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Use of Portable Electronic Assistive Technology to Improve Independent Job Performance of Young Adults with Intellectual Disabilities

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USE OF PORTABLE ELECTRONIC ASSISTIVE TECHNOLOGY TO IMPROVE INDEPENDENT JOB PERFORMANCE OF YOUNG ADULTS WITH INTELLECTUAL DISABILITIES

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ABSTRACT

Poor employment outcomes for persons with intellectual disabilities (ID) persist, despite the development of legal policies designed to enhance access to gainful employment and to promote increased community integration. Recent data suggest that only 37% of young adults with ID obtain paid employment outside of the home. Among persons with ID who do obtain employment, career options are limited and nearly half are paid below minimum wage. Various strategies have been used to improve employment outcomes for those with ID, such as use of a job coach and teaching self-management strategies on the job site. These strategies often involve the use of visual or auditory prompting to assist with task completion; both of which can be provided by assistive technology. The current study examined the use of readily available, inexpensive, and discrete portable electronic assistive technology in an office setting to provide prompting and instruction to three young adults with ID. Results revealed that the technology substantially increased participants' ability to independently and correctly complete office-related tasks. Implications and suggestions for future research are provided.

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CHAPTER ONE

INTRODUCTION

The purpose of this chapter is to provide an overview of intellectual disabilities (ID), employment outcomes of those with ID, and the role that assistive technology can serve to improve these outcomes. The rationale for this study is also described and specific research questions are provided.

Overview of Intellectual Disabilities

The term used to describe those with cognitive and adaptive impairments has gone through several iterations throughout the years, including idiocy, mental disability, feeblemindedness, mental sub-normality, and mental retardation (American Association on Mental Retardation, 1992; Goodey, 2005; Trent, 1994). At present, ID is the appropriate terminology and it refers to a person who, prior to the age of 18, possesses significant intellectual and adaptive limitations that are manifested in conceptual, social, and practical contexts (Schalock et al., 2010). The definition of ID is also commonly divided into several sub-categories, differentiated by specific ranges of intelligent quotient (IQ) scores. These sub-categories include mild (IQ 50-69), moderate (IQ 35-49), severe (IQ 20-34), and profound (IQ <20) (American Psychiatric Association, 2000). ID is the most common developmental disorder in the United States (Centers for Disease Control and Prevention, 2005) with a prevalence rate of approximately 1% of the population (American Psychiatric Association, 2000).

Intellectual Limitations

One fundamental criterion associated with ID is the presence of significantly limited intellectual functioning. Intelligence, typically quantified by an IQ score obtained from a standardized assessment, has historically been described as the global capacity of an individual to act purposefully, to think rationally, and to effectively deal with the environment (Wechsler, 1944). Modern theories suggest that a person's intelligence is best conceptualized by a single general factor, which is commonly referred to as *g* (Schalock et al., 2010). This single factor of intelligence can be readily assessed and is theorized to be at the peak of a hierarchical structure of cognitive skills (Sattler, 2001). The hierarchy is comprised of a variety of skills, such as verbal expression, knowledge of social issues, word knowledge, abstract non-verbal reasoning, visual-spatial reasoning, visual discrimination skills, working memory, and how quickly a person can process information (Kaufman & Lichtenberger, 2005).

Adaptive Behavior Limitations

In addition to deficiencies in intellectual functioning, persons with ID also possess adaptive behavior limitations. Adaptive behavior consists of conceptual skills, social skills, and practical skills that are commonly used by individuals each day (Schalock et al., 2010). Conceptual skills are those that involve language and literacy skills, time, number concepts, and self-direction. Social skills include factors such as interpersonal skills, social responsibility, self-esteem, rule-following behaviors, and avoidance of becoming a victim. Practical skills can involve personal care, healthcare, knowledge and use of transportation, occupational skills, safety practices, and use of money (Schalock et

al., 2010). These skills can be assessed by using standardized measures and must be significantly below average for a person to receive a diagnosis of ID (Schalock et al., 2010).

Employment Outcomes

In recent decades, laws, such as the Americans with Disabilities Act of 1990 (ADA), have been enacted to promote full community integration, including employment domains among those with disabilities. However, the substantive effect of these policy initiatives on employment outcomes for those with disabilities is still relatively limited (C. Hughes, 2008; Wehman & Revell, 2005). Historically, individuals with ID have had difficulty finding gainful employment; a problem that persists today (Wehman & Wevell, 1981). According to the U.S. Department of Education (2010), only slightly more than a third of young adults with ID currently have paid employment outside of the home. This percentage is dramatically less than that for young adults with other disabilities, such as learning disabilities (66.7%), hearing impairments (56.4%), and emotional or behavioral disorders (48.2%). When compared to students with other disabilities, young adults with ID are also more likely to work in sheltered employment (e.g., segregated vocational and non-vocational jobs) following the completion of school (Grigal, Hart, & Migliore, 2011). Among persons with ID who do obtain employment, most work in the food preparation or serving industry, over half work 34 or fewer hours per week, and 45% have an income of less than $7.25 per hour (U.S. Department of Education, 2010). The consequence of such limited employment opportunities, in conjunction with the

corresponding low hourly income, is that individuals with ID could easily have financial difficulties when attempting to live independently.

Improving Outcomes

Research indicates that the most common reason for job loss among those with ID is performance problems stemming from excessive absenteeism, not following instructions, and not being able to complete assigned work responsibilities (Howarth, Mann, Zhou, McDermott, & Butkus, 2006). Consequently, individuals with ID often require specialized instructional methods to accurately and efficiently learn information in a classroom or work environment. This type of instruction often involves the use of prompting, reinforcement, shaping, and chaining to teach specific skills (Cooper, Heron, & Heward, 2007). Additionally, various strategies have been developed that improve employment outcomes among those with ID. Two popular examples are the use of a supported employment model and teaching self-management strategies on the job-site.

Supported employment. This model involves the provision of individualized supports in the natural environment at the job site, generally in conjunction with a job coach, to facilitate the acquisition and retention of gainful and integrated employment (Howarth et al., 2006; Rusch & Braddock, 2004). The role of a job coach is quite multifaceted and changes based on the unique needs of the client (Blitz & Mechanic, 2006); however, responsibilities generally include the provision of direct services to the client, assisting with job identification and placement, and providing training on the job-site (Test, Carver, Ewers, Haddad, & Person, 2000). In general, assistance provided within a supported employment model can include initial assessment of the individual's

skills, matching an individual's skills with those required at a particular job site, developing a plan to obtain gainful employment, placement and training at the job site, and follow-up to monitor performance (McInnes, Ozturk, McDermott, & Mann, 2010). The supported employment model has been found to improve the monthly wages of persons with ID as much as 300 to 500 percent (Kregel, Wehman, & Banks, 1989), increase their likelihood of being employed (McInnes et al., 2010), and improve their quality of life relative to other systems of support (Beyer, Brown, Akandi, & Rapley, 2010).

Self-management strategies in vocational settings. Lancioni and O'Reilly (2001) conducted a review of the literature and found five self-management strategies that are often used to facilitate independent functioning in occupational settings. Strategies included the use of (a) picture cues presented on cards to help a person complete a multistep task or follow an activity schedule, (b) picture cues presented via computer-based systems, (c) object cues (e.g., objects that represent steps in a task or an activity) attached to cards, (d) verbal cues stored in audio devices that consist of short phrases used to facilitate correct responding, and (d) self-verbalizations (e.g., vocalizing words to self as a performance cue). Results revealed that picture cues, whether presented on cards or from computer-based systems, were among the most frequently used instructional materials for individuals with developmental disabilities and that computer-based methods offer numerous advantages over cards. Assistive technology, which includes computer-based methods, has many advantages and is the focus of the next section.

Assistive Technology

Assistive technology (AT) refers to any item, piece of equipment, or system that is used to increase, maintain, or improve functional capabilities of individuals with disabilities (Federal Register, 2000; Individuals with Disabilities Education Improvement Act, 2004). For students with ID, common AT devices range from sophisticated electronic devices such as vibrating pagers and personal computers, to less technological devices such as picture boards and specialized grips for pencils. One advantage of using AT to assist those with ID is its ability to provide a prompt to complete a task or to illustrate an auditory or visual sequence showing a person how to complete a task independently. Prompting is broadly defined as an action taken that is intended to help a student or client engage in an appropriate response (Alberto & Troutman, 2009; Lovass, 2003). Prompts are commonly used to provide individuals with cues that can assist them with remembering to do something, or to show them how to complete a task. The use of prompts can also aid with skill acquisition and generally takes the form of either an environmental prompt, pictorial prompt, gestural prompt, verbal prompt, imitative prompt, or a physical prompt (Rudrud, 2007). Additionally, types of prompts may move from the use of least restrictive prompts (e.g., environmental cues, such as the color of a folder to place completed work in) to the most restrictive prompts (e.g., physical prompting, such as hand-over-hand guidance), or vice versa, based upon the needs of the client until he is able to complete the task independently.

Portable Electronic Assistive Technology

Because of the size and weight of traditional desktop computers, the form of technology often used has been that which is portable and easily accessible to those with disabilities. Handheld computers (e.g., PDA, Pocket PC, iPod, iPad, and palmtop computers) are portable, easier to operate than desktop computers due to the touchscreen and simple input devices, and often have software available that facilitates access for those with ID (Wehmeyer, Palmer, Smith, Davies, & Stock, 2008). Likewise, handheld technology used to deliver auditory instruction can also come in portable and discrete forms, such as a handheld MP3 player (Taber-Doughty, 2005). When compared to other forms of technology used to support persons with ID, such as augmentative communication devices or desktop computers, handheld computers have been found to be the most effective (Wehmeyer et al., 2008).

Use for employment-related tasks. Portable electronic AT has been successfully used to increase the independent completion of employment-related tasks among those with ID via the use of video rehearsal, feedback, pictures, or audio instructions (Davies, Stock, & Wehmeyer, 2002a; Riffel et al., 2005; Van Laarhoven, Van Laarhoven-Myers, & Zurita, 2007). Furthermore, portable technology can provide numerous supports that might otherwise require an assistant to either monitor or prompt the individual when completing tasks (Davies, Stock, & Wehmeyer, 2003; Mechling, 2007). Results from studies utilizing portable electronic AT indicate that individuals with ID derived more benefits from using electronic reminders than traditional paper-based methods (DePompei et al., 2008; Gillette & Depompei, 2008) and required less

direct intervention from peers or others around them, which allowed individuals to achieve greater levels of independence (Davies et al., 2003; E. Hughes, Green, & Ryan, 2011; Wehmeyer et al., 2006).

The use of portable electronic AT among those with ID, in the form of visual or auditory prompts delivered from a small personal computer, has also resulted in improvements in time management skills and adherence to a schedule (Davies, Stock, & Wehmeyer, 2002b; E. Hughes et al., 2011). Similar strategies involving portable electronic AT have been successfully used to aid students with ID in learning how to travel independently without the need of external prompting by an adult or caregiver (Mechling & Seid, 2011). In fact, use of a PDA to teach bus traveling and navigational skills to individuals with ID has resulted in an increased ability to navigate novel bus routes, when compared to simply using a map and verbal directions (Davies, Stock, Holloway, & Wehmeyer, 2010).

Statement of the Problem

Persons with ID have significant cognitive and adaptive limitations that are expressed in many areas of their life (Schalock et al., 2010). This has historically resulted in those with ID having meager salaries, poor employment outcomes, and limited access to a variety of careers (Grigal et al., 2011; U.S. Department of Education, 2010). One method of improving these outcomes has been via the use of supported employment, which includes the provision of supplementary individualized services to the person with ID (Beyer et al., 2010; Kregel et al., 1989; McInnes et al., 2010). These services typically include assistance from a job coach who helps with job identification and

placement, training on the job site, and the development of self-management techniques; each of which can facilitate successful integration at employment settings (Howarth et al., 2006; Lancioni & O'Reilly, 2001; McInnes et al., 2010; Test et al., 2000). The supports provided by a job coach to promote self-management at the job site appear to have merit; however, the prompting provided by the coach can also be provided conveniently, discretely, inexpensively, and independently via the use of portable electronic AT.

Significance of the Study

In summary, individuals with ID have historically had challenges obtaining gainful employment (Wehman & Wevell, 1981). This trend continues today and has resulted in those with ID often having low earnings, high rates of unemployment, and limited access to a variety of jobs (Grigal et al., 2011; U.S. Department of Education, 2010). Enabling clients with ID to become successful, efficient, and independent at work is paramount if these outcomes are to be improved. Supported employment (Howarth et al., 2006; Rusch & Braddock, 2004), job coaches (Test et al., 2000), and the use of self-monitoring strategies (Lancioni & O'Reilly, 2001) have demonstrated efficacy for assisting persons with ID in vocational settings. However, portable electronic AT may be able to provide many of the same benefits and emerging evidence suggests that it can be applied to promote independence on the job site (Cihak, Kessler, & Alberto, 2008; Taber-Doughty, 2005; Van Laarhoven et al., 2007).

The goal of this study was to examine the effectiveness of using portable electronic AT as a prompting mechanism to complete assigned work-related office tasks independently. Assessing the efficacy and applicability of new technology among those

with ID is an important area in need of future research (Wehmeyer et al., 2008). The technology used in this study was accessible, inexpensive, age-appropriate, and had not yet been formally evaluated among those with ID. Additionally, the AT had been readily incorporated by mainstream society, which reduced the likelihood that it would be stigmatizing for users who had ID (Davies et al., 2002a; Gillette & DePompei, 2004).

Purpose of the Study

The purpose of this study was to investigate the effects of portable electronic AT to improve job-related performance among adults with ID. The following research questions were addressed:

1. Can the use of portable and widely-accessible electronic AT improve the independent and correct completion of employment-related tasks among young adults with ID?
2. Does the specific method of prompting (audio, video, or a combination of both) provided by a portable device have an effect on participants' performance when completing an employment-related task?
3. Is the most effective method of prompting related to the participant's preferred prompting format?
4. Will performance levels be maintained over time?

CHAPTER TWO

LITERATURE REVIEW

The purpose of this chapter is to examine the literature regarding the effectiveness of portable electronic AT used to assist with vocational task completion among those with ID. Portable electronic devices are introduced, followed by a review of selected studies associated with their use in employment-related tasks. Components of the studies analyzed include: (a) characteristics of the participants, (b) settings, (c) portable technology used, and (d) components of the intervention. Additionally, (a) research designs, (b) reliability, (c) treatment fidelity, (d) social validity, and (e) major findings are examined.

