Computer-Based Video Instruction to Teach Students with Intellectual Disabilities to Use Public Bus Transportation

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Abstract: This study investigated the effectiveness of computer-based video instruction (CBVI) to teach three young adults with moderate intellectual disabilities to push a “request to stop bus signal” and exit a city bus in response to target landmarks. A multiple probe design across three students and one bus route was used to evaluate effectiveness of the CBVI program. All instructional sessions occurred in simulation with generalization and maintenance measures conducted in-vivo on a public bus route. Results indicate that CBVI was an effective means for creating a simulation to teach the bus route to all three students. Students were able to generalize the skill to the actual bus route with no in-vivo instruction. Maintenance measures further indicate that students were able to maintain the skill across time.

It is recognized that in addition to living, working, recreating, and accessing community services, community integration also includes movement in and around urban settings using public transportation (Taber, Alberto, Hughes, & Seltzer, 2002). The ability to safely move about one’s community can increase independence for adults with disabilities by offering more employment opportunities and means to access community settings such as shopping malls, grocery stores, restaurants, and places for recreation. Because many do not have the cognitive ability to obtain a driver’s license and drive a car, persons with intellectual disabilities are limited to walking, riding a bicycle, or being transported by others if they do not learn to access public transportation when it is available. Although students have been shown to acquire safe pedestrian skills (Branham, Collins, Schuster, & Kleinert, 1999; Horner, Jones, & Williams, 1985; Matson, 1980; Page, Iwata, & Neef, 1976; Spears, Rusch, York, & Lilly, 1981; Vogelsburg & Rusch, 1979), walking may limit them to employment within walking distance to their home; living directly next to a shopping center; or not being able to access recreational facilities (i.e. attending a professional baseball game) that are not within walking distance.

Early studies teaching use of public transportation for community mobility occurred in the 1970s and 1980s when persons with disabilities were exiting institutional settings and an emphasis was being placed on preparing them to function in communities (Coon, Voglesberg, & Williams, 1981; Kubat, 1973; LaDuke & LaGrow, 1984; Marchetti, Cecil, Graves, & Marchetti, 1984; Marholin, O’Toole, Touchedt, Berger, & Doyle, 1979; Neef, Iwata, & Page, 1978; Robinson, Griffith, McComish, & Swashbrook, 1984; Sowers, Rusch & Hudson, 1979; Welch, Nietupski, & Hamre-Nietupski, 1985). Of the nine studies identified, six studies relied on some type of classroom or simulated instruction. These studies demonstrated that simulated practice may be a means for teaching transportation skills, but will unlikely result in generalization of skills to natural environments without inclusion of community-based instruction (Snell & Brown, 2006; Westling & Fox, 2004). Preferably, community skills are taught as much as possible in the natural environments where they will be used, however community-based instruction can be more expensive and limited due to travel time to sites, money for purchasing and accessing community activities, availability of transportation to and from...
sites, and staff availability. Because of these constraints and limited resources, teachers continue to find themselves challenged when providing community-based instruction and finding realistic means to simulate these environments in the classroom setting. Teaching public bus transportation poses additional challenges when trying to teach in-vivo. Trials are often limited to one per route due to time constraints and the inability of bus drivers to allow repeated practice for skills such as boarding the bus, signaling the driver to stop, and exiting the bus. In addition, instruction will likely be limited to one trial per route and one route per day due to the amount of time it requires to wait for a bus, arrive at a destination, re-board the bus and return to the original bus stop.

Use of simulation is a means to balance the challenges of providing community-based instruction with the need for teaching skills that will generalize to the natural environments in which they will be used. While research by Neef et al. (1978) found simulation to be as effective as in-vivo instruction, they also report that in-vivo instruction was more time-consuming and expensive than simulation. In early studies, slide presentations were frequently used as a form of technology for providing realistic simulations. Slides were used to simulate boarding of a bus, riding the bus, signaling the bus driver to stop (pulling the cord), and exiting the bus (Coon et al., 1981; Marchetti et al., 1984; Neef et al.; Robinson et al., 1984; Sowers et al., 1979). Of the five studies using slides as simulation, four reported that students were unable to generalize all skills until instruction in the natural environment was included. LaDuke and LaGrow (1984) also reported that one of four students in their study had difficulty generalizing identification of the correct destination in the community when using photograph albums to prompt step completion of the bus riding task analysis. Similarly, Welch and others (1985) reported 3 of 6 students were unable to generalize to community bus stops until in-vivo training was included for using schedule cards. In particular, the studies found that students frequently committed errors when looking for landmarks in community settings (to determine when to signal the driver to stop) and actually pulling the cord at the correct time.

