-Malone, H. I., Wheaton, J. E., Wu, P.F., Tullis, C. A., & Park, J. H. (2012). Comparing the effects of video prompting with and without error correction on skill acquisition for students with intellectual disability. *Education and Training in Autism and Developmental Disabilities, 47*, 332-344.

Cannella-Malone, J. I., Mizrachi, S. B., Sabielny, L. M., & Jimenez, E. D. (2013b). Teaching physical activities to students with significant disabilities using video modeling. *Developmental Neurorehabilitation, 16*, 145-154.

Chan, J. M., Lambdin, L. Van Laarhoven, T. V., & Johnson, J. W. (2013). Teaching leisure skills to an adult with developmental disabilities using a video prompting intervention package. *Education and Training in Autism and Developmental Disabilities, 48*, 412-420.

Charlop-Christy, M. H., Le, L., & Freeman, K. A. (2000). A comparison of video modeling with in vivo modeling for teaching children with autism. *Journal of Autism and Developmental Disorders, 30*, 537-552.

Cihak, D. F., & Schrader, L. (2009). Does the model matter? Comparing video self-modeling and video adult modeling for task acquisition and maintenance by adolescents with autism spectrum disorders. *Journal of Special Education Technology, 23*, 9-20.

Cihak, D., Alberto, P. A., Taber-Doughty, T., & Gama, R. I. (2006). A comparison of static picture prompting and video prompting simulation strategies using group instructional procedures. *Focus on Autism and Other Developmental Disabilities, 21*, 89-99.

Conyers, C. Miltenberger, R. G., Peterson, B., Gubin, A., Jurgens, M., Selders, A. . . & Barenz, R. (2004). An evaluation of in vivo desensitization and video modeling to increase compliance with dental procedures in persons with mental retardation. *Journal of Applied Behavior Analysis, 37*, 233-238.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2006). *Applied behavior analysis* (2nd ed.). Upper Saddle River, NJ: Prentice Hall.

Edrisinha, C., O'Reilly, M. F., Choi, H. Y., Sigafoos, J., & Lancioni, G. E. (2011). "Say cheese": Teaching photography skills to adults with developmental disabilities. *Research in Developmental Disabilities, 32*, 636-642.

Ergenekon, Y. (2012). Teaching basic first-aid skills against home accidents to children with autism through video modeling. *Educational Sciences: Theory and Practice, 12*, 2759-2766.

Goh, A. E., & Bambara, L. M. (2013). Video self-modeling: A job skills intervention with individuals with intellectual disability in employment settings. *Education and Training in Autism and Developmental Disabilities, 48*, 103-119.

Goodson, J., Sigafoos, J., O'Reilly, M., Cannella, H., & Lancioni, G. E. (2007). Evaluation of a video-based error correction procedure for teaching a domestic skill to individuals with developmental disabilities. *Research in Developmental Disabilities, 28*, 458-467.

Graves, T. B., & Collins, B. C., Schuster, J. W., & Kleinert, H. (2005). Using video prompting to teach cooking skills to secondary students with moderate disabilities. *Education and Training in Developmental Disabilities, 40*, 34-46.

Hagiwara, T., & Myles, B. S. (1999). A multimedia social story intervention: Teaching skills to children with autism. *Focus on Autism and Other Developmental Disabilities, 14*, 82-95.

Hammond, D. L., Whatley, A. D., Ayres, K. M., & Gast, D. L. (2010). Effectiveness of video modeling to teach "iPod" use to students with moderate intellectual disabilities. *Education and Training in Autism and Developmental Disabilities, 45*, 525-538.

Haring, T. G., Kennedy, C. H., Adams, M. J., & Pitts-Conway, V. (1987). Teaching generalization of purchasing skills across community settings to autistic youth using videotape modeling. *Journal of Applied Behavior Analysis, 20*, 89-96.

Hine, J., & Wolery, M. (2006). Using point-of-view video modeling to teach play to preschoolers with autism. *Topics in Early Childhood Special Education, 26*, 83-93.

Horn, J. A., Miltenberger, R. G., Weil, T., Mowery, J., Conn, M., & Sams, L. (2008). Teaching laundry skills to individuals with developmental disabilities using video prompting. *International Journal of Behavioral Consultation and Therapy, 4*, 279-286.