Portable Electronic Assistive Technology

In recent years, computing technology has evolved to the point that handheld PCs can do much of what was previously restricted to larger desktop computers. These devices, and the applications or software used by the devices, are becoming increasingly affordable. The software, often referred to as multimedia, is able to integrate high quality audio, video, and text into graphic displays (Davies et al., 2002a) that can be used to provide prompting or instruction to those who would benefit. Persons with ID are ideal candidates to receive supports from handheld PCs due to the PCs ability to easily organize information (Gillette & DePompei, 2004). Moreover, these devices are unobtrusive, non-stigmatizing, and used by many typical peers, which contributes to their value when applied to integrated employment-related tasks in community settings

(Davies et al., 2002a). In the next section, I review the use of portable electronic AT devices used for employment-related tasks.

Portable Electronic Assistive Technology for Employment-Related Tasks Literature Review

Studies in the literature regarding the effectiveness of video, pictorial, or auditory prompting provided by portable electronic devices among those with ID were identified through a systematic process. First, a thorough electronic search of Educational Resources Information Center (ERIC), Academic Search Premier, and PsycINFO databases from 2000 – 2012 was conducted using the keywords intellectual disability or mental retardation, combined with the words handheld computer, PDA, personal digital assistant, portable media player, palmtop computer, pocket PC, portable electronic device, MP3, iPhone, iPad, or iPod. Next, a hand search was conducted of the following journals, covering the span of 2000 to the present: *Journal of Applied Behavior Analysis, Journal of Special Education Technology, and Education and Training in Autism and Developmental Disabilities.* Finally, an ancestral search of the reference sections of identified articles was conducted. These searches produced 69 articles matching initial search criteria. After the removal of duplicate articles and after restricting the searches to peer-reviewed journals, 41 articles remained. To be included in the review, studies were required to meet the following criteria:

1. At least one of the participants in the study had an ID as a primary diagnosis,
2. The study utilized a portable electronic device as an independent variable for instruction or prompting using video, pictorial, or auditory presentation,

3. The portable device was used to assist with vocational task completion in an employment setting or for a task that could be used in an employment setting, and
4. The study used an experimental, quasi-experimental, or single-subject research design.

Studies were removed if they did not meet the above criteria. Studies were also removed if there was no clear indication of a diagnosis of ID among the participants. Fifteen studies met the criteria for inclusion in this review. The included studies were examined with respect to the characteristics of the participants, settings, portable technology used, components of the intervention, research designs, reliability, treatment fidelity, and social validity. Major findings across studies are provided.

Characteristics of Participants

Across all studies, a total of 136 participants were included. In each study, researchers reported the chronological age, or mean age, of the participants. As shown in Table 2.1, participants' ages ranged from six years to 70 years of age (M = 19.8 years). Among all participants, 81 (60%) were male and 54 (40%) were female. The level of cognitive functioning, or mean level of cognitive functioning, was reported for participants in 14 (93%) of the selected studies. Participants in the remaining study that did not report IQ scores clearly had significant cognitive limitations and were, subsequently, included in this review. The mean IQ of all participants was 50.14, which falls at the low end of a mild ID classification.

Characteristics of Research Settings

Table 2.2 depicts the research settings that were used across the 15 studies. Investigators in seven (47%) of the studies conducted research in integrated community-based locations (e.g., grocery store, restaurant, product assembly room, etc.) Researchers in six (40%) of the studies selected training environments (e.g., school setting, day activity center, kitchen of an apartment rented by the local school district, etc.) to conduct research. Each of the remaining two studies (13%) took place in a variety of locations, depending upon the students' IEP goals or tasks involved.

Portable Technology Used

Researchers in 10 (67%) of the studies used handheld computers or PDAs that were capable of doing a multitude of tasks. As illustrated in Table 2.2, in four of the studies (27%), researchers used handheld technology that was primarily used for delivering visual and auditory material only (i.e., Video iPod or a portable DVD player). The remaining study utilized technology that was exclusively able to deliver auditory content.

Components of the Intervention

Device Prompting Format

In 11 (73%) of the studies, treatment packages were used consisting of auditory instructions paired with video or pictorial prompts. Researchers in two (13%) of the studies used auditory instructions only. In one (7%) of the studies, auditory or vibratory prompting was used in conjunction with pictorial prompts. Additionally, one (7%) study used an audible alarm with text used as a prompt.

Dependent Variables

Researchers used a variety of dependent variables to assess intervention outcomes. All studies evaluated a combination of the following: (a) the number of steps completed correctly within a task, (b) external prompts required, (c) sessions required to meet mastery criterion, (d) support statements provided by researchers, (e) tasks completed on time, (f) level of prompting used, and (g) the duration to complete a task from beginning to end.

Research Designs

For seven (47%) of the studies, a multiple-probe design was used. Researchers used an alternating treatments design in four (27%) of the studies. Likewise, a group design (i.e., t-test or Poisson regression) was implemented in four (27%) of the studies.

Reliability and Procedural Fidelity

Reliability of observations and the implementation of procedures with fidelity are extremely important to confirm the integrity of reported findings.

Inter-observer Agreement

Researchers measured inter-observer agreement (IOA) in 11 (73%) of studies. For the studies that reported IOA, high percentages were obtained and ranged from 85%-100%.

Procedural Fidelity

Researchers in eight (53%) studies measured procedural fidelity, which is the accuracy with which the procedural components of the intervention are followed. For

those who reported procedural fidelity, high percentages were obtained and ranged from 86%-100%.

Social Validity

Social validity, also known as consumer satisfaction, refers to the social acceptability and practicality of research methods and outcomes (Cooper et al., 2007; Horner et al., 2005). Data pertaining to social validity were provided in 11 (73%) of the studies. Information was gathered in a variety of ways, including informal interviews with the participant asking how well he or she liked the device and how beneficial it was, structured interviews asking a series of questions, or asking employers or trainers about the efficacy of device usage. For all studies that reported social validity, the majority of feedback obtained from participants was favorable and all responses from key stakeholders were favorable.

Major Findings

All the studies showed improvements in the target behavior for individuals with ID (see table 2.3). That is, the use of portable electronic AT resulted in increased independent and correct responding for work-related tasks or a reduction in the level of external prompting required for participants to successfully complete tasks. Benefits were shown across multiple settings, participants, and behaviors.

Studies Comparing Multiple Prompting Methods

Davies et al. (2002b) compared the effects of using a written schedule to using a palmtop computer that provided auditory instructions, when completing vocational and daily living tasks. Participants using the palmtop computer required, on average, 1.33

external prompts per task. When using a written schedule, they required an average of 4.58 external prompts per task. These differences were statistically significant ($p < .002$). Moreover, .67 mean scheduling errors occurred when using the palmtop computer, in comparison to 3.58 mean scheduling errors when using a written schedule. These differences also produced statistically significant results ($p < .001$).

Gillette and Depompei (2008) compared the effects of using a list, paper planner, or a PDA that provided an audible alarm and text to the number of tasks completed on time. When compared to use of the list, participants using the PDA had an increase of on-time behavior by 15%. This finding was statistically significant ($p < .024$). Similarly, in comparison to the use of a paper planner, participants using a PDA had an increase of on-time behavior by 25%. This finding was also statistically significant ($p < .002$).

Additionally, Lancioni, O'Reilly, Seedhouse, Furniss, and Cunha (2000) compared the use of picture prompting on a handheld computer to traditional picture cards when teaching participants to independently and correctly complete vocational tasks. In addition to presenting a sequence of pictures for a task, the handheld computer also provided audible or vibratory prompts if a period of time had elapsed since the participant last interacted with the device. Audible or vibratory prompts were used to ensure that the participant remained active and did not advance to subsequent steps without first viewing the appropriate pictorial prompt. During the baseline phase, participants' mean level of independent and correct completion of task steps was approximately 9%. When using the handheld computer, mean independent and correct responding increased to approximately 77%. When using picture cards, mean

independent and correct responding was approximately 58%. Exact percentages were not provided; therefore, the aforementioned values are estimates based on visual inspection of graphically depicted data.

The use of auditory prompting has also been evaluated for promoting task completion among students with ID. For example, Taber-Doughty (2005) compared three prompting mechanisms (least-to-most prompting provided by an instructor, picture prompts stored in a photo album, and auditory instructions provided by a MP3 player) to teach participants with ID to make a paper copy from a copying machine. Baseline data indicated that participants had a mean of 11% correct and independent responding when making a copy and required an average of 199 seconds to complete the task. Following the intervention phase, results revealed that participants had a mean of 89% correct and independent responding when using picture prompting, 71% when prompting was provided by the instructor, and 54% when auditory prompting from the MP3 player was used. Moreover, the duration to complete the copying task decreased to a mean of 100 seconds when picture prompting was used, 96 seconds when prompting was provided by the instructor, and 104 seconds when auditory prompting from the MP3 player was used. Additionally, when participants used their preferred prompting mechanism, which participants individually identified prior to the collection of baseline data, their percentage of correct and independent responses increased and the duration with which they completed the task decreased.

The effectiveness of simultaneous or delayed video instruction for teaching participants how to complete common tasks in a library has also been investigated.

Taber-Doughty, Patton, & Brennan (2008) created video segments, that included audio instructions, related to the steps required to search for a call number and to locate a book or DVD in a public library. The video and audio segments were presented to participants in two separate and alternating formats: (a) viewing the segments on a portable handheld computer while simultaneously completing the task and (b) watching the same video and audio segments on a television in a classroom setting at least one hour prior to attempting the task. During the baseline phase, participants correctly and independently completed a mean of 44% of the steps. Use of a portable handheld computer resulted in a mean of 84% correct and independent responding. During the delayed video instruction phase, participants were able to correctly and independently complete an average of 80% of the steps in the task. Additionally, for the majority of participants, their preferred method of presentation (e.g., simultaneous or delayed) resulted in improved performance while completing the task.

In a related study, Mechling and Gustafson (2009) compared the effectiveness of using a portable DVD player that provided video with audio instructions with using pictorial prompts (e.g., laminated photographs or line drawings) to assist participants in completing steps of a cooking recipe. Video prompting was found to be more effective for all participants and resulted in a mean of 83% independent and correct responding. Conversely, use of pictorial prompts resulted in a mean of 47% independent and correct responding across participants.

Studies Evaluating the Efficacy of Specific Prompting Methods

Cihak, Kessler, and Alberto (2007) investigated the effects of using a handheld computer to provide picture prompts with auditory instructions on participants' ability to independently complete steps for a work-related task. Results revealed that mean independent performance increased from seven percent at baseline to 100% during the intervention phase for all participants in the study. Similarly, Cihak, Kessler, and Alberto (2008) increased participants' ability to independently transition between work tasks by using picture prompts and auditory instructions delivered by a handheld computer. Participants' baseline level of independent transitions was zero and moved to a mean of 86% during the intervention phase.

Davies et al. (2002a) demonstrated that picture prompting with auditory instructions provided by a palmtop computer could significantly decrease external prompting and the occurrence of errors. During baseline phase, participants' averaged 2.25 errors per task. When using the palmtop computer, mean errors per task decreased to .75. Mean external prompts per task also decreased from 2.40 to 1.05 when using the palmtop computer. Likewise, Davies et al. (2003) investigated the effects of using a pocket PC that provided picture prompting with auditory instructions on the number of decision errors (i.e., the ability to correctly navigate decision points within a vocational task), the number errors made when completing the task, and the number of external prompts provided to participants when engaging in the tasks. Use of the pocket PC resulted in a mean of .20 decision errors, in comparison to a mean of 1.72 for those not using the device. The average number of errors made by those using the pocket PC was

1.25, in comparison to 6.38 for those not using the device. The average number of external prompts provided to those using the device was 3.10, in comparison to 9.22 for those not using the device. All findings in this study were found to be statistically significant ($p < .001$).

Mechling, Gast, and Fields (2008) investigated the use of a portable DVD player to teach cooking skills to adults with ID. Cooking tasks were segmented into separate steps, each of which was recorded with video and audio on a DVD. Next, the recorded sequences were loaded on a DVD player that participants used while preparing the recipes during the intervention phase. During baseline, mean levels of correct task completion were approximately 33% across participants. Exact values were not provided for baseline phase and are estimates based on visual inspection of graphically depicted data. During the intervention phase, all participants required an average of 3 sessions to complete each task with 100% accuracy. Moreover, follow-up data obtained 2-10 weeks after completion of the intervention phase indicated that participants were able to use the DVD player to complete tasks with an average of 98% accuracy.

Similarly, Mechling, Gast, and Seid (2010) conducted research involving the use of a pocket PC that provided video with auditory instructions or a pictorial prompt combined with auditory instructions to guide participants through a sequence of steps of a food preparation recipe. Participants were presented with the pocket PC and were able to self-select the level of prompting provided by pressing buttons corresponding to each mode of presentation. Results indicated that baseline mean correct responding rate was approximately 25%. During the intervention phase, mean correct responding increased to

approximately 94% and concluded when a participant achieved 100% unprompted correct responding for one trial. Maintenance probes indicated that, at follow-up, participants had a mean correct responding rate of approximately 94%. Exact mean percentages were not provided; therefore, the aforementioned values are estimates based on visual inspection of graphically depicted data.

Riffel et al. (2005) investigated the use of a palmtop computer that provided pictures with auditory instructions to assist participants with steps of job-related tasks (e.g., rolling silverware in napkins, doing laundry, or setting a table). During baseline phase, participants required an average of 92 external prompts per session and completed approximately 17% of the steps independently. Intervention phase data revealed that external prompting decreased for all participants to a mean value of 45 per session and the average number of steps completed independently increased to approximately 38%. These data were skewed due to one participant requiring significantly more prompting than others. Additionally, approximations were made for some data due to exact values being unavailable.

Van Laarhoven, Johnson, Van Laarhoven-Myers, Grider, and Grider (2009) investigated the use of a portable handheld computer that presented video and audio segments that provided step-by-step instructions for completing work-related tasks (i.e., cleaning a bathroom, mopping the floor, emptying trash cans, and cleaning kennels). During baseline, the mean percentage of correct and independent responding was 17%. During intervention phase, the participant's mean independent and correct responding increased to 91%. Similarly, Van Laarhoven et al. (2007) investigated the use of a pocket

PC that provided video with audio sequences related to completing a task (e.g., rolling silverware, sorting and sanitizing silverware, clocking in, and portioning food). When using the pocket PC, all steps of a video task were presented from beginning to end, followed by the participant immediately beginning the task. During baseline phase, the mean percentage of correct independent responding was 8%. For the intervention phase, mean percentage of independent correct responding increased to 90%. Moreover, the mean percentage of steps requiring external prompts throughout baseline phase was 79%. During the intervention phase, this value decreased to 7%.

Summary

Following an extensive review of all related studies, converging evidence indicates the utility of portable electronic AT used as a prompting mechanism to assist individuals with ID when completing work-related tasks. Use of portable electronic AT consistently resulted in increased independent and correct responding to work-related tasks or a reduction in the level of external prompting required for the participant to successfully complete the task. Furthermore, benefits were obtained across multiple settings, participants, and behaviors.