Although community mobility skills are considered critical for accessing community settings such as shopping malls, grocery stores, and restaurants (Welch et al., 1985) and a primary barrier to accessing and maintaining competitive employment for persons with moderate to severe disabilities (Hutchins & Renzaglia, 1998), teaching these skills has received little to no research attention over the past two decades. Due to new technologies such as video modeling, computer-based instruction, virtual reality, and portable hand-held devices, practitioners may wish to revisit research for teaching use of public transportation which incorporates innovative technologies.

A number of studies have evaluated the use of computer-based video instruction (CBVI) and video instruction to teach community skills. These skills have included: vocational skills (Mechling & Ortega-Hurndon, 2007); grocery shopping (Alcantara, 1994; Mechling & Gast, 2003); operation of a debit card machine (Mechling, Gast, & Barthold, 2003) or ATM machine (Alberto, Gihak, & Gama, 2005); ordering at fast food restaurants (Mechling, Pridgen, & Cronin, 2005); and purchasing (Ayers & Langone, 2002), yet none have been used to teach bus transportation skills.

Because city buses are likely one of the most common forms of public transportation used by persons with intellectual disabilities (LaGrow, Wiener, & LaDuke, 1990), the purpose of the current study was to investigate use of computer-based video instruction (CBVI) to create a “life-like” public bus riding scenario in a simulated environment to teach city bus transportation skills to persons with intellectual disabilities. The study focused on students’ abilities to generalize bus riding skills to a real-life bus route when only simulated instruction was provided. The primary question addressed was: “Will CBVI be effective in teaching students to push the “request to stop” signal at a specific landmark and exit a public bus system?”

Method

Participants

Three students (two females and one male) participated in the study. Students were se-
lected based on their diagnosis of an intellectual disability, age, IEP (Individualized Educational Program) objectives for increasing public bus transportation skills, and transition plans which identified competitive employment and semi-independent living arrangements upon completion of high school. All students had previous experience using public bus transportation and could board a bus using a university student identification card (free access to the system), locate a seat and sit down, push the "request to stop signal" when told, and stand and exit the bus. Each had experience with computer-based instruction, but not computer-based video instruction. In addition, students were screened for the following entry level skills: (a) visual ability to see photographs and video recordings on the computer screen; (b) visual ability to see landmarks and bus stops in the community; and (c) wait response of 3s. The students' classroom was located on the campus of a university which partnered with the local high school's Transition Program for Young Adults (TPYA) to provide an educational setting which focused on community based instruction.

Melissa was a 20 year, 11 month old female diagnosed with a moderate intellectual disability (IQ 52, Kaufman Assessment Battery for Children: Kaufman and Kaufman, 1983; Adaptive Behavior Composite Score 67, Vineland Adaptive Behavior Scales: Sparrow, Balla, & Cicchetti, 1984). She was characterized as being unsure of herself, as having low self-esteem, and easily frustrated by tasks. She was able to speak in complete sentences and was learning to self-advocate for herself in social situations and to answer yes/no questions rather than saying, “I don’t know.” She was able to follow a daily written checklist for completing tasks and could read functional words including those for simple meal preparation. She was able to write her signature, copy a shopping list, and use a visual guide to write personal information on a job application and other forms. She used the “next dollar strategy” when making purchases and could also count bill combinations up to $15. Her instructional objectives included increasing her home living skills (planning, purchasing, and preparing meals), riding a public bus (including locating bus stops), and obtaining a competitive employment position. She enjoyed playing bocce, being with friends, playing basketball, bike riding, playing "Wii", and listening to music. She expressed interest in obtaining a job at a restaurant.

