Exceptional Children

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Effects of Picture Prompts Delivered by a Video iPod on Pedestrian Navigation

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ABSTRACT: *Transportation access is a major contributor to independence, productivity, and societal inclusion for individuals with intellectual and developmental disabilities (IDD). This study examined the effects of pedestrian navigation training using picture prompts displayed through a video iPod on travel route completion with 4 adults with IDD. Results indicated a functional relation between picture prompts on the video iPod and pedestrian navigation skills to and from various locations. Maintenance data indicated all participants continued navigating trained routes for up to 232 days using the video iPod. Generalization measures to untrained routes were positive. Social validity data suggested iPod training was useful and practical for teaching independent pedestrian navigation skills. Last, limitations, suggestions for future research, and implications for practice were provided.*

Individuals with intellectual and developmental disabilities (IDD) face many challenges related to community integration, such as obstacles to independent navigation in the community (Sohlberg, Fickas, Lemoncello, & Hung, 2009). Many rely on care providers for transportation, thus reducing self-determination levels and the desire to learn how to access public transportation systems (Sohlberg et al., 2009). Although 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, independent travel remains one of the most important unmet needs for individuals with disabilities (Goodkin, 1977). In addition, there continues to be a lack of comprehensive programming and curriculum available for teaching travel and pedestrian navigation skills (LaGrow, Weiner, & LaDuke, 1990).

Because traveling independently is not usually taught, but learned incidentally, it needs to be explicitly taught to individuals with IDD (LaGrow et al., 1990). Sohlberg and colleagues (2009) found one study that used a general strategy approach (i.e., series of picture prompts) to teach travel to novel destinations (LaDuke &

LaGrow, 1984). Individuals who learned to travel more independently were better prepared for the world of work, able to experience more economic benefits related to travel, and relied less on others to get them from place to place (LaGrow et al., 1990). Society can also benefit when individuals with IDD independently navigate to vocational sites without reliance on others and can actively contribute in society (Groce, 1996b). With expanded inclusive opportunities for individuals with IDD, travel training is one way to provide 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). 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 such as walking specific routes (LaGrow et al., 1990). Teaching pedestrian navigation skills involves 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). It is important to teach both ways to and from locations. Pedestrian navigation skills are similar to orientation and mobility skills because they involve simultaneous instruction, are based on a success-based sequence, and are aimed at meeting individualized travel needs (LaGrow et al., 1990).

According to Groce (1996a) 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 can help 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. Knowing how to navigate successfully in the community is crucial for increased quality of life, independence, and productivity. More importantly, developing adolescents do not wish to rely on parents or guardians for transportation and tend to appreciate greater independence as they grow older (Myers, 1996).

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. Unfortunately, a large majority of travel training studies were conducted in the 1970s and 1980s when individuals with disabilities were being integrated into communities from institutional settings, and the interventions used were not age-appropriate (e.g., using cardboard simulations of streets and dolls for young adults; Neef et al., 1978; Page et al., 1976). Based on increasing numbers of adolescents with IDD attending postsecondary programs and being 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 they help increase independence or improve 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 (Mechling & O'Brien, 2010) or walk to destinations independently (Mechling & Seid, 2011). First, Mechling and O'Brien investigated the effects of computer-based video instruction 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 (ID). Using a multiple probe design across participants and one bus route, results indicated computer-based video instruction 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.

Second, 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. In addition, students were able to successfully navigate to these destinations after the PDA was removed. With only two recent studies, more research is needed to explicitly teach individuals with IDD pedestrian navigation skills to and from destinations in order to increase functionality and independence. Therefore, 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.

METHOD

Prior to data collection, approval was obtained from the Institutional Review Board for research at the university where the study was conducted. Before beginning the study, the researcher explained and obtained necessary student consents or parent consents and student assents. Only participants with signed assents and consents were included in this study.