Extending the Literature

As indicated in Table 2.3, the majority of studies used treatment packages consisting of auditory instructions paired with video or pictorial prompts. This finding leads to additional research questions since it is unclear which component of the package was responsible for improved performance. After conducting a recent literature review on the use of video prompting among individuals with disabilities, Banda, Dogoe, and

Matuszny (2011) noted a similar concern and recommended that future researchers need to investigate the individual components of each intervention (i.e., video prompting used with and without auditory instructions), rather than use a package consisting of multiple interacting independent variables. Mechling and Gustafson (2009) also concluded that more research was needed to determine the critical features of various modes of prompting so that the most effective could be used to assist individuals with disabilities.

The purpose of this study was to determine the effectiveness of using portable electronic AT as a prompting mechanism to complete assigned work-related office tasks in an independent manner. Each mode of presentation (e.g., audio, video, or both in combination) was separately evaluated to determine the most effective treatment for participants. The technology used was accessible, portable, inexpensive, age-appropriate, and is in need of further evaluation among persons with ID (Wehmeyer et al., 2008).

The decision to teach tasks common to office settings was made due to the simplicity of basic clerical tasks and the broad employment opportunities that knowledge of these skills may bring. Copiers, fax machines, and scanners are presently used in a variety of business, health, and educational settings. Furthermore, the job outlook for office clerks is expected to expand through 2018 due to employment growth and high replacement needs (Bureau of Labor Statistics, 2009).

Table 2.1
Characteristics of Participants

Study	n	Age(s)	Gender (M/F)	Disability	IQ
Cihak et al. (2007)	4	Mean: 18.5 Range: 18-19	M = 3 F = 1	ID	Mean: 44.5 Range: 40-50
Cihak et al. (2008)	4	Mean: 16.5 Range: 16-17	M = 3 F = 1	ID	Mean: 43.5 Range: 36-50
Davies et al. (2002a)	10	Mean: 41.9 Range: 18-70	M = 8 F = 2	ID	Mean: 54.8 Range: 39-72
Davies et al. (2002b)	12	Mean: 34.2 Range: 19-46	M = 8 F = 4	ID	Mean: 62.6 Range: 45-90
Davies et al. (2003)	40	Mean: 29.4 Range: 18-54	M = 23 F = 17	ID	Mean: 55.5 Range: 24-76
Gillette & Depompei (2008)	35	Mean: 14.9 Range: 6-20	*M = 20 *F = 14	ID, TBI	Mean: 68.0 Range: 50-116
Lancioni et al. (2000)	6	Mean: 37.0 Range: 23-47	M = 3 F = 3	ID	**NR
Mechling et al. (2008)	3	Mean: 20.3 Range: 19-22	M = 1 F = 2	ID	Mean: 48.3 Range: 40-53

Note. NR = Not reported; TBI = Traumatic Brain Injury; * = Gender of one participant was not provided; ** Information clearly indicated an intellectual disability, despite the fact that IQ scores were not provided.

Table 2.1 (Continued)
Characteristics of Participants

Study	n	Age(s)	Gender (M/F)	Disability	IQ
Mechling et al. (2010)	3	Mean: 16.3 Range: 15-17	M = 1 F = 2	ID	Mean: 50.0 Range: 44-55
Mechling et al. (2009)	6	Mean: 20.3 Range: 18-22	M = 3 F = 3	ID	Mean: 49.0 Range: 40-54
Riffel et al. (2005)	4	Mean: 19.0 Range: 16-20	M = 1 F = 3	ID	Mean: 48.3 Range: 36-75
Taber-Doughty (2005)	3	Mean: 17.7 Range: 15-21	M = 1 F = 2	ID	Mean: 49.7 Range: 45-53
Taber-Doughty et al. (2008)	3	Mean: 13.7 Range: 13-15	M = 3 F = 0	ID	Mean: 51.0 Range: 46-57
Van Laarhoven et al. (2009)	1	Mean: 17.0 Range: 17-17	M = 1 F = 0	ID	Mean: 52.0 Range: 52-52
Van Laarhoven et al. (2007)	2	Mean: 18.0 Range: 18-18	M = 2 F = 0	ID	Mean: 62.5 Range: 47-78
Total = 136		Mean = 22.3	M = 81; F = 54		*M* = 52.8

Table 2.2
Characteristics of Settings and Portable Electronic Technology

Study	Intervention Setting	Technology Used
Cihak et al. (2007)	Grocery store, department store, and a restaurant	Dell Axim X30 handheld computer
Cihak et al. (2008)	Grocery store, department store, and a restaurant	Dell Axim X30 handheld computer
Davies et al. (2002a)	Community-based vocational training location	Palmtop computer using Visual Assistant software running on the Windows CE Platform
Davies et al. (2002b)	Setting was developed that provided vocational and residential tasks common to those settings	Palmtop computer using Schedule Assistant software running on the Windows CE platform
Davies et al. (2003)	Product assembly room located within an office complex	Pocket PC using Pocket Compass software
Gillette & Depompei (2008)	School or settings related to IEP goals	Dell Axim or Palm Zire 71/72
Lancioni et al. (2000)	Day activity centers	IBM 110 palm-top computer, an auditory output device, and a vibration box
Mechling et al. (2008)	Kitchen of an apartment rented by a school district	Toshiba portable DVD player with a rechargeable battery and a 7-inch screen

Table 2.2 (Continued)
Characteristics of Settings and Portable Electronic Technology

Study	Intervention Setting	Technology Used
Mechling et al. (2010)	Kitchen located at a high school	Hewlett Packard iPAQ Pocket PC with pre-installed software by One Write company)
Mechling et al. (2009)	Kitchen of an apartment rented by a school district	Toshiba portable DVD player with a 7 inch screen
Riffel et al. (2005)	School setting, assisted living center dining room, or home location	Cassiopeia TFT palmtop computer using Visual Assistant software running on the Windows CE platform
Taber-Doughty (2005)	Grocery store	D'Music MP3 Player (Model: SM-320V)
Taber-Doughty et al. (2008)	Library	30G Apple video iPod
Van Laarhoven et al. (2009)	Animal shelter	Fifth generation video iPod
Van Laarhoven et al. (2007)	Restaurant (i.e., Red Robin and Applebees)	Hewlett Packard iPAQ hq2700 Pocket PC running Microsoft Pocket PC 2003 2nd edition

Table 2.3
Components of the Intervention

Study	Device Prompting Format	Dependent Variable(s)	Research Design	Inter-observer Agreement	Procedural Fidelity	Social Validity	Major Findings
Cihak et al. (2007)	Picture with auditory instructions	Number of steps performed independently across increasing task complexity	Multiple-probe	95%-100%	96%-100%	NR	Independent task performance increased and was maintained at follow-up
Cihak et al. (2008)	Picture with auditory instructions	Number of independent task transitions within a series of vocational tasks	Multiple-probe	96%-100%	97%-100%	NR	Independent task transitions increased and was maintained at follow-up
Davies et al. (2002a)	Picture with auditory instructions	Number of external prompts; number of errors	Two group within-subjects	NR	NR	Participants were satisfied with the device	Decrease in external prompting and errors

Note. NR = Not reported

Table 2.3 (Continued)

Components of the Intervention

Study	Device Prompting Format	Dependent Variable(s)	Research Design	Inter-observer Agreement	Procedural Fidelity	Social Validity	Major Findings
Davies et al. (2002b)	Auditory instructions	Number of external prompts; number of errors	Two group within-subjects	NR	NR	Participants were satisfied with the device	Decrease in external prompting and errors
Davies et al. (2003)	Picture with auditory instructions	Number of errors made at decision points; number of overall errors; number of external prompts	Two group within-subjects design	NR	NR	NR	Decrease in decision point errors, overall errors, and external prompting
Gillette & Depompei (2008)	Audible alarm with text	Number of tasks completed on time	Comparison of incidence rate ratios using Poisson regression	NR	NR	Feedback from participants and trainers was positive.	Electronic reminders were more beneficial than traditional paper-based methods

Note. NR = Not reported

Table 2.3 (Continued)

Components of the Intervention

Study	Device Prompting Format	Dependent Variable(s)	Research Design	Inter-observer Agreement	Procedural Fidelity	Social Validity	Major Findings
Lancioni et al. (2000)	Picture with auditory or vibratory prompting	Number of tasks completed correctly and independently; number of computer prompts	Alternating treatment	90%-100%	NR	The majority of participants preferred to use the computer system rather than a picture card system	Increase in number of tasks performed correctly and independently; computer prompting remained relatively unchanged
Mechling et al. (2008)	Video with auditory instructions	Number of steps within the task(s) completed correctly	Multiple probe	89%-100%	86%-100%	Participants preferred use of the DVD player to other options	Increase in number of steps completed correctly and independently; performance was maintained at follow-up

Note. NR = Not reported

Table 2.3 (Continued)

Components of the Intervention

Study	Device Prompting Format	Dependent Variable(s)	Research Design	Inter-observer Agreement	Procedural Fidelity	Social Validity	Major Findings
Mechling et al. (2010)	Video, picture, and auditory instructions	Number of steps completed correctly and independently; prompting level	Multiple probe	95%-100%	91%-100%	Participants selected a DVD player, rather than the PDA, because it could play movies	Increase in number of steps completed correctly and independently; performance was maintained at follow-up; prompt levels became less intrusive over time
Mechling et al. (2009)	Video with auditory instructions	Number of steps completed correctly and independently	Alternating treatment	95%-100%	98%-100%	N/A	Increase in number of steps completed correctly and independently

Note. NR = Not reported

Table 2.3 (Continued)

Components of the Intervention

Study	Device Prompting Format	Dependent Variable(s)	Research Design	Inter-observer Agreement	Procedural Fidelity	Social Validity	Major Findings
Riffel et al. (2005)	Picture with auditory instructions	Number of external prompts; steps completed independently; duration to complete task; number of support statements	Multiple probe	98%-99%	NR	Participants and instructors agreed that the PDA was helpful	Decrease in external prompts; increase in steps completed independently; no difference in duration; use of support statements reduced
Taber-Doughty (2005)	Auditory instructions	Number of steps completed correctly and independently; duration to complete the task	Alternating treatment	88%-100%	NR	Participants were satisfied with all prompting systems evaluated	Increase in steps completed independently; reduced task duration; prompting preference was related to outcome

Note. NR = Not reported

Table 2.3 (Continued)

Components of the Intervention

Study	Device Prompting Format	Dependent Variable(s)	Research Design	Inter-observer Agreement	Procedural Fidelity	Social Validity	Major Findings
Taber-Doughty et al. (2008)	Video with auditory instructions	Number of steps completed correctly and independently	Alternating treatment	89%-100%	92%-98%	2/3 of participants preferred use of the iPod; all indicated excitement about using the iPod	Increase in steps completed independently; prompting preference was related to outcome
Van Laarhoven et al. (2009)	Video with auditory instructions	Number of independent and correct responses; number of error correction prompts; number of prompts to use the technology	Multiple probe	97%-100%	100%	Participant and parent were pleased with use and effectiveness of the video iPod	Increase in independent and correct responding; decrease in the number of prompts given from a job coach; video iPod was generally used independently

Note. NR = Not reported

Table 2.3 (Continued)

Components of the Intervention

Study	Device Prompting Format	Dependent Variable(s)	Research Design	Inter-observer Agreement	Procedural Fidelity	Social Validity	Major Findings
Van Laarhoven et al. (2007)	Video with picture and auditory instructions	Number of independent and correct responses; number of prompts; number of sessions to reach criterion	Multiple probe	85%-100%	100%	Participants enjoyed using the device and employers indicated that it was useful	Increase in independent and correct responding; decrease in the number of prompts; participants met criterion within 3-7 sessions

Note. NR = Not reported

CHAPTER THREE

METHOD

The purpose of this chapter is to describe the methods used to conduct this study. First, the research questions are listed. Second, characteristics of the setting and participants are described. Third, materials needed for the study are provided. Fourth, experimental procedures, dependent measures, research design, and methods for data analysis are reviewed. Finally, descriptions of interobserver agreement, procedural fidelity, and social validity measures are described. This research addressed the following questions:

1. Can the use of portable and widely-accessible electronic AT improve the independent and correct completion of employment-related tasks among young adults with ID?
2. Does the specific method of prompting (audio, video, or a combination of both) provided by a portable device have an effect on participants' performance when completing an employment-related task?
3. Is the most effective method of prompting related to the participant's preferred prompting format?
4. Will performance levels be maintained over time?

The purpose of this research was to investigate the effects of portable electronic AT to improve independent job-related performance among adults with ID. The study was conducted in a natural work environment, an office setting, of three young adults

with ID. Prior to beginning this study, Institutional Review Board approval (IRB# 2008-378) was obtained from the university. Following IRB approval, participant consent for participation in the study was secured.

Setting and Participants

Setting

The research was conducted at a large university campus located in the Southeastern United States. The university serves 19,000 students and provides undergraduate through doctoral degrees in approximately 190 educational programs. Additionally, the university has a residential two-year postsecondary transition program designed for young adults with ID who seek to improve their independent living and employment skills. The program serves approximately 15 students per cohort and provides specialized instruction in independent living skills, employment skills, social skills, functional academics, nutrition, and exercise. Students participating in the program attend classes 5 days per week and are on campus for approximately 8 hours per day. Daily activities vary and include a combination of classroom instruction, job placements, and job training. The research location was an administrative office located on-campus. The office had standard equipment, such as a computer, scanner, printer, as well as many other common items that one would expect to find in a typical office setting.

Participants

The selection criteria for participants in this study required that they: (a) be enrolled in the post-secondary program designed for adults with ID, (b) have a diagnosis

of moderate ID, and (c) not be able to successfully operate a copier, scanner, and a fax machine. After instructors made initial student recommendations, researchers reviewed each participant's psychological evaluation to confirm a diagnosis of moderate ID. Following this, selected participants were interviewed to determine if they were interested in participating in the research study. Last, participants were taken to the office setting and were asked to independently operate the copier, scanner, and fax machine. Participants were excluded if they successfully operated any of the three devices.

Chris. Chris, a Caucasian male, was 21 years and 8 months of age when the study began (see Table 3.1). He was diagnosed with Down syndrome and had moderate articulation difficulties when speaking. Medically, he had glaucoma and congenital cataracts and had numerous surgeries to address these issues. His vision was correctable to within normal limits by wearing glasses or contact lenses, which he wore on a daily basis. Socially, he was very outgoing and enjoyed working and being around others. He was a first year student in the postsecondary transition program.

Dan. Dan, a Caucasian male, was 21 years and 11 months of age when the study began (see Table 3.1). He was diagnosed with Down syndrome and had heart surgery as an infant. No other significant medical concerns were noted. Socially, Dan enjoyed being around others and was very receptive to verbal praise. He was a first year student in the postsecondary transition program.