Michael was a 19 year, 2 month old male diagnosed with a Pervasive Developmental Disorder not Otherwise Specified and described as having stronger verbal than non-verbal skills [IQ 70, Wechsler Intelligence Scale for Children–Third Edition (WISC-III): Wechsler, 1997; Adaptive Behavior Composite Score 75, Scales of Independent Behavior–Revised (SIB-R): Bruininks, Woodcock, Weatherman, & Hill, 1996]. He also had a seizure disorder, AD/HD, severe allergies, and was easily overheated. He was unsure of new tasks and extremely cautious which interfered with daily routines such as crossing the street (i.e. looking back and forth multiple times). He had difficulty pacing himself when working, following simple step directions, and was taking medication to assist with focusing. He used a calculator for math computation and used the computer for word processing, exploring the internet, and to play computer games. He could count coins and bills to sums of $20 and was learning to construct a monthly personal budget. He was composing paragraphs using correct punctuation and capitalization with assistance in spelling and staying on topic. He was able to decode words when reading using context cues. Michael was able to use a microwave and make a sandwich, but was not able to use a stove or oven. He was independent in caring for his personal needs. His instructional objectives included locating correct bus stops and describing specific bus routes. He spoke in complete sentences, however he was described as always having a story to tell and needed to limit the amount of information he provided in social conversations and to know when it was appropriate to talk or listen. He was described as a talented singer who belonged to his church choir. He enjoyed computer games, drawing elaborate figures (full of detail), visiting relatives, and caring for animals. He expressed an interest in pursuing a career as a massage therapist or a bowling instructor.

Fanny was a 19 year, 2 month old female diagnosed with a moderate intellectual disability [IQ 46, Wechsler Intelligence Scale for
Children–Third Edition (WISC-III): Wechsler, 1997; Adaptive Behavior Composite Score 62, Vineland Adaptive Behavior Scales: Sparrow et al., 1984). She was described as being friendly and polite and enjoyed being with peers. She used appropriate communication skills, was eager to please others, and often sought verbal reinforcement and praise. She required a quiet working environment with minimal distractions and visual presentation of material. She was able to read a calendar for information, kept a personal calendar (daily/weekly/monthly), and followed simple directions written onto lists. She was able to locate grocery advertisements in the newspaper, but needed assistance with reading such words and compiling a shopping list. She could recognize coins and their values and was learning to count simple coin combinations counting by fives. One of her greatest needs was to increase her personal hygiene skills and to complete these tasks without reminders. Other identified instructional objectives included operating a washing machine, adding and subtracting with a calculator, and writing basic information on a job application. She tended to go to sleep on the city bus and rode with supervision, requiring verbal assistance to locate different bus stops and routes. She enjoyed playing basketball, soccer, and swimming. She was employed two nights a week at a local restaurant as a greeter and expressed an interest in obtaining more work hours at the same establishment.

Settings
All generalization probe sessions were conducted in vivo on the public city bus route “102.” The instructor sat next to the student on the bus and the reliability data collector sat two rows behind them. CBVI sessions were conducted in a classroom or office area at the TPYA site. The laptop computer with touch screen was placed directly in front of the student on a desk or table. The instructor sat to the left of the student and when present the reliability data collector sat approximately 2 feet behind the student.

Target Behaviors, Materials and Equipment
One destination near a retail outlet mall was selected and targeted for instruction for each student. The destination was located approximately 10 minutes from the students’ TPYA site. The destination was chosen based on teacher and student interviews of where they needed to shop and one which did not require a transfer.

Equipment. Video recordings (with voice over) and still photographs were made using a Canon ZR830 digital video camcorder. Video recordings were made for the destination route, downloaded through the fire wire port of the camera and laptop, edited using Windows Movie Maker, and saved on the hard drive of a Dell Latitude × 300 laptop.