PARTICIPANTS

Participants 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. Each participant had access to full participation in college opportunities and was completing requirements for a 2-year certificate. This program required participants to live on campus, attend college activities, audit courses, complete internships, and navigate successfully to and from campus locations. Participants met the following inclusion criteria: (a) were between the ages of 18 and 26, (b) were an admitted program participant, (c) provided 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) had a documented IDD based on most current psychological or medical assessments (e.g., cerebral palsy, 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 steps, and (g) could independently cross streets using designated crosswalks with minimal supervision.

Eden. Eden was a 22-year-old, Caucasian female, with mild intellectual disability (IQ = 62). Eden had previously attended a compensatory education program at a community college prior to being accepted into the postsecondary program. She was not used to navigating to various college campus locations because her compensatory education setting was housed in one building.

Logan. Logan was a 21-year-old, Caucasian male, with cerebral palsy and moderate intellectual disability (IQ = 53) and Vineland Adaptive Behavior score of 74. Logan had previously attended a basic education program at a community college prior to being accepted into the postsecondary program. He was not used to navigating to various campus locations because his basic education program was housed in one building.

Adam. Adam was a 26-year-old, Caucasian male, with cerebral palsy and mild intellectual disability (IQ = 67). Adam had not previously attended a college-based program, but worked at a sheltered workshop prior to being accepted into the postsecondary program. He was not used to navigating to various locations because his workplace was housed in one building.

Grace. Grace was a 20-year-old, Caucasian female, with Down syndrome and moderate intellectual disability (IQ = 41) and Vineland Adaptive Behavior score of 60. Grace had recently completed high school and had not attended any additional college or workplace programs prior to being accepted into the postsecondary program.

She was not used to navigating to various locations because she was in a self-contained classroom at a small rural high school.

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 housed 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. Out of this enrollment, 256 students (2.4%) had reported and requested accommodations through the Office of Disability Services.

Materials

Teaching materials included digital photographs of landmarks for navigating all predetermined routes. Photographs from the routes contained inserted arrows (using AutoShapes in Microsoft Office) placed within the digital 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 AutoShape arrows were added into each picture with relevant turns. Last, once pictured routes were completed, they were exported or synched onto two video iPods. One iPod was a fifth generation video iPod classic device measuring 4 in. × 2.5 in. The screen for image display was 2 in. × 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 was carried in a protective leather case. The second iPod was a newer version called the iPod Touch (fourth generation). This iPod measured 2.5 in. × 4.5 in. with a 3.5 in. diagonal screen. The screen for image display dimensions was approximately 2 in. × 3 in. Before each use, the chosen device used by each participant was charged through an electrical outlet or computer cord. 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.

Data Collection

Dependent Variables. Data were collected on two dependent variables. The first dependent variable was 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, (b) with no prompting delivered by the researcher, (c) using pictures displayed on the video iPod to arrive and return to the destination, and (d) within an appropriate 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) navigated off the designated path for more than 30 s 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 the destination was reached. Redirection included modeling and looking at the picture on the iPod, talking through the picture and walking back to a landmark, and finally looking at the next pictured landmark on the iPod. If the participant made it to the final destination and back to the starting location without matching all pictured landmarks, this was also considered a correct response because the student was able to achieve the overall outcome of navigating to and from a specified location without assistance from the iPod or researcher. During baseline and intervention, route order for each participant was randomly selected to avoid the possibility of sequence effects.

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 the designated path for more than 30 s before 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 s. Once point A was reached, pictured landmarks from point B back to point 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, 1 = only point A or point B reached independently, and 2 = pictured landmarks reached independently.

Prior to beginning the intervention routes, time limits were collected based on having three college students (i.e., two females, one male) walking at a comfortable and leisurely pace to all predetermined routes, including the 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. For route one, acceptable time ranged from 17 to 23 min with 44 total landmarks. For route two, acceptable time ranged from 18 to 24 min with 58 total landmarks. For route three, acceptable time ranged from 24 to 25 min with 45 total landmarks. For the novel route, acceptable time ranged from 17 to 24 min with 44 total landmarks. Variations of time with routes across three college students were due to walking speeds, crosswalks, and wait times at traffic lights.