Mark. Mark, a Caucasian male, was 22 years and 8 months of age when the study began (See Table 3.1). His medical history was non-significant. Socially, Mark

was very friendly when others initiated conversations, yet he would often otherwise remain quiet. He was a first year student in the postsecondary transition program.

Materials

Portable Electronic Assistive Technology

The device selected for this study was an iPod Touch (fourth generation), which is produced by Apple Inc. An iPod Touch is a portable computer that combines features of a PDA, video camera, media player, and a Wi-Fi mobile device into one unit. It is 4.4 inches in height, 2.32 inches wide, and has a color touch display that measures 3.5 inches diagonal. It is capable of using an array of software applications, which are downloadable and accessible from the device when a Wi-Fi connection is available or when it is connected to a computer that has access to the internet. At the time of this study, the iPod Touch cost $199 and was available on-campus for purchase.

Application Software

The application software that was purchased and installed on the iPod Touch was the Functional Planning System, which is produced by the Conover Company, and is capable of introducing individual steps of a task analysis via video, pictorial, and auditory modes of presentation. At the time of this study, the Functional Planning System cost $19.99.

Experimental Procedures

Tasks

The researcher and two special education graduate student assistants developed a task analysis for three novel job-related tasks (see Table 3.2) that would be expected to

commonly occur in an office setting. The task analysis was initially developed by completing the tasks while concurrently documenting each step of the process. After several iterations and a brief pilot with a student not included in this study, the finished analysis was obtained. Tasks included (a) making a copy of a document, (b) scanning and emailing a document, and (c) faxing a document. Each of the tasks consisted of nine to eleven steps and all tasks were of similar difficulty levels.

Technology. Following the development of a task analysis, each step of the task was sequentially recorded within the Functional Planning System application using the built-in video camera and microphone of the iPod Touch. For video recordings, the video for each step was taken from a point-of-view perspective that the participant would have when actually completing the task. Audio recordings provided explicit and concise instructions related to completion of the task. Procedures related to use of the device and differences among modes of presentation are described next.

Video presentation. After turning on the iPod Touch and pressing the Functional Planning System application icon, a screen appeared that provided the participant with a list of tasks that could be selected (See Figure 3.1). To access the sequence of steps for a task, a large grey icon with a brief text description of the task (e.g., How to Make a Copy) needed to be pressed. After the icon was pressed, a vertical list of ordered steps for the task appeared on the iPod Touch screen (See Figure 3.2). Each step in the list could be selected by pressing a large grey icon that included text indicating which step the icon represented (e.g., Step 1, Step 2, Step 3, etc.). After this icon was pressed, a new screen appeared that automatically began playing the video prompt for that step (See Figure

3.3). After it finished playing, the participant could press an icon to immediately replay it or he could press an icon titled "Task Completed" indicating that the step was complete. After clicking the "Task Completed" icon, the list of tasks re-appeared and the recently completed step had a green checkmark indicating that it had been finished. Subsequent steps within the task were completed in the same manner until all were complete.

Audio presentation. Procedures were identical to the video presentation, except that audio instructions replaced the use of video prompting. Internal speakers of the iPod Touch were used, rather than ear buds, for several reasons: (a) to allow the researcher to hear which step of the task analysis that the participant was completing, (b) to allow the participant to be receptive to verbal prompting procedures, and (c) the setting was generally quiet, so noise interference was minimal. However, in an actual work setting where research isn't being conducted, use of ear buds would be a viable option.

Combined video and audio presentation. Procedures used for video and audio presentations were combined, which allowed the concurrent presentation of video with the corresponding audio instructions.

Baseline

During baseline phase, each session included one trial for a specific task. No prior training for the task was provided and the participant did not have access to the iPod Touch. The participant was brought into the office and a research assistant provided a verbal instruction, such as "Please make a copy of the documents". The participant was encouraged to complete as much of the task as he could and was provided with non-specific verbal praise for attempting the task. The research assistant provided no further

assistance or prompting during this phase. If the participant either (a) failed to initiate a response within 15 seconds, (b) indicated that he was finished, (c) indicated that he did not know how to do the task, or (d) did not successfully complete the task within 10 minutes, the trial was ended.

Training

Following the completion of baseline phase, each participant was introduced to the iPod Touch and was shown how to turn it on and how to navigate to the Functional Planning System application. Participants were then shown how to touch the icon of the application to activate it. Next, participants were shown how to select and advance through a sequence of steps for a non-related task (how to use a paper shredder) so that they would learn how to operate the application. Participants were informed that they would be allowed to replay each step as many times as they desired. All three modes of presentation (video, audio, and combined video and audio) were introduced during training to familiarize participants and so they could initially identify a preferred method of instruction. Next, the iPod Touch was placed in standby mode to replicate what it would be like when the device had been idle for a period of time. It was then placed in front of the participant and he was asked to use the iPod Touch and application to complete the paper shredding task. Assistance was provided as needed and the process continued until the participant could operate the device and complete all steps independently and correctly for three consecutive trials using any mode of presentation.

Intervention

During the intervention phase, one session occurred per day. Each session included a total of three trials; one trial for each office task using one mode of presentation per task (audio, video, or a combination of both). The choice of the specific mode of presentation for a given trial was initially randomly selected for each participant and then counterbalanced in a semi-random manner across subsequent sessions to control for order effects and to minimize carryover effects (Barlow, Nock, & Hersen, 2009).

Each session began when the research assistant gave the participant an iPod Touch and provided a verbal instruction, such as "Please make a copy of the documents while using the iPod to help you". Following the initial verbal instruction and for all steps in the task analysis, if the participant failed to initiate a response within 15 seconds, if the response was incorrect, or if he asked for help, then prompting or assistance was provided following a continuum of least-to-most restrictive prompts. If the participant failed to correctly respond to a given prompting level within 5 seconds, then the next prompting level was used. The least-to-most prompting hierarchy occurred in the following sequence: (a) gestural prompting to redirect the participant back to the iPod Touch; (b) verbal prompting, such as asking the participant to replay a particular step on the iPod Touch or reminding him how to use the iPod Touch or application; (c) imitative prompting to show the participant how to use the iPod Touch or application for a particular step; or (d) physical prompting to guide the participant's hands or fingers over the correct controls on the iPod Touch and application for a particular step. Upon

completion of each trial, participants received non-specific verbal praise for completing the task.

Withdrawal

The withdrawal phase was introduced after participants demonstrated mastery while completing the task with AT to (a) assess the extent to which participants were able to sustain levels of performance after AT was withdrawn and (b) demonstrate functional control of the target behavior (Cooper et al., 2007). Procedures were identical to those used during baseline phase.

Preferred Mode of Presentation

The iPod Touch and Functional Planning System application were re-introduced during this phase using each participant's preferred mode of presentation. Procedures were identical to those used during the intervention phase.

Maintenance

The maintenance phase was conducted to assess participants' level of skill maintenance after a two week break from using the office equipment and portable electronic AT. Procedures were identical to those used during the intervention phase.

Dependent Measures

During all phases, data were collected on the number of steps within a task analysis completed independently and correctly. Additionally, the participant's self-reported prompting mode preference when using the iPod Touch was recorded prior to implementation of the intervention phase and again upon completion of the study. Finally, the duration per task was recorded for each trial of the intervention phase.

Research Design and Phase Change Criteria

Research Design

An alternating treatments design (Barlow & Hayes, 1979) was used, with common adaptions that included an initial baseline phase, followed by an intervention phase with rapidly alternating treatments (Cooper et al., 2007), then concluding with a phase limited to the client's preferred treatment. Additionally, a brief withdrawal was introduced following the intervention phase to assess participants' independent performance without use of the iPod Touch. One follow-up probe was also conducted to evaluate maintenance of skill acquisition.

Phase Change Criteria

The following criteria were required before discontinuation of one phase and the beginning of the next: (a) For baseline and withdrawal conditions, data were visibly stable and had a minimum of three data points, (b) for the intervention phase, data were collected for a minimum of three data points per alternating treatment (resulting in a minimum of ten total trials during this phase) and all participants had to have three consecutive scores of 100% correct and independent responding, (c) for the preferred treatment phase, data were visibly stable and each participant needed to obtain at least three consecutive scores of 100% correct and independent responding on each of the office tasks while using their preferred mode of presentation, and (d) for the follow-up probe, one trial was conducted two weeks after completion of the preferred treatment phase.

Data Recording and Analysis

Data Recording

During each trial, data were collected by the researcher pertaining to the number of steps completed independently and correctly by the participant (see Appendices A through C for Data Collection Forms). Responses were only scored as being completed independently and correctly if (a) the researcher provided no prompting, (b) the step was completed with 100% accuracy, and (c) the step was in the correct sequence that corresponded with the task analysis. At the conclusion of each trial, data were converted to a percentage by dividing the number of steps completed independently and correctly by the total number of steps in the task and then multiplying this value by 100. During the intervention phase, the duration to complete each task was also recorded. Timing began as soon as the researcher finished saying the last word of instructions and it concluded when the participant placed papers in the "Finished" folder.

During baseline, data concerning the independent and correct completion of steps was scored in a slightly different manner; participants received credit for completing steps that were out of sequence. This was done to provide a conservative estimate of participants' knowledge of the office equipment because participants had not yet been exposed to the task analysis.

Data Analysis

As recommended by Cooper, Heron, and Heward (2007), graphical representations depicting the dependent variable were examined within conditions and between conditions with respect to the (a) number of data points in each phase, (b)

variability of the data points, (c) level of the measure, and (d) data trend. The number of data points is simply a sum of points of data and is examined to ensure that enough trials occurred so that researchers have confidence in the stability of data. Variability is the extent to which multiple measures of the dependent variable differ from one another. Level is the value of converging data points on the y-axis and can be evaluated by calculating descriptive statistics, such as the mean, median, and range. Last, the data trend is the general direction of data and can be described with respect to its direction, magnitude, and scatter among data points surrounding the trend (Cooper et al., 2007). Additionally, when comparing the effects of treatments, the percentage of overlapping data points was evaluated (Alberto & Troutman, 2009).

Table 3.1
Participant Information

Participant	Age	Race	Gender (M/F)	Disability	Full Scale IQ	Adaptive Composite
Chris	21:8	Caucasian	M	ID	44[a]	54[d]
Dan	21:11	Caucasian	M	ID	41[b]	62[c]
Mark	22:8	Caucasian	M	ID	47[b]	57[d]

[a]Wechsler Intelligence Scale for Children – Third Edition; [b]Wechsler Intelligence Scale for Children – Fourth Edition; [c]Adaptive Behavior Assessment System – Second Edition; [d]Vineland Adaptive Behavior Scales

Table 3.2
Task Analysis of Skills

Skill	Number of Steps	Sequence of Steps
Copying	11	1) Pick up papers from inside the purple folder that is labeled "Copy" 2) Place papers to be copied face up in the tray on top of the machine 3) Press purple "Copy" button 4) Press yellow "Reset" button 5) Press the "2" button on the number key pad for number of copies being made 6) On the digital screen, touch the gray box labeled "Duplex" 7) On the digital screen, touch the box labeled "1-sided>>2-sided" 8) Press the green "Start" button 9) After copying is complete, remove original papers from the top tray 10) Remove copies from the side tray on the left 11) Place all papers in the red folder that is labeled "Finished"
Scanning	9	1) Pick up papers from inside the green folder that is labeled "Scan" 2) Place papers to be scanned face up in the tray on top of the machine 3) Press the red "Send" button. 4) Press the yellow "Reset" button 5) On the digital screen, touch the name "Alan Smith" 6) On the digital screen, touch the gray box labeled "Ok" 7) Press the green "Start" button 8) After scanning is complete, remove original papers from the top tray 9) Place all papers in the red folder that is labeled "Finished"

Table 3.2 (Continued)
Task Analysis of Skills

Skill	Number of Steps	Sequence of Steps
Faxing	9	1) Pick up papers from inside the orange folder that is labeled “Fax” 2) Place the empty orange folder beside the fax machine 3) Place papers with the words face down in the tray on top of the fax machine 4) Press the “Hook/Hold” button and dial the number on the orange folder 5) Wait until you hear the fax sound and then press the blue start button 6) Wait until all papers are scanned and ejected in the bottom tray 7) Remove original papers from the bottom tray 8) Place the empty orange folder on the rack 9) Place all papers in the red folder that is labeled “Finished”

Figure 3.1. Screen image of the list of tasks that could be selected.

Figure 3.2. Screen image of the list of ordered steps for a task.

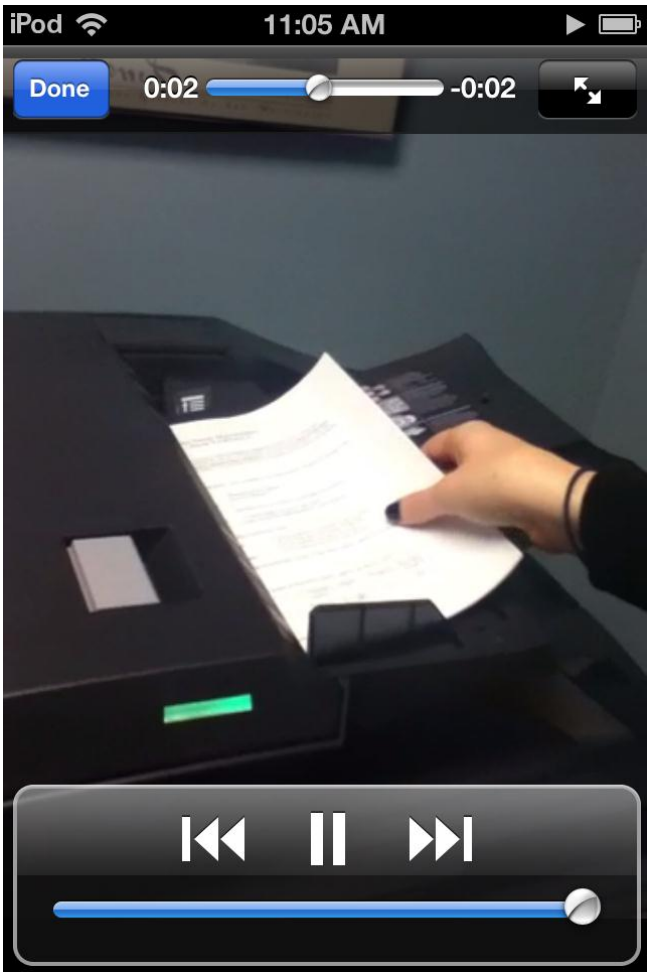

Figure 3.3. Screen image of a video segment that played after selecting a step.

CHAPTER FOUR

RESULTS

The following information summarizes results obtained for all participants during each phase of the research process, which lasted for a total of 30 days. Data are examined by initially evaluating results obtained within each phase, followed by a comparison of findings between each phase (Cooper et al., 2007). Additionally, interobserver agreement, procedural fidelity, and social validity outcomes are provided.