PowerPoint was used to develop the CBVI program which simulated the bus route and destination using video and photographs. Students accessed the program using a Magic Touch touch screen (Keytec, Inc). The first slide for each video model contained a photograph of the destination store and recorded voice with the task direction, “Riding the bus to Target.” The slide was advanced to the next slide which contained an inserted video model of the bus route and three photographs of the landmarks (Figure 1).

Video models. Video recordings were developed from a person first perspective as if the student was walking to the bus stop, boarding the bus and using a bus pass, sitting down, riding the bus, looking out the window for landmarks and bus stops, pushing the “request to stop signal” and exiting the bus. While recording the video model the person operating the camera also recorded (voice over) verbal cues associated with the three landmarks: “Look for Advanced Auto Parts”, “Look for Olive Garden,” “Push the request to stop signal when you see the Chick-Fil-A and Target sign.” At the beginning of each session the student watched the entire video model for the target route and destination followed by the first trial using video prompting (Mechling et al., 2003).

Video prompts. Video segments were recorded for the bus route for use during 0s and 3s video prompting instructional trials. These recordings were also made from a person first perspective, but did not include voice over. The video segments were for: a) walking to the bus stop, boarding the bus, using a pass, sitting down, riding the bus, passing landmarks, pushing the “request to stop signal” at the...
target landmark; and b) standing up and exiting at the correct bus stop. During the first trial using CBVI (following video modeling) the student saw the first PowerPoint slide of a video segment (from a person first perspective) of walking to the bus stop, boarding the bus, using a pass, sitting down, riding the bus, and looking out the window for landmarks. Because the bus stops were located on the right side of the street, video recording of the bus route with landmarks focused out the window of the right side of the bus. As the bus passed the three landmarks there were no verbal cues provided during video prompting. During the playing of this video segment (looking out the window for landmarks), a photograph of the “request to stop bus signal” was positioned at the bottom right corner of the PowerPoint slide (Figure 2). When selected (using the touch screen) the photograph button was programmed to stop the video. If correct (selecting the photograph at the correct landmark) the instructor advanced the program to the next slide which contained a voice over, “Yes, that’s right. Push the request to stop signal when you see the Chick-Fil-A and Target sign” and a video segment showed the bus stopping and exiting the bus.

**Experimental Design**

A multiple probe design across participants and one bus route (Tawney & Gast, 1984) was used to evaluate the effectiveness of CBVI to teach public bus transportation skills.

**General Procedure**

Three target landmarks were selected to visually cue students. The purpose of the first two landmarks was to cue or prime the student to look for the third landmark which was a visual cue to push the “request to stop bus signal.” The third landmark was approximately 500 yards from the target bus stop destination and positioned between the previous bus stop and

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**Figure 1.** PowerPoint slide depicting video model of the bus route and three photographs of the landmarks.
the target bus stop on the route. The actual Target store was not visible from the final landmark which was a Target and Chick-Fil-A advertising sign).

Students were not required to identify the correct bus for boarding because only the route “102” bus stopped where the students boarded the bus. Students were taught to identify landmarks using a 3s constant time delay (CTD) procedure and CBVI. CBVI included video modeling (presentation of the entire bus route to its target destination with verbal cues) for the first trial of each session and video prompting (presentation of bus route with target landmarks as decision points for pushing the “request to stop bus signal” at the target landmark) for three trials. Each prompting video lasted 9 minutes and 59 seconds. Instructional sessions occurred 2–3 days per week and consisted of watching the video model one time followed by three trials using video prompting. When students performed 100% unprompted correct for one session, the video model was removed. Criterion was met when each student performed 100% unprompted correct responses without the video model.

**Bus Riding Generalization and Maintenance Probe Condition Procedures**

Prior to CBVI, each student’s ability to push the “request to stop bus signal” at the target landmark and exit the bus was evaluated in the natural environment. Probe sessions were conducted in a one-to-one arrangement for a minimum of three sessions or until data stabilized (Probe 1). Each session consisted of one trial. The student was taken to the bus stop and verbally directed to “Take the bus to Target.” No other instructions or prompts were provided for identifying landmarks, pushing the “request to stop bus signal”, or exiting at the correct stop.

