EFFECTS OF PICTURE PROMPTS DELIVERED BY A VIDEO IPOD® ON PEDESTRIAN NAVIGATION

by

Kelly Renee Kelley

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Approved by:

____
Dr. David W. Test

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Dr. Nancy L. Cooke

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Dr. Christopher P. O'Brien

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Dr. Suzanne M. Leland

ABSTRACT

KELLY RENEE KELLEY. Effects of picture prompts delivered by a video iPod® on pedestrian navigation. (Under the direction of DR. DAVID W. TEST)

National data continue to indicate many individuals with intellectual and developmental disabilities (IDD) have not had the same access to education, employment, independent living, or extracurricular activities as the general population after high school (Blackorby & Wagner, 1996; Newman, Wagner, Cameto, & Knokey, 2009; Wagner, Newman, Cameto, Garza, & Levine, 2005; Wagner, Newman, Cameto, Levine, & Garza, 2006). Transportation access can be a major contributor to independence, productivity, and societal inclusion for individuals with disabilities (Myers, 1996). Individuals with IDD face many challenges related to community integration such as obstacles to independently navigate in the community (Sohlberg, Fickas, Lemoncello, & Hung, 2009). Travel training and pedestrian navigation skills are critical since these skills impact how people live, work, and participate in their community (Groce, 1996b). It is important to have an organized and sequential way to teach independent travel to individuals with IDD since most do not learn these skills incidentally or obtain a driver's license to navigate independently (LaGrow, Wiener, & LaDuke, 1990).

This study examined the effects of pedestrian navigation training using picture prompts displayed through a video iPod® on travel route completion with four young adults with IDD (18-26 years old) participating in an inclusive individualized postsecondary program at a 4-year university. Results indicated a functional relation between picture prompts displayed on the video iPod® and participants' acquisition of pedestrian navigation skills to and from various campus locations. Maintenance data indicated all four participants were able to continue to navigate trained routes independently for up to 28 days using the video iPod®. Generalization measures indicated 3 out of 4 participants were able to use the video iPod® to navigate untrained routes without any prompts given by the researcher. Social validity data suggested iPod® training and supports were useful and practical for teaching independent pedestrian navigation skills. Finally, limitations, suggestions for future research, and implications for practice were provided.

DEDICATION

I would like to dedicate this dissertation to several instrumental people in my life who have sacrificed a lot for me during this journey of life. First to my wonderful and patient husband, David, who has encouraged me throughout many obstacles always believing in me. Next, to all my family and friends who has stood by me through it all including my wonderful mother who fought and lost her battle with esophageal cancer for 16 months of my doctoral journey. Even in her hardest last days, she continued to encourage me to finish my dreams despite losing her battle with cancer. This dissertation is in memory of (mom) Fran Drinnon as I was also able to cherish times with her during this journey and she has continued to remain an inspirational angel to me as I finished this chapter of my life.

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CHAPTER 1: INTRODUCTION

Statement of Problem

National data continue to indicate many individuals with intellectual and developmental disabilities (IDD) have not had the same access to education, employment, independent living, or extracurricular activities as the general population due to the lack of opportunity, limited transportation options, accessibility, and training (e.g., knowing what transportation systems are available, how to access and plan travel safely; Groce, 1996a). For example, based on findings reported in the Wave 3 National Longitudinal Transition Study 2 data (NLTS2, 2005), only 27% of individuals with intellectual disabilities (formally referred to as mental retardation) reported participating in postsecondary education such as vocational, technical, community, and university settings (Newman, Wagner, Cameto, & Knokey, 2009). With employment, 57% of youth with disabilities leaving high school were employed outside of the home compared to 67% of the general population. Out of this 57%, only 31% of individuals with intellectual disabilities were currently working during the interview period. With independent living, 25% of youth with disabilities compared to 28% of the general population reported living independently with only 14% of individuals with intellectual disabilities living independently (Newman et al., 2009).

In addition, extracurricular activities within NLTS2 Wave 4 data (2007), reported a total of 69% of youth with various disabilities had a driver's license or learning permit and only 31% of youth with intellectual disabilities had a license or permit. During the previous 12 month period (a) 28% of youth with intellectual disabilities reported they "never get together" with friends outside of organized activities, (b) only 17% of youth with intellectual disabilities reported participation in volunteer or community service opportunities, and (c) 31% of youth with intellectual disabilities reported involvement in out-of-school group activities. Without these skills, and ways to access various extracurricular activities such as going to the mall, movies, work, and other places, individuals with disabilities often feel isolated and do not have the same quality of life as others after they finish high school (Myers, 1996). Based on comparisons to the general population, there appears to be a need to explicitly teach individuals with IDD how to access transportation and navigate as independently as possible to improve outcomes. One place to start this training could be on postsecondary campuses where navigation skills can be taught in a larger yet more controlled setting and then transferred into the community.

History of Federal Initiatives

Over the past 35 years, federal initiatives have supported more inclusive education and employment opportunities and transportation access for individuals with disabilities. For example, during the 1970s there were limited opportunities for individuals with IDD to experience college outside of specialized programs (Neubert, Moon, Grigal, & Redd, 2001). In the 1980s, more programs and opportunities for participation in regular college coursework evolved for students with IDD due to the

Rehabilitation Act of 1973 (P. L. 93-112; Neubert et al., 2001). During the 1990s transition service mandates of the Individuals with Disabilities Education Act (IDEA, 1990) and IDEA (1997) created dual enrollment and individual support models to help increase access to postsecondary coursework, job opportunities, and recreational activities based on individualized interests and needs for students with IDD (Neubert et al., 2001). The most recent legislation passed on August 14, 2008 was the Higher Education Opportunity Act (HEOA, P.L. 110-315) reauthorizing the Higher Education Act of 1965. The HEOA included $11 million in allocated funds to provide (a) federal financial aid for students with IDD for the first time in history, (b) funding for model demonstration postsecondary programs designed for individuals with IDD at institutes of higher education, and (c) a coordinating center to conduct research and provide technical assistance to model demonstration programs across the United States (P.L. 110-315, Stat. 3078).

In terms of transportation access, the Americans with Disabilities Act (ADA, 1990) regulates accessibility of transportation systems for individuals with physical disabilities. In addition, the Individuals with Disabilities Education Acts (IDEA 1990; 1997; 2004) requires public schools to provide “transition services” to youth to prepare them for adulthood. Transition services are simply “a coordinated set of activities intended to prepare young people with disabilities to participate in everyday life of their community” (Groce, 1996b, p. 3). Within transition services, travel training is included and public schools are required to provide support to students with more significant cognitive disabilities for developing an awareness of their environment and learning skills necessary to move effectively and safely from place to place (Groce, 2000; IDEA, 1997). Transportation access and pedestrian navigation skills are critical to secondary transition since these skills impact how people live, work, and participate in their community (Groce, 1996b). Therefore, it is critical to have an organized and sequential way to teach independent travel as part of educational programming for individuals with IDD since most are unable to learn these skills incidentally or obtain a driver's license to navigate independently (LaGrow, Wiener, & LaDuke, 1990).

Definition and Benefits of Travel Training

Travel training has provided sequential and explicit ways for accessing transportation. Travel training has been defined by Groce (1996b) as "a short-term, comprehensive, intensive instruction designed to teach students with disabilities how to travel safely and independently on public transportation" (p. 2). It provides customized instructional strategies for teaching individualized travel skills based on each person's needs (Groce, 1996b). According to Groce (1996b) and LaGrow et al. (1990) there are many benefits to travel training for individuals with disabilities. First, travel training can improve self-esteem as individuals gain independence and assume responsibility for accessing transportation. Second, if individuals can travel more independently, it helps expand opportunities for employment, education, and independent living. Third, although travel training can be costly at first due to the extensive supports needed, in the long term it can be a worthwhile investment for individuals to pay for their own travel and navigate independently. Last, as students become less dependent on others they are able to lead productive lives and make significant contributions to society.

Travel training has commonly included teaching public transportation and pedestrian skills such as riding the bus and crossing the street; however it has not traditionally included comprehensive instruction for teaching pedestrian navigation skills to walk specific routes to get students from one location to another (LaGrow et al., 1990). Teaching pedestrian navigation skills involve using a step-by-step method for navigating from point A (starting location) to a specified destination (point B) and also navigating back to the starting location (point A). Pedestrian navigation skills are similar to orientation and mobility skills since it involves simultaneous instruction and is based on a success-based sequence and aimed at meeting individualized travel needs (LaGrow et al., 1990). Pedestrian navigation skills for students with IDD are different from orientation and mobility skills typically offered to individuals with visual impairments because there is less focus on mobility and greater emphasis on the development of appropriate navigation behaviors (LaGrow et al., 1990).

With increasing development and enrollment in postsecondary programs for individuals with IDD (Grigal & Hart, 2010), expanded post-school opportunities, transportation access, and recent federal initiatives promoting more inclusive opportunities, knowing how to navigate successfully in the community is crucial for increased quality of life, independence, and productivity. In addition, parents are often not able to take their child to community events due to work responsibilities, aging, health problems, or various other reasons. More importantly, developing adolescents do not wish to have parents or guardians taking them places and tend to appreciate greater independence, as they grow older (Myers, 1996).

Brief Overview of Travel Training Research

Many studies have taught travel training related to bus riding (Coon, Vogelsberg, & Williams, 1981; Kubat, 1973; Marchetti, Cecil, Graves, & Marchetti, 1984; Neef, Iwata, & Page, 1978; Sowers, Rusch, & Hudson, 1979; Welch, Nietupski, & Hambre-Nietupski, 1985) and pedestrian skills (Batu, Ergenekon, Erbas, & Akmanoglu, 2004; Marchetti, McCartney, Drain, Hooper, & Dix, 1983; Matson, 1980; Page, Iwata, & Neef, 1976) using combinations of simulation, role playing, and prompting systems. For example, Neef et al. (1978) examined the effects of using cardboard simulations containing buildings, trees, stop signs, traffic lights, and a doll on bus riding skills with five participants' ages 18 to 24 with moderate intellectual disabilities. Using a multiple baseline across subjects design (i.e., bus stop location, boarding, exiting, signaling of bus), results indicated all students learned these skills successfully in a classroom and were able to generalize these skills into natural settings. In terms of pedestrian skills, Page et al. (1976) examined the effects of pedestrian skill training on generalization of skills to natural environments. Participants ranged in age from 16 to 25 and included five males with moderate intellectual disabilities. Using a multiple baseline across participants and behaviors, five major pedestrian behaviors were taught using dolls to simulate behaviors (i.e., intersection recognition, pedestrian light skills, intersections with traffic lights, intersections with stop signs and cars traveling across pedestrian paths, and intersections with stop signs with cars traveling the same direction as pedestrians). Results indicated pedestrian skills could be taught within classroom settings and generalized to natural environments with minimal additional training, but did not reduce the amount of time required to teach each skill.

In summary, a large majority of travel training studies were conducted in the 1970s and 1980s when individuals with disabilities were just beginning to be integrated into communities from institutional settings. Many were conducted in simulated classroom environments with skill generalization to natural environments producing mixed results. For example, Neef et al. (1978) found positive generalization results between classroom and natural settings while Coon et al. (1981) indicated weak generalization of skills from classroom to natural settings with bus riding skills. With pedestrian skills, Page et al. (1978) found training on one pedestrian skill led to increases in untrained skills, but did not reduce the instructional time required for teaching each skill.

After examining many of the interventions used to teach these skills, there is a continued need to investigate methods to help students with IDD generalize pedestrian navigation skills in more age-appropriate ways. Based on increasing numbers of adolescents with IDD attending postsecondary programs and included within their communities, methods for teaching pedestrian navigation skills need to be researched and addressed using the latest age appropriate technologies available to see if it helps increase independence or improve quality of life. If researchers do not begin investigating ways to expand or teach pedestrian navigation skills and other crucial discrete skills there will continue to be limited access to activities for students with IDD and limited ways for evaluating outcomes or quality of life.

To date, only two studies have paired travel training with the latest, age-appropriate technologies to teach students how to navigate by bus or walk to destinations independently. First, Mechling and O'Brien (2010) investigated the effects of computer-based video instruction (CBVI) paired with constant time delay on bus transportation skills (i.e., requesting stop signal at specific landmarks). Participants included three students, ages 19 to 20, with mild to moderate intellectual disabilities. Using a multiple probe design across participants and one bus route, results indicated CBVI was effective and efficient for teaching two of three students to locate landmarks, request stops, and generalize these skills with 100% accuracy on all in-vivo (natural environments) sessions, as well as maintaining the request for stop behaviors for at least 52 days.

In another study, Mechling and Seid (2011) examined the effects of using a personal digital assistant (PDA) paired with a self-prompting system on pedestrian navigation skills to destinations located on a college campus. Destinations included campus cafeteria and food courts, a game and entertainment center, and a copy/print center. Participants included three females with moderate disabilities ages 20 to 21. Using a multiple probe design across destinations replicated across participants, results demonstrated a functional relationship between the use of the PDA with prompting and percentage of landmarks and destinations located by the students. Additionally, students were able to successfully navigate to these destinations after the PDA was removed. Despite these results, several limitations were noted. First, students were not able to travel independently without an adult present. Second, preselected landmarks changed during the study beyond the control of the experimenter (e.g., bike rack removed). Future studies need to frequently monitor to be sure landmarks have not changed. Additional limitations are also noteworthy. First, the study did not provide instruction on how to get back to starting locations to improve functionality of learning the skill. Future studies need to teach pedestrian navigation skills both to and from destinations for greater independence. Second, this study did not address “independent” pedestrian navigation skills since the researcher was always close by to assist. Future studies need to evaluate participants from a greater distance to see if they can truly navigate independently without the researcher close by. Third, this study used an adult model in the video to help with prompting. Future studies need to closely match prompting typical to navigation devices by providing the visual prompts (e.g., directional arrows) similar to global positioning systems rather than videos. This will help improve functionality, safety, and accuracy of walking rather than requiring the participant to simultaneously walk and watch a video of where to go or having to pause frequently. Finally, as indicated by classroom teachers the device used (i.e., Cyrano Communicator, PDA) was not cost effective for purchase ($1,300). Future studies need to explore economical and universally accessible devices for teaching pedestrian navigation skills.

Significance and Contributions

This study will respond to the limited research in the area of travel training instruction on pedestrian navigation skills for students with IDD. It will offer an age-appropriate device to teach pedestrian navigation skills to adolescents and adults with IDD where global positioning systems (GPS) might not be as feasible to use due to limited address availability. This study will also expand research on how to teach pedestrian navigation skills using economical and universally accessible technologies (i.e., handheld technology device) for young adults with IDD who need to learn navigation in relevant environments (i.e., university campus) while also addressing several limitations found from one similar study (Mechling & Seid, 2011). Given the current federal interest in increasing the number of students with IDD who are attending postsecondary education programs the college campus can provide an excellent environment for teaching pedestrian navigation skills. As such, results of this study may help expand the limited resources for postsecondary programs at a national level by providing a cost effective method for teaching pedestrian navigation skills within inclusive individualized programs. Finally, this study will teach individuals with IDD to navigate entire routes both to and from destinations and use picture prompts displayed through a video iPod® providing individuals with a modified user-friendly version similar to information given on more cost efficient GPS devices while still providing explicit instruction needed for individuals with IDD.

Purpose

The purpose of this study was to investigate the effects of using picture prompts displayed through a video iPod® on pedestrian navigation with young adults with IDD (18-26 years old) participating in an inclusive individualized postsecondary program at a 4-year university.

Research Questions. This study sought to answer the following research questions:

1. What is the effect of pedestrian navigation training using a video iPod® (i.e., picture prompts of a series of intermediate on-route and final locations) on travel route completion to and from specified locations for young adults (age 18-26) with IDD?
2. To what extent do young adults (age 18-26) maintain independent use of the video iPod® for pedestrian navigation skills?
3. To what extent do young adults (age 18-26) generalize use of the video iPod® to untrained locations?
4. What are participants' perceptions of using the video iPod® as a method for independent travel?

5. What are undergraduate special education majors’ and minors perceptions of developing materials for video iPod® training?

Delimitations

First, this study was conducted in a university setting rather than the community. This setting limited the ability to generalize results to other settings. Furthermore, the population was unique because participants were selected from a program designed for students with IDD living and participating in an individualized inclusive postsecondary program. This also limited generality and replication for future studies.

Second, participants selected for this study were living on-campus prior to implementation of this research study. This means participants could have learned some of the landmarks and destination areas prior to participation in the study. To address this potential delimitation, predetermined destinations were carefully selected in more remote locations of campus rather than areas where participants might have already lived close to or were familiar with.

Third, this study did not address indoor travel necessary for reaching classroom destinations. Due to the nature of navigation and differences between indoor and outdoor travel training and additional skill set required (e.g., recognition of room numbers, use of elevators), this study only focused on getting participants to building door locations rather than continuing navigation to specific room numbers.

Definitions

Intellectual and developmental disability (IDD): According to the American Association on Intellectual and Developmental Disabilities (2010; formally known as the American Association on Mental Retardation) intellectual disabilities are defined as "a disability characterized by significant limitations both in intellectual functioning (i.e., reasoning, learning, problem solving) and in adaptive behavior, which covers a range of everyday social and practical skills originating before the age of 18" (FAQ on Intellectual Disability, para 1). A person with developmental disabilities is one who has a "severe, chronic disability" related to a physical and/or mental impairment that can affect life functioning in areas such as self-care, language, learning, mobility, self-direction, independent living, and economic self-sufficiency (Developmental Disabilities Assistance and Bill of Rights Act, 2000). Many individuals can have a combination of intellectual and developmental disabilities.

Multimedia instruction: The "combination of several different types of media linked together by a computer and produced for viewing on the computer screen. The presentation media usually involved in multimedia are audio, text, videotape, print, and graphics" (Bender & Bender, 1996, p. 103). This often falls under the broader term computer-assisted instruction.

Pedestrian navigation skills: Pedestrian navigation skills allow an individual to navigate from point A (starting location) to a specified destination (point B) and back to the starting location (point A). Pedestrian navigation skills are similar to orientation and mobility skills in that simultaneous instruction is based on a success-based sequence and designed to meet travel needs of an individual (LaGrow et al., 1990). Pedestrian navigation skills are different from orientation and mobility skills since they are typically offered to individuals with IDD rather than visual impairments and include less focus on mobility and greater emphasis developing appropriate navigation behaviors (LaGrow et al., 1990).

Picture prompting: Still or static picture prompting is a lower level of multimedia prompting. This is simply the use of still or static photographs organized in a specific sequence (e.g., photo album) to serve as visual prompts (Alberto, Cihak, & Gama, 2005). Picture prompts are sometimes used in combination with auditory prompts (e.g., picture of a tower and auditory prompt to “turn right”).

Postsecondary program models: There are three postsecondary program models. First, *substantially separate models* evolved in the 1970s to provide employment training, job opportunities, and life skill curriculums, but offer little to no opportunities for inclusive activities with peers without disabilities. Substantially separate models often have larger numbers of students (21-70 students in each program; Hart, Mele-McCarthy, Pasternack, Zimbrich, & Parker, 2004). With this model, there is little need for learning pedestrian navigation skills since most activities occur in one place. Second, the *mixed model* is frequently implemented with local school systems and typically located on community college or university campuses. In mixed or hybrid models, individuals attend separate classes as well as participate in some inclusive classes, social, and employment opportunities with peers without disabilities (Neubert & Moon, 2006). Finally, the *inclusive individualized model* is primarily student centered and based on the identification of the student’s strengths, interests, and supports needed within fully inclusive postsecondary educational settings (Neubert & Moon, 2006). There is a high demand with this model for learning pedestrian navigation skills since there are many opportunities for varied inclusive opportunities across postsecondary settings.

Travel training: Travel training is defined by Groce (1996b) as "a short-term, comprehensive, intensive instruction designed to teach students with disabilities how to travel safely and independently on public transportation" (p. 2). Travel training also provides customized instructional strategies to teaching individualized travel skills based on each person's needs (Groce, 1996b).

Video iPod®: The video iPod® is commonly referred to as the 5th generation iPod® classic created by Apple Inc. It is a portable electronic device that stores and plays audio and/or video files (e.g., digital photographs). The classic iPod® has a navigation wheel with play, stop, forward, and back as well as a menu button. An additional video iPod® version used in this study was the iPod® Touch. This does not have the navigation wheel, but has a touch screen to display pictures and uses a simple sweeping touch motion of one finger to move pictures forward and backward. This iPod® measured 2.5 in x 4.5 in. with a 3.5 in diagonal screen. The screen for image display dimensions was approximately 2 in x 3 in. This iPod® also has a built in camera feature.