Within Phase Data Analysis

Baseline

During the baseline phase, all participants were unable to successfully operate the copier, scanner, or fax machine. Despite the use of appropriate strategies to problem-solve, such as reading the text printed on buttons or reading text displayed on the screen, participants made errors by pressing start before placing papers on the tray, placing a stack of papers under the lid and closing it when trying to scan or copy multiple sheets, randomly pressing buttons that had nothing to do with the procedure, attempting to insert papers where they are ejected, or attempting to fax with the scanner.

Participants were given credit for completing any step of the task analysis (e.g., pressing the green start button); however, steps were out of sequence and did not result in successful operation of the devices. The baseline phase included three trials for each task per participant. Data were consistently stable across all participants and tasks, which resulted in a horizontal trend when visually depicted. In fact, each participant made identical errors for each trial of the baseline phase. This pattern of responding was likely

due to each participant consistently completing only those steps that he knew how to do. Chris completed a mean of 27.3% (range = 27.3%-27.3%) of steps associated with copying, 22.2% (range = 22.2%-22.2%) for scanning, and 0% for faxing. Dan completed a mean of 9.1% (range = 9.1%-9.1%) of steps associated with copying, 11.1% (range = 11.1%-11.1%) for scanning, and 0% for faxing. Mark completed a mean of 45.5% (range = 45.5%-45.5%) of steps associated with copying, 33.3% (range = 33.3%-33.3%) for scanning, and 22.2% (range = 22.2%-22.2%) for faxing.

Training

Each participant successfully completed the initial iPod Touch and application training in less than one hour and immediately proceeded to the first trial of the intervention phase after identifying a mode of presentation preference.

Mode of Presentation Preference

All participants initially reported a preference for the video and audio combined presentation mode. After completion of the intervention phase, participants were again asked to identify a preferred mode of presentation and all preferred their original selection.

Intervention

All participants experienced an abrupt and substantial increase in their ability to correctly and independently operate office equipment when using the iPod Touch and application. For each participant, the intervention phase included 20 trials per task, with a balanced distribution of modes of presentation for each task. Participants' data became relatively stable after the first two trials per mode of presentation, initially resulting in an

ascending trend and then followed by a horizontal trend when visually depicted. The exception to this was Dan when operating the fax machine; his data stabilized slowly and resulted in a gradual ascending trend and concluding in a horizontal pattern when depicted visually.

Chris. Averaging the means obtained by Chris for each mode of presentation across all tasks resulted in none being superior (see Table 4.1). The mean duration to complete the first three trials of all tasks was 264 seconds, in comparison to 174 seconds for the last three trials, which resulted in a 34.1% decrease in the overall time to complete tasks. Analysis of the effect size (ES) of Chris' data revealed 0% overlap between the baseline and intervention phase data points (see Figure 4.1).

For the copying task, Chris' percentage of correct and independent responding increased to a mean of 100% for all modes of presentation. For the scanning task, he obtained a mean of 100% while using the video mode of presentation, 98.4% (range = 88.9%-100%) using the audio mode of presentation, and 100% using the combined mode of presentation. For the faxing task, Chris obtained a mean of 98.4% (range = 88.9%-100%) while using the video mode of presentation, 98.2% (range = 88.9%-100%) using the audio mode of presentation, and 98.4% (range = 88.9%-100%) using the combined mode of presentation.

Dan. Averaging the means obtained by Dan for each mode of presentation across all tasks resulted in none being superior (see Table 4.2). Additionally, the mean duration to complete the first three trials of all tasks was 283 seconds, in comparison to 186 seconds for the last three trials, which resulted in a 34.3% decrease in the overall time to

complete tasks. Analysis of the ES of Dan's data revealed 0% overlap between the baseline and intervention phase data points (see Figure 4.2).

For the copying task, Dan's percentage of correct and independent responding increased to a mean of 95.5% (range = 72.7%-100%) while using the video mode of presentation, 97.4% (range = 81.8%-100%) using the audio mode of presentation, and 100% using the combined mode of presentation. For the scanning task, he obtained a mean of 98.4% (88.9%-100%) while using the video mode of presentation, 96.8% (range = 77.8%-100%) using the audio mode of presentation, and 100% using the combined mode of presentation. For the faxing task, Dan obtained a mean of 100% while using the video mode of presentation, 90.8% (range = 66.7%-100%) using the audio mode of presentation, and 95.2% (range = 77.8%-100%) using the combined mode of presentation.

Mark. Averaging the means obtained by Mark for each mode of presentation across all tasks resulted in none being superior (see Table 4.3). Additionally, the mean duration to complete the first three trials of all tasks was 265 seconds, in comparison to 217 seconds for the last three trials, which resulted in an 18.1% decrease in the overall time to complete tasks. Analysis of the ES of Mark's data revealed 0% overlap between the baseline and intervention phase data points (see Figure 4.3).

For the copying task, Mark's percentage of correct and independent responding increased to a mean of 100% while using the video mode of presentation, 98.5% (range = 90.9%-100%) using the audio mode of presentation, and 100% using the combined mode of presentation. For the scanning task, he obtained a mean of 98.2% (range = 88.9%-

100%) while using the video mode of presentation, 100% using the audio mode of presentation, and 100% using the combined mode of presentation. For the faxing task, Mark obtained a mean of 98.6% (range = 88.9%-100%) while using the video mode of presentation, 100% using the audio mode of presentation, and 100% using the combined mode of presentation.

Withdrawal

Use of the iPod Touch and application was withdrawn and baseline procedures were re-introduced during this phase. Without having the benefit of AT, all participants performed less proficiently for the majority of tasks; however, results improved from those observed during the initial baseline phase. The withdrawal phase continued until data stability was observed across all tasks for each participant, which required five trials for Chris, four trials for Dan, and six trials for Mark. Data trends varied by participant, but generally followed a pattern of having an abrupt decrease in level and a horizontal trend when visually depicted. The exceptions to this were (a) Chris, who retained 100% accuracy with the copying task and concluded with 100% accuracy with the scanning task once stability occurred and (b) Mark who retained 100% accuracy with the faxing task and presented an increasing data trend with the scanning task before stabilizing at a level below that which was observed during the intervention phase.

For the copying task, Chris obtained a mean percentage of correct and independent responding of 100%. For the scanning task, he obtained a mean of 91.1% (range = 77.8%-100%). For the faxing task, Chris obtained a mean of 88.9% (range = 88.9%-88.9%). For the copying task, Dan obtained a mean percentage of correct and

independent responding of 31.9% (range = 18.2%-36.4%). For the scanning task, he obtained a mean of 44.4% (range = 44.4%-44.4%). For the faxing task, he obtained a mean of 66.7% (range = 66.7%-66.7%). For the copying task, Mark obtained a mean percentage of correct and independent responding of 72.7% (range = 72.7%-72.7%). For the scanning task, he obtained a mean of 59.3% (range = 22.2%-77.8%). For the faxing task, he obtained a mean of 100%.

Preferred Mode of Presentation

An abrupt increase in participants' ability to correctly and independently complete the majority of office tasks was observed following the re-introduction of AT during this phase, which lasted for five trials for all participants. For participants who did not experience an immediate increase for specific office tasks, it was due to having already mastered the task(s) prior to the re-introduction of AT. Data were stable throughout this phase for all participants and resulted in a horizontal trend when visually depicted. Moreover, Chris, Dan, and Mark each obtained a mean percentage of correct and independent responding of 100% for all tasks.

Maintenance

One follow-up probe was conducted using each participant's preferred mode of presentation two weeks after completing the preceding phase. All participants maintained 100% correct and independent responding for the maintenance probe.

Between Phase Data Analysis

Baseline to Intervention

All participants demonstrated an immediate increase in the percentage of steps completed correctly and independently once the intervention phase began. Considering that limited differences were observed across modes of presentation for participants, data from all modes were combined for each participant and a mean value was calculated, which was then compared to the corresponding mean baseline value for that participant. Results from this comparison are as follows: For the copying task, Chris' score increased by 72.7 percentage points from baseline. For the scanning task, an increase of 77.3 percentage points was observed. Similarly, the faxing task resulted in an increase of 98.3 percentage points. For the copying task, Dan's score increased by 88.5 percentage points from baseline. For the scanning task, his score increased by 87.3 percentage points. For the faxing task, an increase of 95.3 percentage points was noted. For the copying task, Mark's score increased by 54.0 percentage points from baseline. For the scanning task, an increase of 66.1 percentage points was observed. For the faxing task, his score increased by 77.3 percentage points.

Intervention to Withdrawal

Similar to the previous comparisons, data from all modes of the intervention phase were combined for each participant, resulting in a mean value that was compared to the corresponding mean withdrawal value for that participant. Results are as follows: For the copying task, Chris' score remained the same as during the intervention phase. For the scanning task, a decrease of 8.4 percentage points was observed. Similarly, the

faxing task resulted in a decrease of 9.4 percentage points. For the copying task, Dan's score decreased by 65.7 percentage points from the intervention phase. For the scanning task, his score decreased by 54.0 percentage points. For the faxing task, a decrease of 28.6 percentage points was noted. For the copying task, Mark's score decreased by 26.8 percentage points from the intervention phase. For the scanning task, a decrease of 40.1 percentage points was observed. For the faxing task, his score increased by 0.47 percentage points.

Withdrawal to Preferred Mode

Mean values obtained for every task during the withdraw condition were compared to each participant's corresponding mean preferred mode of presentation value. Results are as follows: For the copying task, Chris' score remained the same as during the withdrawal phase. For the scanning task, an increase of 8.9 percentage points was observed. Similarly, the faxing task resulted in an increase of 11.1 percentage points. For the copying task, Dan's score increased by 68.1 percentage points from withdrawal. For the scanning task, his score increased by 55.6 percentage points. For the faxing task, an increase of 33.3 percentage points was noted. For the copying task, Mark's score increased by 27.3 percentage points from withdrawal. For the scanning task, an increase of 40.7 percentage points was observed. For the faxing task, his score remained the same.

Preferred Mode to Maintenance

Following a two week break between the preferred mode of presentation phase and the maintenance phase, all participants obtained 100% correct and independent responding with the follow-up probe.

Inter-observer Agreement

Inter-observer agreement **(**IOA) is the degree to which two independent observers agree that an observed behavior occurred (Kazdin, 1982) and serves four purposes: (a) to determine the level of competence of new observers, (b) to measure observer drift, (c) to assess the clarity of operational definitions and the complexity of the system of measurement, and (d) for studies that use multiple data collectors, high IOA percentages increase one's confidence that variability in the data is not related to different measurement techniques deployed by different observers (Cooper et al., 2007).

Throughout all phases of this study, IOA was calculated during 45% of the sessions and was conducted on a per-phase basis for the following percentage of sessions: baseline (100%), intervention (40%), withdrawal (47%), preferred mode of presentation (40%), and maintenance (100%). Additionally, IOA was calculated during 33% of the sessions in which the duration was recorded for participants to complete the first and last three trials of the intervention phase. Last, IOA was measured for both (100%) of the mode of presentation preference assessments.

For frequency measures, IOA was calculated using the trial-by-trial method by dividing the number of agreements (i.e., the number of steps within a task analysis for which both observers noted that the behavior was performed independently and correctly)

by the number of agreements plus disagreements, then multiplying by 100 (Cooper et al., 2007). For duration measures, IOA was calculated using the total duration method by dividing the shorter duration by the longer duration, then multiplying by 100 (Cooper et al., 2007).

Overall mean IOA was 99.9% (range = 91.0%-100%) for all phases of this research. During the baseline phase, Mean IOA for steps completed independently and correctly was 99.0% (range = 91.0%-100%). Mean IOA during the intervention, withdrawal, preferred treatment, and maintenance phases were 100%. Mean IOA for the duration to complete the first and last three trials of the intervention phase was 99.7% (range = 99.0%-100%). Additionally, mean agreement for both mode of presentation preference assessments was 100%.

Procedural Fidelity

Procedural fidelity refers to the extent to which the intervention is implemented as intended (Cooper et al., 2007). Throughout all phases of this study, data related to procedural fidelity were collected on the following research assistant behaviors: (a) correct verbal instructions to the participant, (b) timely initiation of prompting procedures, and (c) adherence to the least-to-most prompting hierarchy (see Appendix D for the Procedural Fidelity Data Collection Form). Procedural fidelity was calculated during 45% of all sessions and was conducted on a per-phase basis for the following percentage of sessions: baseline (100%), intervention (40%), withdrawal (47%), preferred mode of presentation (40%), and maintenance (100%). Procedural fidelity was

calculated by dividing the number of steps that the research assistant completed correctly by the sum of correct and incorrect steps, then multiplying by 100.

During all phases in this study, mean procedural fidelity was 100% for correct verbal instructions, timely initiation of prompts, and adherence to the prompting hierarchy.

Social Validity

Participant and research assistant satisfaction was evaluated at the end of the study using two separate questionnaires. Participants were asked questions related to their satisfaction with and the utility of the iPod Touch and Functional Planning System application (see Appendix E). All participants unanimously indicated that (a) the technology helped them learn new jobs, (b) it was easy to use, (c) it helped them function independently, (d) they would like to use it to learn other job skills, and (e) they would recommend it to their friends. While using the iPod Touch and application, participant comments included a variety of positive statements, such as "Oh yeah!!", "I love this", and "I want the iPod back!" after it was withdrawn. Additionally, while completing steps using the device, students often were observed nodding their heads after completing a step successfully. The research assistant was asked similar questions (see Appendix F) and she strongly agreed that (a) the intervention was helpful for participants, (b) the iPod Touch and Functional Planning System application were easy to use for participants, (c) the device and application enabled participants to work independently, (d) the intervention could be successfully applied to other job tasks, (e) participants were

motivated to use the device and application, and (f) she would recommend this intervention to participants' employers.

Summary of Findings

Use of an alternating treatments design enabled researchers to evaluate the individual effects of varying modes of presentation (e.g., audio, video, or a combination of both) for prompting participants how to complete common office tasks. Results revealed that all participants benefited from the use of the iPod Touch and Functional Planning System application. Mean correct and independent responding across participants, tasks, and modes of presentation increased from 19.0% during baseline to 98.6% during the intervention phase. Additionally, in comparison to the first three trials of the intervention phase, participants' mean duration required to complete the last three trials of the intervention phase decreased by 28.8%. Limited differences were observed across modes of presentation. Moreover, all participants were less proficient completing tasks when the device and application were withdrawn and all returned to 100% proficiency when the preferred mode of presentation was re-introduced. Following a two week break from using the technology and office equipment, participants were able to maintain 100% correct and independent responding.

Findings also suggest that the device and application served as an effective instructional tool, in addition to being a prompting device, due to performance improvements noted when comparing baseline and withdrawal phases. Consumer satisfaction was favorable for participants, each of whom wanted to use the device to assist with other job-related tasks. Likewise, feedback obtained from the research

assistant further validated the utility of the iPod Touch and application for promoting independence and success at an employment setting.