Johnson, J. W., Blood, E., Freeman, A., & Simmons, K. (2013). Evaluating the effectiveness of teacher-implemented video prompting on an iPod touch to teach food preparation skills to high school students with autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities, 28*, 147-158.

Kagohara, D. M. (2011). Three students with developmental disabilities learn to operate an iPod to access age-appropriate entertainment videos. *Journal of Behavioral Education, 20*, 33-43.

Kagohara, D. M., Sigafoos, J., Achmadi, D., van der Meer, L., O'Reilly, M. F., & Lancioni, G. E. (2011). Teaching students with developmental disabilities to operate an iPod Touch to listen to music. *Research in Developmental Disabilities, 32*, 2987-2992.

Kagohara, D. M., Sigafoos, J., Achmadi, D., O'Reilly, M., & Lancioni, G. (2012). Teaching children with autism spectrum disorders to check the spelling of words. *Research in Autism Spectrum Disorders, 6*, 304-310.

Kellems, T. O., & Morningstar, M. E. (2012). Using video modeling delivered through iPods to teach vocational tasks to young adults with autism spectrum disorders. *Career Development and Transition for Exceptional Individuals, 35,* 155-167.

Lee, C. Y. Q., Anderson, A., & Moore, D. W. (2013). Using Video Modeling to Toilet Train a Child with Autism. *Journal of Developmental and Physical Disabilities*, 1-12.

LeGrice, B., & Blampied, N. M. (1994). Training pupils with intellectual disability to operate educational technology using video prompting. *Education and Training in Mental Retardation and Developmental Disabilities, 29*, 321-330.

MacDonald, R., Sacramone, S., Mansfield, R., Wiltz, K., & Ahearn, W. H. (2009). Using video modeling to teach reciprocal pretend play to children with autism. *Journal of Applied Behavior Analysis, 42*, 43-55.

Martin, J. E., Mithaug, D. E., & Frazier, E. S. (1992). Effects of picture referencing on PVC chair, love seat, and settee assemblies by students with mental retardation. *Research in Developmental Disabilities, 13*, 267-286.

Mason, R. A., Ganz, J. B., Parker, R. I., Boles, M. B., Davis, H. S., & Rispoli, M. J. (2012). Video-based modeling: Differential effects due to treatment protocol. *Research in Autism Spectrum Disorders, 7*, 120-131.

Mechling, L. C. (2004). Effects of multimedia, computer-based instruction on grocery shopping fluency. *Journal of Special Education Technology, 19*, 23-34.

Mechling, L. C. (2005). The effect of instructor-created video programs to teach students with disabilities: A literature review. *Journal of Special Education Technology, 20*, 25-36.

Mechling, L. C., & Collins, T. S. (2012). Comparison of the effects of video models with and without verbal cueing on task completion by young adults with moderate intellectual disability. *Education and Training in Autism and Developmental Disabilities, 47*, 223-235

Mechling, L. C., & Cronin, B. (2006). Computer-based video instruction to teach the use of augmentative and alternative communication devices for ordering at fast-food restaurants. *Journal of Special Education, 39*, 234-245.

Mechling, L. C., & Seid, N. H. (2011). Use of a hand-held personal digital assistant (PDA) to self-prompt pedestrian travel by young adults with moderate intellectual disabilities. *Education and Training in Autism and Developmental Disabilities, 46*, 220-237.

Mechling, L. C., & Stephens, E. (2009). Comparison of self-prompting of cooking skills via picture-based cookbooks and video recipes. *Education and Training in Developmental Disabilities, 44*, 218-236.

Mechling, L. C., Ayres, K. M., Purrazzella, K., & Purrazzellla, K. (2012). Evaluation of the performance of fine and gross motor skills within multi-step tasks by adults with moderate intellectual disability when using video models. *Journal of Developmental and Physical Disabilities, 24*, 469-486.

Mechling, L. C., Gast, D. L., & Barthold, S. (2003). Multimedia computer-based instruction to teach students with moderate intellectual disabilities to use a debit card to make purchases. *Exceptionality, 11,* 239-254.

Mechling, L. C., Gast, D. L., & Fields, E. A. (2008). Evaluation of a portable DVD player and system of least prompts to self-prompt cooking task completion by young adults with moderate intellectual disabilities. *Journal of Special Education, 42*, 179-190.

Mechling, L. C., Gast, D. L., & Langone, J. (2002). Computer-based video instruction to teach persons with moderate intellectual disabilities to read grocery aisle signs and locate items. *Journal of Special Education, 35*, 224-240.