During probe trials students could perform the target step correctly, incorrectly, or not
respond. A correct response was defined as initiating and pushing the “request to stop bus signal” within 3s of the target landmark appearing in the student’s bus window. An incorrect response was defined as the student pushing the “request to stop bus signal” at an incorrect landmark and a no response was defined as the student failing to push the “request to stop bus signal” within 3s of the target landmark appearing in the student’s window. If the student did not respond, the instructor and the student remained on the bus and returned to the school site. If the student responded incorrectly or correctly, the instructor and the student exited at the stop where the signal was pushed. Incorrect responses resulted in the instructor and student boarding the next available bus and returning to the school site. Correct responses were reinforced by walking to the destination and making a purchase before boarding the bus and returning to the school site. Students also received non-specific verbal praise such as, “You’re doing a nice job,” on the average of one time per bus route for general attending and completion of mastered steps (i.e. “You sat down quickly when you got on the bus”).

Following each CBVI condition students returned to the community bus stop and evaluated across three trials on their ability to generalize location of the target landmarks, pushing the “request to stop bus signal”, and exiting at the correct bus stop. Maintenance data were collected up to 52 days after the final probe session and sessions were conducted identical to generalization sessions.

**Computer-Based Video Instruction Condition Procedures**

Following the first probe condition, CBVI was conducted individually with each student. Each session began with the first PowerPoint slide with a photograph of the destination store, three landmarks, and the recorded task direction, “Riding the bus to Target” (Figure 1). Following the task direction the program automatically advanced to the next slide which contained the video model. At the conclusion of the video model, the first trial began with video prompting. Intervention began using CTD with a 0s delay. Each student remained at 0s until 100% correct wait responses (correct responses after the instructor prompt) for one session (three trials). The controlling prompt for each student was the instructor touching the photograph of the “request to stop bus signal” on the computer screen. When the target landmark appeared in the video the instructor delivered the controlling prompt (gesture) and pointed to the photograph of the “request to stop bus signal” and said, “When you see the Chick-Fil-A and Target sign push the request to stop signal.” Correct wait responses (touching the photograph) resulted in the instructor advancing the program to the next slide which contained a voice over, “Yes, that’s right. Push the request to stop signal when you see the Chick-Fil-A and Target sign” and a video segment showed the bus stopping and exiting the bus.

Following 0s delay trials, CTD trials implementing a 3s delay interval were provided. Using the CTD procedure a student response was recorded as: (a) unprompted correct (initiating and touching the photograph of the “request to stop bus signal” within 3s of the target landmark appearing on the screen); (b) unprompted incorrect (touching the photograph before the target landmark appeared on the screen); (c) prompted correct (touching the photograph within 3s of the instructor prompt); (d) prompted incorrect (touching something else on the screen); and (e) no response (failure to initiate touching the photograph within 3s of the instructor prompt). An unprompted or prompted correct response resulted in the instructor advancing the program to the next slide which contained a voice over, “Yes, that’s right. Push the request to stop signal when you see the Chick-Fil-A and Target sign” and a video segment showed the bus stopping and exiting the bus. An incorrect or no response was followed by the instructor restarting the video prompting segment, pointing to the video and saying, “Look for Advanced Auto Parts”, “Look for Olive Garden”, “When you see the Chick-Fil-A and Target sign push the request to stop signal” and touching the photograph when the target landmark appeared. Students also received non-specific verbal praise on the average of one time per trial for general attending and attempts to complete the task.

After a student performed 100% unprompted correct for one session (three tri-
ass) the video model was discontinued and CBVI with 3s CTD continued with only video prompting until a student performed 100% unprompted correct for one session.

Reliability Measures

Data were collected simultaneously on students’ ability to push the “request to stop bus signal” during CBVI and generalization sessions in the natural environment (interobserver agreement) and on the instructor following condition procedures (procedural reliability). Data were collected on 100% of in-vivo generalization probe and maintenance sessions and 20% of all CBVI sessions. Interobserver agreement was calculated using the point-by-point method in which the number of agreements was divided by the number of agreements plus disagreements. Inter-observer agreement was 97.9% for student performance using CBVI (range = 66.7–100) and 100% in-vivo.