Table 4.1
Mean Task Performance for Chris

	Baseline	Intervention	Intervention	Intervention	Withdrawal	Preferred	Maintenance
Mode	N/A	Video	Audio	Combined	N/A	Combined	Combined
Copying	27.3%	100%	100%	100%	100%	100%	100%
Scanning	22.2%	100%	98.4%	100%	91.1%	100%	100%
Faxing	0%	98.4%	98.2%	98.4%	88.9%	100%	100%
Overall	**16.5%**	**99.5%**	**98.9%**	**99.5%**	**93.3%**	**100%**	**100%**

Table 4.2
Mean Task Performance for Dan

	Baseline	Intervention	Intervention	Intervention	Withdrawal	Preferred	Maintenance
Mode	N/A	Video	Audio	Combined	N/A	Combined	Combined
Copying	9.1%	95.5%	97.4%	100%	31.9%	100%	100%
Scanning	11.1%	98.4%	96.8%	100%	44.4%	100%	100%
Faxing	0%	100%	90.8%	95.2%	66.7%	100%	100%
Overall	**6.7%**	**98.0%**	**95.0%**	**98.4%**	**47.7%**	**100%**	**100%**

Table 4.3
Mean Task Performance for Mark

	Baseline	Intervention	Intervention	Intervention	Withdrawal	Preferred	Maintenance
Mode	N/A	Video	Audio	Combined	N/A	Combined	Combined
Copying	45.5%	100%	98.5%	100%	72.7%	100%	100%
Scanning	33.3%	98.2%	100%	100%	59.3%	100%	100%
Faxing	22.2%	98.6%	100%	100%	100%	100%	100%
Overall	**33.7%**	**98.9%**	**99.5%**	**100%**	**77.3%**	**100%**	**100%**

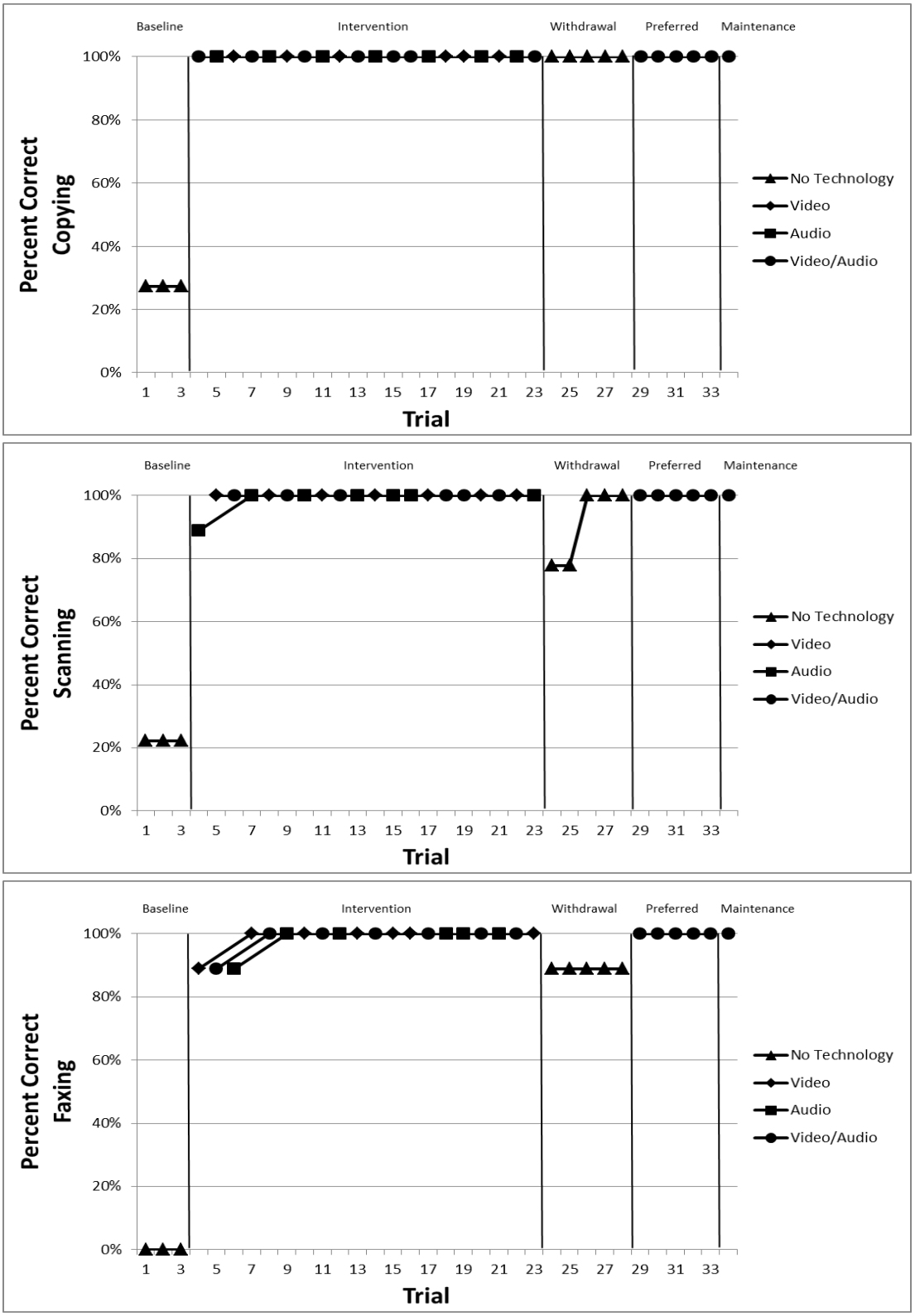

Figure 4.1. Percentage of steps completed correctly and independently by Chris.

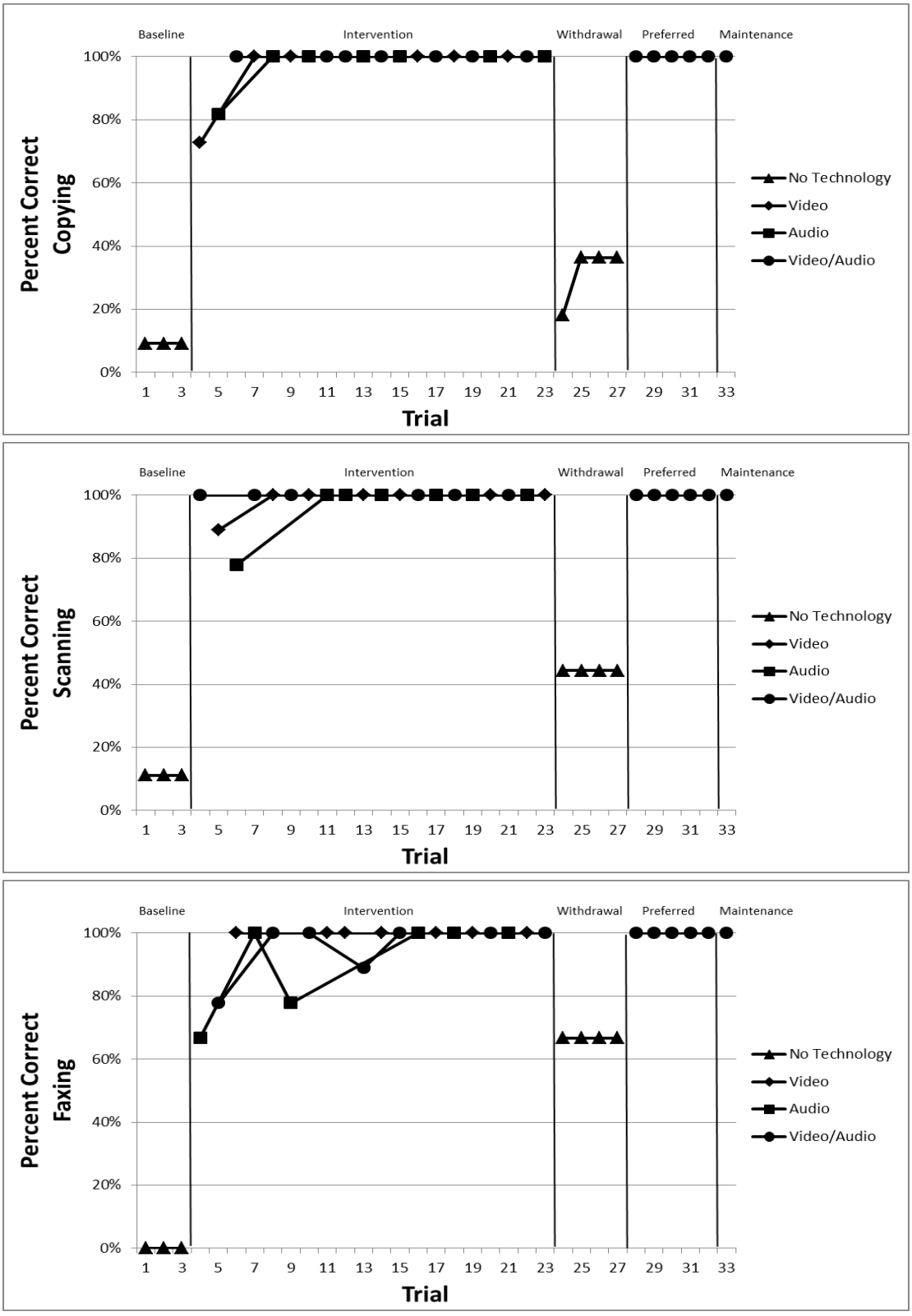

Figure 4.2. Percentage of steps completed correctly and independently by Dan.

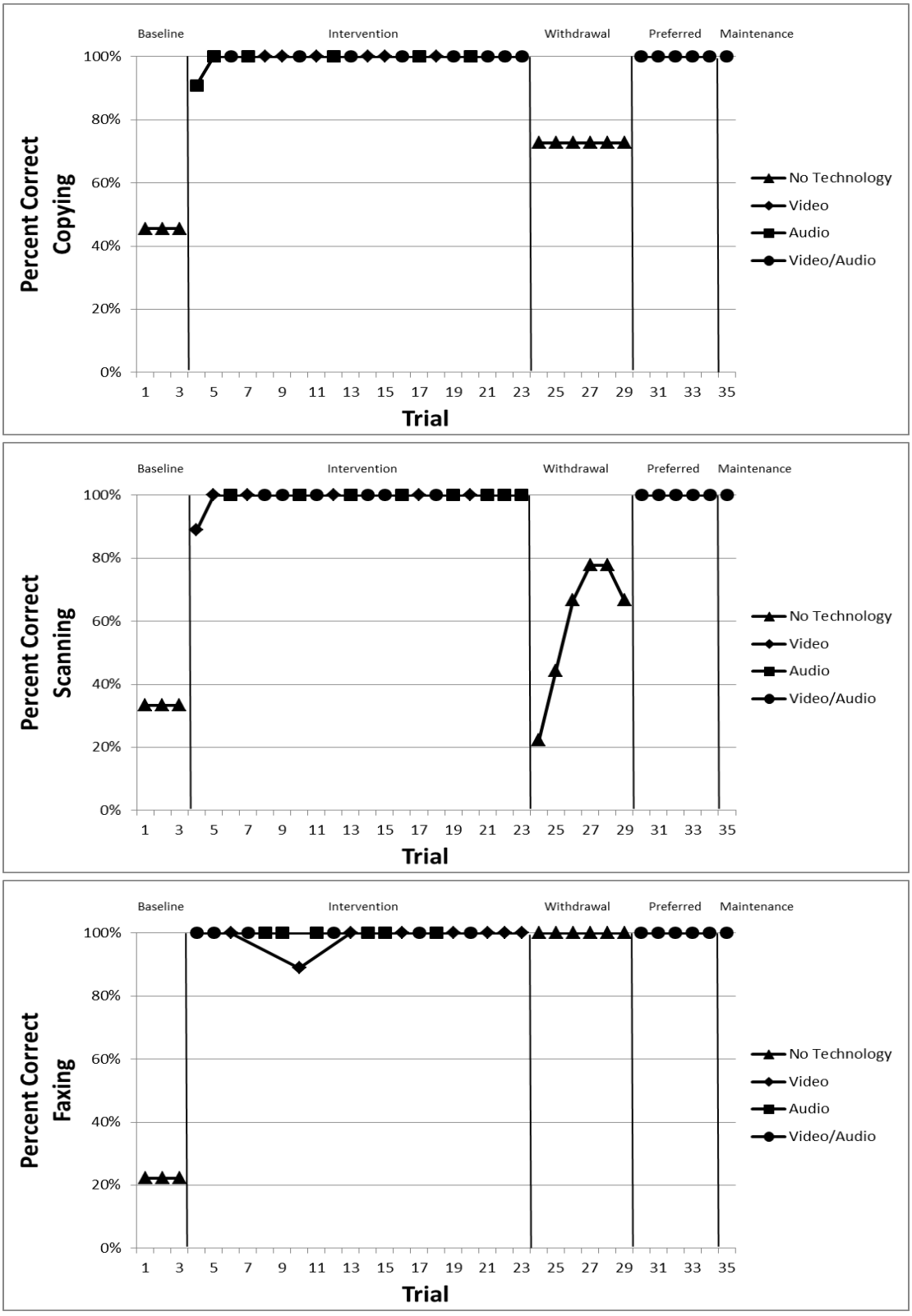

Figure 4.3. Percentage of steps completed correctly and independently by Mark.

CHAPTER FIVE

DISCUSSION

The primary purpose of this research was to evaluate the effectiveness of portable electronic AT to improve independent job performance of young adults with ID. Additionally, the mode of presentation used for prompting (e.g., audio, video, or a combination of both) was evaluated to determine if one was more effective than others and if performance was related to participant preference. The following section will summarize the results of this research by (a) addressing the research questions, (b) describing the benefits and implications for practice, (c) identifying limitations of this study, (d) providing recommendations for future research, and (e) closing with concluding comments.

Research Questions Addressed

Four research questions were developed for this study. Each question was designed to answer a specific and relevant topic that would contribute to the field and guide future researchers with ongoing evaluations of portable electronic AT.

Research Question #1

The first question was designed to determine if portable and widely-accessible electronic AT can improve the independent and correct completion of employment-related tasks among young adults with ID. Results revealed that all participants had an abrupt and substantial increase in their ability to independently complete common office tasks once portable AT was introduced. This finding provides evidence concerning the utility of portable electronic AT and corroborates previous research in the same area. For

example, Cihak et al. (2007) used portable technology to present a sequence of digital photos to assist persons with ID while completing tasks at employment settings. Similar to the current study, researchers included a training session, baseline phase, intervention phase, and a maintenance phase. However, the design differed and tasks progressively increased in difficulty (i.e., the number of steps increased) as they were sequentially introduced. Despite these differences, outcomes were the same and all participants reached 100% independent responding.