In addition, 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. Generalization for each route also occurred when the participants used only the iPod device to navigate to and from a novel destination and were able to complete routes within acceptable time limits.

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 read and collected by one of the second observers unknown to the participants through a questionnaire to determine 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 given at the conclusion of the study. This questionnaire required less than 5 min to complete. 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. At the end of this training session, a 4-point Likert scale questionnaire was distributed to evaluate the social acceptance of procedures and goals of using the iPod to teach pedestrian navigation skills.

Design

The experimental design was a multiple probe across participants design to evaluate the effects of picture prompts displayed through a video iPod on pedestrian navigation skills across multiple routes.

Baseline. During baseline, participants were given a campus map and asked to walk from point A to point B, and back to point A. This type of support is typical for college students on a university campus. The researcher pointed to point 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 away from the targeted route for more than 15 min, 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. 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. Because all participants scored incorrect on all baseline routes, a participant was selected at random.

Video iPod Training. After baseline had ended, participants were provided with an initial training on how to use the video iPod, including how to use relevant buttons on the device. Participants were taught how to look at the displayed picture while using navigation buttons on the iPod (i.e., forward, backward buttons) and the purpose of the forward and backward buttons on the video iPod for self-correcting when they needed to use the buttons to travel to pictured landmarks. The researcher used a training script with the student while viewing the pictured landmarks and hitting the appropriate video iPod buttons. The practice route included unfamiliar pictures of two landmarks to the 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) as part of the training phase, which did not require participants to physically travel to destinations. All participants were assessed prior to beginning the training session for skill levels with crosswalks because this was an initial inclusion criterion requirement. Training was brief and required only one training session lasting fewer than 10 min per participant. When participants were able to recall and point to device buttons independently they entered the intervention phase and training ended.

Video iPod Intervention. Routes and landmarks were chosen starting at different locations on campus with minimal overlap to previous routes navigated. Routes were also selected in remote areas on campus to address previously navigated routes to other classes or activities attended by participants. All intervention and novel routes were navigated in different directions to avoid overlapping landmarks. All routes had similar stationary landmarks, but starting locations were different. Selected pictures of stationary landmarks near directional turns or longer routes were included in each route and measured based on percentage navigated correct (e.g., trash cans, road or building signs, crosswalks, traffic lights).

During intervention, participants were given the video iPod and the researcher said, "Use the pictures on the iPod to help you get to point B 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 within the 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 as the participant navigated the route without the researcher present. Next, another baseline probe was administered to the remaining participants, and intervention began with the next participant with the greatest amount of time needed. This pattern continued until all participants had entered and completed intervention with all three routes.

During intervention, the researcher followed the participant and provided prompts to points A and B only if a participant requested assistance. If a participant was stuck, the researcher waited 30 s and then delivered generic questions, such as: "Because you cannot find the landmark that matches the picture, what should you do?" After prompting with a question if the participant did not respond with a correct answer (e.g., go back to the previous landmark) 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 s of unsuccessful travel while walking and modeling how to use the iPod to go back to where the error occurred. Once the participant and researcher were back to the previous landmark and on track with the pictured sequence, navigation continued until the route was completed. When the participant navigated to the appropriate ending landmark a smiley face appeared on the iPod picture to indicate they had reached the midpoint or final destination successfully.

Other anticipated errors addressed while en route included missed landmarks, interruptions by someone, device malfunction, route/landmark changes, and getting lost.

When the participant navigated to the appropriate ending landmark a smiley face appeared on the iPod picture to indicate they had reached the midpoint or final destination successfully.

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 s 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 Landmark 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.