Procedural reliability agreement was determined by dividing number of each observed investigator behavior by the number of opportunities to emit that behavior or function, multiplied by 100 (Billingsley, White, & Munson, 1980). Procedural reliability data were collected on the following instructor and computer behaviors: (a) delivery of task direction; (b) delivery of controlling prompt (CBVI only); (c) error correction (CBVI only); (d) advancement of computer program to next slide; (e) exiting or remaining on the bus in response to student errors in-vivo; and (f) delivery of intermittent reinforcement. Mean procedural agreement was 97.9% (range = 91.7–100) for CBVI and 100% for in-vivo sessions. Errors during CBVI occurred most frequently for advancement to the correct slide.

Results

Figure 3 displays the percentage of correct responses for each student for pushing the “request to stop bus signal” during computer-based video instruction (CBVI) and while riding the actual bus in-vivo. The figure indicates that CBVI was an effective and efficient method for teaching students to locate landmarks and the target bus stop. Two of the three students met criteria for correctly pushing the “request to stop bus signal” using CBVI within the minimum possible number of sessions (five). Melissa was the only student who made an error during CBVI. Visual analysis of the data also indicated that with the exception of Fanny, each student was able to generalize the skill with 100% correct performance on all in-vivo sessions. Fanny did not push the request to stop signal on her first session in-vivo following CBVI. She verbally identified the two landmarks as they were passed. When the bus approached the last landmark she turned to the instructor and asked, “Do I push it now?” The instructor did not answer (probe data) and she did not push the signal. When she saw the Target store, she said, “I should have pushed it.” She correctly pushed the signal to stop on the next two in-vivo sessions. Melissa maintained the ability to push the signal at the correct landmark after 52 days and Michael maintained the skill for 17 days after his last CBVI session. Maintenance data was after only 7 days for Fanny who also maintained the skill at 100% accurate performance.

Social Validity

During the last maintenance session each student was asked by the instructor to, “Tell me about what you know about riding the bus” followed by “Did you like using the computer?” and “Would you like to use the computer again?” and if so, “What would you like to learn on the computer?” Megan said, “I know route 102” in response to the first question and that she liked pressing the button on the computer. She also said she liked shopping. When asked what she would like to learn on the computer she said, “What time the bus comes.” Matthew provided the following responses to the first question: “When you see the land points press the stop button”, “The bus is 102 and the land points are Advanced Auto Parts, Olive Garden, and Target.” To the second question he responded, “It was fun and it makes everything high tech.” He said that he would like to learn to ride the bus to his favorite place, Mayfair Mall, using the computer. Fanny said that she had learned, “Not to fall asleep on the bus” and “I can use the new route.” To the second question she responded, “I liked doing the computer thing
Figure 3. Percentage of correct responses for each student for pushing the “request to stop bus signal” during computer-based video instruction (CBVI) and while riding the actual bus in-vivo.
and it tried to teach me where to go.” She said that she would like to learn to go to Wal-Mart when asked what else she would like to learn with the computer.

**Discussion**

The ability to safely move about one’s community can increase the independence of persons with disabilities and expand their opportunities in areas such as living options, employment, and recreation when they experience a greater freedom to decide where to go and have a means for getting there. The purpose of this study was to evaluate the use of computer-based video instruction (CBVI) to teach use of a public bus transportation system and to promote generalization of the skill to the natural environment. Results indicated that CBVI was an effective and efficient (maximum of 6 instructional sessions for Melissa and 5 instructional sessions for Michael and Fanny) method for teaching each student to use landmarks on the bus route and to push the request to stop signal to exit at the correct bus stop. The current study adds to previous research by providing a means for students to accurately use landmarks for determining when to push the request to stop signal. Previous work in this area found that students frequently failed to look for landmarks while riding the public bus and therefore were unable to pull or push the signal at the correct time (Marchetti et al., 1984; Robinson et al., 1984).