Video modeling: Video modeling involves several steps including (a) making a video of someone performing a targeted behavior or completing a designated task, (b) showing the individual the video from beginning to end for each training session, and (c) giving the individual the opportunity to perform the behavior or task in its entirety (Alberto et al., 2005; Cannella-Malone et al., 2006). Video modeling and video prompting can be easily confused, but there are noticeable distinctions with these terms, which should not be used interchangeably.

Video prompting: Video prompting involves showing one step of a task video clip and then giving the person an opportunity to complete that step before moving on to the next step on the video (Cannella-Malone et al., 2006).

CHAPTER 2: REVIEW OF LITERATURE

Finishing high school is an exciting, yet crucial, time for exploring new opportunities as individuals seek to become productive members of their communities. However, for many individuals with intellectual and developmental disabilities (IDD) this has not always been true. Intellectual disabilities are defined by the American Association on Intellectual and Developmental Disabilities (AAIDD, 2010) as “a disability characterized by significant limitations both in intellectual functioning (i.e., reasoning, learning, problem solving) and in adaptive behavior, which covers a range of everyday social and practical skills originating before the age of 18” (FAQ on Intellectual Disability, para 1). A person with developmental disabilities is one who has a “severe, chronic disability” related to a physical and/or mental impairment that can affect life functioning in areas such as self-care, language, learning, mobility, self-direction, independent living, and economic self-sufficiency (Developmental Disabilities Assistance and Bill of Rights Act, 2000). Many individuals have a combination of IDDs. Unfortunately, this population is often left at home as their peers go off to college, find jobs, and live independently.

Although reports of post-school outcome data for youth with disabilities are showing promising improvements since the first National Longitudinal Transition Study (NLTS) conducted from 1985 to 1993, they continue to remain quite dismal for individuals with IDD when compared to their peers without disabilities (Blackorby &

Wagner, 1996; Wagner, Newman, Cameto, Garza, & Levine, 2005). Based on the most current Wave 4 data (NLTS2, 2007), only 20% of individuals with IDD reported attendance at postsecondary settings while 46% reported having paid employment outside the home. With independent living, 69% of individuals with IDD reported living with parents and only 8% lived on their own. Sadly,
individuals with IDD are among the least likely to take part in community groups and volunteer activities after high school (Wagner, Newman, Cameto, Levine, & Garza, 2006). This lack of community and volunteer involvement could be due to the limited number of individuals (31%) with IDD having a driver's license, learners permit, and knowing how to access public transportation. In addition, 32% of individuals with IDD and their parents reported difficulties in getting where they need to go in the community (NLTS2, 2007). Many individuals with IDD also have an abundance of free time, but lack skills needed to take control or make choices about education, employment, or recreation/leisure opportunities (Miller & Chan, 2008). Until recently, these individuals have not had access to inclusive postsecondary opportunities to further their education beyond segregated compensatory programs and many were employed in sheltered workshops due to lack of transportation or opportunity rather than participating in competitive or self-employment positions. Unfortunately, choices in the areas of education, employment, and independent living remain limited due to factors such as lack of transportation (Myers, 1996).

Previous legislative mandates (e.g., Americans with Disabilities Act, 1990; President's Committee on Mental Retardation, 1972; Rehabilitation Act of 1973) have helped govern public transportation accessibility; however, independent travel remains one of the most important unmet needs for individuals with disabilities (Goodkin, 1977). Although research in travel training has been limited, it could be one tool for providing greater access to inclusive opportunities and more positive post-school outcomes for individuals with IDD. Additionally, there continues to be a lack of comprehensive programming and curriculum available for teaching travel/pedestrian navigation skills (LaGrow et al., 1990).

Transportation access is one major contributor to independence, productivity, and inclusion in society for individuals with disabilities (Myers, 1996). Individuals with IDD also face many challenges related to community integration such as obstacles to independently navigate in the community (Sohlberg et al., 2009). Typically, many rely on care providers for transportation reducing self-determination levels and the desire to learn how to access public transportation systems (Sohlberg et al., 2009). Based on a brief literature review attempting to provide a theoretical and functional model for community navigation, Sohlberg et al. (2009) only found one study that used a general strategy approach to teach travel to novel destinations (i.e., series of picture prompts; LaDuke & LaGrow, 1984). To date, no studies other than LaDuke and LaGrow (1984) have used strategy-based instruction in order to teach independent travel to and from novel destinations (Sohlberg et al., 2009). Since traveling independently is not usually taught, but learned incidentally; it needs to be explicitly taught to individuals with IDD (LaGrow et al., 1990). Individuals who learn to travel more independently are better prepared for the world of work, able to experience more economic benefits related to travel, and rely less on others to get them from place to place (LaGrow et al., 1990). Learning navigation skills can produce more opportunities and greater independence for individuals with disabilities. Society can also benefit when individuals with IDD independently navigate to vocational sites without reliance on others and can actively contribute in society (Groce, 1996a).

To address these issues the following literature review includes studies related to: (a) travel training such as transportation and pedestrian navigation skills, (b) using multimedia instruction to teach independent living skills, (c) using multimedia paired with handheld or portable devices to teach independent living skills, and (d) using multimedia and handheld devices to teach travel training.

Travel Training

Travel training is defined by Groce (1996b) as “a short-term, comprehensive, intensive instruction designed to teach students with disabilities how to travel safely and independently on public transportation” (p. 2) Travel training also provides customized instructional strategies for teaching individualized travel skills based on each person’s needs (Groce, 1996b). However, in order to gain the possible benefits of travel training (i.e., pedestrian navigation skills), there are four common limitations that have to be addressed (Groce, 1996a). First, there is fear and anxiety related to the individual travelling alone for the first time. Second, there can be overprotection by family or caregivers for allowing the individual to travel independently. Third, as with any preliminary activity conducted alone, there are safety concerns. Last, individuals can easily be lost in the community and lack necessary problem solving skills to seek assistance. To address these limitations, Voorhees (1996) suggested several travel training phases beginning with intense instruction for travel routes and then fading instruction over time. The intense instruction should be followed by direct observation, introduction to emergency procedures such as cell phone use, indirect observations, undercover observations, and follow-up observations. To overcome these barriers and follow suggested training phases, it is also important to review the history of empirical research related to travel training. To date, no literature review is available related to travel training alone and only two literature reviews have examined pedestrian/street crossing in combination with other community survival and safety skills (Martin, Rusch, & Heal, 1982; Mechling, 2008a). The following sections describe literature on teaching transportation and pedestrian navigation skills to individuals with IDD.

Teaching Transportation Navigation Skills

No current studies were found for teaching transportation navigation skills to elementary age students. However, there were eight studies for teaching adolescents and adults various bus riding skills (Coon et al., 1981; Kubat, 1973; LaDuke & LaGrow, 1984; Marchetti et al., 1984; Neef et al., 1978; Robinson, Griffith, McComish, & Swasbrook, 1984; Sowers et al., 1979; Welch et al., 1985).

First, Kubat (1973) used a pretest posttest group design to determine the percentage of bus riding skills acquired from a participant’s home to a work center in Utah (i.e., bus stop behavior, bus boarding behavior, pass presentation, bus riding behavior, bus exiting, reaching destination). Twenty-six adults (13 males and 13 females) with IDD were taught bus riding behaviors in four phases (i.e., Phase 1- Instruction on appropriate bus riding behaviors; Phase 2- Route familiarization; Phase 3- Simulation of bus ride; Phase 4- Riding the city bus). Results indicated the treatment group achieved 0% of skills during the pretest and 100% of skills during the posttest. Additionally, long term follow up (i.e., two and five months) with the treatment group indicated participants who received bus riding training were able to maintain skills with 100% mastery.

Next, Neef et al. (1978) examined using a task analysis to teach bus riding skills to five students ages 18-24 with moderate IDD. A multiple probe across participants design was used to evaluate four bus riding components (i.e., bus stop location, boarding bus, exiting bus, signaling bus). These behaviors were taught through a cardboard simulation model used by Page et al. (1976), role playing, modeling, and slide projections for teaching bus riding skills. Results indicated bus riding skills could be taught in the classroom and generalized to novel locations and routes.

One year later, Sowers et al. (1979) investigated the effects of using task analysis, modeling, verbal instructions, and feedback on bus riding skills to and from work with a 20-year old adult with severe IDD. Ten bus riding steps were taught in three phases (i.e., riding city bus to and from home to work with trainer, riding city bus with trainer in morning and by himself in the afternoon, and riding the city bus independently in the morning and afternoon with the trainer recording arrival and departure times). Although considered preexperimental because of the lack of an experimental design, findings indicated this individual was able to travel independently to and from work on the city bus after 17 days of training suggesting adults with severe disabilities can independently use public transportation systems.

Next, Coon et al. (1981) examined the effects of classroom acquired functional mobility on skill generalization to natural environments with a 20-year old woman with severe IDD. The intervention included 15 skills required to ride a city bus grouped in two skill areas (i.e., bus boarding and departing). A multiple baseline across the two skill sequences design was used to evaluate the effects of functional mobility on skill generalization to natural environments. Results indicated the student learned skills to ride the public bus independently after seven days of classroom instruction. The student acquired bus boarding and departing skills after receiving classroom instruction and was able to generalize classroom instruction to the community.

In 1984, three studies were conducted on teaching transportation skills (LaDuke & LaGrow, 1984; Marchetti et al., 1984; Robinson et al., 1984). First, LaDuke and LaGrow (1984) compared the effects of a photo-bus-route map and verbal instruction on accessing public transportation systems with four adults with moderate IDD ages 22 to 26. A multiple baseline across participants design was used. Behaviors included walking to boarding points, boarding designated buses, pressing the buzzer at correct times, standing and moving forward to get off the bus, exiting to designated locations, and walking to designated locations. Results indicated number of steps and behaviors completed correctly increased with use of photo-bus-route map and decreased when the map was taken away. Next, Marchetti et al. (1984) compared the effects of classroom, community, and facilities ground instruction on bus riding skills. A total of 27 participants with mild to severe IDD ages 17 to 54 participated. Classroom training included simulations of city using slide presentations. Community training included training and prompting in the community with two bus routes. Facilities ground training was similar to community training, but only occurred on actual residential facility grounds. A pretest posttest group design was used to evaluate four targeted behaviors (i.e., locating a bus stop, signaling, boarding and riding, and exiting a bus). Results indicated all groups increased scores; however, facilities grounds training showed the most significant improvements with an average increase of 6.6 steps per participant compared to 5.8 steps for the community group and 4.5 for the classroom group. Next, Robinson et al. (1984) replicated Neef et al. (1978) by comparing the effects if classroom and community training on bus riding skills. Modifications included using a slide presentation and role play to assess initial skill levels and then training and testing these skills in natural environments. Participants included 34 individuals with multihandicaps ranging in age from 15 to 46. A modified multiple probe across participants design was used. Bus riding skills taught included locating and signaling the bus, boarding and riding, and exiting the bus. Results indicated the mean number of trials needed to reach criterion was 10 with a range of 3 to 30. Only 11 instructional trials were needed for 20 of the 34 participants to successfully complete the response sequence. Participants who had previous riding experience acquired bus riding skills more quickly than novice riders.

Finally, Welch et al. (1985) examined the effects of prosthetic picture prompt cards and problem solving procedures on arrivals at community bus stops. Participants included six adults with moderate IDD ages 18 to 20. A task analysis was used to measure steps performed correctly for walking to a bus stop, using prosthetic cards to match times on a watch to determine if they were on time or late for the bus, taking the bus if on time, and if not on time completing steps such as calling into work if late and taking the next bus. A multiple probe across three pairs of students design was used. Results indicated simply talking students through problem solving steps for missing the bus were not enough for teaching problem solving within the community. Half of the students were able to generalize information taught from simulated to natural environments, but half needed more direct instruction.

Teaching Pedestrian Navigation Skills

Pedestrian navigation skills allow an individual to navigate from point A (starting location) to a specified destination (point B) and back to the starting location (point A). Pedestrian navigation skills are similar to orientation and mobility skills in that simultaneous instruction is based on a success-based sequence and designed to meet travel needs of an individual (LaGrow et al., 1990). Pedestrian navigation skills are different from orientation and mobility skills since they are typically offered to individuals with IDD rather than visual impairments and include less focus on mobility and greater emphasis developing appropriate navigation behaviors (LaGrow et al., 1990). To date, no literature reviews have been conducted specifically on pedestrian navigation skills, but have addressed overall survival skills. For example, Martin et al. (1982) reviewed results of studies in survival skill areas such as travel, money management, meal preparation, clothing and personal care, telephone use, housekeeping, self-medication, leisure, social interaction, and conversation. Within the category of travel, studies included skills such as bus riding, street crossing, and driving a car. Findings from these eight studies indicated individuals with disabilities could learn to travel independently. Results also indicated in vivo (natural environment) training were more effective than simulated training for students with more moderate intellectual disabilities. In addition, Mechling (2008a) reviewed empirical literature from 1976 to 2006 related to personal safety skills. Findings were summarized into six categories including pedestrian/street crossing (n=8), home accident prevention (n=6), first aid (n=7), stranger danger (n=6), fire safety (n=6), and making emergency phone calls (n=5). Specific pedestrian skills taught included (a) proper sidewalk behaviors, (b) recognition of intersections, (c) street crossing with stop signs and traffic lights, and (d) crossing uncontrolled streets and parking lots. Due to the limited research on travel training specific to pedestrian skills it is important to review interventions for all individuals with IDD in order to gain a broader knowledge of what has been used to teach pedestrian navigation skills. As a result, pedestrian interventions for children, adolescents, and adults will be reviewed next.

Pedestrian skills for children with IDD. To date, only three studies have taught pedestrian skills to elementary age students with IDD (Batu et al., 2004; Colozzi & Pollow, 1984; Spears, Rusch, York, & Lilly, 1981).

First, Spears et al. (1981) extended a study originally conducted with adults by Gruber, Reeser, and Reid (1979) using a task analysis procedure to teach a 12-year old child with intellectual disabilities to complete a sequence of behaviors (i.e., walking and entering a building, locating the bedroom, putting up bookbag and coat, and locating and entering playroom). A combined multiple baseline and reversal design was used. Results indicated the student was able to walk independently from the bus to the playroom after 46 consecutive days of training with the step-by-step task analysis.

Second, Colozzi and Pollow (1984) examined the effects of a cue fading procedure within a six-step training sequence on independent walking skills with five elementary students with moderate to severe disabilities ages 7 to 12. Individuals learned how to walk from the school entrance to their classrooms. Using a multiple baseline across students was used to determine if cue fading procedures had an effect on independent walking skills for the entire distance from the parking area to the classroom. Results indicated four of five students were able to acquire independent walking skills within 6.6 days of training and maintain 100% of these skills up to two years after intervention ended.

Third, Batu et al. (2004) investigated the effects of a most to least prompting procedure on three pedestrian skills (i.e., crossing street, using overcrossing and pedestrian lights, crossing without traffic controls) with five individuals with moderate to severe disabilities with a mean age of 10. Using a multiple probe across behaviors replicated across participants design, findings indicated all five participants were able to learn the three pedestrian behaviors within 70 sessions. Crossing the street without traffic controls was the most difficult behavior to master. Data indicated pedestrian behaviors were maintained at 100% for four weeks after training ended.

Pedestrian skills for adolescents and adults with IDD. Six studies were found teaching pedestrian skills to adolescents and adults with IDD. While some studies related specifically to indoor travel (Gruber et al., 1979; Lancioni et al., 2010) most related to specific pedestrian skills such as safely crossing the street (Collins, Stinson, & Land, 1993; Horner, Jones, & Williams, 1985; Marchetti et al., 1983; Matson, 1980; Page et al., 1976; Vogelsburg & Rusch, 1979).

First, Page et al. (1976) investigated the effects of a classroom pedestrian skills training program on skill generalization to natural environments with five males with moderate IDD ranging in age from 16 to 25. Classroom training and review sessions included models of four square city blocks made from posterboard to represent streets, cardboard houses, trees, traffic signals, and people. A multiple baseline across participants and behaviors design was used to evaluate pedestrian behaviors (i.e., intersection recognition, pedestrian light skills, intersections with traffic lights, intersections with stop signs and cars traveling across pedestrian paths, and intersections with cars traveling the same direction as pedestrians). Results indicated a functional relationship between pedestrian skill training and generalization of skills to natural environments. Four of five students maintained pedestrian skills for six weeks after intervention.

Second, Vogelsburg and Rusch (1979) examined the effects of instructional feedback on street crossing behaviors. This study included individuals with severe and profound IDD ranging in age from 17 to 21. Three individuals were taught how to cross partially controlled intersections by walking to the curb, stopping, walking across the street, and stepping up on the opposite curb. A multiple baseline across participants design with a partial sequential reversal was used to determine the level of assistance required for selected street crossing behaviors. Results indicated all three students acquired the approach and walk behaviors with verbal instruction only.

Third, Matson (1980) extended Page et al. (1976) by examining the effects of systematic training procedures using movable cars, human figurines, and cardboard figurines on pedestrian behaviors (i.e., proper sidewalk behavior, recognition of intersections, street crossing). Participants included 16 males and 14 females with moderate to severe IDD ranging in age from 21 to 55 with a mean of 38 years. A pretest posttest group design was used to examine three experimental conditions (i.e., no treatment control group, classroom training group, independent training group). The no treatment control group received training on cooking skills and how to make a bed. The classroom training group received 30 minutes of one-on-one training five days a week with prompting, shaping, and social reinforcement. The independent training group involved teaching participants common pedestrian signs, targeted street crossing behaviors using simulated materials, social reinforcement from peers, and self-evaluations. Results indicated pretest scores across groups were not significantly different; however, post hoc analysis indicated independent training was significantly more effective than classroom and no training. Findings from this study were similar to findings from Page et al (1976).

Three years later, Marchetti et al. (1983) also used a pretest posttest group design to compare the effects of classroom and community training procedures on pedestrian skills for individuals with IDD ranging in age from 19-59 with a mean age of 41. This study used a modified task analysis from the Page et al (1976) study. Students in the classroom or community training group were taught targeted pedestrian skills (i.e., crossing an intersection with no traffic lights or signs, crossing with a stop sign and cars going one direction, crossing with a stop sign and cars going an opposite direction, crossing with a single traffic light and multiple lights). The classroom training group used a simulated model of four square city blocks and dolls. The community training group used actual intersections in the local community. Results indicated community training procedures were significantly more effective than classroom training procedures.

Fifth, Horner et al. (1985) examined the effects of general case programming on street crossing with three students with severe IDD ranging in age from 12 to 53. Training was conducted on multiple streets within the community paired with verbal and physical prompting. A multiple probe across participants design was used to evaluate the percentage of nontrained probed streets crossed correctly. Results indicated a functional relationship between training and generalized street crossing. Social validation measures were also positive from parents and other service providers.

Finally, Collins et al. (1993) compared simulation and in vivo instruction to teach street crossing and using a public telephone to call home and request help. Participants in the street crossing study included four adolescents with moderate IDD. Training was conducted in vivo at the corner of a low-volume traffic street near the student’s high school and simulated trainings occurred in a special education classroom at the high school. The simulated environment included a street with parallel strips of masking tape on the classroom floor. A task analysis and progressive time delay were used to teach street crossing in simulated and in vivo settings. An adapted multiple probe across participants design was used to compare in vivo and simulated instruction with treatment and skills trained counterbalanced across participants. Results indicated progressive time delay was effective for teaching pedestrian street crossing skills.

Summary of Travel Training Research

There are several similarities and differences to note from the 17 studies reviewed. First, a majority of studies used varied types of explicit techniques using a task analysis (Sowers et al., 1979; Spears et al., 1981), most to least prompting (Batu et al., 2004), and progressive time delay (Collins et al., 1993). Second, a few of the studies were extensions or replications of previous studies. For example, the study by Page et al. (1976) taught pedestrian skills and was extended to teach bus riding skills in Neef et al. (1978). Third, several studies included classroom simulated instruction (e.g., cardboard buildings, trees, people, traffic lights, stop signs) to teach travel training before moving to in vivo training (i.e., training in natural environments). Results from these four studies showed a decrease in instructional time needed to generalize skills to natural settings (Coon et al, 1981; Neef et al., 1978; Page et al., 1976; Robinson et al., 1984). However, in three other studies, using in vivo and classroom instruction did not show significant differences related to where skills were taught (LaGrow et al., 1990; Matson, 1980; Welch et al., 1985). In contrast, in vivo training was often necessary for helping students generalize travel training skills taught (Batu et al., 2004; Coon et al., 1981; Marchetti et al., 1983; Matson, 1980). Finally, three studies found acquisition and maintenance of skills had positive results when structured prompting systems (Batu et al., 2004; Colozzi & Pollow, 1984) or visual cues (LaDuke & LaGrow, 1984) were used.