Similar to the current study, Van Laarhoven et al. (2007) investigated the use of portable electronic AT with participants with ID who completed vocational tasks while following video and audio sequences provided by the device. In contrast to the current study, tasks were related to those commonly found at a restaurant (e.g., rolling silverware, sorting and sanitizing silverware, portioning food, etc.), corrective feedback was provided by the device after every fifth error, and a different research design was used. Regardless, participants' levels of independent and correct responding abruptly and substantially increased following the introduction of AT.

Research Question #2

The purpose of the second research question was to determine if a specific method of prompting (e.g., audio, video, or a combination of both) provided by a portable device would have an effect on participants' performance when completing an employment-related task. Findings indicated that the specific mode of prompting provided by the iPod Touch and Functional Planning System application had little effect

on participants' success. All modes resulted in relatively equal performance across tasks during the intervention phase.

This research question was particularly relevant because a review of the literature indicated that the majority of existing studies used portable electronic AT within a treatment package that consisted of auditory instructions paired with video or pictorial prompts. All studies resulted in an increase of participants' correct and independent responding or a decrease in the level of external prompting provided. However, few of the studies compared the effects of different prompting methods and none made direct comparisons across the three modes of presentation evaluated in this study. Findings from the literature review revealed that three studies evaluated differences between the prompting methods (see Lancioni et al., 2000; Mechling et al., 2009; Taber-Doughty, 2005). The majority of these studies included two independent variables consisting of pictorial prompts that were compared to auditory or video and auditory prompting. Likewise, the majority of the studies occurred at training centers, rather than actual employment settings, and all compared technological methods to non-technological methods (e.g., a picture card system). Thus, the importance of isolating independent variables and determining if a particular mode of presentation was responsible for improved performance (Banda et al., 2011; Mechling & Gustafson, 2009).

Research Question #3

The third research question was designed to investigate if the most effective method of prompting was related to the participant's preferred prompting format. All participants preferred to use a combination of video and audio prompting, yet this mode

of presentation was found to be unrelated to task performance. This finding differs from those obtained by Taber-Doughty (2005) and Taber-Doughty et al. (2008); however, the discrepancy could be partially attributed to several reasons. First, each of the aforementioned studies compared a different set of independent variables than the present study. For example, Taber-Doughty (2005) evaluated the effectiveness of auditory instructions delivered by portable AT, picture prompting from a photo album, and prompting provided by an instructor. In the second study, Taber-Doughty (2008) compared delayed video and audio instruction provided by a television and DVD player to real-time presentation of the same instruction using portable electronic AT. Thus, differences observed between student preference and performance outcomes may have been related to the prompting devices used or a variable that the current study didn't assess (i.e., delayed vs. real-time presentation).

Second, consistent with the present study, both of the other studies had small sample sizes (three participants in each); hence the limited ability to generalize findings to different participants (Barlow et al., 2009). Last, considering that participants in the current study performed very well using all modes of presentation, it is possible that the tasks were not challenging enough to permit detection of subtle differences across the three modes. Therefore, ceiling effects (Sattler, 2001) may have occurred since participants' scores were consistently clustered in the upper range of possible scores. As a result, each participant's percentage of independent and correct responding may be more representative of the test ceiling (e.g., 100% correct responding for all steps of a task analysis), rather than their proficiency with a specific mode of presentation.

Research Question #4

The final research question was designed to determine if performance levels would be maintained over time following a two week break from using the office equipment and iPod Touch. Results revealed that all participants maintained 100% correct and independent responding during the maintenance phase. This finding is consistent with other research that investigated maintenance of skill acquisition for employment-related tasks, yet two interesting differences were noted. First, of the four studies that reported maintenance data across all participants and tasks (see Cihak et al., 2007; Cihak et al., 2008; Mechling et al., 2008; Mechling et al., 2010), half were conducted in community-based settings such as grocery stores, department stores, and restaurants. The remaining studies took place at training locations such as a kitchen in a high school classroom or a kitchen located off campus that was used by high school teachers for instructional purposes. The present study was conducted at an actual office setting and, subsequently, is consistent with the former half of studies. Second, variability was observed concerning the length of time that lapsed before maintenance data were collected. The majority of studies collected maintenance data between nine and ten weeks after participants met the mastery criterion during the intervention phase. This is substantially different than the present study, in which maintenance probes were conducted two weeks after the intervention phase ended. Irrespective of the aforementioned differences, and consistent with the current research study, all studies resulted in participants maintaining at or near 100% of previously acquired skills.

These findings provide converging evidence supporting the efficacy of portable electronic AT for maintenance of skill acquisition. However, the question still exists whether or not participants would eventually be able to complete the tasks independently without using the technology. The importance of this question may be moot because, after taking into consideration the size of the iPod Touch and one's ability to use it discretely, ongoing use would likely pose minimal problems.

Benefits and Implications

Results from this research revealed the utility of portable electronic AT to promote independent job performance among young adults with ID. The technology served as an effective prompting mechanism, as well as an instructional tool, to teach participants how to complete novel office tasks. Moreover, this research extended the knowledge base by evaluating new technology used by young adults with ID and by investigating the effects of multiple modes of prompt presentation in isolation while using this technology.

Additionally, consumer satisfaction was very favorable in this study, which is congruent with findings from related studies that used similar technologies (Davies et al., 2002a, 2002b; Gillette & Depompei, 2008; Riffel et al., 2005; Taber-Doughty, 2005; Taber-Doughty et al., 2008; Van Laarhoven et al., 2009; Van Laarhoven et al., 2007). As mentioned previously, social validity refers to the social acceptability and practicality of research methods and outcomes (Cooper et al., 2007; Horner et al., 2005). There are several ways that a researcher can assess social validity; however, the most common method is to simply ask the participants (Cooper et al., 2007). Participants in this study

were interviewed and all indicated that they enjoyed using the technology, wanted to continue using it to learn other job skills, found it easy to use, and unanimously reported that it helped them work independently. The importance of these findings cannot be understated. As noted by Wolf (1978), the benefit derived from a program can only be truly evaluated by the consumer. If the individual doesn't enjoy or see value in using a particular technology, no matter how beneficial that it may be, the technology may never be put to use.

Advantages of Using Technology

The technology used in this study was portable, accessible, inexpensive, easy to use, and required less than one hour of training for each participant to become proficient with its use. The technology was also readily available for purchase on-campus and was commonly used by same-age peers, which decreased the likelihood that it would be stigmatizing for participants (Davies et al., 2002a; Gillette & DePompei, 2004). Furthermore, another advantage is that the technology could be used privately without disturbing others. This study required participants to use the internal speakers of the iPod Touch, rather than ear buds, so that the researcher could accurately monitor each step of the task analysis as it was being completed. However, outside of a research context, use of ear buds would allow the consumer to quietly work while still receiving the benefits derived from technology.

The present study required participants to use technology for each step of a task analysis, yet in an applied setting, it could be easily and independently used by an individual only when he or she needs assistance with completing a portion of a task.

Specifically, the device could function much like an on-demand tutorial for steps or tasks that the individual needs recurring assistance with. Thus, instead of repeatedly providing one-on-one instruction at employment settings, it may be more efficient for job coaches to create and integrate video and audio sequences of tasks into portable electronic AT, which can then be used independently by persons with ID.

Mode of Prompting Advantages

As previously noted, participants' preferred mode of prompting was unrelated to their performance while completing office tasks; all modes were relatively equal. However, if the goal is for participants to truly function autonomously by using portable electronic AT in an employment setting, the combined video and audio mode of presentation has distinct advantages over others. For example, in the present study some participants were unable to initially distinguish a fax machine from a scanner. If only auditory prompts were provided, independent completion would have been challenging without having a job coach or researcher present to provide corrective feedback. The use of video modeling was also effective, yet it didn't successfully convey critical information necessary to complete steps in tasks, such as verbal instructions to wait to hear the "fax sound" before pressing the blue start button on the fax machine. Thus, participants' preferred method of receiving combined video and audio instructions appears to be the most logical if portable technology is to be used in a completely independent manner on the job site.

Despite the noted advantages of using the combined video and audio mode of presentation, it is quite possible that a person may need both hands while working or may

not be able to regularly take the time to look at a screen while completing a task. An added benefit of using a combined mode is that it could serve equally well as an auditory prompting device if the consumer simply stored it in his or her pocket while listening to instructions provided through the speakers or ear buds.

Potential to Improve Outcomes

Employment outcomes among those with ID are far worse than individuals with other disabilities (U.S. Department of Education, 2010) and a distinct need exists to find innovative ways to improve these outcomes. One method has been via the use of job coaches (Howarth et al., 2006); however, one-on-one services can be expensive and perhaps even aversive to a consumer who may be embarrassed by a coach providing specialized assistance in an employment setting. Findings from this study suggest that an alternative approach may be to implement portable electronic AT, which can provide many of the same benefits that a job coach can, such as prompting, explicit instruction, and a level of repetition tailored to the needs of the client. Use of AT in this study enabled participants, particularly Dan and Mark, to complete tasks that were otherwise too challenging for them to do.

Considering that the majority of employed young adults with ID work in the food service industry (U.S. Department of Education, 2010), it seems prudent to use technology that may have the capability of enabling successful and independent task completion in other employment areas that have more complex task requirements. Assuming that tasks can be analyzed, recorded, and presented in a systematic fashion, then portable electronic AT may be a viable solution to expand employment opportunities

and to facilitate success at the job site. It is doubtful that any form of technology will be able to eliminate the need for human assistance; however, reducing the reliance on others for assistance is an obvious method to increase one's level of independence.

Considerations. The AT used in this study was effective, yet results were specific to the evaluated tasks. The tasks selected for this study were deliberately chosen because they were easily measurable and fell within a career path that is projected to grow for the next several years (Bureau of Labor Statistics, 2009). Additionally, the setting was located in a quiet hallway, which minimized external interference that could introduce confounds into the study. As a consequence, the level of experimental control was increased, but the setting was somewhat contrived because there were no interruptions that one would expect to occur in a typical office setting (e.g., telephone ringing, co-workers interrupting tasks, etc.). Thus, it is unknown how participants would have performed in an environment more prone to distractions; although, other studies that used portable electronic AT in community-based settings (i.e., department stores, grocery stores, and restaurants) were found to promote independence (Cihak et al., 2008; Cihak et al., 2007) even though less control was imposed on the environment.

Results from this study suggest that portable electronic AT may expand employment opportunities to non-traditional settings; however, research also indicates that the technology is a viable tool that can be used to improve levels of independence within traditional settings (e.g., the food service industry) for food preparation and related tasks (Cihak et al., 2008; Cihak et al., 2007; Mechling et al., 2008; Mechling et al., 2010; Mechling & Gustafson, 2009; Riffel et al., 2005; Van Laarhoven et al., 2007).

Unfortunately, considering the recent developments with portable electronic AT and the limited amount of research in this area, it is quite possible that AT is being under-utilized by persons with ID at all employment settings.

Limitations

Although the intervention was successful at increasing correct and independent task completion among three young adults with ID, there are several limitations that need to be taken into consideration when interpreting results. First, carryover effects, which are undesirable effects that persist from one treatment condition to subsequent conditions (Barlow et al., 2009), may have occurred since differing conditions involved the same tasks. Even though the tasks and modes of presentation were both counterbalanced, relatively complex, and presented with a 24 hour delay between sessions, the possibility exists that carryover effects interfered with results.

Second, considering the amount of repetition that was involved with this study, it is reasonable to assume that participants may have gained some knowledge from repeatedly completing tasks using any mode of presentation. Hence, practice effects, which result in improved performance simply due to having multiple opportunities to rehearse a behavior (Cooper et al., 2007), may have been responsible for a portion of gains observed during the intervention, preferred treatment, and maintenance phases.

Third, due to the small sample size and specific characteristics of participants, generality of findings across subjects is limited (Barlow et al., 2009). Fourth, results indicated limited differences across modes of presentation; participants performed well with all modes. It is possible that tasks needed to be more complex to enable the

researcher to identify subtle differences across modes. Last, maintenance probes were conducted following a two week break from using the technology and office equipment. It is unknown if participants would have had similar levels of success if the delay had been for a different period of time.

Recommendations for Future Research

Based upon the results of this study, several recommended areas for future research are provided. First, systematic replication of this research should be conducted in different settings, with different tasks, and with different participants to strengthen the validity and generality of findings. Most prior research in this area has involved small sample sizes and, considering the confluence of studies supporting the efficacy of portable electronic AT, research that includes rigorous experimental group designs (i.e., randomized controlled trials) should be pursued by future researchers.

Second, future researchers should consider creating and evaluating video and audio sequences of task analyses with varying levels of detail. For example, a task analysis including very few steps could be used for participants who are higher functioning and another with many steps could be used for those who function at lower levels. For persons who require greater levels of assistance, also including task analyses designed to troubleshoot and help teach how to correct errors that occur with routine use of office equipment (e.g., what to do if the receiving fax machine has a busy signal, if a wrong number is dialed, if the copier is out of paper, if there is a paper jam, etc.) may prove to be useful and conducive to promoting independence.

Third, considering the rate at which technology is evolving, new technology should be evaluated as it becomes available. Just as technology has improved for mainstream society in the previous few years, so has accessible technology for individuals with ID. This technology has continued to become more affordable and is now at a price that makes it a very attractive target for ongoing research and use among persons with ID and the agencies that provide them with supports.

Fourth, the need exists for more research in the area of mode of presentation preference as it relates to performance outcomes on the job site while using AT. Findings from this study indicated that participants performed as well while using their preferred mode of presentation as they did with less preferred modes, which differs from the results obtained by previous researchers.

Last, this study used folders to contain papers used for the office tasks and each participant had some degree of difficulty placing papers inside the "Finished" folder after a task was completed. Participants were able to complete the task using folders; however, it occasionally resulted in participants spending an inordinate amount of time doing so. Future researchers should consider using paper trays instead, particularly for participants with fine motor difficulties.

Conclusion

Findings from this study validate previous research regarding the utility of portable electronic AT for employment-related tasks among those with ID. In addition to being an effective prompting mechanism, the iPod Touch and Functional Planning System application served as a useful instructional tool that could greatly reduce the level

of supports provided by job coaches at employment settings. Considering the minimal training requirements, ease of use, affordability, and consumer satisfaction ratings, further evaluation and use of this technology should be investigated. There is considerable room for improvement in the area of employment outcomes for individuals with ID and, perhaps, one way to improve these outcomes may simply be found in the palm of our hand.