Getting Lost. If a participant was navigating independently with a second observer following and they got lost during a route, they were instructed to call the researcher using their cell phone and describe the landmarks around them. The researcher would then meet them at that location. Intervention sessions lasted approximately 15 to 30 min, 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 and to see if the learning strategies taught (i.e., iPod support) generalized to novel untrained routes. First, maintenance data were collected using one of the three previously trained routes randomly selected across participants up to 232 days after instruction on the route had been completed. Second, two measures of generalization were collected. The first were collected after mastery was demonstrated during the intervention phase across each of the three trained routes without the help of the researcher. The second generalization measures were collected using a selected unknown route in a remote location of the campus. Each participant was presented with this unfamiliar route in order to see if they could navigate to a new location using only the pictures displayed on the iPod with no training provided by the researcher.

Interrater Reliability. 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., 0–2). 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, and multiplied by 100. Overall interrater reliability ranged from 91.3% to 100% with a mean of 98.6%. 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. 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. 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. Procedural fidelity was 100% across all sessions and phases.

RESULTS

Figure 1 presents the percentage of correct landmarks to and from destinations across four participants as well as navigation from point A to point B and back to point A. 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.

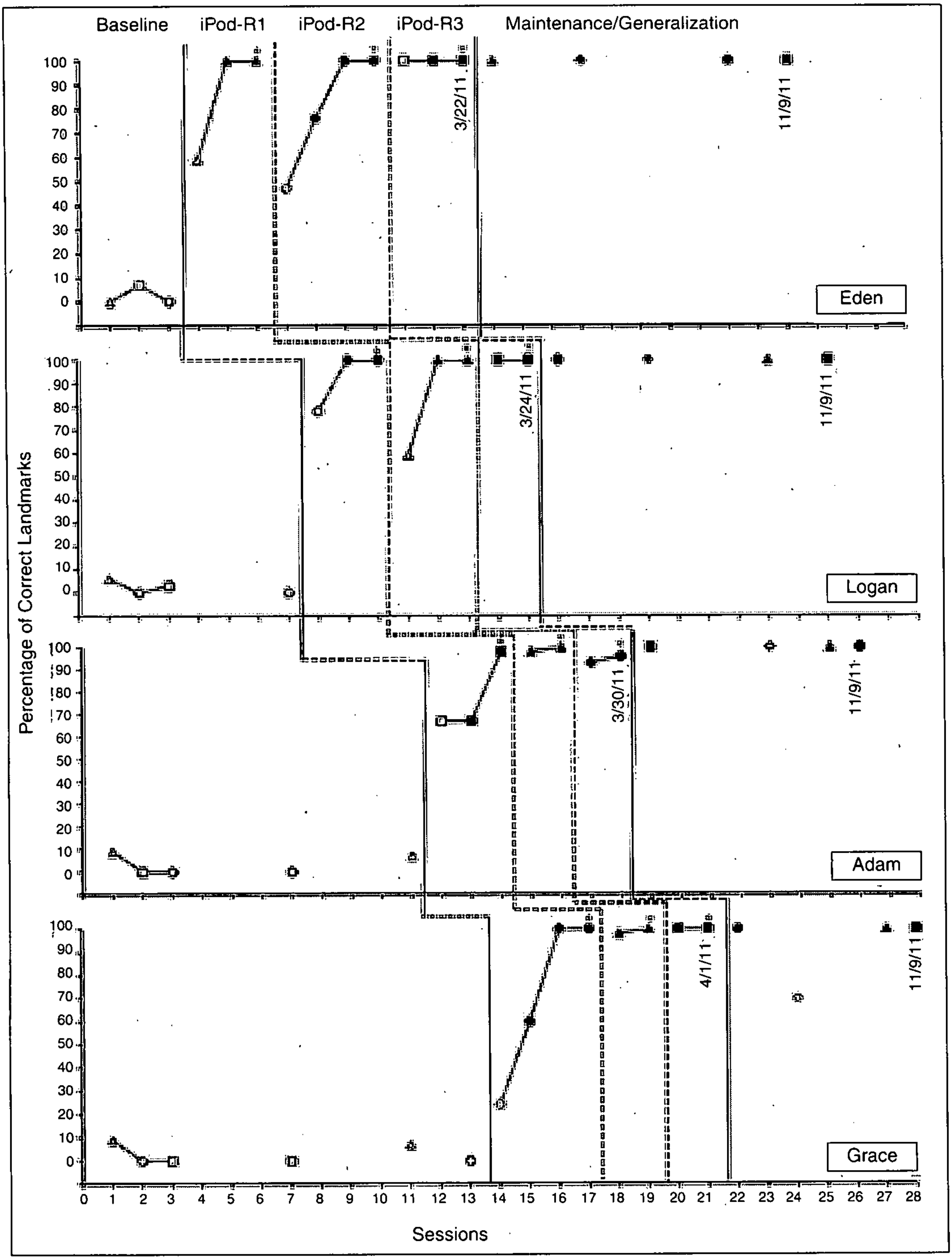
Eden. During baseline, Eden's performance was 0 for correct routes traveled. For percentage of landmarks during baseline, Eden's scores remained stable and ranged from 0% to 7% with a mean of 4.3% correct. During intervention, for correct routes her scores ranged from 1 to 2 with a mean of 1.7 correct. 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, 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 for 232 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 for all trained routes with 100% correct pictured landmarks. In addition, Eden was able to use the video iPod to navigate to and from a novel location with 100% correct landmarks.