In addition, only three studies taught elementary aged students with disabilities independent walking skills (Batu et al., 2004; Colozzi & Pollow, 1984; Spears et al., 1981). A few studies taught individuals with profound disabilities indoor navigation skills (Gruber et al., 1979; Lancioni et al., 2010) while the remaining studies taught adolescents and adult pedestrian skills or bus riding skills (e.g., street crossing, exiting the bus). Overall results indicated a majority of the interventions used to teach travel training to adolescents with IDD were effective. Results provide a minimal foundation for guiding unexplored areas related to travel training. In addition, only one study provided participants with general or strategy based instruction such as a series of picture prompts to use beyond classroom settings or specific environments (LaDuke & LaGrow, 1984). Based on suggested implications for practice, Vogelsburg and Rusch (1979) suggested travel training should include less verbal instruction and more opportunities for problem solving and independent decision making for students so they will decrease their reliance on others. Furthermore, Matson (1980) found pedestrian skill training for street crossing was more effective when it included components of independent training (i.e., self-evaluation of performance, social reinforcement, and sign recognition) over classroom training (i.e., shaping, social reinforcement, instructions from others, and physical, gestural, and verbal prompts).

As a result, travel training is an area with many additional areas for future research. Research should include multiple destinations (Kubat, 1973) or more novel locations with travel training using a general strategy approach (e.g., picture cues; LaDuke & LaGrow, 1984) rather than a specific prompting system or treatment package used in previous studies. In order to investigate travel training in the 21st century, future research needs to explore the effects of various technologies and self-prompting systems used to teach travel training independence for individuals with various disabilities. With many new advances with technology (i.e., video modeling, self-prompting using picture-based prompting, Global Positioning Systems) future research should investigate how new technologies can be used to teach travel training. None of the studies conducted from 1979 to 2004 used technology devices with travel training (e.g., pedestrian navigation skills).

Using Multimedia Instruction to Teach Independent Living Skills

Cronin (1996) defined independent living skills as “those skills or tasks that contribute to the successful, independent functioning of an individual in adulthood” (p. 54). These skills are typically grouped in five broad clusters: self-care and domestic living, recreation and leisure, communication and social skills, vocational skills, and other skills vital for community participation. Using technology, multimedia tools, interactive simulations, and computer-assisted instruction resources for teaching independent living skill acquisition can offer more cost-effective and time efficient methods of instruction to help students learn functional academics, vocational, and independent living skills (Langone, Clees, Rieber, & Matzko, 2003; Wissick, Gardner, & Langone, 1999). Multimedia instruction involves the "combination of several different types of media linked together by a computer and produced for viewing on the computer screen. The presentation media usually involved in multimedia are audio, text, videotape, print, and graphics" (Bender & Bender, 1996, p. 103). This often falls under the broader term of computer-assisted instruction.

Unlike travel training, there is an abundance of research on using technology such as video modeling, video prompting, and picture or auditory prompting to teach other independent living skills to individuals with IDD. For example, Mechling (2005) summarized empirical research from 1999-2003 based on instructor created video programs. Results from this review expanded previous literature reviews on video self-modeling (Dowrick, 1999; Hitchcock, Dowrick, & Prater, 2003). Findings included 24 studies related to video feedback, video modeling, video self-modeling, subjective point of view, interactive video instruction and prompting, and computer-based video instruction. Outcomes from the included studies indicated positive effects of instructor created video programs (e.g., visual stimuli) as effective ways to increase skill acquisition and independence for individuals with disabilities. Other literature reviews on video modeling or prompting relate specifically to students with autism (Ayres & Langone, 2005; Bellini & Akullian, 2007; Delano, 2007; McCoy & Hermansen, 2007) and students with emotional/behavioral disorders (Baker, Lang, & O'Reilly, 2009). To date, no literature reviews have been conducted for using multimedia instruction such as video modeling or prompting to specifically teach skills to individuals with IDD. Therefore, it is important to evaluate the effectiveness of multimedia instruction used with individuals with IDD to teach specific and complex independent living skills.

Many studies have used combinations of video modeling, video prompting, and/or picture prompting to teach complex skills. Video modeling and video prompting can be easily confused, but there are noticeable distinctions with these terms and should not be used interchangeably. First, video modeling involves (a) making a video of someone performing a targeted behavior or completing a designated task, (b) showing the individual the video from beginning to end for each training session, and (c) giving the individual the opportunity to perform the behavior or task in its entirety (Alberto et al., 2005; Cannella-Malone et al., 2006). Next, video prompting involves showing one step of a task video clip and then giving the person an opportunity to complete that step before moving on to the next step on the video (Cannella-Malone et al., 2006). Another form of multimedia instruction is picture prompts. This is simply the use of still photographs organized in a specific sequence (e.g., photo album) to serve as visual prompts (Alberto et al., 2005). Picture prompts are sometimes used in combination with auditory prompts. Auditory prompts are defined as "prerecorded antecedent cues to increase the probability of a desired behavioral outcome" (Post & Storey, 2002, p. 317). These types of prompts can help students to self-initiate, self-maintain, and self-monitor their own behaviors.

The rationale for using technology to teach independent living skills is to provide individuals with realistic simulations for learning containing stimuli similar to community environments since most technology is commonly paired with generalization measures or combined instruction in community settings (Westling & Fox, 2009). Prior research has shown students with disabilities had increased acquisition and generalization of independent living skills when technology was used in combination with natural environments (e.g., Bates, Cuvo, Miner, & Korbeck, 2001; Branham, Collins, Schuster, & Kleinert, 1999; Cihak, Alberto, Kessler, & Taber, 2004; Westling & Fox, 2009). Furthermore, research has also found mixed results on which multimedia instruction is more effective. It is difficult to compare video or picture prompting interventions when many are paired together. For example, some researchers have found picture prompting more effective than video modeling (Van Laarhoven, Van Laarhoven-Myers, & Zurita, 2007) while other researchers who have compared strategies such as picture and video prompting have found them to be equally effective and efficient for teaching complex skills to individuals with IDD (Cihak, Alberto, Taber-Doughty, & Gama, 2006; Taber-Doughty, 2004). In addition, there are a limited number of studies evaluating the use of video modeling/prompting or picture prompting beyond one-on-one instruction and have still found video prompting and picture prompting to be equally effective and efficient for teaching independent living skills with group instruction (Cihak et al., 2006). Additionally, Mechling and Gustafson (2009) found video prompting more effective than picture prompting. With many mixed treatment packages and findings, it is important to review research explicitly describing interventions used (e.g., video modeling, video prompting, or picture prompting) when teaching complex skills to students with IDD.

Several empirical studies have used multimedia instruction such as video modeling, video prompting, or picture prompting to teach specific independent living tasks including safety (Mechling, Gast, & Gustafson, 2009), daily living skills (Cannella-Malone et al., 2006), cooking (Graves, Collins, Schuster, & Kleinert, 2005; Mechling &

Gustafson, 2009; Mechling & Stephens, 2009; Sigafoos et al., 2005), and grocery shopping (Mechling, Gast, & Langone, 2002).

Using multimedia instruction to teach safety. With safety, Mechling, Gast, and Gustafson (2009) examined the effects of video modeling on teaching three students with moderate intellectual disabilities to extinguish cooking related fires. Using a multiple probe across behaviors design replicated across three students, results supported previous research that video modeling was effective for acquisition and generalization of difficult skills and can serve as a good "priming" tools with potentially frightening events and help increase predictability and performance accuracy in future events. In addition, video modeling has been used as a priming tool for potentially dangerous events requiring 100% accuracy (e.g., street crossing skills, exiting rooms in response to fire alarms; Branham et al., 1999; Tiong, Blampied, & Le Grice, 1992).

Using multimedia instruction to teach daily living. Studies such as setting the table and putting away groceries have been taught using video modeling and prompting. For example, Cannella-Malone et al. (2006) compared video prompting and modeling to teach six individuals with IDD two daily living tasks. A multiple probe across subjects design with alternating treatments was used to compare the effects of video based instruction on student acquisition of steps for setting the table and putting away groceries. The alternating treatments design indicated video prompting was more effective than video modeling to teach daily living skills. Once one method of instruction (video modeling, video prompting) indicated effectiveness, a final best fit phase was used to teach the task taught using the most effective method (video prompting). Results from this study were consistent with other studies indicating video prompting was more effective than video modeling (Graves et al., 2005; Sigafoos et al., 2007; Tiong et al., 1992) due to the briefness of each video clip requiring more minimal attentional and retentional cues compared to video modeling.

Using multimedia instruction to teach cooking. Several studies have used multimedia to teach cooking. First, Graves et al. (2005) examined effects of video prompting on teaching food preparation skills to three participants with moderate IDD ages 16 to 20. A multiple probe across behaviors design replicated across students was used to evaluate the effects of video prompting on three cooking tasks (i.e., making Ramen noodles on stovetop, macaroni in the microwave, and a sandwich on the counter). Results indicated using video prompting in combination with constant time delay procedures was effective for teaching food preparation skills.

Next, Sigafoos et al. (2005) examined effectiveness of video prompting on teaching microwave oven use with three adults with IDD ranging in age from 34 to 36. Participants used the microwave and followed a 10-step task analysis to prepare a bag of popcorn. A delayed multiple probe design was used to evaluate the effects of video prompting on independent task performance. Results indicated two of three participants reached mastery criterion using video prompting procedures. Although all three participants did not independently acquire the skills, based on other findings, video prompting may be an effective instructional strategy for teaching independent living skills to individuals with IDD.

Third, Mechling (2008b) conducted a review of literature on cooking paired with technology for teaching individuals with moderate to severe IDD. Between 1986 and 2006, 21 studies and two additional literature reviews related to cooking and technology

(Marchand-Martella, Smith, & Agran, 1992; Schuster, 1988) were identified. High tech devices are usually more expensive and involve computers, electronic equipment, and software while low tech devices are less expensive and manually operated. Technology in this review only included high tech interventions which used picture prompts (n=7), palmtop hand held computer systems (n=3), audio cassette players (n=5), and video based systems (n=7). Overall findings from this review indicated technology devices could be effective for teaching independent living skills such as cooking.

Next, Mechling and Gustafson (2009) compared the effects of picture and video prompts on acquisition of cooking tasks with six adults with moderate IDD. Cooking related tasks included opening a can of cinnamon rolls and grating cheese. An adapted alternating treatments design with baseline, follow-up, and final treatment condition, were used to compare picture prompting and video prompting on performance of independent cooking tasks. Findings indicated video prompting was more effective than picture prompting alone since video prompting provided additional features such as motion and sound.

Finally, Mechling and Stephens (2009) compared the effects of static picture prompting and video prompting on multi-step cooking tasks with four individuals with moderate IDD. Cooking tasks were derived from *Visual Recipes: A Cookbook for Non-Readers* and included making hot chocolate, ravioli, broccoli, chocolate pudding, tuna, and French fries. An adapted alternating treatments design with baseline, alternating treatments, and final treatment conditions was used to compare the effects of static picture prompts and video prompts on the performance of cooking tasks. Findings indicated although both methods were effective, video prompting was more effective than static picture prompts for independently completing multi-step cooking tasks with all four students.

Using multimedia instruction to teach grocery shopping. Mechling et al. (2002) evaluated the use of computer-based video instruction for teaching sight word reading of grocery store aisles and locating grocery items on shelves with four students with moderate disabilities ranging in age from 9 to 17 years old. They used a multiple probe across three sets of words and replication across participants design to evaluate computer-based video instruction and system of least prompts on percentage of steps completed correctly while reading words on grocery aisle signs to select appropriate grocery items. Results indicated a functional relationship between computer-based video instruction and prompting and reading aisle signs and locating grocery items with photographs and typed shopping lists with all four students. Follow-up data from parents indicated students increased responding within natural grocery store settings after receiving computer-based video instruction for all sets of words.

Summary of Multimedia Instruction to Teach Independent Living Skills Research

Based on this brief literature review of multimedia instruction used to teach independent living skills there are several similarities, limitations, and areas of future research. First, according to Mechling (2005) multimedia instruction offers a variety of ways to teach independent living skills and offers systematic, repetitive, and realistic representations of natural environments. Second, advances in technology have allowed easier creation of materials that can save teachers instructional preparation time. Third, future research is still needed to investigate multimedia instruction and its impact on skill acquisition in natural environments. Fourth, current hardware and software costs with multimedia technology continue to limit affordability and practicality for schools and classroom teachers (Mechling, 2005; Sigafoos et al., 2005). In addition, research questions remain about which multimedia instruction is most effective and efficient as a majority of studies found video prompting more effective than video modeling for teaching daily living skills (Canella-Malone et al., 2006; Graves et al., 2005; Sigafoos et al., 2005), while Mechling, Gast, and Gustafson (2009) found video modeling produced immediate skill acquisition, generalization, and maintenance for extinguishing cooking fires.

Many studies continue to use a combination of multimedia instruction such as verbal and visual cues making it harder to distinguish which is most responsible for the acquisition of skills taught (Sigafoos et al., 2005). Based on the cooking literature review by Mechling (2008b) there are many additional areas of research such as (a) generalization measures to see which multimedia instruction might work best when teaching other independent living skills, (b) more studies on handheld or portable systems to deliver multimedia instruction, and (c) social validation measures and student preferences of multimedia instruction. In addition, future research is still needed to explore the influence of multimedia instruction and handheld devices for other independent living skills such as self-management related to employment, personal care, managing a daily schedule, and transportation (Mechling & Stephens, 2009).

Multimedia Instruction Paired with Handheld or Portable Devices

Handheld devices for displaying visual cues may be more useful than computers since they are more transportable, easy to carry, relatively common and inexpensive, and also used by individuals without disabilities making them more socially acceptable (Van

Laarhoven, Johnson, Van Laarhoven-Myers, Grider, & Grider, 2009; Van Laarhoven et al., 2007). Personal support technologies such as personal digital assistants (PDAs) or other assistive technologies have been suggested as ways to increase productivity, independence, and quality of life for individuals with IDD (Braddock, Rizzolo, Thompson, & Bell, 2004; Post & Storey, 2002). One recent study provided individuals with IDD training on how to use an iPod® device. Hammond, Whatley, Ayres, and Gast (2010) examined the effectiveness of video modeling to teach independent iPod® navigation skills to individuals with moderate IDD. They provided instruction on three task analyses through video modeling to teach students how to navigate the iPod® to movies, music, and photos. Using a multiple probe across participants and behaviors design, findings suggested participants were able to learn how to navigate to movies, music, and photos on the iPod® device independently after receiving explicit instruction on how to use the iPod® device. The video iPod® is commonly referred to as the 5th generation iPod® classic created by Apple Inc. It is a portable electronic device that stores and plays audio and/or video files (e.g., digital photographs). The classic iPod® has a navigation wheel with play, stop, forward, and back as well as a menu button. An additional video iPod® version is the newer iPod® Touch. This does not have the navigation wheel, but has a touch screen to display pictures and uses a simple sweeping touch motion of one finger to move pictures forward and backward. This iPod® measured 2.5 in x 4.5 in. with a 3.5 in diagonal screen. The screen for image display dimensions was approximately 2 in x 3 in. This newer iPod® also has a built in camera feature. PDAs or other handheld devices (e.g., video iPods®) have also been used to teach a variety of different skills related to vocational tasks (Cihak, Kessler, & Alberto, 2007; Cihak, Kessler, & Alberto, 2008; Riffel et al., 2005; Van Laarhoven et al., 2009; Van Laarhoven et al., 2007), improving transitional behaviors (Cihak, Fahrenkrog, Ayres, & Smith, 2010), and teaching cooking skills (Mechling, Gast, & Fields, 2008; Mechling, Gast, & Seid, 2009).

Using handheld or portable devices to teach vocational skills. First, Riffel et al. (2005) investigated the effects of the *Visual Assistant* computer program displayed on a handheld device (i.e., step by step picture prompting system paired with auditory instructions) on productivity and task completion with four high school students with mild to moderate intellectual disabilities. A multiple probe across participants design was used to evaluate the effects of the *Visual Assistant* computer program on: (a) total number of prompts required for task completion, (b) number of support statements provided to the student to complete a task, and (c) time required to complete the task. Results indicated three out of four students increased independence with tasks using the *Visual Assistant* and reduced total number of support statements and prompting needed to complete tasks. There was no difference between the length of time needed to complete tasks between the students using the *Visual Assistant* program and those who did not.

Next, Cihak et al. (2007) examined the effects of using handheld computer prompting systems on student task performance and generalization of skills to complete complex vocational tasks with four adolescents with moderate IDD. Tasks completed included gathering carts, stocking milk, vacuuming, making sub-rolls, self-prepping, preparing broccoli, skewering shrimp, preparing tea, straightening mushrooms, stocking bananas and pineapples, and cleaning a fitting room. A multiple probe across tasks design was used to evaluate the efficacy of the handheld prompting device on student task performance. Results indicated increased independent performance across tasks when using the handheld prompting system. Data also indicated all four skills were maintained at 100% independence nine weeks after intervention ended.

Next, Van Laarhoven et al. (2007) evaluated the use of a pocket PC to teach vocational tasks to two youth with IDD in competitive work settings. Vocational tasks at a restaurant included rolling silverware, sorting and sanitizing silverware, clocking in and out, portioning recipes, and sanitizing work spaces. Each task analysis was recorded using self-modeling and displayed through a Pocket PC. A multiple probe across tasks design was used to evaluate the effects of the video-based instruction on percentage of prompts required across participants. Findings indicated video-based instruction reduced prompting required and increased task completion and independence. Participants were able to meet mastery criterion with all three tasks after the handheld device was introduced.

Next, Cihak et al. (2008) examined effects of using a handheld computer prompting system on independent performance of vocational tasks with four high school students with moderate to severe disabilities. They used a handheld computer containing pictures and auditory prompts to measure independent transitions between vocational tasks. A multiple probe across participants design was used to evaluate transition between tasks at a vocational site. Results indicated a functional relationship between the use of the handheld computer prompting system and decreased times with vocational tasks across all four participants. Data indicated participants were able to maintain vocational tasks taught after a nine week period.

Finally, Van Laarhoven et al. (2009) evaluated the effects of a video iPod® prompting device on teaching three work related tasks (i.e., cleaning bathrooms, mopping floors and emptying garbage, and cleaning kennels) with a 17-year old with moderate IDD. A multiple probe across tasks design was used to evaluate independent responding and percent of error correction prompts needed with and without technology. Results indicated a functional relationship between video iPod® prompting and completion of three work tasks. The number of prompts required to complete the tasks decreased across instructional sessions when the video iPod® was used.

Using handheld or portable devices to teach transitional behaviors. One study was found for improving transitional behaviors. Cihak, Fahrenkrog, et al. (2010) evaluated the use of video modeling delivered through a video iPod® on transitions between locations and activities with four elementary students with autism. An ABAB withdrawal design was used to determine the effects of video modeling procedures displayed on the video iPod® on independent student transition behaviors. Results indicated a functional relationship between using the video iPod® and independent transition behaviors. Transition behaviors were also maintained for nine weeks.

Using handheld or portable devices to teach cooking. Two studies were found for cooking. First, Mechling, Gast, and Fields (2008) evaluated the effects of video prompting with a portable DVD player on completing multi-step cooking tasks with three students with moderate intellectual disabilities ranging in age from 19 to 22. A multiple probe across behaviors and participants design was used to evaluate the percentage of steps completed for three food preparation tasks (i.e., making grilled cheese sandwich, ham salad, Hamburger Helper microwave singles). Results indicated increased percentages in correct responses from students in completing cooking task analysis steps with support of a DVD player video prompting device.

Second, Mechling, Gast, and Seid (2009) evaluated the use of a self-prompting cooking steps displayed through a personal data assistant (PDA) on completion of cooking recipes with three high school students diagnosed with autism. Cooking tasks were replicated based on cooking tasks in Mechling, Gast, and Fields (2008) including making a grilled ham and cheese sandwich, using the microwave to make Hamburger Helper singles, and using a toaster oven to make individual sized pizzas. A multiple probe across three sets of cooking recipes replicated across students design was used to evaluate the use of the PDA as a self-prompting device (i.e., contained video, audio, and picture prompting). Results indicated the PDA containing video, picture, and auditory prompts were effective self-prompting device for students with autism performing complex tasks.