APPENDICES

Appendix A

Copying Data Collection Form

Presentation Format

Video / Audio / Video + Audio

Student:_____ **Date:_____**

Step	Independent and Correct Completion	Prompting Level Required
1. Pick up papers from inside the purple folder that is labeled "Copy"		
2. Place papers to be copied face up in the tray on top of the machine		
3. Press purple "Copy" button		
4. Press yellow "Reset" button		
5. Press the "2" button on the number key pad for number of copies being made		
6. On the digital screen, touch the gray box labeled "Duplex"		
7. On the digital screen, touch the box labeled "1-sided>>2-sided"		
8. Press the green "Start" button		
9. After copying is complete, remove original papers from the top tray		
10. Remove copies from the side tray on the left		
11. Place all papers in the red folder that is labeled "Finished"		

Scoring instructions

Independent and Correct Completion
Record a "1" if the participant completed the step independently and correctly
Record a "0" if the participant did not complete the step independently and correctly

Prompting Level Required (If applicable)
Record a "G" for gestural prompting
Record a "V" for verbal prompting
Record an "I" for imitative prompting
Record a "P" for physical prompting

Appendix B

Scanning Data Collection Form

Presentation Format

Video / Audio / Video + Audio

Student:_____ **Date:_____**

Step	Independent and Correct Completion	Prompting Level Required
1. Pick up papers from inside the green folder that is labeled "Scan"		
2. Place papers to be scanned face up in the tray on top of the machine		
3. Press the red "Send" button		
4. Press the yellow "Reset" button		
5. On the digital screen, touch the name "Alan Smith"		
6. On the digital screen, touch the gray box labeled "Ok"		
7. Press the green "Start" button		
8. After scanning is complete, remove original papers from the top tray		
9. Place all papers in the red folder that is labeled "Finished"		

Scoring instructions

Independent and Correct Completion
Record a "1" if the participant completed the step independently and correctly
Record a "0" if the participant did not complete the step independently and correctly

Prompting Level Required (If applicable)
Record a "G" for gestural prompting
Record a "V" for verbal prompting
Record an "I" for imitative prompting
Record a "P" for physical prompting

Appendix C

Faxing Data Collection Form

Presentation Format

Video / Audio / Video + Audio

Student:_____ **Date:_____**

Step	Independent and Correct Completion	Prompting Level Required
1. Pick up papers from inside the orange folder that is labeled "Fax"		
2. Place the empty orange folder beside the fax machine		
3. Place papers face down in the tray on top of the fax machine		
4. Press the "Hook/Hold" button and dial the number on the orange folder		
5. Wait until you hear the fax sound and then press the blue start button		
6. Wait until all papers are scanned and ejected in the bottom tray		
7. Remove original papers from the bottom tray		
8. Place the empty orange folder on the rack		
9. Place all papers in the red folder that is labeled "Finished"		

Scoring instructions

Independent and Correct Completion
Record a "1" if the participant completed the step independently and correctly
Record a "0" if the participant did not complete the step independently and correctly

Prompting Level Required (If applicable)
Record a "G" for gestural prompting
Record a "V" for verbal prompting
Record an "I" for imitative prompting
Record a "P" for physical prompting

Appendix D

Procedural Fidelity Data Collection Form

Date:_____

	Correct Verbal Instructions	Timely Initiation of Prompts	Adherence to Prompting Hierarchy
Prior to Beginning Task			
Step 1			
Step 2			
Step 3			
Step 4			
Step 5			
Step 6			
Step 7			
Step 8			
Step 9			
Step 10			
Step 11			

Scoring instructions

For All Columns
Record a "1" if done correctly
Record a "0" if done incorrectly
Record "N/A" if not applicable

Appendix E

Participant Questionnaire

Participant:_____ Date:_____

Question	Response
Did the iPod Touch and application help you learn new job skills?	Yes / No
Was the iPod Touch easy for you to use?	Yes / No
Was the application easy for you to use?	Yes / No
Did the iPod Touch and application help you work on your own?	Yes/ No
Would you like to use it to help you learn other job skills?	Yes / No
Did you enjoy using the iPod Touch and application?	Yes / No
Would you recommend it to your friends?	Yes / No

Appendix F

Research Assistant Questionnaire

Research Assistant:_____ Date: _____

1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 = Strongly Agree

Question	**Response**
This intervention was helpful for participants	1 2 3 4 5
The iPod Touch was easy to use for participants	1 2 3 4 5
The Functional Planning System application was easy to use for participants	1 2 3 4 5
The iPod Touch/application enabled participants to work independently	1 2 3 4 5
This intervention could be successfully applied to other job tasks	1 2 3 4 5
The participants were motivated to use the iPod Touch/application	1 2 3 4 5
I would recommend this intervention to participants' employers	1 2 3 4 5

REFERENCES

Alberto, P. A., & Troutman, A. C. (2009). *Applied behavior analysis for teachers* (8th ed.). Upper Sadle River, NJ: Pearson Education.

American Association on Mental Retardation. (1992). *Mental retardation: Definition, classification, and systems of supports* (9th ed.). Washington, DC: Author.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders (Revised 4th ed.)*. Washington, DC: Author.

Americans with Disabilities Act of 1990. (Vol. 42 U.S.C. §§ 12101-12213).

Banda, D. R., Dogoe, M. S., & Matuszny, R. M. (2011). Review of video prompting studies with persons with developmental disabilities. *Education & Training in Autism & Developmental Disabilities, 46*(4), 514-527.

Barlow, D. H., & Hayes, S. C. (1979). Alternating treatments design: One strategy for comparing the effects of two treatments in a single subject. *Journal of Applied Behavior Analysis, 12*(2), 199-210.

Barlow, D. H., Nock, M. K., & Hersen, M. (2009). Single case experimental designs: Strategies for studying behavior change (3rd ed.): Pearson Education, Inc.

Beyer, S., Brown, T., Akandi, R., & Rapley, M. (2010). A comparison of quality of life outcomes for people with intellectual disabilities in supported employment, day services and employment enterprises. *Journal of Applied Research in Intellectual Disabilities, 23*(3), 290-295.

Blitz, C. L., & Mechanic, D. (2006). Facilitators and barriers to employment among individuals with psychiatric disabilities: A job coach perspective. *Work, 26*(4), 407-419.

Bureau of Labor Statistics. (2009). Occupational Outlook Handbook, 2010-11 Edition, Office Clerks, General. Retrieved January 24, 2012, from http://www.bls.gov/oco/ocos130.htm

Centers for disease control and prevention. (2005). How common is intellectual disability? Retrieved June 5th, 2011, from http://www.cdc.gov/ncbddd/dd/mr3.htm

Cihak, D. F., Kessler, K., & Alberto, P. A. (2008). Use of a handheld prompting system to transition independently through vocational tasks for students with moderate and severe intellectual disabilities. *Education and Training in Developmental Disabilities, 43*(1), 102-110.

Cihak, D. F., Kessler, K. B., & Alberto, P. A. (2007). Generalized use of a handheld prompting system. *Research in Developmental Disabilities: A Multidisciplinary Journal, 28*(4), 397-408.

Cooper, J. O., Heron, T. E., & Heward, W. L. (2007). Applied behavior analysis (2nd ed.). Upper Sadle River, NJ: Pearson Education.

Davies, D. K., Stock, S. E., Holloway, S., & Wehmeyer, M. L. (2010). Evaluating a GPS-based transportation device to support independent bus travel by people with intellectual disability. *Intellectual and Developmental Disabilities, 48*(6), 454-463.

Davies, D. K., Stock, S. E., & Wehmeyer, M. L. (2002a). Enhancing independent task performance for individuals with mental retardation through use of a handheld self-directed visual and audio prompting system. *Education and Training in Mental Retardation and Developmental Disabilities, 37*(2), 209-218.

Davies, D. K., Stock, S. E., & Wehmeyer, M. L. (2002b). Enhancing independent time-management skills of individuals with mental retardation using a palmtop personal computer. *Mental Retardation, 40*(5), 358.

Davies, D. K., Stock, S. E., & Wehmeyer, M. L. (2003). A palmtop computer-based intelligent aid for individuals with intellectual disabilities to increase independent decision making. *Research & Practice for Persons with Severe Disabilities, 28*(4), 182-193.

DePompei, R., Gillette, Y., Goetz, E., Xenopoulos-Oddsson, A., Bryen, D., & Dowds, M. (2008). Practical applications for use of PDAs and smartphones with children and adolescents who have traumatic brain injury. *NeuroRehabilitation, 23*(6), 487-499.

Electronic and Information Technology Accessibility Standards; Final Rule, 36 CFR Part 1194 (2000).

Gillette, Y., & DePompei, R. (2004). The potential of electronic organizers as a tool in the cognitive rehabilitation of young people. *NeuroRehabilitation, 19*(3), 233-243.

Gillette, Y., & Depompei, R. (2008). Do PDAs enhance the organization and memory skills of students with cognitive disabilities? *Psychology in the Schools, 45*(7), 665-677.

Goodey, C. F. (2005). Blockheads, roundheads, pointed heads: Intellectual disability and the brain before modern medicine. *Journal of the History of the Behavioral Sciences, 41*, 165-183.

Grigal, M., Hart, D., & Migliore, A. (2011). Comparing the transition planning, postsecondary education, and employment outcomes of students with intellectual and other disabilities. *Career Development for Exceptional Individuals, 34*(1), 4-17.

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*(2), 165-179.

Howarth, E., Mann, J. R., Zhou, H., McDermott, S., & Butkus, S. (2006). What predicts re-employment after job loss for individuals with mental retardation? *Journal of Vocational Rehabilitation, 24*(3), 183-189.

Hughes, C. (2008). Postsecondary outcomes in the 21st century--A change is gonna come? *Research and Practice for Persons with Severe Disabilities, 33*(3), 100-102.

Hughes, E., Green, J., & Ryan, J. B. (2011). The use of assistive technology to improve time management skills of a young adult with an intellectual disability. *Journal of Special Education Technology, 26*(3), 13-20.

Individuals with Disabilities Education Improvement Act. (2004) (Vol. P.L. 108-446, 20 U.S.C. § 1400 et seq.).

Kaufman, A. S., & Lichtenberger, E. O. (2005). *Assessing adolescent and adult intelligence* (3rd ed.). Hoboken: John Wiley & Sons, Inc.

Kazdin, A. E. (1982). *Single-case research designs: Methods for clinical and applied settings*. New York: Oxford University Press.

Kregel, J., Wehman, P., & Banks, D. (1989). The effects of consumer characteristics and type of employment model on individual outcomes in supported employment. *Journal of Applied Behavior Analysis, 22*(4), 407-415.

Lancioni, G. E., & O'Reilly, M. F. (2001). Self-management of instruction cues for occupation: Review of studies with people with severe and profound developmental disabilities. *Research in Developmental Disabilities, 22*(1), 41-65.

Lancioni, G. E., O'Reilly, M. F., Seedhouse, P., Furniss, F., & Cunha, B. (2000). Promoting independent task performance by persons with severe developmental disabilities through a new computer-aided system. *Behavior Modification, 24*(5), 700.

Lovass, O. I. (2003). *Teaching individuals with developmental delays: Basic intervention techniques*. Austin, TX: Pro-Ed.

McInnes, M. M., Ozturk, O. D., McDermott, S., & Mann, J. R. (2010). Does supported employment work? *Journal of Policy Analysis and Management, 29*(3), 506-525.

Mechling, L. C. (2007). Assistive technology as a self-management tool for prompting students with intellectual disabilities to initiate and complete daily tasks: A literature review. *Education and Training in Developmental Disabilities, 42*(3), 252-269.

Mechling, L. C., Gast, D., & Fields, E. (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*(3), 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*(3), 422-439.

Mechling, L. C., & Gustafson, M. (2009). Comparison of the effects of static picture and video prompting on completion of cooking related tasks by students with moderate intellectual disabilities. *Exceptionality, 17*(2), 103-116.

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*(2), 220-237.

Riffel, L. A., Wehmeyer, M. L., Turnbull, A. P., Lattimore, J., Davies, D., Stock, S., & Fisher, S. (2005). Promoting independent performance of transition-related tasks using a palmtop PC-based self-directed visual and auditory prompting system. *Journal of Special Education Technology, 20*(2), 5-14.

Rudrud, E. (2007). *Applied behavior analysis: Home grown from the field*. St. Cloud, MN: St. Cloud State University.

Rusch, F. R., & Braddock, D. (2004). Adult day programs versus supported employment (1988-2002): Spending and service practices of mental retardation and developmental disabilities state agencies. *Research and Practice for Persons with Severe Disabilities, 29*(4), 237-242.

Sattler, J. M. (2001). *Assessment of children: Cognitive applications* (4th ed.). San Diego: Satler.

Schalock, R. L., Borthwick-Duffy, S. A., Bradley, V. J., Buntinx, W. H. E., Coulter, D. L., Craig, E. M., . . . Yeager, M. H. (2010). *Intellectual disability: Definition, classification, and systems of supports* (11th ed.): American Association on Intellectual and Developmental Disabilities.

Taber-Doughty, T. (2005). Considering student choice when selecting instructional strategies: A comparison of three prompting systems. *Research in Developmental Disabilities: A Multidisciplinary Journal, 26*(5), 411-432.

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), 1-18.

Test, D. W., Carver, T., Ewers, L., Haddad, J., & Person, J. (2000). Longitudinal job satisfaction of persons in supported employment. *Education and Training in Mental Retardation and Developmental Disabilities, 35*(4), 365-373.

Trent, J. W., Jr. (1994). *Inventing the feeble mind: A history of mental retardation in the United States*. Berkeley: University of California Press.

U.S. Department of Education. (2010). *National Longitudinal Transition Study-2*. Washington, DC: National Center for Education Research.

Van Laarhoven, T., Johnson, J. W., Van Laarhoven-Myers, T., Grider, K. L., & Grider, K. M. (2009). The effectiveness of using a video iPod as a prompting device in employment settings. *Journal of Behavioral Education, 18*(2), 119-141.

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*(1), 28-45.

Wechsler, D. (1944). *The measurement of adult intelligence*. Baltimore: Williams & Wilkins.

Wehman, P., & Revell, G. (2005). Lessons learned from the provision and funding of employment services for the MR/DD population. *Journal of Disability Policy Studies, 16*(2), 84-101.

Wehman, P., & Wevell, G. (1981). *Competitive employment: New horizons for severely disabled individuals*. Baltimore: Brookes.

Wehmeyer, M. L., Palmer, S. B., Smith, S. J., Davies, D. K., & Stock, S. E. (2008). The efficacy of technology use by people with intellectual disability: A single-subject design meta-analysis. *Journal of Special Education Technology*, *23*(3), 21-30.

Wehmeyer, M. L., Palmer, S. B., Smith, S. J., Parent, W., Davies, D. K., & Stock, S. (2006). Technology use by people with intellectual and developmental disabilities to support employment activities: A single-subject design meta analysis. *Journal of Vocational Rehabilitation*, *24*(2), 81-86.

Wolf, M. M. (1978). Social validity: The case for subjective measurement or how applied behavior analysis is finding its heart. *Journal of Applied Behavior Analysis*, *11*, 203-214.