Mechling, L. C., Gast, D. L., & Seid, N. H. (2009). Using a personal digital assistant to increase independent task completion by students with autism spectrum disorder. *Journal of Autism and Developmental Disorders, 39*, 1420-1434.

Mechling, L. C., Gast, D. L., & Seid, N. H. (2010). Evaluation of a personal digital assistant as a self-prompting device for increasing multi-step task completion by students with moderate intellectual disabilities. *Education and Training in Autism and Developmental Disabilities, 45*, 422-439.

Mechling, L. C., Pridgen, L. S., Cronin, B A. (2005). Computer-based video instruction to teach students with intellectual disabilities to verbally respond to questions and make purchases in fast food restaurants. *Education and Training in Developmental Disabilities, 40*, 47-59.

Murzynski, N. T., & Bourrett, J. C. (2007). Combining video modeling and least-to-most prompting for establishing response chains. *Behavioral Interventions, 22*, 147-152.

Test, D. W., Cease-Cook, J., Fowler, C. H., & Bartholomew, A. (2011). *Tool for College and Career Ready Standards and Secondary Transition Planning for Students with Disabilities: 101.* National Secondary Transition Technical Assistance Center.

Norman, J. M., Collins, B. C., & Schuster, J. W. (2001). Using an instructional package including video technology to teach self-help skills to elementary students with mental disabilities. *Journal of Special Education Technology, 16*, 5-18.

Odom, S. L., Collet-Klingenberg, L., Rogers, S. J., & Hatton, D. D. (2010). Evidence-based practices in interventions for children and youth with autism spectrum disorders. *Preventing School Failure, 54*, 275-282.

Ozen, A., Batu, S., & Birkan, B. (2012). Teaching play skills to children with autism through video modeling: Small group arrangement and observational learning. *Education and Training in Autism and Developmental Disabilities, 47*, 84-96.

Ozkan, S. Y. (2013). Comparison of peer and self-video modeling in teaching first aid skills to children with intellectual disability. *Education and Training in Autism and Developmental Disabilities, 48*, 88-102.

Palechka, G., & MacDonald, R. (2010). A comparison of the acquisition of play skills using instructor-created video models and commercially available videos. *Education and Treatment of Children, 33*, 457-474.

Payne, D., Cannella-Malone, H. I., Tullis, C. A., & Sabielny, L. M. (2012). The effects of self-directed video prompting with two students with intellectual and developmental disabilities. *Journal of Developmental and Physical Disabilities, 24*, 617-634.

Rai, K. (2008). Technology to teach self-help skills to elementary students with mental disabilities. *Journal of the Indian Academy of Applied Psychology, 34*, 201-214.

Rayner, C. (2011). Teaching students with autism to tie a shoelace knot using video prompting and backward chaining. *Developmental Neurorehabilitation, 14*, 339-347.

Rayner, C. S. (2010). Video-modeling to improve task completion in a child with autism. *Developmental Neurorehabilitation, 13*, 225-230.

Rehfeldt, R. A., Dahman, D., Young, A., Cherry, H., Davis, P. (2003). Teaching a simple meal preparation skill to adults with moderate and severe mental retardation using video modeling. *Behavioral Interventions, 18*, 209-218.

Rosenberg, N. E., Schwartz, I. S., & Davis, C. A. (2010). Evaluating the utility of commercial videotapes for teaching hand washing to children with autism. *Education and Treatment of Children, 33*, 443-455.

Shipley-Benamou, R., Lutzker, J. R., & Taubman, M. (2002). Teaching daily living skills to children with autism through instructional video modeling. *Journal of Positive Behavior Interventions, 4*, 165-175.

Shrestha, A., Anderson, A., & Moore, D. W. (2013). Using point-of-view video modeling and forward chaining to teach a functional self-help skill to a child with autism. *Journal of Behavioral Education, 22*, 157-167.

Sigafoos, J., O'Reilly, M., Cannella, H., Upadhyaya, M., Edrisinha, C., Lancioni, G. E. . ., & Young, D. (2005). Computer-presented video prompting for teaching microwave oven use to three adults with developmental disabilities. *Journal of Behavioral Education, 14*, 189-201.

Sigafoos, J., O'Reilly, M., Cannella, H., Edrisinha, C., de la Cruz, B., Upadhyaya, M., Lancioni, G. E. . ., & Young, D. (2007). Evaluation of a video prompting and fading procedure for teaching dish washing skills to adults with developmental disabilities. *Journal of Behavioral Education, 16*, 93-109.