Summary of Multimedia Instruction Paired with Handheld or Portable Devices

There are similarities to note among all the studies included. First, a majority of the studies found participants successfully maintained skills for up to nine weeks after interventions had ended (Cihak et al., 2007; 2008; 2010). Second, studies measuring the number of prompts indicated decreased amounts of prompting when technology was introduced and increased productivity (Mechling, Gast, & Fields, 2008; Riffel et al., 2005; Van Laarhoven et al., 2007; Van Laarhoven et al., 2009). Third, findings demonstrated a wide range of skills and complex behaviors that can be taught using technology displayed through handheld devices. Finally, when using multimedia instruction paired with handheld devices research indicates it is important to consider the task to be completed and remember that visual cues (e.g., video or pictures) can serve as more permanent cues unlike auditory cues that are typically too brief and momentary (Mechling, Gast, & Fields, 2008). Based on the literature reviewed, results indicated handheld devices seem to be more feasible, more socially acceptable, and more practical for teaching varied independent living skills. In addition, handheld devices were successfully used with various disability groups and age groups represented under the IDD umbrella (e.g., mild, moderate, severe IDD, autism; Mechling, Gast, & Seid, 2009).

In looking specifically at independent living skills paired with video iPods®, it is important to note: (a) participants with moderate IDD were able to successfully navigate iPod® device features when explicitly taught how to operate the device (Hammond et al., 2010); (b) iPods® served as a self-prompting device to increase independence and decrease time needed for skill acquisition (Van Laarhoven et al., 2009); (c) iPods® provided students with features of video, audio, and picture prompts all at once and were faded over time (Van Laarhoven et al., 2009); and (d) iPods® were motivating for students and used in several environments without causing disruptions to others in the environment (Cihak et al., 2010).

Using Multimedia and Handheld Devices to Teach Travel Training

Based on promising results from using technology to teach complex independent living skills, it is worthwhile to see if handheld technology devices such as iPods® can be used to teach travel training (i.e., pedestrian navigation skills). During the past decade, society has begun to rely heavily on technology for navigating around unfamiliar places. However, navigation devices such as global positioning systems (GPS) have typically been too complex for individuals with IDD to use and not as practical to use on a college campus due to limited address availability. Only one study previously mentioned above (Coon et al., 1981) used technology such as picture slides to teach bus riding skills to students with IDD. To date, only three recent studies have taught travel training using technology (Fickas, Sohlberg, & Hung, 2008; Mechling & O'Brien, 2010; Mechling & Seid, 2011).

First, Mechling and O'Brien (2010) investigated the effects of computer-based video instruction (CBVI) simulating public bus riding scenarios paired with constant time delay on bus transportation skills (i.e., requesting stop signal at specific landmarks). Participants included three students, ages 19 to 20, with mild to moderate intellectual disabilities. Using a multiple probe across participants design and one bus route, results indicated CBVI was effective and efficient for teaching two of three students to locate landmarks, request stops. Students were able to generalize these skills with 100% accuracy to all in-vivo (natural environments) sessions, as well as maintain the request for stop behaviors for at least 52 days.

Second, Fickas et al. (2008) used a wristwatch iPAQ and iPod® style device with audio or text prompts, aerial, or point of view images to teach pedestrian navigation routes to 20 adults with traumatic brain injuries. A within subjects design was used to compare navigation performance using the four prompting modes on four routes. ANOVA and pairwise comparisons revealed statistically significant differences between four prompting modes with high scores when participants were guided by audio prompting over point of view image and aerial image prompting.

Finally, Mechling and Seid (2011) examined the effects of using a personal digital assistant (PDA) paired with a self-prompting system on pedestrian navigation skills to destinations located on a college campus. Destinations included campus cafeteria and food courts, a game and entertainment center, and a copy/print center. Participants included three females with moderate disabilities ages 20 to 21. Using a multiple probe design across destinations replicated across participants, results demonstrated a functional relationship between the use of the PDA with prompting and percentage of landmarks and destinations located by the students. Additionally, students were able to successfully navigate to these destinations after the PDA was removed. Despite these results, several limitations were noted. First, students were not able to travel independently without an adult present or take short cuts on routes that became more familiar over time. Second, preselected landmarks changed during the study beyond the control of the experimenter (e.g., bike rack removed). As a result, future studies need to frequently monitor to be sure landmarks have not changed.

Additional limitations are also noteworthy. First, the study did not provide instruction on how to get back to starting locations to improve functionality of learning the skill. Future studies need to teach pedestrian navigation skills both to and from destinations for greater independence. Second, this study did not address "independent" pedestrian navigation skills since the researcher was always close by to assist. Future studies need to evaluate participants from a greater distance to see if they can truly navigate independently without the researcher close by. Third, Mechling and Seid (2011) used an adult model in the video to help with self-prompting. Future studies need to closely match typical navigation devices by providing the visual and auditory prompts similar to global positioning systems rather than videos. This will help improve functionality, safety, and accuracy of walking rather than having to simultaneously watch a video of where to go or having to pause frequently. Finally, as indicated by classroom teachers the device used (i.e., Cyrano Communicator, PDA) was not cost effective for purchase ($1,300). Future studies need to explore economical and universally accessible devices for teaching pedestrian navigation skills.

Summary of Multimedia and Handheld Devices to Teach Travel Training

With only three studies using multimedia to teach travel training (i.e., pedestrian navigation and bus riding skills), there are similarities, limitations, and many areas of future research left to explore. First, research indicates landmarks can be used successfully to teach students when to request stop while riding a bus during classroom based instruction (Mechling & O'Brien, 2010). Second, financial savings for school systems and decreased instructional time were noted when multimedia instruction was used before training occurred in the community (Mechling & O'Brien, 2010). Third, according to Mechling and Seid (2011) future research on pedestrian navigation skills should (a) evaluate features of video and pictures to determine which type of prompting is needed, (b) evaluate if prompting can be simplified to decrease preparation time for teachers and researchers such as using still pictures rather than video, and (c) evaluate student abilities when only pictures of landmarks are used without additional auditory prompts serving as a more realistic representation of actual environments and less dependency on others.

Summary of Literature Review

Research indicates individuals with IDD continue to have poor post-school outcomes and need more explicit instruction to enhance participation in postsecondary education, competitive employment, and independent living (NLTS2, 2007; Wagner, Newman, Cameto, Levine, & Garza, 2006). Lack of transportation or travel training skills is one factor that can inhibit independence, productivity, and inclusion in society for these individuals (Myers, 1996). To prepare students with IDD to travel independently, explicit instruction is needed. Based on this review, various technologies such as video modeling, video prompting, and picture prompting have been demonstrated to be effective interventions for teaching independent living life skills (safety, daily living, and employment) to individuals with IDD. Furthermore, handheld devices with prompting systems also appear to be effective for promoting independent responses for longer periods of time from individuals with IDD.

However, research on using multimedia instruction to teach travel training is limited to only three studies. As a result, additional research is needed to teach individuals with IDD pedestrian navigation skills needed to be successful and productive adults in society. To date, Mechling and Seid (2011) is the only study that has taught pedestrian navigation skills on a college campus. With many students with IDD being admitted to inclusive postsecondary programs and needing to learn how to navigate to various campus locations independently, this study will help contribute to the limited research. As individuals with IDD are being included in more postsecondary opportunities, they will need to be equipped with a more universal strategy to travel more independently. Having appropriate navigation skills in one's community can allow greater self-determination, increased independence, and improved quality of life for individuals with IDD.

Therefore, the purpose of this study was to investigate the effects of pedestrian navigation training using picture prompts displayed through a video iPod® on travel route completion with young adults with IDD (18-26 years old) participating in an inclusive individualized postsecondary program at a 4-year university.

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CHAPTER 3: METHOD

The purpose of this study was to investigate the effects of pedestrian navigation training using a video iPod® on travel route completion with young adults with intellectual and developmental disabilities (IDD; 18-26 years old) participating in an individualized inclusive postsecondary program. The study focused on teaching pedestrian navigation skills using a video iPod® displaying picture prompts with landmarks and directional arrows to navigate to and from various campus locations. A multiple probe across participants design was used to determine if young adults with IDD could travel independently to and from multiple destinations using the video iPod® as a result of the intervention. Social validity, maintenance, and generalization measures were also collected.

Institutional Review Board

Prior to data collection, approval was obtained from the Institutional Review Board (IRB) for research with human subjects through the University of North Carolina at Charlotte and the university where the study was conducted. Before beginning the study, the researcher explained and obtained necessary student consents (if participants are over age 18 and had been declared their own guardian) or parent consents and student assents if participants had not been declared their own guardians. Only participants with signed consents and/or assents are included in this study.

Participants

Participants for this study included four young adults with IDD between the ages of 18 and 26 attending a postsecondary inclusive program designed for individuals who had completed a high school Certificate of Attendance or did not receive a regular high school diploma. Each participant qualifying for this postsecondary program had access to full participation in college opportunities and all participants were completing specific requirements for a University Participant (UP) Certificate of Accomplishment. This certificate required participants to live on campus, attend college activities, audit courses, complete internships, and navigate successfully to and from campus locations. Participants in this study had an Individualized Plan for College Participation including goals related to navigation and met the following inclusion criteria: (a) were between the ages of 18 and 26; (b) were a qualified UP program participant; (c) provided student consent if age 18 or older and declared their own guardian or parental consent and student assent if they are not their own guardian; (d) had a documented IDD (e.g., cerebral palsy, autism, Down syndrome); (e) had visual acuity to see pictures of campus landmarks displayed on a video iPod® screen and actual landmarks from a distance; (f) were ambulatory and able to walk up and down steps; (g) could independently cross streets using designated crosswalks with minimal supervision.

Eden. Eden was a 22-year-old, Caucasian female, with a mild intellectual disability completing her first year in the inclusive postsecondary program. Eden had previously attended a compensatory education program at a local community college prior to being accepted into the University Participant program. She was not used to navigating to various college campus locations since her compensatory education setting was housed in only one building. Eden struggled with reading decoding (limiting her ability to read building signs), but had developed sufficient listening comprehension strategies. At the time of the study, Eden had adjusted well to the inclusive setting with supports, but was still nervous when navigating independently to various campus locations fearing she would get lost.

Logan. Logan was a 21-year-old, Caucasian male, with cerebral palsy and a moderate intellectual disability completing his first year in the inclusive postsecondary program. Logan had previously attended a basic education program at a local community college prior to being accepted into the University Participant program. He was not used to navigating to various campus locations since his basic education program was also housed in one building. Logan struggled with reading decoding (limiting his ability to read building signs), but had developed sufficient listening comprehension and survival skills. At the time of the study, Logan had adjusted well to the inclusive setting with supports, but remained anxious when navigating independently to various campus locations fearing he would get lost.

Adam. Adam was a 26-year-old, Caucasian male, with cerebral palsy and a mild intellectual disability completing his first year in the inclusive postsecondary program. Adam had not previously attended a college-based program, but worked at a sheltered workshop in the community prior to being accepted into the University Participant program. He was not used to navigating to various locations since his workplace was housed in one building. Adam had sufficient reading decoding skills to read building signs, but got lost easily due to memory and attention problems. At the time of the study, Adam had adjusted well to the inclusive setting with supports, but still had a fear of getting lost on campus. He had expressed a great desire to learn how to navigate campus independently.

Grace. Grace was a 20-year-old, Caucasian female, with Down syndrome and a moderate intellectual disability completing her first year in the inclusive postsecondary program. Grace had recently completed high school and had not attended any additional college or work place programs prior to being accepted into the University Participant program. She was not used to navigating to various locations since she was in a self-contained classroom at a small rural high school. Grace had good reading decoding skills to read building signs, but got lost easily due to memory and attention problems. At the time of the study, Grace was somewhat adjusted to the inclusive setting with supports, but still needed guidance when navigating. Grace had verbally expressed a desire to navigate campus independently, but had always navigated campus with supports prior to this study.

Setting

All training, probe, and intervention sessions were conducted at various locations on a public, accredited university campus located in a rural community in southeastern United States. The campus is located in the Blue Ridge Mountains on approximately 600 acres and included 13 residence halls, 14 classroom buildings, seven performing arts buildings, 12 recreational buildings and fields, three dining and food courts, and 10 administrative support buildings. Additional campus locations included student centers, community convenience and retail stores, commercial restaurants, banks, and religious organizations. At the time of the study, the college had more than 10,000 students including 10.5% minority (i.e., 5.5% African Americans, 1.1% American Indian, 0.9%

Asian, 1.5% Hispanic, 1.5% International). Out of this enrollment, 256 students (2.4%) had reported and requested accommodations through the Office of Disability Services. The study was conducted in the spring 2011 semester.

Researcher

The researcher for the study was a part-time student working towards a doctoral degree in special education. She had 3 years of public school teaching experience and 4 years working in higher education settings, with 2 years as coordinator of a postsecondary program for young adults with IDD. The researcher received her bachelor's degree and master's degree in special education. The researcher served as the coordinator of a postsecondary program for students with IDD and as the primary trainer and data collector. She was also responsible for (a) training a second observer to collect interrater reliability data, (b) gaining IRB approval, (c) coordinating agreements with the university to conduct the study, (d) developing training and intervention materials, and (e) maintaining ongoing communication and planning with her dissertation committee.

Additional Observers

A graduate student attending the university pursuing a degree in school counseling and working as a graduate assistant for the University Participant program served as a second observer to establish interrater reliability for each of the dependent variables across phases and participants. She also collected procedural reliability data by observing the researcher implementing the intervention across all three routes in baseline, training, intervention, generalization (with confederates), and maintenance. The second observer had completed the Collaborative Institutional Training Initiative modules for the Institutional Review Board prior to collecting data. Three additional observers (i.e., one undergraduate student in special education and two undergraduates in communication sciences disorders) were also trained to collect generalization and procedural fidelity data (after each route was traveled successfully with the researcher) using the same data sheets as the researcher and second observer.

Materials

Teaching materials included digital photographs of landmarks for navigating all predetermined routes (see Appendix A for a sample route). Photographs from the routes contained inserted arrows (using Smart Art) as needed placed within the picture to show directional turns. Pictures were taken using a Canon PowerShot A490 10.0 Mega Pixel digital camera ($90 with memory card) and downloaded into a MacBook Pro laptop using Canon PowerShot A490 software. Next, pictures of landmarks were sequenced based on the predetermined route into Microsoft PowerPoint© slides and blue Smart Art arrows were added into each picture with relevant turns. Finally, once pictured routes were sequenced and arrows were added, they were exported or synched onto two video iPods®. One iPod® was a fifth generation video iPod® classic device measuring 4 in x 2.5 in. The screen for image display was 2 in. x 1.5 in. The video iPod® also contained a circular wheel with buttons including forward, backward, play, pause, and menu options under the video screen. The iPod® will be carried in a protective leather case. The second iPod® was a newer version called the iPod® Touch (4^{th} generation). This iPod® measured 2.5 in x 4.5 in. with a 3.5 in diagonal screen. The screen for image display dimensions was approximately 2 in x 3 in. Before each use, the chosen device used by each participant was charged through an electrical outlet or computer cord, since neither use internal batteries. For direct observations, materials included copies of data sheets, a stopwatch for measuring total times, procedural fidelity checklists, interrater reliability forms, a clipboard, and a pencil for data recording.

Data Collection

Dependent variables. Data were collected on three dependent variables in the study. The first dependent variable was the correct and independent travel of a route to and from specified locations. A correct response was defined as (a) successfully navigating to and from a specified location by the participant, (b) with no prompting delivered by the researcher within the environment, (c) using the pictures displayed on the video iPod® to arrive and return to the destination, and (d) within a predetermined time limit. An incorrect response was recorded if the participant (a) indicated a need for assistance from the researcher during any part of the route, or (b) if student navigated off the designated path for more than 30 seconds and had to be redirected by the researcher. Once an incorrect response occurred and was recorded on data sheets, the researcher continued to redirect students using the iPod® and necessary prompting along the route until destination was reached. Route travel was measured using the following scale: 0= mid or end point route not reached independently or within predetermined time limit; 1= either mid or end point reached independently and within time limit; 2= both mid and end points reached independently and within predetermined time limit. If the participant made it to the final destination and back to starting location without matching all pictured landmarks this was also considered a correct response (2=both mid and end points reached independently and within predetermined time limit) since the student was able to achieve the overall outcome of navigating to and from specified location without assistance from the iPod® or researcher (see Appendix B for data sheet).

A second dependent variable was the percentage of correct pictured landmarks reached for each route. A correct response was defined as successfully navigating to and from each landmark using the pictures displayed on the iPod® with no assistance from the researcher during route completion. An incorrect response was recorded if participants requested assistance from the researcher for any landmarks or if they navigated off designated path for more than 30 seconds needing to be redirected. Once an incorrect response occurred at a specific landmark and was recorded on datasheets the researcher continued to redirect students using the iPod® and necessary prompting (only when requested) until route completion. The remaining pictured landmarks to point A were scored as 0 when the first landmark on the route was missed or prompting had to be given to the participant navigating off route for more than 30 seconds. Once Point A was reached, pictured landmarks from Point B back to A were also collected until a landmark was missed. Percentage of landmarks measured for the entire route used the following scale: 0= pictured landmark not reached independently; 2= pictured landmark reached independently.

A third dependent variable was the length of time it took participants to complete the entire travel route (i.e., from point A to point B and back to point A). Time measures began when the participant took the first step from relevant starting location and ended when participant had navigated from the predetermined destination and back to starting location (e.g., return to dorm or building doors), within 3 feet of the ending point (i.e., point A). This was measured using a stopwatch based on total cumulative time needed to complete the route from point A to point B and point B back to point A recorded in minutes and seconds.

Prior to beginning the intervention routes, time limits were collected from three college students (i.e., two females, one male) walking at a comfortable and leisurely pace to all predetermined routes including the novel generalization route to provide a range of time necessary for navigating routes and setting socially valid time limits for navigating both to and from destinations. Routes were navigated with and without the use of the video iPod®. This information helped to validate social importance of behavior change (Schwartz & Baer, 1991) from immediate community members to gain a normative sample or range of time needed for navigating routes to and from destinations to compare to participants' performance.

Additionally, setting/situation generalization data (Cooper, Heron, & Heward, 2007) were collected on participants' ability to navigate using the iPod® to reach novel destinations without the researcher accompanying the participant. Setting/situation generalization is defined as "the extent to which a learner emits the target behavior in a setting or stimulus situation that is different from the instructional setting" (Cooper et al., 2007, p. 617). An additional observed participants from a distance to see if they could successfully and independently use the video iPod® for navigating routes. Generalization occurred when the participants used only the iPod® device to support navigation to and from a novel route and was able to reach routes within acceptable time limits. Generalization measures were collected and distinctly represented with the dependent variables once participants demonstrated mastery with each trained route with the researcher and in the predetermined time period. Data collection from the confederates followed the same measurements and procedures as the researcher.

Interrater reliability. Interrater reliability is the extent to which two observers report the same results when measuring the same event (Cooper et al., 2007). Interrater reliability data were collected on 30.1% of all dependent variables by a second observer using the same type of scoring sheet used by the researcher. The second observer collected data on independent travel routes to and from specified locations (i.e., correct or incorrect) and percentage of landmarks based on points obtained from the performance scale (i.e., 0-2 points). An agreement was recorded when both observers identically scored the outcome as correct or incorrect (i.e., 0 to 2). A disagreement was recorded if outcomes of cumulative or intermediate landmarks were not scored the same. The percentage of agreement for correct independent travel routes and percentage of landmarks were calculated by dividing the number of agreements by the number of agreements plus disagreements multiplied by 100. The second observer also collected the duration of time to and from specified routes simultaneously. For this dependent variable, interrater reliability was calculated using the total duration IOA formula by dividing the shorter of the two durations reported by observers by the longer duration and multiplying by 100 (Cooper et al., 2007).

Social Validity

Social validity data were collected from participants (i.e., direct consumers; Schwartz & Baer, 1991) at the end of the study to evaluate social acceptance of procedures (Wolf, 1978). Participant perceptions were collected by one of the second observers through a questionnaire to determine the level of participant satisfaction with using iPods® with picture prompts to support navigation skills. The questionnaire included a 4-point Likert scale (i.e., 1= strongly disagree; 2 = disagree, 3 = agree, 4 = strongly agree) and was read aloud to the participants at the conclusion of the study. This questionnaire required less than 5 minutes to complete (see Appendix C). Also after the intervention phase ended, the researcher taught five undergraduate special education majors and minors (i.e., immediate and extended community members) how to develop travel training routes and navigation of the video iPod® (see Appendix D for "how to" training session materials). At the end of this training session, a 4-point Likert scale questionnaire (i.e., 1= strongly disagree; 2 = disagree, 3 = agree, 4 = strongly agree) was distributed to evaluate the social acceptance of procedures and goals of using the iPod® to teach pedestrian navigation skills (see Appendix E).