Logan. During baseline, Logan's performance was 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 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 for 230 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 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 location with 100% correct landmarks.

Adam. During baseline, Adam's performance was 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 Adam was able to navigate using the iPod without the help of the researcher on the first attempt. During maintenance, Adam's performance on the trained routes traveled remained stable at 2 for 224 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 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 location with 100% correct landmarks.

FIGURE 1

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 route without trainer; * = routes without researcher present.

Grace. During baseline, Grace's performance was 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 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 for 223 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 for all trained routes with 100% correct pictured landmarks. Grace was also able to use the video iPod to navigate to a novel location for half of the route independently; however, she missed one turn within the route while navigating to Point A. After she received one prompt to revisit the pictured landmark missed, she was able to navigate back to the starting location independently with 70% correct total landmarks for the entire route.

GENERALIZATION

Overall, results for generalization showed that all four participants could travel trained routes without the researcher present. Also, three of the four participants were able to travel independently to novel, untrained routes using only the support of the video iPod, and one participant only needed one prompt from the researcher to navigate the untrained route.

SOCIAL VALIDITY

Social validity data were collected from participants at the end of the study. The mean ratings ranged between 3.5 and 4.0 (i.e., agree or strongly agree). The lowest item rated 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 enjoyed most and least about using the iPod to travel. Participants indicated they enjoyed having pictures to help them know where they were on campus and to get to where they needed to go. Grace indicated she did not enjoy having help with crosswalks and Adam did not enjoy having to ask for assistance if the iPod had to be cued back to the pictures.

In addition, 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 hr per week in order to work on participant goals developed in person centered planning meetings. 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. 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 in 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 that it could be adapted to any variety of tasks, (c) it was age-appropriate, (d) it allowed participants to be more independent, and (e) technology could help ease difficulty of tasks. The undergraduate students also stated what they liked least about the iPod travel training strategy were: (a) data collection procedures seemed confusing at first, but once explained they were 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, that were already familiar; and (e) training focused on iPod use only, before talking about alternative ways to use picture prompts without a video iPod.

DISCUSSION

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 post-secondary program at a 4-year university. Findings indicated a functional relation between the picture prompts delivered through the video iPod and pedestrian navigation skills for all participants. All four participants also used the video iPod to master the third training route on the first attempt without help from the researcher. 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. This indicated the iPod was used as a prompting device, but participants could also navigate independently after receiving explicit instruction delivered through the iPod.

Overall, results of this study support previous research related to travel training and technology. First, current findings suggested young adults with IDD 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 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), and using landmarks to recognize pedestrian routes (Mechling & Seid, 2011). More recent studies (e.g., Van Laarhoven, Johnson, Van Laarhoven-Myers, Grider, & Grider, 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.