Smith, M., Ayres, K. M., Mechling, L., & Smith, K. (2013). Comparison of the effects of video modeling with narration vs video modeling on the functional skill acquisition of adolescents with autism. *Education and Training in Autism and Developmental Disabilities, 48*, 164-178.

Stokes, F. T., & Baer, D. M. (1977). An implicit technology of generalization. *Journal of Applied Behavior Analysis, 10*, 349-367.

Stokes, T. F., & Osnes, P. G. (1988). The developing applied technology of generalization and maintenance. In R. H. Horner, G. Dunlap, & R. L. Koegel (Eds.), *Generalization and maintenance: Life-style changes in applied settings* (pp.5-20). Baltimore, MD: Paul H. Brookes.

Taber-Doughty, T., Bouck, E. C., & Tom, K., Jasper, A. D., Flanagan, S. M., & Bassette, L. (2011). Video modeling and prompting: A comparison of two strategies for teaching cooking skills to students with mild intellectual disabilities. *Education and Training in Autism and Developmental Disabilities, 46*, 499-513.

Taber-Doughty, T., Patton, S. E., Brennan, S. (2008). Simultaneous and delayed video modeling: An examination of system effectiveness and student preferences. *Journal of Special Education Technology, 23*, 1-18.

Tereshko, L., MacDonald, R., & Ahearn, W. H. (2010). Strategies for teaching children with autism to imitate response chains using video modeling. *Research in Autism Spectrum Disorders, 4*, 479-489.

Tiong, S., Blampied, N. M., & Le Grice, N. M., (1992). Training community-living, intellectually handicapped people in fire safety using video prompting. *Behaviour Change, 9*, 65-72.

Van Laarhoven, T., Johnson, J. W., Van Laarhoven-Myers, T., Grider, K. L., & Grider, K. M. (2009a). The effectiveness of using a video iPod as a prompting device in employment settings. *Journal of Behavioral Education, 18*, 119-141.

Van Laarhoven, T., Kraus, E., Karpman, K., Nizzi, R., & Valentino, J. (2010). A comparison of picture and video prompts to teach daily living skills to individuals with autism. *Focus on Autism and Other Developmental Disabilities, 25*, 195-208.

Van Laarhoven, T., & Van Laarhoven-Myers, T. (2006). Comparison of three video-based instructional procedures for teaching daily living skills to persons with developmental disabilities. *Education and Training in Developmental Disabilities, 41*, 365-381.

Van Laarhoven, T., Van Laarhoven-Myers, T., & Zurita, L. M. (2007). The effectiveness of using a pocket PC as a video modeling and feedback device for individuals with developmental disabilities in vocational settings. *Assistive Technology Outcomes and Benefits, 4*, 28-45.

Van Laarhoven, T., Winiarski, L., Blood, E., & Chan, J. M. (2012). Maintaining vocational skills of individuals with autism and developmental disabilities through video modeling. *Education and Training in Autism and Developmental Disabilities, 47*, 447-461.

Van Laarhoven, T., Zurita, L. M., Johnson, J. W., Grider, K. M., & Grider, K. L. (2009b). Comparison of self, other, and subjective video models for teaching daily living skills to individuals with developmental disabilities. *Education and Training in Developmental Disabilities, 44*, 509-522.

Walser, K., Ayres, K. M., & Foote, E. (2012). Effects of a video model to teach students with moderate intellectual disability to use key features of an iPhone. *Education and Training in Autism and Developmental Disabilities, 47*, 319-331.

Yakubova, G., & Taber-Doughty, T. (2013). Brief report: Learning via the electronic interactive whiteboard for two students with autism and a student with moderate intellectual disability. *Journal of Autism and Developmental Disorders, 43*, 1465-1472.

Yanardag, M., Akmanoglu, N., Yilmaz, I. (2013). The effectiveness of video prompting on teaching aquatic play skills for children with autism. *Disability and Rehabilitation, 35*, 47-56.

Zisimopoulos, D., Sigafoos, J., & Koutromanos, G. (2011). Using video prompting and constant time delay to teach an internet search basic skill to students with intellectual disabilities. *Education and Training in Autism and Developmental Disabilities, 46*, 238-250.