Design

The experimental design was a multiple probe across participants design (Horner & Baer, 1978) to evaluate the effects of picture prompts displayed through a video iPod® on pedestrian navigation skills across multiple routes. In a multiple probe design, each probe determines if a behavior change has occurred prior to starting the intervention. This design allows for evaluation of the change in the initial level of performance and what happens when the intervention is applied. The multiple probe design was appropriate for evaluating instruction on skill sequences in this study because participants were not as likely to improve their performance on later steps. Unlike the multiple baseline design, this design also avoided collecting repetitive baseline data when a change in behavior or skills was highly unlikely without implementation of the intervention.

Procedures

Baseline. A minimum of three data probes was collected until baseline data were stable to determine student level of performance prior to training and intervention. The three predetermined routes used in baseline were randomly assigned among participants.

During baseline, participants were given a campus map and asked to walk to point A, point B, and back to point A. This type of support is typical for college students on a university campus. The researcher pointed to A on the map and said, “This is where you are now.” After the student demonstrated eye gaze toward that point on the campus map, the researcher pointed to destination B and said, “This is where you need to go. Use this map to help you get there.” If the participant indicated they did not know how to get to the location or wandered farther from the targeted route for more than 15 minutes, the researcher recorded the route as incorrect. A new trial began the next day and was then recorded as correct or incorrect. If the participant began walking the researcher recorded the correct and independent travel of a route including landmarks and mid and end points to and from specified locations (0= mid or end point route not reached independently or within predetermined time limit; 1= either mid or end point reached independently and within time limit; 2= both mid and end points reached independently and within predetermined time limit). Each route was counted as two separate routes during data collection (i.e., Point A to Point B; Point B to Point A). The total time was recorded and compared to the range of time noted from social comparison data collected from three college students. During baseline, the researcher only observed participants and did not provide any additional supports or prompts beyond the campus map. The participant with the lowest stable baseline entered training and intervention first. Since all participants scored incorrect on all baseline routes, a participant was selected at random.

Video iPod® training. Participants were provided with an initial training on how to use the video iPod®. Training showed participants relevant buttons on the device to simulate navigation to a practice destination. For example, participants were taught how to look at the displayed picture while using navigation buttons on the iPod® (i.e., forward, backward buttons). Participants were taught the purpose and use of the forward and backward buttons on the video iPod® to self-correct when they needed to use the buttons to travel forward and travel backward to the pictured landmarks. The researcher explicitly taught participants how to move through and read the displayed pictures using a training script. The researcher used the training script with the student while viewing the pictured landmarks and hitting the appropriate video iPod® buttons. The practice route included pictures of up to two landmarks to destination and two landmarks back to the starting point. Training concluded when participants were able to demonstrate skills in using the device features independently (i.e., forward, backward, black screen) during the guided practice part of the training phase (see Appendix F). Skills were assessed after the guided practice had ended to see if participants could independently use buttons to navigate through the practice route displayed on the iPod® by talking through each of the navigation buttons. Training was explicit and brief following the training script for all four participants (i.e., one time training for less than 10 minutes with each participant). When participants were able to recall and point to device buttons independently they entered the intervention phase with a new route and training ended.

Video iPod® intervention. During intervention, participants were given the video iPod® and the researcher said, “Use the pictures on the iPod® to help you get to XX and then back to here.” All routes began outside a relevant campus building (e.g., dorm, student center, dining hall, academic building). Once the first participant demonstrated 100% independence to and from a destination in a socially accepted time period on the first route trained, the researcher asked an additional observer who had been trained by the researcher to collect data on the participant navigating independently without researcher presence. Next, another baseline probe was administered to the remaining participants and intervention began with the next participant with the highest amount of time needed to reach predetermined routes. This pattern continued until all participants had entered and completed intervention with all three routes.

Prompting. The researcher followed the participant and was available to prompt them to Points A and B only if they requested assistance. If the participant was stuck, the researcher waited 30 seconds and then delivered generic questions such as, “So, since you cannot find the landmark that matches the picture, what should you do?” or “Since you reached the pictured landmark, what do you do next?” After prompting with a question if the participant did not respond with a correct answer (e.g., go back to the previous landmark, hit backward button on iPod®) the researcher modeled how to use the backward button on the iPod® and locate the previous landmark where the error occurred. If participants could not locate landmarks independently with picture prompts on the iPod®, the researcher verbally prompted participants after 30 seconds of unsuccessful travel while walking and modeling how to use the iPod® to go back to where the error occurred. Once participant and researcher were back to previous landmark and back on track with the pictured sequence, the researcher allowed participants to continue navigating routes and requesting assistance when needed until the route was completed.

Additional corrections. Other anticipated errors addressed while in route included missed landmarks, interruptions by someone, device malfunction, and route/landmark changes. The only one addressed with participants in this study was the missed landmarks.

Missed landmarks. The researcher cued the participant to hit the backward button and delivered a verbal prompt to the participant about missing the landmark. The researcher pointed out items within the picture prompt displayed on the video iPod® that were similar to the existing landmark nearby. Once the participant understood the current location, the researcher stepped back and allowed the participant to use the iPod® to continue the route.

Interruptions. If there was an interruption, the researcher allowed the participant to talk to someone while stopping the stopwatch for up to 30 seconds and then restarted the stopwatch once the participant ended the conversation and began walking again. The researcher noted interruptions on the data sheet and allowed the participant to continue the route to see if he or she could still meet the predetermined time limit.

Device malfunction. If there was a device malfunction, the researcher took the device from the participant and fixed the device immediately (if possible) and gave it back to the participant. If the device was not easily or quickly repaired, the route ended for the day and continued when the iPod® had been fixed or replaced. Device malfunctions were also noted on data collection sheets if the route had to end.

Route or landmarks changes. For route or landmark changes due to possible construction detours or weather related issues, it was planned that the route would be stopped until pictures could be revised to reflect necessary changes. If this occurred, these changes were documented by the researcher and described in the discussion chapter.

During intervention, measures of time were also taken to monitor total times needed to reach and navigate back to starting locations. Once the student was able to navigate without any assistance from the researcher and reach the destination using the iPod® within the predetermined time limits, a generalization measure was collected for that route with the help of a second observer. When this occurred, the participant met the researcher at the starting point to get the iPod® and then the second observer followed the participant to collect data. The confederate was instructed to call the researcher to meet with the participant if they got lost for more than 2 minutes. Once the participant had demonstrated independence with one route independently, all participants were probed and the next participant entered intervention with the first route. Mastery criteria were based on successful completion of the trained route navigated independently and successfully within a predetermined time limit. The second participant then used the iPod® to reach a second designated route. This pattern continued until all participants had independently demonstrated mastery using the iPod® across campus destinations and within predetermined time limits. The intervention sessions lasted for approximately 15 to 30 minutes, four to five times per week.

Maintenance and Generalization. Maintenance and generalization data were collected to determine the extent to which participants continued to perform targeted behaviors after the intervention had been terminated (i.e., training; Cooper et al., 2007) and to see if the learning strategies taught (i.e., iPod® support) could be generalized to novel untrained routes. In this study, it was more important to see if the generalized strategy of using picture prompts displayed on an iPod® could be maintained and generalized to novel untrained routes rather than focusing on specific routes being navigated. For example, it was important to see if participants could generalize use of the video iPod® device from novel and untrained routes with different starting locations and without the researcher present. Therefore, once participants demonstrated mastery during the intervention phase across three trained routes without the help of the researcher, generalization data were also collected across a selected unknown route in a remote location of the campus. Maintenance data were also collected on one of the three previously trained routes randomly selected across participants between 16 to 28 days after instruction on the route had been completed.

Procedural fidelity. Procedural fidelity (also known as treatment integrity) evaluates the extent that intervention procedures are implemented as intended (Cooper et al., 2007). A procedural fidelity checklist was used for video iPod® training along with the training script, during intervention measures across all campus destinations, and with the second and additional observers (see Appendices G-I). Procedural fidelity data were collected for 55% of the sessions distributed across participants by the researcher, second observer, and additional observers (i.e., training, intervention, generalization). Fidelity was calculated as the number of steps followed correctly divided by the total number of required steps, and multiplied by 100.

CHAPTER 4: RESULTS

This chapter presents findings of the study. Interrater reliability and procedural fidelity measures are presented first, followed by results for each research question.

Interrater Reliability

A second observer collected interrater reliability data on 30.1% of the data collected on the two dependent variables of independent travel routes to and from specified locations completed and percentage of landmarks (i.e., correct or incorrect). Overall interrater reliability was 100% for each of these dependent variables during baseline, intervention, maintenance, and generalization measures.

The same observer also collected interrater reliability data on 30.1% of the data collected on the third dependent variable (i.e., duration of time to complete entire route). Interrater reliability on time was calculated using total duration IOA. Overall interrater reliability ranged from 91.3% to 100% with a mean of 98.6%. Time was not calculated during baseline measures since the total time walking was the only time measure collected (i.e., total of up to 15 minutes per route) even if off pictured route and since no participant was able to get to the first pictured landmark in baseline and/or headed in the opposite direction. During intervention, interrater reliability ranged from 91.3% to 100% with a mean of 96.7%. During maintenance, interrater reliability ranged from 94.2% to

100% with a mean of 98%. During generalization, interrater reliability ranged from 96.8% to 100% with a mean of 99.2%.

Procedural Fidelity

Procedural fidelity was collected on 55% of the sessions distributed across participants, routes, and study phases by the researcher, second observer, and additional observers. Procedural fidelity was 100% across all sessions and phases.

Dependent Variables

Research Question 1: What is the effect of pedestrian navigation training using a video iPod® (i.e., picture prompts of a series of intermediate on-route and final locations) on travel route completion to and from specified locations for young adults (age 18-26) with IDD?

Research Question 2: To what extent do young adults (age 18-26) maintain independent use of the video iPod® for pedestrian navigation skills?

Research Question 3: To what extent do young adults (age 18-26) with IDD generalize use of the video iPod® to untrained locations?

Figure 1 presents the number of correct routes traveled (to and from destinations) across four participants and Figure 2 presents the percentage of correct landmarks to and from destinations across four participants. All four participants were trained on, and learned, three routes during intervention. Results indicated a functional relation between the picture prompts displayed on the video iPod® and pedestrian navigation skills for all four participants. Both figures also display generalization data in two ways. First, generalization measures were collected after each participant demonstrated mastery with the route and walked without the researcher. As the final data point for each trained route (once the participant had demonstrated route mastery with the researcher) data were collected on each participant's ability to navigate the trained route without the researcher present. During this probe, a second observer trained by the researcher walked behind the participant for safety using a "follow along" procedure and taking data (i.e., time and percentage of landmarks correct). These generalization data are represented with an asterisk above the relevant data points. Next, generalization data were also collected on untrained, novel routes between maintenance measures. Each participant was presented with a new route they had never navigated in order to see if they could navigate to an unfamiliar location using only the pictures displayed on the iPod® with no additional training provided by the researcher. This route was also across the street from the college campus. Data for each participant are described below.

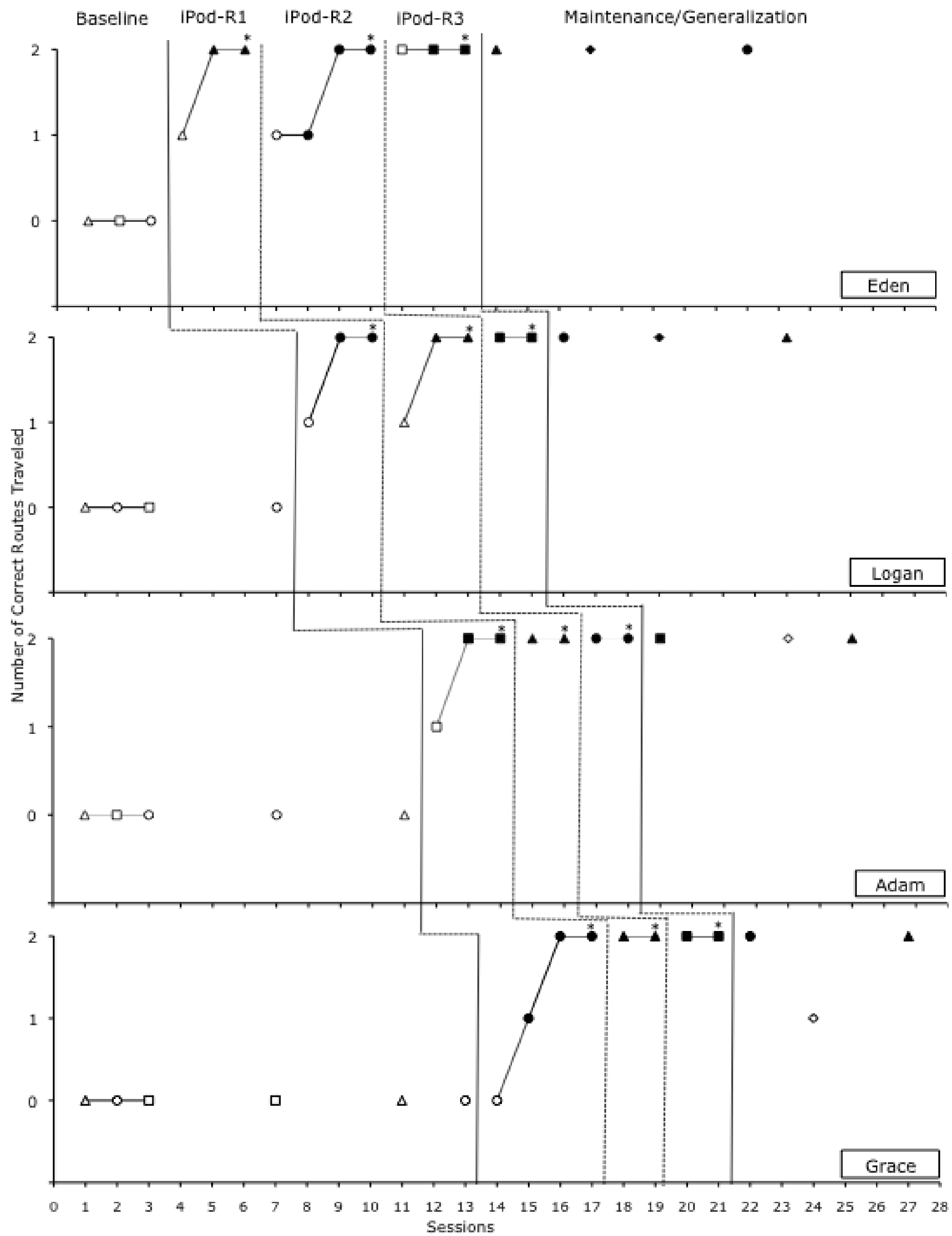

Figure 1. Number of correct routes navigated (to and from destinations) across four participants. Note. Closed data points= navigated route within appropriate time limits; Open data points = navigated route, but not within appropriate time limits; Route 1 = △ to and from Hunter Library and Moore Building; Route 2 = □ to and from Natural Sciences Building and Student Catholic Center; Route 3 = ○ to and from Student Recreation Center and Graham Building; ◇ = Novel untrained route without trainer; * = routes without researcher present

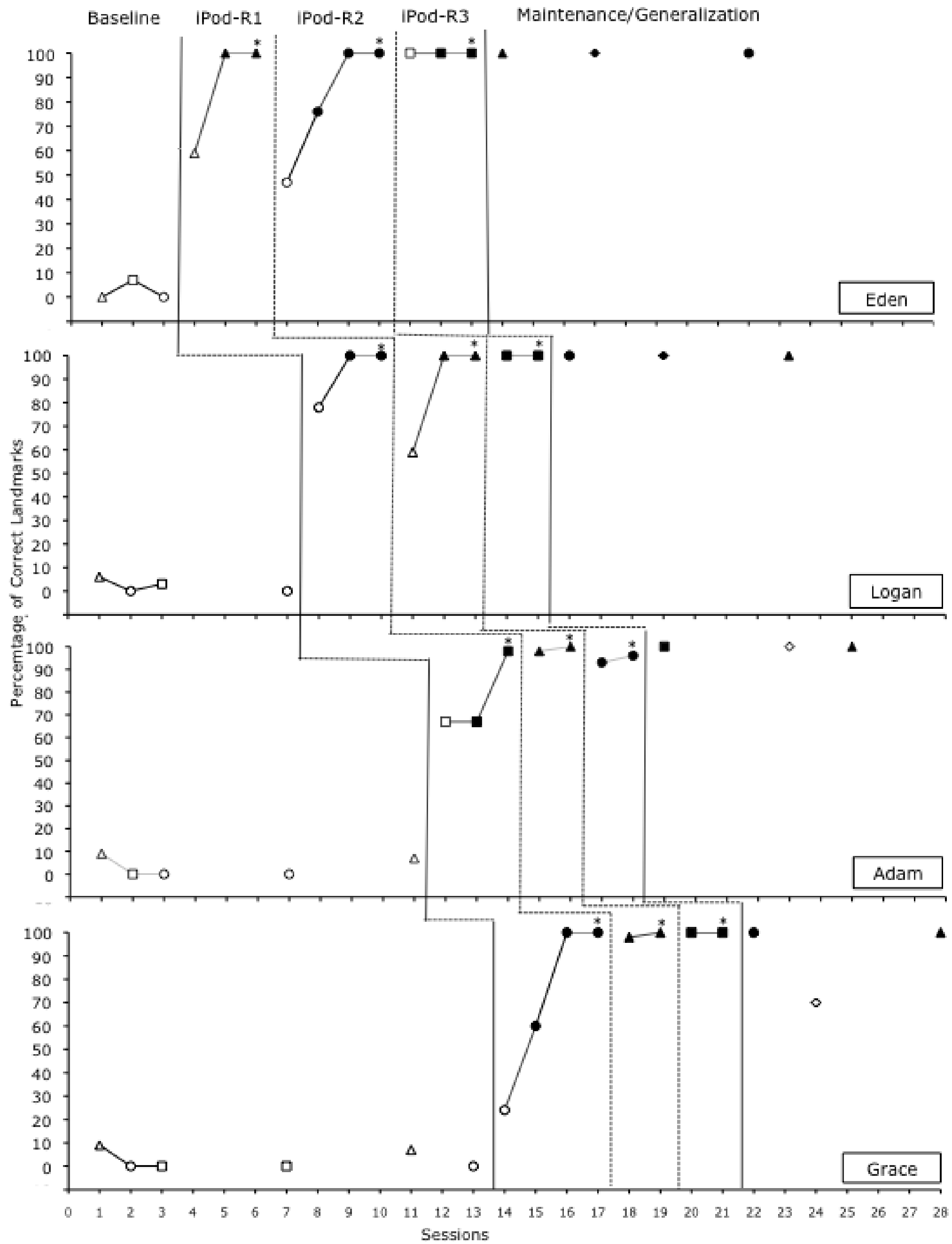

Figure 2. Percentage of correct landmarks (to and from destinations) across four participants. Note. Closed data points= navigated route within appropriate time limits; Open data points = navigated route, but not within appropriate time limits; Route 1 = △ to and from Hunter Library and Moore Building; Route 2 = □ to and from Natural Sciences Building and Student Catholic Center; Route 3 = ○ to and from Student Recreation Center and Graham Building; ◇ = Novel untrained route without trainer; * = routes without researcher present

Eden. During baseline, Eden's performance remained stable at 0 for correct routes traveled. For percentage of landmarks during baseline, Eden's scores remained stable and ranged from 0% to 7% with a mean of 4.3% correct. During intervention, for correct routes her scores ranged from 1 to 2 with a mean of 1.7 correct. The percentage of landmarks indicated an immediate change in level and an increasing trend with a range of 47% to 100% correct and a mean of 88.2% correct. By her third route trained (i.e., Natural Sciences Building to the Student Catholic Center) Eden was able to navigate using the iPod® without the help of the researcher, but did not do it within the specified time period due to the sun shining on the pictures displayed on the video iPod®. During maintenance, Eden's performance on the trained routes traveled remained stable at 2, 27 days after instruction on the route ended. The percentage of landmarks reached independently on trained routes was 100% correct. During generalization, Eden was able to navigate independently (without researcher present and only the use of the video iPod®) for all trained routes with 100% correct pictured landmarks. In addition, Eden was able to use the video iPod® correctly to navigate to and from a novel untrained location with 100% correct landmarks.

Logan. During baseline, Logan's performance remained stable at 0 for correct routes traveled. For percentage of landmarks during baseline, Logan's scores remained stable and ranged from 0% to 6% with a mean of 4.4% correct. During intervention, for correct routes his scores ranged from 1 to 2 with a mean of 1.8 correct. The percentage of landmarks indicated an immediate change in level and an increasing trend with a range of 59% to 100% correct and a mean of 92.1% correct. By his third route trained (i.e., Natural Sciences Building to the Student Catholic Center) Logan was able to navigate using the iPod® without the help of the researcher on the first attempt. During maintenance, Logan's performance on the trained routes traveled remained stable at 2, 28 days after instruction on the route ended. The percentage of landmarks reached independently on trained routes was 100% correct. During generalization, Logan was able to navigate independently (without researcher present and only the use of the video iPod®) for all trained routes with 100% correct pictured landmarks. In addition, Logan was able to use the video iPod® correctly to navigate to and from a novel untrained location with 100% correct landmarks.