Other possible advantages of teaching bus riding skills through computer-based video simulations include financial savings and a decrease in time allotted for teaching the skill in community settings. Students in the current study were able to board the bus at no extra charge due to their classroom being located on the campus of the local university and their use of student identification cards. Unlike the current study, most high school programs for persons with disabilities must pay to ride the bus each trip. In addition to cost of the bus fare, time is a consideration and constraint for many school programs. In the current study each student rode the bus in-vivo 8 times for the sake of research fidelity. It is likely that students learning to ride a bus route using CBVI in an applied school setting could do so with even fewer trips on the actual bus. In this study, the bus route to Target took approximately 10 minutes one way after boarding at the students’ program site, however use of the public bus will likely include longer routes for many students. Because of issues surrounding such time constraints, teachers are often limited to using one trial per session (verses three trials using CBVI) and fewer instructional sessions per week. With CBVI students can be presented with repeated trials for steps such as locating landmarks and pulling the cord or pushing the signal to stop.

It is also possible that although the instructor in the current study sat with the student during CBVI, that some students could interact independently with this or similar programs. Consideration should also be made for the amount of time required for a single trial. The program used in this study required approximately 10 minutes for completion of the route during video prompting (one trial). Other routes will be longer and teachers may wish to use fewer than three trials during one session.

Although positive, results of the current study must be interpreted with caution due to the small number of students and the use of only one bus route. Future research may wish to extend the limited research evaluating the effectiveness of teaching riding of a city bus through CBVI by using multiple destinations and more complex routes. Of the identified studies only Coon et al. (1981) measured the generalized effects of simulation (slides and a simulated bus in the classroom) across multiple bus stops in the natural environment. Future research may further wish to address the limitations in the scope of the current study whereby students did not use transfers or follow a bus schedule (printed or adapted).

Future studies should also include examples of unexpected events (i.e. someone stands in view of the landmark or a seat is not available on the right side of the bus) and teach related functional skills such as what to do when a stop is missed [i.e. keep riding or use a cell phone (Taber et al., 2002)].

A further limitation to the current study and its evaluation of functional bus riding skills is that students were not provided an opportunity to ride the bus alone. Due to liability concerns the instructor always rode...
with the student, but school programs may wish to have teachers ride in a car following the bus in order to gain a clearer measure of generalization.

Although the purpose of this study was to evaluate the effects of CBVI when used alone, future studies and practitioners may prefer to use a combined system of instruction through CBVI, community-based instruction, and some means of permanent prompting for identification of bus numbers, route names, and location of destinations while riding the bus. Earlier studies such as that by LaDuke and LaGrow (1984) relied on photograph systems as permanent prompts. Advancements in technology now permit evaluation of electronic hand held systems such a personal digital assistant (PDA) to provide visual task analysis using photographs (Cihak, Kessler, & Alberto, 2007; Riffel et al., 2005) video recordings (Taber-Doughty, Patton, & Brennan, 2008; Van Laarhoven, Van Larrhoven-Myers, & Zurita, 2007), or a combination of both photographs and video prompts (Mechling, Gast, & Seid, in press).

In summary, the current study supports the use of CBVI as an effective and cost efficient means to teach use of public bus transportation by students with moderate intellectual disabilities. While the current study presented all instruction via the computer-based program, future studies may wish to evaluate the concurrent use of in-vivo instruction and CBVI to teach this skill. Although CBVI may hold the advantages of lower cost, decreased time, and increased repetitive practice, its use cannot over-ride the importance of including instruction within the natural environments in which skills will be used. It is unlikely that most students will be able to generalize all skills to the natural environment without a community-based component to instruction (Westling & Fox, 2004).

Independence and self-determination are recognized goals for persons with disabilities. Among the skills linked to each is the ability to decide where one wants to go and the ability to get there. Movement into more independent living arrangements and competitive work environments may be hindered if persons with disabilities do not have adequate means of transportation in order to access these environments. Research evaluating available technologies holds continued potential in assisting persons with the development of these skills.

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The Mental Retardation and Learning Disability Bulletin, 12, 71–75.

Received: 8 January 2009
Initial Acceptance: 16 March 2009
Final Acceptance: 6 June 2009