Table 1

Research Question and Generalization Assessment

Reference	Research Question Regarding Gen.	If and How Generalization Was Assessed	Met Criteria for Generalization Assessment
Alcantara (1994)	Yes	Response generalization occurred within MP	–
Avcioglu (2013)	Yes	No BL	–
Ayres et al. (2006)	Yes	Did not assess acquisition response in BL	–
Ayres et al. (2009)	Yes	Did not assess acquisition response in BL	–
Ayres & Cihak (2010)	Yes	Did not assess acquisition response in BL	–
Bereznak et al. (2012)	No	NA	–
Bidwell & Rehfeldt (2004)	Yes	Pre/Post 1 session	■
Boudreau & D'Entremont (2010)	No	No BL	–
Branham et al. (1999)	Yes	Did not assess acquisition response in BL	–
Burke et al. (2013)	No	NA	–
Burton et al. (2013)	Yes	No BL	–
Canella-Malone et al. (2011)	No	NA	–
Cannella-Malone et al. (2013a)	No	NA	–
Cannella-Malone et al. (2012)	No	NA	–
Cannella-Malone et al. (2013b)	No	NA	–
Cannella-Malone et al. (2006)	No	NA	–
Chan et al. (2013)	No	NA	–
Charlop-Christy et al. (2000)	Yes	Interspersed in BL, Post after criteria for acquisition skills	■
Cihak, & Schrader (2009)	No	NA	–
Cihak et al. (2006)	No	NA	–
Conyers et al. (2004)	No	NA	–
Edrisinha et al. (2011)	No	Instruction in "generalization"	–
Ergenekon (2012)	Yes	NR (no formal data)	–
Goh & Bambara (2013)	No	NA	–
Goodson et al. (2007)	No	NA	–
Graves et al. (2005)	Yes	NR (no formal data)	–
Hagiwara & Myles (1999)	No	NA	–
Hammond et al. (2010)	No	NA	–
Hine & Wolery (2006)	Yes	Pre/Post 1-4 sessions	■
Horn et al. (2008)	No	NA	–
Johnson et al. (2013)	No	NA	–
Kagohara (2011)	No	NA	–
Kagohara et al. (2011)	No	NA	–
Kagohara et al. (2012)	No	NA	–

Kellems & Morningstar (2012)	No	NA	–
Lee et al. (2013)	Yes	No BL	–
LeGrice & Blampied (1994)	No	No BL	–
MacDonald et al. (2009)	No	NA	–
Martin (1992)	No	NA	–
Mechling (2004)	No	Did not assess acquisition response in BL	–
Mechling & Collins (2012)	No	NA	–
Mechling & Cronin (2006)	No	Did not assess acquisition response in BL	–
Mechling & Seid (2011)	No	NA	–
Mechling & Stephens (2009)	No	NA	–
Mechling et al. (2012)	No	NA	–
Mechling et al. (2003)	Yes	Did not assess acquisition response in BL	–
Mechling et al. (2008)	No	NA	–
Mechling et al. (2002)	Yes	Did not assess acquisition response in BL	–
Mechling et al. (2009)	No	NA	–
Mechling et al. (2010)	No	NA	–
Mechling et al. (2005)	No	Did not assess acquisition response in BL	–
Murzynski & Bourrett (2007)	No	NA	–
Norman et al. (2001)	Yes	No BL	–
Ozen et al. (2012)	No	NA	–
Ozkan (2013)	No	NA	–
Palechka & MacDonald (2010)	No	NA	–
Payne et al. (2012)	Yes	Instruction in "generalization"	–
Rai (2008)	Yes	No BL	–
Rayner (2011)	No	Pre-/Post to mastery	■
Rayner (2010)	No	Continuous	■
Rehfeldt et al. (2003)	Yes	No BL	–
Rosenberg et al. (2010)	No	Interspersed BL & IV	■
Shipley-Benamou et al. (2002)	No	NA	–
Shrestha et al. (2013)	Yes	No BL	–
Sigafoos et al. (2005)	No	NA	–
Sigafoos et al. (2007)	No	NA	–
Smith et al. (2013)	No	NA	–
Taber-Doughty et al. (2011)	No	NA	–
Taber-Doughty et al. (2008)	Yes	No BL	–
Tereshko et al. (2010)	No	Pre/Post until mastery	■
Tiong (1992)	No	NA	–
Van Laarhoven et al. (2009a)	No	NA	–
Van Laarhoven et al. (2010)	No	Pre/Post 1 session	■
Van Laarhoven & Van Laarhoven-Myers (2006)	Yes	Pre/Post Multiple Sessions	■
Van Laarhoven et al. (2007)	No	NA	–