Adam. During baseline, Adam's performance remained stable at 0 for correct routes traveled. For percentage of landmarks during baseline, Adam's scores remained stable and ranged from 0% to 9% with a mean of 3.1% correct. During intervention, for correct routes his scores ranged from 1 to 2 with a mean of 1.9 correct. The percentage of landmarks indicated an immediate change in level and an increasing trend with a range of 67% to 100% correct and a mean of 88.4% correct. By his second route trained (i.e., Hunter Library to Moore Building and back) Adam was able to navigate using the iPod® without the help of the researcher on the first attempt. However, Adam's percentage of landmarks ranged from 96% to 100% correct (due to navigating around a building a different way and getting back on the route with the pictures displayed on the iPod®). During maintenance, Adam's performance on the trained routes traveled remained stable at 2, 26 days after instruction on the route ended. The percentage of landmarks reached independently on trained routes was 100% correct. During generalization, Adam was able to navigate independently (without researcher present and only the use of the video iPod®) for all trained routes with 96% to 100% correct pictured landmarks. In addition, Adam was able to use the video iPod® correctly to navigate to and from a novel untrained location with 100% correct landmarks.

Grace. During baseline, Grace's performance remained stable at 0 for correct routes traveled. For percentage of landmarks during baseline, Grace's scores remained stable and ranged from 0% to 9% with a mean of 3.8% correct. During intervention, for correct routes her scores ranged from 1 to 2 with a mean of 1.6 correct. The percentage of landmarks indicated a small immediate change in level and an increasing trend with a range of 24% to 100% correct and a mean of 85.3% correct. By her second route trained (i.e., Hunter Library to Moore building and back) Grace was able to navigate using the iPod® without the help of the researcher. During maintenance, Grace's performance on the correct trained routes traveled remained stable at 2, 27 days after instruction on the route ended. The percentage of landmarks reached independently on trained routes also remained stable at 100% correct. During generalization, Grace was able to navigate independently (without researcher present and only the use of the video iPod®) for all trained routes with 100% correct pictured landmarks. Grace was also able to use the video iPod® to navigate to a novel untrained location for half of the route independently. This was a result of one turn within the route being missed navigating to Point A. She received one prompt to revisit the pictured landmark missed and was able to navigate back to the starting location independently with 70% correct total landmarks for the entire route.

Overall, results for generalization indicated 3 of 4 participants were able to travel independently without the help of the researcher to the novel untrained route using only the support of the video iPod® and one participant only needed one prompt to navigate the untrained route.

Social Validity

Research Question 4: What were participants' perceptions of using the video iPod® as a method for independent travel?

Social validity data were collected from participants at the end of the study to evaluate social importance of outcomes (Fawcett, 1991) and social acceptance of procedures (Wolf, 1978). The second observer read the questionnaire to each participant to gather the level of satisfaction using the iPod® with picture prompts to support navigation skills. The questionnaire took less than 5 minutes to complete.

Table 1. *Participant Social Validity Questionnaire Summary*

Questions	Participant Rating				
	Eden	Logan	Adam	Grace	Mean
The iPod® helped me travel with more confidence on my own.	4.0	4.0	4.0	4.0	4.0
The picture prompts on the iPod® were easy to use when I needed help.	4.0	3.0	4.0	3.0	3.5
The iPod® helped me learn how to get to other places on campus.	4.0	4.0	4.0	4.0	4.0
I would like to tell my friends about how to use pictures on the iPod® to travel.	4.0	4.0	4.0	4.0	4.0
My navigation skills improved because I learned how to use the iPod® to help me travel.	4.0	4.0	4.0	4.0	4.0

Note: Scores based on a 4-point Likert-type scale (1=strongly disagree, 2= disagree, 3=agree, 4= strongly agree).

The mean ratings ranged between 3.5 and 4.0. All items were rated as agree or strongly agree. The one item rated lowest was the picture prompts being easy to use when help was needed with mean ratings of 3.5. Participants were also asked two open ended questions related to what they liked most and least about using the iPod® to travel. Participants indicated they liked having the pictures to help them know where they were on campus and to get to where they needed to go. Grace indicated she did not like having help with crosswalks and Adam did not like having to ask for assistance if the iPod® had to be cued back to the pictures.

Research Question 5: What are undergraduate special education majors' and minors perceptions of developing materials for video iPod® training?

Finally, social validity data were collected from five undergraduate students majoring or minoring in special education on their perception of developing navigation routes using picture prompts and the video iPod. These five students were paid to provide support to the participants for 10 to 15 hours per week in order to work on participant goals developed in person centered planning meetings. Several goals related to navigating campus and accessing transportation as well as social or academic goals. All five of them observed the participants during route training, but did not implement training directly. At the end of the training session, a 4-point Likert scale questionnaire was distributed and collected to evaluate the appropriateness of procedures, practicality, and relevance of using the iPod to teach pedestrian navigation skills. Results are presented in Table 2.

Table 2. *Undergraduate Special Education Social Validity Questionnaire Summary*

Questions	Response Rating by Special Education Majors/Minors					
	Becky	Terri	Stella	Jessie	Sally	Mean
Developing pictured landmark routes seems easy and practical.	4.0	3.0	3.0	4.0	4.0	3.6
After seeing how to develop iPod® training materials, I am more confident I could create materials on my own.	4.0	3.0	3.0	4.0	4.0	3.6
If I had access to all necessary training materials, I would use the iPod® device to teach travel training in my future teaching.	4.0	3.0	4.0	4.0	4.0	3.8
After seeing how iPod® training was developed and works, I feel I could use it with other independent living tasks.	4.0	3.0	4.0	4.0	4.0	3.8
I feel iPod® training should be shared with other students and future teachers to help individuals with disabilities.	4.0	4.0	4.0	4.0	4.0	4.0
I feel comfortable teaching skills to individuals with disabilities using technology.	4.0	4.0	4.0	3.0	4.0	3.8

Note: Scores based on a 4-point Likert-type scale (1=strongly disagree, 2= disagree, 3=agree, 4= strongly agree).

The mean ratings ranged between 3.6 and 4.0. All items were rated as agree or strongly agree. The two items that were rated lower were developing landmarked routes and confidence for creating materials for the iPod independently with mean ratings of 3.6. Based on open ended comments related to the training session, students stated (a) the iPod training strategy was simple and practical for participants, (b) they liked the fact that it could be adapted to any variety of tasks, (c) it was age appropriate, (d) it allowed participants the ability to be more independent, and (e) it was technology that could help ease difficulty of tasks. Students also stated what they liked least about the iPod travel training strategy which were (a) data collection procedures seemed really confusing at first, but once explained it was manageable and made sense; (b) it appeared that the strategy could be time consuming especially if you have to recreate the routes; (c) the fact that it relied solely on pictures reduced the opportunity for participants to practice reading; (d) training included several strategies such as posting pictures into the PowerPoint were already familiar; and (e) training focused on iPod use only, before talking about alternative ways to use picture prompts without a video iPod.

Social Comparison Data on Average Times

Before beginning intervention, time limits were collected from three college students (two females, one male) walking at a comfortable and leisurely pace to all three predetermined routes to provide typical time limits for navigating both to and from destinations. These data determined the normative sample of time used for navigating routes to and from destinations to compare to participants' performance. This information is represented in Table 3 and represented on Figures 1 and 2 as open data points if participants did not navigate within the average time limits and closed data points if participants were able to navigate within the average time limits.

Table 3. *Social Comparison Data of Average Cumulative Walking Times from College Students*

Routes	Students Walking in Minutes With and Without iPod							
	Student A		Student B		Student C		Average Time	
	iPod	No iPod	iPod	No iPod	iPod	No iPod	iPod	No iPod
Route 1 to	8:00	4:00	10:00	5:00	9:00	5:00	9:00	4:40
Route 1 from	9:00	5:00	11:00	6:00	13:00	6:00	11:00	5:40
Route 1 Total	17:00	9:00	21:00	11:00	22:00	11:00	20:00	10:20
Route 2 to	12:00	9:00	12:00	10:00	14:00	10:00	12:40	9:40
Route 2 from	14:00	9:00	13:00	10:00	12:00	10:00	13:00	9:40
Route 2 Total	26:00	18:00	25:00	20:00	26:00	20:00	25:40	19:20
Route 3 to	10:00	6:00	10:00	7:00	10:00	7:00	10:00	6:40
Route 3 from	9:00	6:00	14:00	7:00	8:00	7:00	10:20	6:40
Route 3 Total	19:00	12:00	24:00	14:00	18:00	14:00	20:20	13:20
Novel Route to	11:00	9:00	9:00	9:00	10:00	9:00	10:00	9:00
Novel Route from	12:00	9:00	9:00	8:00	10:00	9:00	10:20	8:40
Novel Route Total	23:00	18:00	18:00	17:00	20:00	18:00	20:20	17:40

Note. Route 1= Hunter Library to Moore Building and back; Route 2= Natural Sciences to Catholic Center and back; Route 3= Student Recreation Center to Graham Building and back; Novel Untrained Route = The Village Dormitories to North Carolina Center for Advancement of Teaching and back

Overall, Table 3 indicates (a) a 9 min 40 s difference between the use of the iPod® with the total time needed to complete route 1, (b) a 6 min 20 s difference to complete route 2, (c) a 7 min difference to complete route 3, and (d) a 4 min 40 s difference to complete the novel generalization route.

Table 4. Social Comparison Data of Average Cumulative Walking Times from Participants

Participant Walking Times with iPod	Mean and Range for Intervention Routes in Minutes and Seconds					
		Mean	Route 1	Route 2	Route 3	Novel Route
Eden	R1	19:00	16-23:00			
	R2	25:00		20-30:00		
	R3	20:30			17-27:00	
	NR					22:00
Logan	R1	19:00	16-23:00			
	R2	24:30		24-25:00		
	R3	22:00			17-25:00	
	NR					23:00
Adam	R1	20:30	20-21:00			
	R2	26:40		25-30:00		
	R3	23:00			23:00	
	NR					25:00
Grace	R1	20:30	20-21:00			
	R2	25:00		25:00		
	R3	23:45			22-26:00	
	NR					30:00

Note. Route 1= Hunter Library to Moore Building and back; Route 2= Natural Sciences to Catholic Center and back; Route 3= Student Recreation Center to Graham Building and back; Novel Route = The Village Dormitories to North Carolina Center for Advancement of Teaching and back (note: novel untrained route was also located off campus)

Social comparison data on total time to complete each route from point A to point B and back are shown in Figure 3. The shaded grey bars represent the range of time needed for three typical college students to walk routes using the iPod® device. The mean of each route is represented by the dashed horizontal line of the three college students walking times with the iPod®. The bars (i.e., vertical brackets) in baseline and maintenance represent the range of time it took college students to walk each route and the data points with varied shapes represent specific routes navigated by each participant and total means for relevant routes.

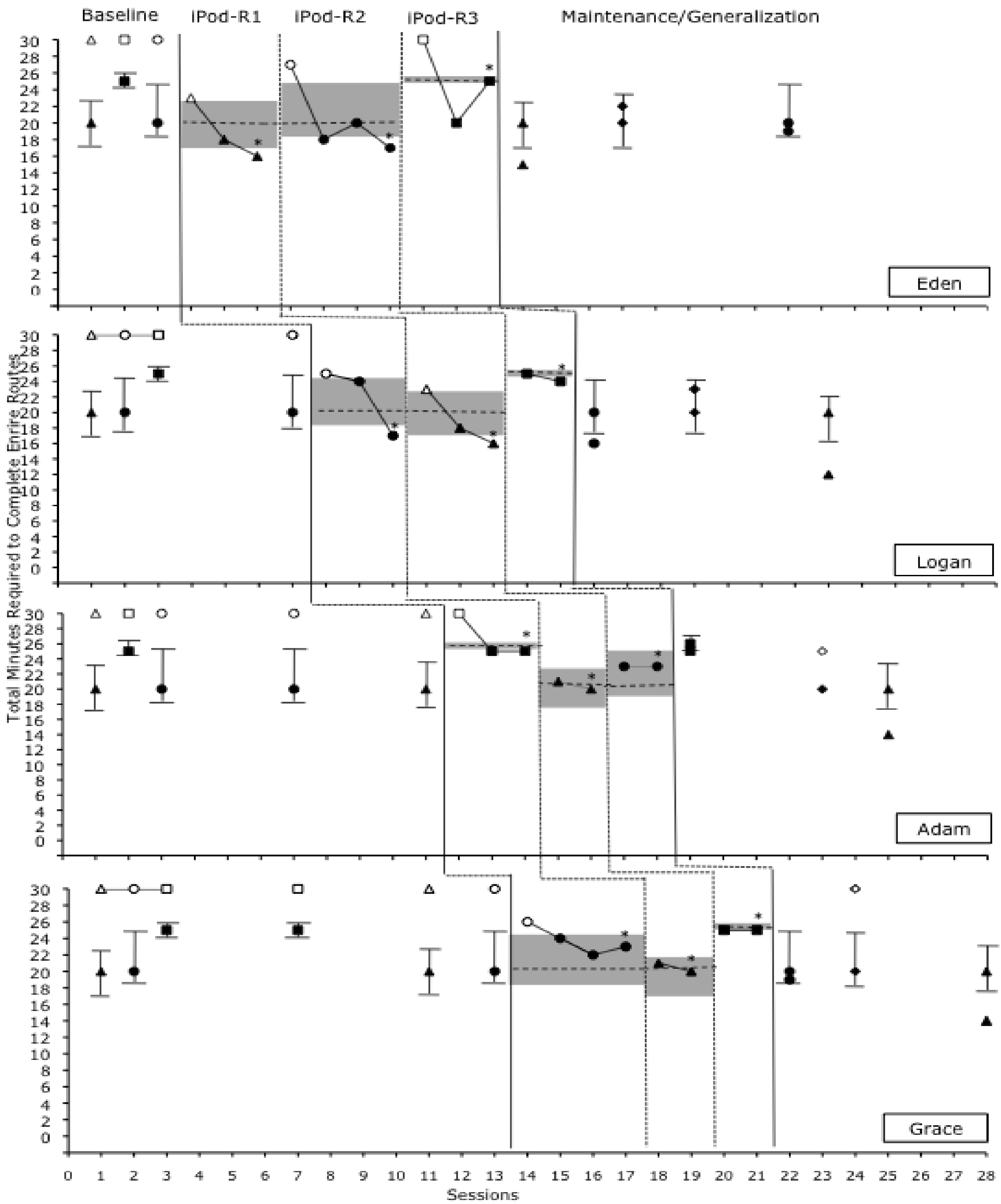

Figure 3. Number of minutes required to complete routes (to and from destinations) across four participants. Note. Closed data points= navigated route within appropriate time limits; Open data points = navigated route, but not within appropriate time limits; Route 1 = △ to and from Hunter Library and Moore Building; Route 2 = □ to and from Natural Sciences Building and Student Catholic Center; Route 3 = ○ to and from Student Recreation Center and Graham Building; ◇ = Novel untrained route without trainer; * = routes without researcher present

Eden. During baseline, Eden attempted to walk three routes using the campus map. She navigated far away from the target and either exceeded the time limits of 15 minutes each way or verbalized she did not know how to get to point B before 15 minutes had passed. This is represented in baseline showing she was unable to navigate to and from the predetermined route within an allotted 30 minute time period given across all three routes during baseline. During intervention, when using the video iPod® device, Eden was able to achieve the socially acceptable time limit by the second attempt for each route previously set by three college students walking with the iPod®. During all generalization measures with the second observer, Eden increased her efficiency in navigating routes she had learned without stopping for longer periods of time to reference picture prompts on the iPod®. When Eden became more comfortable with each route, she relied less on the iPod® and her times improved with each attempt. On a few routes, Eden lost time navigating due to the sun and having to locate shade to see the pictures displayed on the video iPod®. Over time, Eden was able to navigate all trained and untrained routes given in socially acceptable time limits and maintain these skills with continued efficiency for up to three weeks by briefly glancing at the picture prompts on the video iPod® to navigate the entire route. At the end of the study, Eden indicated she did not feel she could navigate the routes independently without support of the iPod®.

Logan. During baseline, Logan attempted to walk three routes using the campus map. He navigated far away from the target and either exceeded the time limits of 15 minutes each way or verbalized he did not know how to get to point B before 15 minutes had passed. This is represented in baseline showing he was unable to navigate to and from the predetermined route within an allotted 30 minute time period given across all three routes during baseline. During intervention, when using the video iPod® device, Logan was able to achieve the socially acceptable time limit by the second attempt for the first two routes and by the first attempt on the third route previously set by three college students walking with the iPod®. During all generalization measures with the second observer, Logan increased his efficiency in navigating routes he had learned without stopping for longer periods of time to reference picture prompts on the iPod®. When Logan became more comfortable with each route, he relied less on the iPod® and his times improved with each attempt. Logan was able to navigate all trained and untrained routes given in socially acceptable time limits and maintain these skills with continued efficiency for up to three weeks by briefly glancing at the picture prompts on the video iPod® to navigate the entire route. At the end of the study, Logan indicated he felt he could navigate all three routes independently without support of the iPod®.

Adam. During baseline, Adam attempted to walk three routes using the campus map. He navigated far away from the target and either exceeded the time limits of 15 minutes each way or verbalized he did not know how to get to point B before 15 minutes had passed. This is represented in baseline showing he was unable to navigate to and from the predetermined route within an allotted 30 minute time period given across all three routes during baseline. During intervention, when using the video iPod® device, Adam was able to achieve the socially acceptable time limit by the first attempt on the second route previously set by three college students walking with the iPod®. During all generalization measures with the second observer, Adam increased his efficiency in navigating routes he had learned without stopping for longer periods of time to reference picture prompts on the iPod®. When Adam became more comfortable with each route, he relied less on the iPod® and his times improved with each attempt. Adam was able to navigate all trained routes given in socially acceptable time limits and maintain these skills with continued efficiency for up to three weeks by briefly glancing at the picture prompts on the video iPod® to navigate the entire route. For the untrained route, Adam did not navigate the route in the socially acceptable range of time due to accidentally hitting extra icons on the iPod® as he walked. At the end of the study, Adam indicated he felt he could navigate all three trained routes independently without support of the iPod®.

Grace. During baseline, Grace attempted to walk three routes using the campus map. She navigated far away from the target and either exceeded the time limit of 15 minutes each way or verbalized she did not know how to get to point B before 15 minutes had passed. This is represented in baseline showing she was unable to navigate to and from the predetermined route within an allotted 30 minute time period given across all three routes during baseline. During intervention, when using the video iPod® device, Grace was able to achieve the socially acceptable time limit by the first attempt on the second route previously set by the three college students walking with the iPod®. During all generalization measures with the second observer, Grace increased her efficiency in navigating routes she had learned without stopping for longer periods of time to reference picture prompts on the iPod®. When Grace became more comfortable with each route, she relied less on the iPod® and her times improved with each attempt. Grace was able to navigate all routes given in socially acceptable time limits and maintain these skills with continued efficiency for up to three weeks by briefly glancing at the picture prompts on the video iPod® to navigate the entire route. For the untrained route, Grace did not navigate the route in the socially acceptable range of time since she missed a landmark in route to Point A. At the end of the study, Grace indicated she felt she could navigate all three routes independently without support of the iPod®.

CHAPTER 5: DISCUSSION

The purpose of this study was to investigate the effects of using picture prompts delivered through a video iPod® on pedestrian navigation with four young adults (18-26 years old) with IDD participating in an inclusive individualized postsecondary program at a 4-year university. A multiple probe across participants design was used to determine the effects of the independent variable (i.e., picture prompts on a video iPod®) on the dependent variables (i.e., independent travel of a route to and from specified locations; percentage of correct landmarks; length of time to complete the entire travel route from point A to point B and back to point A). Participants met the following inclusion criteria (a) age range between 18 to 26; (b) qualified University Participant (UP) program participant; (c) student consent if age 18 or older and declared their own guardian or parental consent and student assent if they were not their own guardian; (d) documented IDD (e.g., cerebral palsy, autism, Down syndrome); (e) visual acuity to see pictures of campus landmarks displayed on a video iPod® screen and actual landmarks from a distance; (f) ambulatory and able to walk up and down steps; (g) able to independently cross streets using designated crosswalks. Results indicated a functional relation between picture prompts displayed on the video iPod® and participants' acquisition of pedestrian navigation skills to and from various campus locations. Maintenance data indicated all four participants were able to continue to navigate trained routes independently for up to

28 days using the video iPod®. Generalization measures indicated 3 out of 4 participants were able to use the video iPod® to navigate untrained route independently without prompting and one participant only needing a single prompt. Social validity data indicated undergraduate students felt the iPod® training and intervention were useful and practical for teaching independent pedestrian navigation skills. Participants felt more confident using the picture prompts displayed on the iPod® to travel independently. Findings and discussion points are presented in this chapter organized by research questions. Specific contributions, limitations of this study, suggestions for future research, and implications for practice are also discussed.