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 (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 choices of the participants and the 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.

Last, 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. Generalization data from this study extends previous research by 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.

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 et al., 1985). Two out of three travel training and technology studies reported positive maintenance data from 1 week to 67 days after intervention had ended (Mechling & O'Brien, 2010; Mechling & Seid, 2011). This study collected maintenance for a longer time period of up to 232 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, Jones, & Williams, 1985; Vogelsburg & Rusch, 1979). However, this study extended previous research because 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.

Participants indicated they were more confident in their ability to travel independently to other destinations on campus using iPod support. This is one of the first studies that gathered participants' perceptions for using the iPod to travel independently.

Based on social validity data from participants, it appears participants 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 is one of the first studies that gathered participants' perceptions for using the iPod to travel independently. All participants also indicated they enjoyed using the iPod to learn new skills, which was 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, Whatley, Ayres, & Gast, 2010).

Social validity data were collected to evaluate future teachers' perceptions of acceptability for using the iPod strategy. Results indicated that undergraduate 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).

The results of this study make several unique contributions to research related to travel training and technology. First, it addressed travel training to include navigation to a specific location and back to a starting location. Second, no assistance beyond the iPod was provided during generalization measures to ensure participants could travel independently using the "following procedure" for safety suggested by Groce (2000). Third, this study used the iPod, which was a practical strategy and a nonintrusive support that looked very typical to others in a university setting. It was easy to create and allowed participants to be alert to their surroundings when traveling. Last, 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 used in this study.

LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

This study had several limitations and implications for future research. There is limited generality of findings. Future research should continue to investigate the use of iPods as well as other technologies (e.g., iPads) to teach pedestrian navigation skills and other functional skills to individuals with varied disabilities and in a variety of community settings.

Second, participants in this study seemed to have more confidence and comfort in traveling independently because they had been living on the college campus prior to the implementation of the study. However, it was still important to consider street crossing attentiveness before allowing independent navigation at busy crosswalks (Groce, 2000; Vogelsburg & Rusch, 1979). Future research should examine comfort levels before independent travel is introduced to avoid anxiety or fear with traveling alone.

Third, 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. In this present study, participants were taught to navigate to the entrance of a building.

Fourth, using this technology has some disadvantages. Traveling in the rain and bright sunlight made it difficult to see 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 taught to carry an umbrella and the iPod when it was raining. Future studies should consider weather, address protective devices in harsh weather, and find ways to display pictures in bright sunlight.

Last, 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 because 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. 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, Kessler, & Alberto, 2007). Second, it is important for practitioners to stay abreast of technology research and collaborate with assistive technology experts who keep 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 an intervention. Considering the use of auditory or video prompting and modeling paired with travel training is important due to limited alertness or safety concerns. Participants can be more alert with cars without auditory prompts. In this study, picture prompting with directional arrows allowed participants to be alert to the surroundings.

Fourth, teachers must also be prepared when teaching travel training to use permanent landmarks that will not be moved. 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 (e.g., in winter, trees should be bare in the pictures). Considerations must also 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, 2008b). 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. 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" on the iPod 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. Most importantly, a support system such as a volunteer walker should 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.

Last, 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, 2008a). Although iPods are age-appropriate, 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 that it can provide repeated practice, teach several trials, and provide overlearning in many emergency and nonemergency situations (Mechling, 2008b). 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.

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 independent travel for young adults with IDD. When using video iPods, it is important to consider how to teach these explicitly in an age-appropriate way while keeping individuals alert to their surroundings. 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 paired handheld technology with pedestrian navigation skills (Fickas, Sohlberg, & Hung, 2008; Mechling & O'Brien, 2010; Mechling & Seid, 2011). Therefore, additional research is needed before using picture prompts displayed on video iPods to teach pedestrian navigation skills can be considered a research- or evidence-based practice.

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