Van Laarhoven et al. (2012)	No	NA	–
Van Laarhoven et al. (2009b)	No	Not enough information	–
Walser et al. (2012)	Yes	No BL	–
Yakubova & Taber-Doughty (2013)	No	No BL	–
Yanardag et al. (2013)	No	Pre/Post 1 session	■
Zisimopoulos et a. (2011)	Yes	No BL	–

NA=Not assessed; No BL=No baseline data; NR=study reported generalization occurred, but no formal data are reported

Table 2

Participant Information

Reference	Participant Number	# of target behaviors*	Sex	Age	Diagnoses	IQ	Developmental Level**
Bidwell & Rehfeldt (2004)	1	1	F	72	ID	25	35 months
	2	1	F	33	ID; down syndrome	29	8 years
Charlop-Christy et al. (2000)	1	2	M	7	autism	NR	
Hine & Wolery (2006)	1	2	F	2	autism	NR	NR
	2	2	F	3	autism	NR	NR
Rayner (2011)	1	1	M	10	autism	NR	NR
	2	1	M	9	autism	NR	NR
Rayner (2010)	1	1	M	12	autism	NR	31 months
Rosenberg et al. (2010)	1	1	M	5	autism	NR	<1.9 yrs
	2	1	M	4	autism	NR	<1.9 yrs
	3	1	M	3	autism	NR	<1.9 yrs
Tereshko et al. (2010)	1	3	M	6	autism	NR	43 months
	2	3	M	5	NR	NR	65 months
	3	3	M	6	autism	NR	NR
	4	3	M	4	autism	NR	71 months
Van Laarhoven et al. (2010)	1	1	M	13	autism; ID	52	NR
	2	1	M	14	autism; ID	39	NR
Van Laarhoven & Van Laarhoven-Myers (2006)	1	3	M	18	autism; ID	48	NR
	2	3	M	17-19	ID; down syndrome	51	NR
	3	3	F	17-19	ID	52	NR
Yanardag et al. (2013)	1	3	M	8	autism	NR	NR
	2	3	M	6	autism	NR	NR
	3	3	F	6	autism	NR	NR

F=female; M=male; NR=Not reported; ID=Intellectual disability

*Number of target behaviors for which a generalization measure was assessed

**For many studies not including an IQ score, a developmental level or age equivalence was reported to provide additional information on participant characteristics

Table 3

Setting & Target Behavior

Reference	Setting (s)	Target Behavior (s)	Number of Steps
Bidwell & Rehfeldt (2004)	Classroom – clinic	Making coffee/serving peer	23
Charlop-Christy et al. (2000)	Kitchen – clinic	Brushing Teeth	8
Hine & Wolery (2006)	Therapy room – University	Gardening play scheme Cooking play scheme	6 5
Rayner (2011)	Classroom – primary school	Shoelace tying	11
Rayner (2010)	Classroom – school for students with disabilities	Unpacking book bag Brushing teeth	15 15
Rosenberg et al. (2010)	Bathroom – University preschool	Hand washing	9
Tereshko et al. (2010)	Therapy room – clinic	Toy Construction (n=3)	8
Van Laarhoven et al. (2010)	Faculty lounge – middle school	Fold clothes Make pasta	23 22
Van Laarhoven & Van Laarhoven-Myers (2006)	Home Classroom – school	Microwave pizza Fold laundry Wash table	NR NR NR
Yanardag et al. (2013)	Swimming pool – University	Aquatic Play (“kangaroo”) Aquatic Play (“cycling”) Aquatic Play (“snake”)	3 3 3

NR=not reported

Table 4

Design Quality

Reference	Meets Design Standards?
Bidwell & Rehfeldt (2004)	No
Charlop-Christy et al. (2000)	W/Reservations
Hine & Wolery (2006)	Yes
Rayner (2011)	No
Rayner (2010)	No
Rosenberg et al. (2010)	W/reservations
Tereshko et al. (2010)	No
Van Laarhoven et al. (2010)	Yes
Van Laarhoven & Van Laarhoven-Myers (2006)	Yes
Yanardag et al. (2013)	W/reservations