Effects of Intervention on Dependent Variables

Research Question 1: What is the effect of pedestrian navigation training using a video iPod® (i.e., picture prompts of a series of intermediate on-route and final locations) on travel route completion to and from specified locations for young adults (age 18-26) with IDD?

Findings indicated a functional relation between the picture prompts delivered through the video iPod® and pedestrian navigation skills for all participants. All four participants showed changes in level and percentages of pictured landmarks and independent navigation when presented with a video iPod® over the campus map used during baseline. All four participants also mastered their third training route on the first attempt, using the video iPod® without help from the researcher. Due to Grace's attention span it seemed harder for her to connect the purpose of the iPod® in relation to navigating a route even after the training phase had ended and throughout the first route. Once she realized its purpose and how it would help her get to different places independently, she was able to follow the picture prompts easily on the remaining routes. Additionally, it is important to note from Figure 3 that once participants became comfortable using the iPod®, total times typically decreased for walking each of the routes. Eden and Logan already owned video iPods®, but had only used the music feature and were unfamiliar with the photo feature. Finally, by the second or third walk with each route, all four participants became more confident and did not rely on the video iPod® as much to complete routes once they were learned. The iPod® then served as a backup if they forgot a turn or pictured landmark. When participants forgot where they were going they could all cue the iPod® to appropriate pictures. This indicated the iPod® was used as a prompting device, but participants could also navigate independently after receiving explicit instruction delivered to them through the iPod®. For example, for route 2, Adam had a class in a building that was near the route. On the first and second attempt at this route, Adam did not follow the exact route displayed on the iPod® as he recognized the building and knew how to get back without the iPod® support. He followed the pictures for most of the route, but had a decreased percentage of landmarks correct since he went around the opposite side of the building and then got back on the pictured route. Even though he detoured from the route, he was able to get back on track and ended at the correct location within the time limit.

Overall, results of this study support previous research related to travel training and technology. First, similar to previous studies, current findings suggested young adults with intellectual disabilities can learn to travel with greater independence when explicitly taught before entering and/or within, natural environments (Batu et al., 2004; Coon et al., 1981; Mechling & O’Brien, 2010; Mechling & Seid, 2011; Sowers et al., 1979).

Second, this study supports findings of previous research that used high tech handheld devices displaying pictures or low tech picture prompts printed out and used in photo albums to teach complex tasks such as bus riding behaviors (LaDuke & LaGrow, 1984); recognizing bus stops (Mechling & O'Brien, 2010; Welch et al., 1985), using landmarks to recognize pedestrian routes (Mechling & Seid, 2011), independent job task completion (Copeland & Hughes, 2000), and assembling work task packages on the job (Wacker & Berg, 1984). More recent studies (e.g., Van Laarhoven et al., 2009) have also found similar results for using video iPods® indicating these devices can be powerful instructional tools for helping individuals with disabilities to acquire new skills. This study extends this research to teaching a new behavior (i.e., pedestrian navigation skills) using iPod® technology. In addition, as indicated from social validity results in this study, iPods® also serve as good rewards for individuals with disabilities (Hammond et al., 2010; Van Laarhoven et al., 2009).

Third, although previous studies teaching new tasks have found video prompting more effective than picture prompting (Mechling & Gustafson, 2009; Mechling & Stephens, 2009), this study supports findings that still photographs were effective for teaching new behaviors such as pedestrian navigation. Previous research comparing video and picture prompting have indicated both are effective and efficient for teaching functional skills such as using an automated teller machine (ATM; Cihak, Alberto, Taber-Doughty, & Gama, 2006). Despite the contrasting findings and continued need to explore video, picture, and auditory prompting (Lancioni, O'Reilly, & Emerson, 1996), it is more important to consider the choice of the participants and task being taught (Taber-Doughty, 2004). It might be dangerous to watch a video while trying to navigate crosswalks or listen to auditory prompts delivered on an iPod® if participants need to be alert to oncoming traffic.

Finally, this study extends research by using picture prompts of actual landmarks, providing stimuli closer to natural environments and extending travel training research beyond cardboard simulations and dolls used in earlier studies (Neef et al., 1978; Page et al., 1976). Together this study and findings from Marchetti et al. (1983) indicate community training can be effective.

Research Question 2: To what extent do young adults (age 18-26) maintain independent use of the video iPod® for pedestrian navigation skills?

Maintenance data from this study were positive and similar to maintenance data collected in previous travel training research (Coon et al., 1981; Kubat, 1973; Mechling & O'Brien, 2010; Neef et al., 1978; Welch, 1985). Additionally, only three recent studies (Fickas et al., 2008; Mechling & O'Brien, 2010; Mechling & Seid, 2011) used current technologies to teach travel training and met the quality indicators for single subject research (Horner et al., 2005). Other previous studies related to travel training were written before these criteria existed and several failed to meet quality indicators for single subject research based on (a) limited number of participants, (b) experimental design, (c) lack of procedural fidelity and interrater reliability, and/or (d) limited number of data points collected during baseline and intervention. This study addressed all of the quality indicators required for single subject research contributing to recent research related to travel training. Two out of three travel training and technology studies reported positive maintenance data from one week to 67 days after intervention had ended (Mechling & O'Brien, 2010; Mechling & Seid, 2011). This study also indicated positive maintenance results from 16 to 28 days. Problem solving skills for street crossing were addressed throughout this travel training study similar to street crossing behaviors (e.g., pushing the crosswalk button and recognizing the walk signal or flashing to hurry) taught in previous research (Horner et al., 1985; Vogelsburg & Rusch, 1979). However, this study extended previous research since street crossing skills were embedded within actual pedestrian navigation routes. Many routes used in this study involved different types of crosswalks with and without crosswalk buttons to provide greater generalization opportunities.

Research Question 3: To what extent do young adults (age 18-26) with IDD generalize use of the video iPod® to untrained locations?

This study collected setting/situation generalization data (Cooper et al., 2007) on participant pedestrian navigation skills without the researcher present, as well as to a novel untrained route. All four participants were able to generalize skills learned without the researcher present for all three trained routes using only picture prompts on the video iPod® while being followed by a second observer (i.e., situation generalization). This occurred after each participant had mastered each intervention route with the researcher. In addition, with setting generalization data 3 of the 4 participants were able to use the iPod® to successfully navigate an untrained novel route off campus and back to campus without any help or prompting. This occurred at least two weeks after intervention had ended and between the maintenance measures. This study is similar to findings from Coon et al. (1981) as both found positive generalization measures when navigating to untrained novel routes and locations. This study extends previous research addressing navigation to and from trained and untrained routes. All previous research had only taught participants to navigate to locations on trained and untrained routes without teaching navigation back to starting locations.

Furthermore, the measures used in this study extended Groce's (2000) suggestion to use a "following procedure" when teaching travel training. This allows participants to feel more independent when navigating, while still providing the safety net in case of an emergency. "Following procedures" involve having the travel trainer (i.e., researcher) train another person (i.e., second observer) to follow close enough to ensure safety while also assessing the performance of the travel skills (i.e., generalization measures) and allowing the participant to travel independently (Groce, 2000). In this study, following procedures were used with the observers to ensure safety for each participant and in case of emergencies.

Finally, findings from this study contributed to previous research using picture prompts combined with actual instruction taught within natural environments. Both previous studies found promising results when functional skills such as using an ATM (Cihak et al. 2006) and pedestrian navigation skills were taught within natural environments (Mechling & Seid, 2011). When teaching safety skills, it is important to evaluate the nature of the task and consider providing instruction within natural environments (Mechling, 2007) as natural stimuli with safety training can provide more meaningful instruction (Collins et al., 1993). This study contributed to preliminary concepts pairing pedestrian navigation skills with handheld technology within natural environments. It extends previous research by teaching these pedestrian and safety skills on an inclusive college campus where there has been limited research conducted (Mechling & Seid, 2011).

Discussion of Social Validity Findings

Research Question 4: What were participants' perceptions of using the video iPod® as a method for independent travel?

Based on social validity data from participants, it appears that they felt explicit travel training allowed them to explore college activities to greater degrees than they would have without instruction. Participants indicated they were more confident in their ability to travel independently to other destinations on campus using iPod® support. This study is one of the first studies that gathered participants' perceptions for using the iPod® to travel independently. All participants also indicated they liked using the iPod® to learn new skills similar to social validity findings in previous research using iPods® to deliver prompts for completing vocational tasks (Van Laarhoven et al., 2009) and using iPods® during independent leisure time (Hammond et al., 2010). All four participants from this study felt (a) more confident, (b) the iPod® was easy to use to help them navigate campus, and (c) it taught them how to get to different places. In regards to accessibility, all participants in this study either agreed or strongly agreed that the video iPod® training was helpful and easy to use. Finally, all participants agreed or strongly agreed they would tell their friends about using the iPod® to navigate around campus.

Research Question 5: What are undergraduate special education majors' and minors perceptions of developing materials for video iPod® training?

Social validity data were collected to evaluate future teachers' (i.e., undergraduate students) perceptions of acceptability for using the iPod® strategy to teach pedestrian navigation skills on a college campus. Undergraduate special education majors and minors working as paid supports in participants' immediate community completed a

1-hour training session to learn how to create training materials using the iPod® to teach navigation skills and learn overall outcomes of this study. When training concluded, a questionnaire was given including questions related to the social acceptance and importance of using the iPod® to teach various skills. Results indicated that students perceived the iPod® training and strategy to be an effective method for teaching individuals with IDD how to navigate independently. These findings are similar to social validity data collected from teacher perceptions in previous research (Mechling & Seid, 2011). First, students indicated procedures for generating iPod® routes were practical and easy to use once they were trained. These findings are similar to Cihak et al. (2006) as teachers also found it easy to develop static picture prompt materials. Second, all five undergraduates felt picture prompts displayed through video iPods® can be a good strategy to use when teaching other complex independent living skills or pedestrian navigation skills. Third, all agreed or strongly agreed that they would recommend this training strategy to other teachers and students and felt comfortable teaching with technology. Therefore, results of this study indicate that picture prompts delivered through handheld devices such as video iPods® were viewed by five undergraduate students as an effective and efficient strategy for teaching individuals with IDD pedestrian navigation skills, as well as a way to develop independent travel skills.

Contributions of this Study

This study makes several unique contributions to research related to travel training and technology. First, this is the first study to address travel training that included navigation to a specific location and then back to a starting location. While all previous travel training research has taught participants to navigate from a starting point to specific location, it has not taught participants to navigate back to the starting point. Second, this study allowed for independent pedestrian travel with generalization measures using a second observer who followed the participant and recorded data, while the trainer (researcher) stayed behind at the starting location. No assistance beyond the iPod® was provided during these measures to ensure participants could travel independently using the "following procedure" for safety suggested by Groce (2000). In the present study, since participants quickly learned how to independently navigate each route, confederates were only used as a safety precaution and to collect data. Third, this study used the iPod® which was a practical strategy and a non-intrusive support (i.e., pictures with arrows rather than video) that looked very typical to others. It was easy to create and allowed participants to be alert to their surroundings when traveling. The iPod® Touch has a built in camera for pictures and blue arrows were added through PowerPoint© rather than actual adult models used in Mechling and Seid (2011). This allowed for easier replication of routes without having to have an adult model, and by using only pictured landmarks and directional arrows it took less time to create. Social validity data indicated routes were practical to use and easy to create. Fourth, this study used a handheld device to display pictures to teach pedestrian navigation skills to individuals with IDD, adding to previous research on using handheld devices displaying digital photographs to teach self-management, daily living, food preparation, and vocational tasks to individuals with disabilities (Mechling, 2007). Finally, the iPod® device and digital camera used to create the routes were more economical than the PDA Cyrano Communicator device used in Mechling and Seid (2011) with comparison costs of $1,300 for the PDA Cyrano Communicator versus $130 to $299 for the video iPod® device.

Limitations and Suggestions for Future Research

This study had several limitations and implications for future research to consider. First, using a single subject research design with a small number of participants (i.e., four young adults at one postsecondary setting) limits generality of findings. Future research should continue to investigate the use of iPods®, as well as, other technologies to teach pedestrian navigation skills (e.g., iPads with bigger screens) and other functional skills to individuals with varied disabilities and in a variety of community settings. Future research should also be conducted at varied geographic locations and other postsecondary settings to see if the video iPod® is effective (e.g., urban vs. rural settings).

Second, due to the length of this study, maintenance data were only collected up to 28 days after intervention had ended across four participants. Future research should include long term maintenance (e.g., six months to one year) for travel training as necessary.

Third, participants in this study seemed to have more confidence to travel independently since they had been living on the college campus prior to the implementation of the study. Remote campus locations were chosen for all predetermined routes. Some participants in future studies could be very apprehensive about traveling more independently if they have not adjusted to their surroundings. During the first maintenance check, one participant verbally asked the researcher why they had to be followed expressing they were confident to travel alone with the iPod®. In this study, 3 of the 4 participants were able to cross streets with confidence and accuracy, and already knew if they were lost not to panic because they knew other students attending the university. It is important to consider street crossing attentiveness before allowing independent navigation at busy crosswalks (Groce, 2000; Vogelsburg & Rusch, 1979). At the beginning of iPod® training, more support had to be given to Grace at crosswalks due to her inattentiveness to watch crosswalk lights that alerted her to cross. Future research should examine comfort levels before independent travel is introduced in case there is anxiety or fear with traveling alone or unanticipated attention problems hindering street crossing performance.

Fourth, this study did not address indoor travel training due to the skill sets that would have been required for teaching number recognition, elevator or stairwell navigation, and having more than one destination within a route. Future research should address components of combined indoor and outdoor travel training and add more stops within the route such as navigating to class from dormitories and then going from class to lunch and back to the dormitory. In this present study, participants were taught to navigate to the entrance of a building. Future research is needed to teach individuals not only to get to a specific building, but to also navigate to a room within a building and multiple places embedded within starting and ending locations.

Fifth, by the second or third travel attempt with each route, it was hard to determine if participant did or did not need the iPod® to navigate. For example, Adam did not always use or feel he needed the iPod® pictures for entire routes. Over time, all participants did not need to look at every picture when walking routes. Future studies should incorporate taking the iPod® support away to see if participants still need the iPod® or picture supports over time (Mechling & Gast, 1997; Welch et al., 1985).

Next, it was difficult to collect actual walking times between each landmark while trying to stay as far behind the participant as possible letting them lead the way using the iPod®. Since it was important not to influence participant decisions on turns in the routes, time data were not as accurate because recorded times between landmarks were documented when the researcher and interrater reached the pictured landmark rather than when participants' had reached the landmarks. This also limited the reliability of times recorded accurately by the researcher and second observer because some pictured landmarks were omitted or misinterpreted when actual times should be recorded on the datasheets. Although overall interrater reliability on times was high ranging from 91.3% to 100% with a mean of 98.6%, it could be improved. Future research should find ways to collect time data without being close to the participants when they navigate routes that more accurately capture time to each landmark if it is one of the dependent variables.

In addition, using this technology has some disadvantages. Traveling in the rain and bright sunlight made it somewhat difficult to see the pictures displayed on the video iPod®. Participants were taught to find shade if they could not see the pictures due to the sunlight and were also taught to carry an umbrella and the iPod® when it was raining. Future studies should consider weather and address protecting devices in harsh weather and find ways to display pictures in bright sunlight.

Next, iPod® technology can offer a menu of routes or choices to individuals with disabilities (Mechling et al., 2009). Before this menu can be used, it is important to teach individuals how to "cue" the iPod® to various routes or menu choices. While this study did not attempt to show participants how to choose the routes navigated, both Eden and Logan (i.e., previous iPod® owners) were able to "cue" the video iPod® to the photo folder and begin the route. Future research should teach individuals how to “cue” routes from start to finish rather than selecting routes for participants to navigate once all routes are learned.

Finally, social validity measures were gathered from undergraduate special education majors and minors who also provided paid support for the program working directly with participants on a weekly basis. Therefore, these individuals were not naïve to the study since they worked with participants directly when participants navigated some of the campus routes.

Implications for Practice

There are several implications for practice based on findings from this study. First, when using technology with individuals with IDD it is important to consider physical and fine motor skills needed to operate iPod® devices. In this study, the two participants with cerebral palsy were able to use the iPod® Touch version better than the 5th generation wheel iPod® classic. Using the wheel, they could not pick up their fingers to push the forward and backward button easily, but could use the iPod® Touch screen to swipe the pictures back and forth without losing their place on the pictured route. As a result, before using technology devices, practitioners should try out the device to see if it must be adapted or modified because one system may not fit all students. When considering which technological devices or strategies to use it is important to find ways to address the unique needs of individuals with disabilities and accommodate individualized strategies when possible (Cihak et al., 2007; Stock, Davies, Davies, & Wehmeyer, 2006).

Second, this study required an initial review of technological devices to determine advantages and disadvantages before choosing one that would be most effective to teach pedestrian navigation. It is important for practitioners to stay abreast of technology research and/or collaborate with assistive technology experts who can help keep assistive technology devices circulating, rather than sitting on shelves because technology can facilitate increased learning or independence for individuals with disabilities (Mechling, 2007).

Third, it is important to consider the behaviors to be taught before choosing a device. Based on findings from this study, it might be important to consider not using auditory or video prompting and modeling with travel training due to limited alertness or safety concerns. Participants can be more alert if they can hear cars rather than listening to auditory prompts through earphones from the iPod®. Although many have considered video modeling and prompting superior to picture prompting for teaching functional skills in previous research (Cannella-Malone et al., 2006; Cihak et al., 2006; Graves et al., 2005; Sigafoos et al., 2005; 2007; Van Laarhoven & Van Laarhoven-Myers, 2006) video prompting and video modeling were not used in this study because participants also needed to be alert and watch where they were walking to get from landmark to landmark. In this study, picture prompting with directional arrows allowed participants to be alert to what was going on within their environment.

Fourth, teachers must also be prepared when teaching travel training to look for permanent landmarks that are stationary and will not be moved. In addition, pictures taken for any type of instruction should closely match targeted stimuli. For example, if taking pictures of landmarks or outdoors, it is important to consider the weather and seasons to closely match targeted landmarks and not take the pictures too far in advance. If training will occur in winter, trees should be bare in the pictures. If it is a picture you will use in the fall season, wait until that particular season when the leaves are in color on trees to provide closer stimuli since some students might have a hard time making these distinctions.

Furthermore, this study indicated several considerations for taking pictures of landmarks and adding directional arrows. For example, considerations should be made for people or cars in the pictures. If you take picture prompts to include different objects (e.g., cars, people) it is important during training to discuss how these items might not be in the picture when they actually get to complete the routes in natural environments or try to take pictures that do not include these items. This teaches individuals to attend to the important details or landmarks and ignore extraneous images or items in the picture prompts (Mechling, 2008a). Additionally, some students may have a hard time making these distinctions and may even try to look for the directional arrows if this is not explained before navigating a pictured route. In addition, with each picture taken for travel training it is important to consider the visible landmark, as well as how to appropriately add the directional arrows. When making the pictured routes, capture pictures where individuals will have to make decisions for turning on the route. For example, if there is a fork to go right or left on a sidewalk, take a picture of the fork and then add the appropriate directional arrow so the individual will not be confused on which sidewalk to take. When adding the directional arrows, it is important for the individuals navigating to learn how to walk to the end of the arrow displayed in the picture and then push forward to get to the next pictured landmark. When developing training materials, be sure not to put the end point of the directional arrow in the middle of a crosswalk or intersection. Individuals need to be alert to look for cars and not at the iPod® pictures when crossing streets. Most importantly, a support system such as a volunteer should frequently use the pictures from the video iPod® at least once a week to check routes for changes with landmarks and notify the researcher of any changes so the route can be modified.