Table 5

Type of Generalization Assessment

Reference	What type of generalization was assessed?	In what way was generalization assessed?	Combined assessment of different types of generalization?	When did last generalization probes occur?
Bidwell & Rehfeldt (2004)	S, M, P	Pre/Post 1 session assessed	Yes; all	Immediately after IV*
Charlop-Christy et al. (2000)	S, M, P	Interspersed in BL, Post after criteria for acquisition skill	Yes; all	3-5 days after IV
Hine & Wolery (2006)	S, M	Pre/Post 1-4 sessions	No	During Maintenance*
Rayner (2011)	M	Pre/Post to Mastery	No	30 days after IV (=maintenance)
Rayner (2010)	B	Continuous	No	29 days after IV
Rosenberg et al. (2010)	S, P	Interspersed in BL and IV	Yes; P only & S+P	NR
Tereshko et al. (2010)	S	Pre/Post until mastery	No	Immediately after IV*
Van Laarhoven et al. (2010)	S, M	Pre/Post 1 session	Yes; all	42 days after IV
Van Laarhoven & Van Laarhoven-Myers (2006)	S	Pre/Post multiple sessions	No	Immediately after IV*
Yanardag et al. (2013)	S	Pre/Post 1 session	No	Immediately after IV*

S=settings; M=materials, P=People, B=behaviors/tasks, IV=intervention
*The number of days after intervention was not reported

Table 6

Participant Outcomes

Reference	Participant Number*	# of sessions to acquire Tb #1	# of sessions to acquire TB #2	# of sessions to acquire TB #3	Acquired GR #1**	Acquired GR #2**	Acquired GR #3**	Acquired GR #4**	Maintenance Results (days after IV, percent)
Bidwell & Rehfeldt (2004)	1	12	–	–	100% (75%)	–	–	–	30, 100%
	2	10	–	–	100% (55%)	–	–	–	20, 100%
Charlop-Christy et al. (2000)	1	4	12	–	100% (37%)	–	–	–	–
Hine & Wolery (2006)	1	NR	NR	–	67% (50%)[2]	60% (40%)[2]	42% (8%)[2]	0% (0%)[2]	NR, 73%[2]
	2	NR	NR	–	67% (42%)[2]	20% (20%)[2]	58% (50%)[2]	0% (-13%)[2]	NR, 63%[2]
Rayner (2011)	1	18	–	–	100% (64%)	–	–	–	30, 100%[3]
	2	DNA	–	–	82% (73%)	–	–	–	30, 100%[3]
Rayner (2010)	1	NR	NR	NR	57% (45%)[1]	–	–	–	29, 68%
Rosenberg et al. (2010)	1	14	–	–	100% (78%)	33% (11%)	–	–	28, 100%
	2	DNA	–	–	22% (0%)	44% (22%)	–	–	28, 100%
	3	DNA	–	–	78% (67%)	78% (67%)	–	–	28, 67%
Tereshko et al. (2010)	1	2	2	2	100% (63%)	100% (100%)	100% (100%)	–	NR, 100%
	2	25	25	5	100% (100%)	100% (100%)	100% (100%)	–	NR, 100%
	3	NR	NR	2	100% (100%)	100% (100%)	100% (100%)	–	NR, 100%
	4	6	ABL	NR	100% (100%)	ABL	100% (100%)	–	NR, 100%
Van Laarhoven et al. (2010)	1	4	–	–	100% (60%)	–	–	–	7, 91%
	2	4	–	–	95% (65%)	–	–	–	7, 100%
Van Laarhoven & Van Laarhoven-Myers (2006)	1	VO: 2	V+IV: 2	V+P: 2	VO: 50% (50%)[1]	V+IV: 41% (41%)[1]	V+P: 44% (44%)[1]	–	42, 50%[1]
	2	VO:4	V+IV: 2	V+P: 2	VO: 42% (28%)[1]	V+IV: 62% (50%)[1]	V+P: 42% (42%)[1]	–	42, 42%[1]
	3	VO: 5	V+IV: 2	V+P: 2	VO: 30% (26%)[1]	V+IV: 50% (34%)[1]	V+P:58% (38%)[1]	–	42, 30%[1]
Yanardag et al. (2013)	1	4	4	4	100% (100%)	100% (100%)	100% (100%)	–	28, 100%
	2	4	4	4	100% (100%)	100% (100%	100% (100%)	–	28, 100%
	3	4	4	4	100% (100%)	100% (100%)	100% (100%)	–	28, 100%

TB=target behavior, GR=generalization response; NR=not reported; −=Not applicable; DNA=Did not acquire; ABL=Acquired in baseline before the independent variable was introduced; VO=video only; V+IV=video + in vivo probes; V+P=video + pictures; XX[1]=estimation of percentages from graph; XX[2]=data reflects a mean change rather than the last data point because data were reported in a table as a mean rather than graphically for generalization; XX[3]=Maintenance probe was also generalization probe

*Participant order is identical to Table 2

**Percent reported is that of the last generalization data point, the number on parentheses represents the change from pre-intervention data to the last generalization session

Appendix C

Data Sheets

Condition: Screening

Participant__________________ Date ___________________

Part 1: Daily living and vocational skills

Setting 1: Outside

Skill: Set up board game	
Steps	**Response**
1. Open box	
2. Remove game board and place on table	
3. Put stack of cards on board	
4. Put game piece on board	
5. Put second game piece on board	

Setting 2: Daily living center

Skill: Prepare a potato for baking	
Steps	**Response**
1. Place potato on foil square	
2. Cover potato with foil	
3. Use fork to put holes in potato	
4. Use fork to put holes in potato again	

Setting 3: Office

Skill: Collate and staple	
Steps	**Response**
1. Stack paper one on paper two	
2. Stack paper three on paper one	
3. Put papers into stapler	
4. Press stapler until closed	

Part 2: Screening of initiation of self-instruction

Step	Response
Removal of iPhone from pocket within 5s of task direction	

Circle the correct condition: Baseline Intervention Generalization Maintenance

Participant______________________

IOA ☐ IOA collector _____

Date	
Steps	Response
Delay	
Initiation	
1. Removes phone from pocket	
Summary	
Navigation	
1. Pushes Home	
2. Slides to Unlock	
3. Pushes Home	
4. Selects Videos App	
5. Select Correct Video	
Summary	
Daily living/Vocational	
1	
2	
3	
4	
5	
6	
Summary	

IOA ☐ IOA collector _____

Date	
Steps	Response
Delay	
Initiation	
1. Removes phone from pocket	
Summary	
Navigation	
1. Pushes Home	
2. Slides to Unlock	
3. Pushes Home	
4. Selects Videos App	
5. Select Correct Video	
Summary	
Daily living/Vocational	
1	
2	
3	
4	
5	
6	
Summary	

IOA ☐ IOA collector _____

Date	
Steps	Response
Delay	
Initiation	
1. Removes phone from pocket	
Summary	
Navigation	
1. Pushes Home	
2. Slides to Unlock	
3. Pushes Home	
4. Selects Videos App	
5. Select Correct Video	
Summary	
Daily living/Vocational	
1	
2	
3	
4	
5	
6	
Summary	

Participant________________________________

Procedural Fidelity (baseline, generalization, maintenance)

Key: Correct (+); Incorrect (-), Not applicable (NA)

Date					
Time					
Researcher					
Observer					
Condition					
1. Correct materials for daily living/vocational skill available					
2. iPhone set up correctly					
3. iPhone in participant's pocket at least 3 min, no more than 10 min prior to the session beginning					
4. Correct task direction provided					
6. If student independently initiates, no prompting is provided					
7. If participant does not remove iPhone from his pocket, session is ended					
8. If participant removes iPhone from pocket, allow 50 s to access correct video					
9. If participant does not view correct video, session is ended					
10. If participant views correct video, he is given 30 s to complete vocational or daily living skill					
11. Participant is provided with general praise at the end of the session					
Summary					

Participant________________________________

Procedural Fidelity (Intervention)

Key: Correct (+); Incorrect (-), Not applicable (NA)

Date					
Time					
Researcher					
Observer					
Condition					
1. Correct materials for daily living/vocational skill available					
2. iPhone set up correctly					
3. iPhone in participant's pocket at least 3 min, no more than 10 min prior to the session beginning					
4. Correct task direction provided					
6. If student independently initiates, no prompting is provided					
7. If participant does not remove iPhone from his pocket, prompt is provided on correct delay interval					
8. If participant removes iPhone from pocket, allow 50 s to access correct video					
9. If participant does not view correct video, session is ended					
10. If participant views correct video, he is given 30 s to complete vocational or daily living skill					
11. Participant is provided with general praise at the end of the session					
Summary					