Finally, with minimal preparation time, picture prompts can also be used to teach many functional or academic skills beyond pedestrian navigation as they have in similar studies related to independent living or vocational skills (Copeland & Hughes, 2000; Riffel et al., 2005; Wacker & Berg, 1984). If video iPods® are not available, photo albums or rings of pictures can also be used to help with navigation or prompting of other skill sets (Mechling, 2008b). Although iPods® are age-appropriate and this technology has many advantages, there are other ways to deliver picture prompt instruction while still providing explicit instruction and stimuli closer to natural environments. It is important to remember an advantage of using multimedia instruction (e.g., videos or pictures) is it can provide repeated practice, teach several trials, and provide over learning in many emergency and nonemergency situations (Mechling, 2008a). By using technology and picture prompts, individuals with disabilities are not exempt from travel training if they are unable to read or tell time consistently.

Conclusion

Teaching pedestrian navigation skills using picture prompts displayed on a video iPod® appears to be a promising support for expanding access to employment, recreational opportunities, and increasing independence and confidence for young adults with IDD. When using video iPods® to support pedestrian navigation skills it is important to consider how to teach these explicitly, in an age-appropriate way, and also keep individuals alert to their surroundings. Although global positioning system devices offer common supports to everyone in unfamiliar surroundings, these devices might still be too cumbersome for individuals with IDD to use to help them navigate successfully on college campuses. This study was designed to demonstrate the use of handheld devices to teach pedestrian navigation skills to individuals with IDD. Although results from this study were positive, this is only the third study that has used handheld technology to teach pedestrian navigation skills (Fickas et al., 2009; Mechling & Seid, 2011). Therefore, additional research is needed before using picture prompts displayed on video iPods® to teach pedestrian navigation skills can be considered an evidence-based practice.

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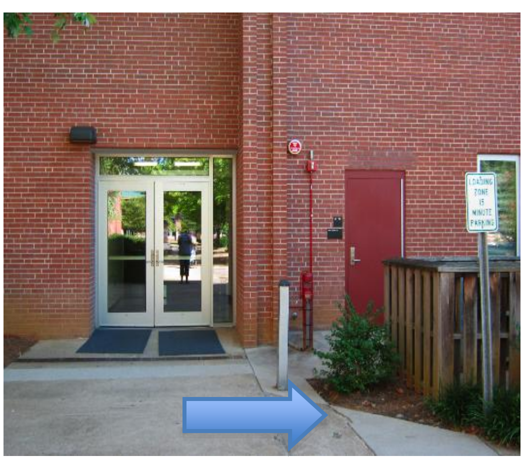
APPENDIX A: SAMPLE NAVIGATION ROUTE

Clock Tower to University Health Center and back

1. 

2. 

3. 

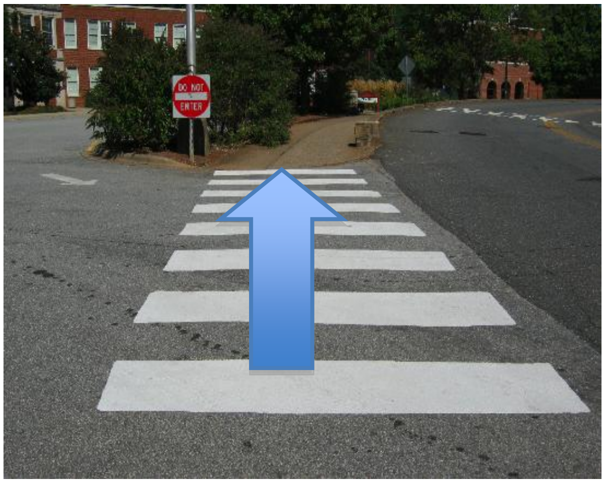
4. 

5. 

6. 

7. 

8. 

9. 

10 

11. 

12. 

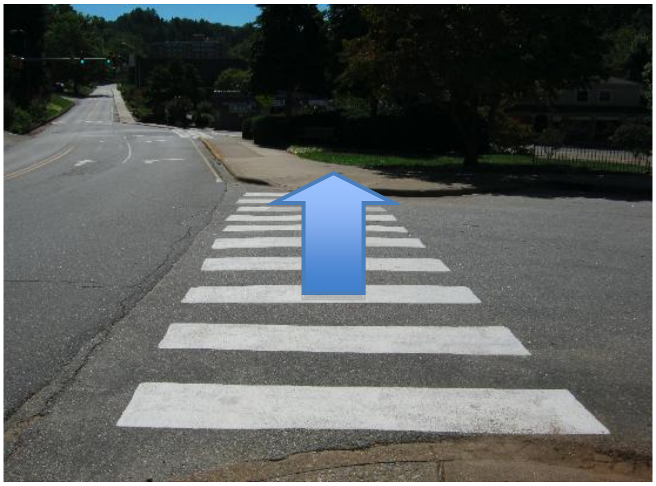
13. 

Return route back from University Health Center to Clock Tower

14. 

15. 

16. 

17. 

18. 

19.

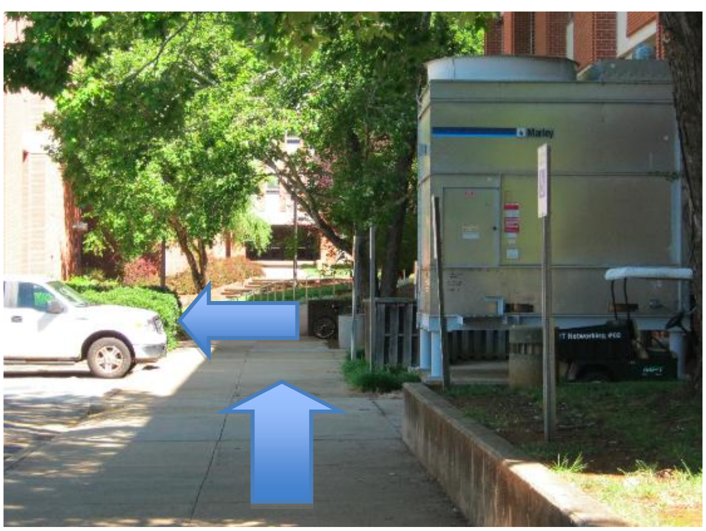

KILLIAN
CENTENNIAL DR
WHEEL LOCK
ZONE
FACULTY AND
STAFF PARKING
ONLY
LOT
34

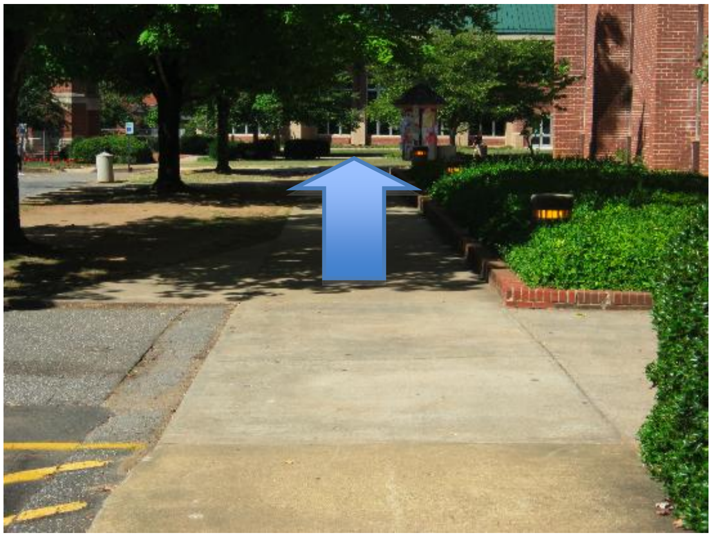
20.

21.

22. 

23. 

24. 

25. 

26. 

APPENDIX B: PEDESTRIAN NAVIGATION DATA SHEET

Participant: ____ Date: _____________

Completed by: ______________________________________

Phase (circle/#): BL___ INT ____ R1____ R2 ____ R3 ____ GM/MAINT ______

POINT A TO POINT B Campus Location: ________________________	Correct 1= either mid or end point reached independently and within time limit; 2= both mid and end points reached independently and within predetermined time limit	Incorrect 0= mid or end point route not reached independently or within predetermined time limit	Time in minutes and seconds (add all times from points and record in last row)
Starting location (Point A) ________________________	No data recorded	No data recorded	Start:
Picture 2	2 OR 1	0	
Picture 3	2 OR 1	0	
Picture 4	2 OR 1	0	
Picture 5	2 OR 1	0	
Picture 6	2 OR 1	0	
Picture 7	2 OR 1	0	
Picture 8	2 OR 1	0	
Picture 9	2 OR 1	0	
Picture 10	2 OR 1	0	
Picture 11	2 OR 1	0	
Picture 12	2 OR 1	0	
Picture 13	2 OR 1	0	
Destination (Point B) ________________________	2 OR 1	0	Stop: Start:

Participant: ______________________________________ Date: ____________

Completed by: ___________________________________

Phase (circle/#): BL___ INT ____ R1____ R2 ____ R3 ____ GM/MAINT ______

POINT B TO POINT A Campus Location: _____________________	Correct 1= either mid or end point reached independently and within time limit; 2= both mid and end points reached independently and within predetermined time limit	Incorrect 0= mid or end point route not reached independently or within predetermined time limit	Time in minutes and seconds (add all times from points and record in last row)
Picture 14	2 OR 1	0	
Picture 15	2 OR 1	0	
Picture 16	2 OR 1	0	
Picture 17	2 OR 1	0	
Picture 18	2 OR 1	0	
Picture 19	2 OR 1	0	
Picture 20	2 OR 1	0	
Picture 21	2 OR 1	0	
Picture 22	2 OR 1	0	
Picture 23	2 OR 1	0	
Picture 24	2 OR 1	0	
Picture 25	2 OR 1	0	
Ending location (Point A) _____________________	2 OR 1	0	Stop:
TOTALS			____ min ____sec
Notes:			

APPENDIX C: STUDENT SOCIAL VALIDITY QUESTIONNAIRE

Name ________________________________ Date _____________

Questions	Responses			
1. The iPod® helped me travel with more confidence on my own.	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree
2. The picture prompts on the iPod® were easy to use when I needed help.	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree
3. I like eating in the dining hall more than any other restaurants on campus.	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree
4. I liked using the iPod® to help me travel independently.	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree
5. The iPod® helped me learn how to get to other places on campus.	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree
6. I would like to tell my friends about how to use pictures on the iPod® to travel.	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree
7. I like making new friends in college.	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree
8. My navigation skills improved because I learned how to use the iPod® to help me travel.	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree

What did you like most about using the iPod® to travel?
What did you like least about using the iPod® to travel?

APPENDIX D: SOCIAL VALIDITY "HOW TO" TRAINING SESSION MATERIALS

Guide for Using Picture Prompts Displayed on Video iPods

Kelly R. Kelley
Social Validity Training for Undergraduate Special Education Majors

A Picture Can Be Worth 1,000 Words!

Which Would You Prefer for Navigating?

Overall Findings with Different Video iPods

Sample of Training Script

Tips for Designing Routes

"How To" Steps

1. Take pictures using digital camera or iPod Touch of the routes and landmarks
2. Load pictures on your computer from camera or iPod
3. Import pictures into PowerPoint slides- one picture per slide and save as background for each
4. Add directional arrows into sequenced route from the shapes tab in PowerPoint and position arrows in each picture
5. When all pictures on route are added, choose "save as pictures" from file menu in PPT. Pictures will save in a single folder separately as JPGs
6. Sync iPod with photos from program (iPhoto) in iTunes to your iPod
7. Check your photos for the arrows and begin training on the route or skill. Update as needed if routes change.

3. Importing Pictures as Background

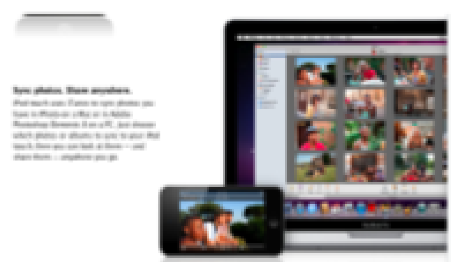
- Right click on slide outside a textbox and select "Format Background"
- Choose the "picture tab" at the top
- Choose a picture from your saved location
- Once picture is chosen from location click on "Insert" and then click "Apply"

Words sometimes work better, BUT…

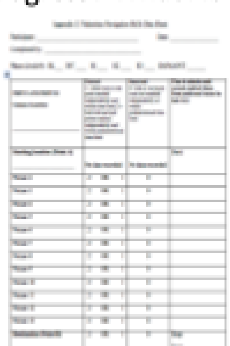
4. Adding Directional Arrows in PowerPoint

Pictures of complex tasks can be worth 1,000 words to some learners who can't read!

5. Syncing Your Photos



Making Progress? What About Data?



So Now What?

- Using technology (video iPods or iPads) to teach other skills such as…
  - Using the ATM machine
  - Following a morning or evening routine
  - Making a purchase
  - Cooking
  - Gluten free pictured menu
  - Completing complex vocational tasks (cleaning the bathroom, checking email)
  - Other ideas?

APPENDIX E: SOCIAL VALIDITY QUESTIONNAIRE: UNDERGRADUATES

Name ___________________________________ Date _______________

Questions	Responses			
1. Developing pictured landmark routes seems easy and practical.	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree
2. After seeing how to develop iPod® training materials, I am more confident I could create materials on my own.	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree
3. If I had access to all necessary training materials, I would use the iPod® device to teach travel training in my future teaching.	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree
4. After seeing how iPod® training was developed and works, I feel I could use it with other independent living tasks.	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree
5. I feel iPod® training should be shared with other students and future teachers to help individuals with disabilities.	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree
6. I feel comfortable teaching skills to individuals with disabilities using technology.	1 Strongly Disagree	2 Disagree	3 Agree	4 Strongly Agree

What did you like most about the iPod® travel training strategy?

What did you like least about the iPod® travel training strategy?

APPENDIX F: VIDEO IPOD® TRAINING SCRIPT

Researcher	Participant	Researcher
We're going to learn how to use a video iPod®. What are we going to learn how to use?	A video iPod®	Yes. A video iPod®.
The iPod® will show you pictures of how to get to around campus. What will the iPod® show you? Let me show you how to use the video iPod®. First, you can see there is a screen where you will see pictures. Do you see it? *(point to the screen)*	How to get around campus. Yes. I see it.	Right. Good listening. Good eyes and paying attention.
There will be pictures on this screen of things around campus such as crosswalks and signs to help you get to different places. What will be on the screen? Now, look below the screen. There is a wheel with buttons. Do you see it?	Umm…I forgot. A picture of a crosswalk. Yes.	Ok. Let's look at the screen together. What do you see? Correct. You see a crosswalk with a sign. We will use these pictures to help us get around campus. You will look at the picture and try to find it as you look around you. Good. You will use buttons on this wheel to see the different pictures.

The first button you will use on the wheel is the “forward” button. *(point to forward button on the wheel)*		
What is this button called?	The forward button.	Right. Now, you quickly push this button (don’t hold it down for long) and tell me what happens.
	It changed the picture.	Right, the forward button moves you to the next picture of what you should look for around you.
The next button you will use on the wheel is the “backward” button. *(point to the backward button on the wheel)*		
What is this button called?	The back button.	Yes. It is the back or backward button. It will help you if you get lost or need to go back to a place you just came from. Now, you quickly push this button and tell me what happens (don’t hold it down long)
	It changed the picture.	Yes. It changed the picture, but is it a picture you have already seen before?
	Um. Yeah.	Right. So if you get stuck or lost, use the backward button to go back to the place you came from and then try again.
There is one more trick I want to show you for using the iPod®. Sometimes the pictures on the iPod® will		

disappear or the screen will go black. When this happens you can lightly tap the wheel anywhere and the picture will come back on the screen. *(tap the wheel)*	Ok. That makes sense.	
So what do you do if the screen is black?	Tap the wheel.	Awesome job. Let's practice one short route using only the iPod®.
Guided Practice:		
Go through the four pictures using the backward and forward buttons and thinking aloud to locate the nearby matching landmarks shown in the pictures. Allow the participant to push the buttons and match the pictures to practice. Mention the arrows in the pictures are there to show which way to walk.	Student pushes the backward and forward buttons and taps the center of the wheel to look at the pictures and match the landmarks.	
Ok. Now that you have practiced using these buttons, let me ask you to push them when I name them.		
1. The screen is black. What button would you tap?	Taps the wheel.	Screen goes from black to a picture. "Correct."
2. Push the "forward" button.	Pushes the backward button.	Oops. Try again. It is the button that looks like the fast forward button on a VCR or DVD player. (Point to forward button).
		Great job. Now what does

		this button do when you push it?
	Pushes the forward button.	Wow! You are a quick learner. It shows the next picture.
	Shows new picture.	
3. Now push the “backward” button.	Pushes the backward button.	You got it. What does the backward button do?
	It takes you back to a picture.	Awesome. You will be able to travel to the moon!
I think you are ready to try to use the iPod® to get you somewhere. Are you ready to try? Any questions?	Yes.	Great. Let’s go!

APPENDIX G: PROCEDURAL FIDELITY CHECKLIST FOR TRAINING

Date: ____________ Participant: ______________ Completed by: ______________

Destination: ____________________________________

Circle Yes, No, or N/A			
Yes	No	N/A	Researcher ensures iPod® is functioning properly by checking pictures of entire route before training session begins.
Yes	No	N/A	Researcher shows the participant the screen, wheel, and "forward" and "backward" buttons on the video iPod® following the training script.
Yes	No	N/A	Researcher allows the participant to push the "forward" and "backward" button on the iPod® during guided practice training.
Yes	No	N/A	Researcher provides specific feedback and error correction following the script throughout the training phase for previewing pictures and using "forward" and "backward" buttons on the iPod®.
Yes	No	N/A	If the iPod® projects an error during the preview training, researcher makes note of the problem, corrects it, and resets the iPod® for the participant to continue using the wheel and "forward/backward" buttons.
Yes	No	N/A	Researcher fades assistance and allows participant to use the iPod® to preview the entire training route with picture prompts by pushing navigation buttons.
Yes	No	N/A	Researcher evaluates participant at end of training session to see if they can use the wheel and "forward" and "backward" button on the iPod® correctly and independently following the training script.
Yes	No	N/A	Participant returns iPod® device after training phase ends (point A, B, A).

Number of YES circled or N/A Marked: _____/8 = _________ x 100 = _______ %

Notes:

APPENDIX H: PROCEDURAL FIDELITY CHECKLIST FOR INTERVENTION

Date: ____________ Participant: ______________ Completed by: ______________

Destination: ____________________________________

Circle Yes, No, or N/A			
Yes	No	N/A	Researcher ensures iPod® is functioning properly by checking pictures of entire route before navigation begins.
Yes	No	N/A	Researcher provides the cued iPod® to the participant and delivers predetermined destination.
Yes	No	N/A	Participant uses iPod® throughout predetermined route to navigate to each landmark.
Yes	No	N/A	Researcher does not provide feedback or talk to the participant during intervention phase unless requested by participant and after recording an incorrect response.
Yes	No	N/A	When participant navigates off the route for 30 seconds researcher provides prompting using relevant pictures on the iPod® device following a model-lead-test error correction procedure and allowing at least one practice attempt after an error is made. If an interruption occurs and the participant stops to talk to someone the researcher stops the stopwatch.
Yes	No	N/A	If the iPod® projects or displays an error, researcher makes note of the problem, corrects it, and resets the iPod® for the participant to continue navigating route.
Yes	No	N/A	Participant uses the iPod® to navigate to each landmark before moving to the next picture prompt.
Yes	No	N/A	Participant returns iPod® device after navigating to and from predetermined location (point A, B, A).

Number of YES circled or N/A Marked: ______/8 = _________ x 100 = _______ %

Notes:

APPENDIX I: PROCEDURAL FIDELITY CHECKLIST FOR OBSERVERS

Date: ____________ Participant: ______________ Completed by: _______________

Destination: _____________________________________

Circle Yes, No, or N/A			
Yes	No	N/A	Researcher ensures iPod® is functioning properly by checking pictures of entire route before navigation begins.
Yes	No	N/A	Researcher provides the participant with iPod®.
Yes	No	N/A	Participant uses iPod® throughout predetermined route.
Yes	No	N/A	Researcher meets the participant if second observer contacts researcher by cell phone stating the participant seems lost or needs assistance after 2 min. of being off the targeted route.
Yes	No	N/A	If the iPod® projects or displays an error, the participant corrects the error or continues navigating the route independently when possible.
Yes	No	N/A	If the iPod® projects or displays an error, the confederate makes a note of a malfunction if it can be determined from a distance and informs the researcher of what occurred on the data sheet.
Yes	No	N/A	Participant uses the iPod® to navigate to correct landmarks before moving to the next picture prompt.
Yes	No	N/A	Participant returns iPod® device after navigating to and from predetermined location (point A, B, A) to the researcher waiting at Point A.

Number of YES circled or N/A Marked: ______/8 = _________ x 100 = ________ %

Notes: