Computer-Based Video Instruction to Teach the Use of Augmentative and Alternative Communication Devices for Ordering at Fast-Food Restaurants

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In the study reported on here, the authors used computer-based video instruction (CBVI) to teach 3 high school students with moderate or severe intellectual disabilities how to order in fast-food restaurants by using an augmentative, alternative communication device. The study employed a multiple probe design to institute CBVI as the only intervention tool and measured generalization of skills to community restaurants. For 2 of the 3 students, the ability to order their meals dramatically increased immediately following CBVI; for the third student, the ability to perform this task increased during a second generalization condition. Performance was maintained for each student. The authors discuss their results as support for this approach, which would be one solution for providing instruction in a simulated environment when community-based instruction is limited.

Augmentative and alternative communication (AAC) provides a way for persons with limited or no verbal speech to communicate. Augmentative systems provide a means to enhance speech; alternative systems provide a substitution for speech (Quill, 2000). AAC includes unaided systems, such as manual signs and gestures; aided voice output systems; and aided nonvoice output systems, such as symbols and manual communication books.

AAC can provide an independent means for persons to interact with other members of the community and to become integrated into society. Communicative competence through such interactions can increase confidence levels and feelings of acceptance among AAC users (Beck, Fritz, Keller, & Dennis, 2000).

Functional communication through AAC refers to systems that allow greater independence for the user across a range of settings and partners (Schlosser, 2000), including the use of communication across normalized community settings. Functional communication provides for interacting socially and sharing intentions (i.e., needs, wants, interests, and feelings; Snell & Brown, 2000). To be functional, communicative attempts need to be understood by communicative partners across everyday settings (Dyches, Davis, Lucido, & Young, 2002), including unfamiliar environments and with persons who are unfamiliar with the person's communicative mode (Schepis & Reid, 1995). Such settings may include schools, places of employment, department stores, grocery stores, specialty stores, and restaurants.

When providing instruction to meet the communicative needs of persons with disabilities, instructors need to consider the environments in which these individuals will communicate. Ideally, use of an AAC device should be taught in the functional contexts where it will be used (Calculator, 1999). Although daily and natural interactions across a variety of functional contexts should be included during instruction (Reichle, 1997), there often is a lack of naturally occurring communicative opportunities during instruction (Soto, Belfiore, Schlosser, & Haynes, 1992).

Faced with budgetary and scheduling issues that affect the ability to provide sufficient community-based instruction within natural environments, special education teachers often resort to providing instruction within simulated environments. For young adults and children with disabilities, these simulations often occur within the constructs of school settings. Such simulations may include replicas of equipment, materials, and/or settings found in natural community environments.

To be effective, simulations need to provide multiple examples that replicate the natural cues and stimuli of the functional contexts in which they will be used (Chadsey-Rusch & Halle, 1992; Horner, McDonnell, & Bellamy, 1986; Reichle, 1997). Research has supported these same principles for promoting generalization during AAC intervention:

1. exemplars representing the range of variation across natural settings,
2. numerous opportunities to practice skills,

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3. opportunities to practice skills across a variety of contexts, and
4. natural occurring consequences (Reichle, 1997; Schlosser, 2000; Schlosser & Braun, 1994; Schlosser & Lee, 2000).

Computer-based video instruction (CBVI) involves providing simulated instruction within realistic, interactive learning environments through incorporation of video captions and computer-based instruction. This form of simulation offers multiple teaching examples that replicate the varied environments in which the skills will be used. In a number of recent studies, researchers have evaluated the use of CBVI in teaching functional community skills, including grocery shopping (Mechling, 2004; Mechling & Gast, 2003; Mechling, Gast, & Langone, 2002); shopping in convenience stores (Wissick, Lloyd, & Kinzie, 1992); purchasing with the "next dollar strategy" (Ayres & Langone, 2002) or a debit card (Mechling, Gast, & Barthold, 2003); and verbally ordering at fast-food restaurants (Mechling, Pridgen, & Cronin, 2005).

Given statistics indicating that one out of every four adult Americans eats in a fast-food restaurant every day, the ability to access such establishments that serve inexpensive food on the run is considered functional for consumers, including individuals with disabilities (Koorland & Cooke, 1990; Snell & Brown, 2000; Westling & Fox, 2000). An important subskill necessary for using a fast-food restaurant is placing an order. A variety of ordering procedures have been evaluated in fast-food restaurants, including sign language (Rotholz, Berkowitz, & Burberry, 1989); manual communication books (Doss et al., 1991; Rotholz et al. 1989); handing pictures or word cards to cashiers (Berg et al., 1989; Cooper & Browder, 1998, 2001; McDonnell, 1987; Van Den Pol et al., 1981**);** voice output devices (Doss et al., 1991; Dyches et al. 2002; Wacker, Wiggins, Fowler, & Berg, 1988); and verbal skills (Marholin, O'Toole, Touchette, Berger, & Doyle, 1979; McDonnell & Ferguson, 1988; Mechling et al., 2005; Sowers & Powers, 1995).

Although numerous studies have supported the use of video technology to teach verbal skills to students with disabilities (Buggey, 1995; Hitchcock, Dowrick, & Prater, 2003; Mechling, 2005), none that teach the generalized use of AAC have been identified. In the current study, we evaluated the effectiveness of (a) CBVI for participants using AAC and (b) AAC within the generalized community setting of fast-food restaurants. The study further addressed the limited empirical data evaluating AAC in real-life community settings (Dyches et al., 2002) and the need to evaluate the effects of systematic instruction on the generalized use of AAC. In their meta-analysis of effectiveness research promoting generalization and maintenance of AAC, Schlosser and Lee (2000) found that the majority of studies continued to rely on what Schlosser and Lee termed *nonstrategies* (i.e., "train and hope") rather than best practices.

This study, which is unique in its focus on students' abilities to generalize use of AAC in real-life situations when only simulated instruction is provided, addressed the following primary research question: Would CBVI increase the percentage of correct responses made by students using an augmentative and alternative communication device to answer questions and make requests in fast-food restaurants?

Method

Participants

Three students (two young men and one young woman) ages 17 to 21 years participated in the study. Each student was enrolled in the Transition Program for Young Adults through the local public school system. The program served students with mild to severe intellectual disabilities who were transitioning from high school to community living and included a strong community-based instructional component. Students were taught job skills within community work sites, mobility through public transportation, purchasing, recreational skills, and access to community services. In addition, they received instruction in daily and home living skills within a two-bedroom, two-bath apartment setting leased by the school system. We selected participants for the study based on age, intellectual disability, interest in ordering at fast-food restaurants, and need for augmentative and alternative communication. Prior to beginning the study, we screened the participants for the following entry-level skills: (a) visual ability to make selections on the computer screen and AAC device, (b) auditory ability to hear posed questions on the computer and in the community fast-food restaurant, (c) physical ability to make selections on the AAC device, and (d) wait response of 3 s. Each participant had received instruction through discrete trial training, response prompting (including constant time delay), and computer-based instruction.

Cathy was a 17-year, 11-month-old young woman who had been diagnosed with Down syndrome, moderate intellectual disability (IQ 50; *Stanford-Binet Intelligence Scale, Fourth Edition* [Thorndike, Hagen, & Sattler, 1986]), mild hearing loss, and hypothyroidism (for which she was taking medication). She was able to read some functional sight words, including signs and words related to calendars, cooking, grocery shopping, and personal information. She showed high interest in wearing makeup, nail polish, and clothing accessories. She communicated primarily through verbal attempts, but her speech was often unintelligible, and she demonstrated dysfluency. She needed to slow her rate of speech and learn how to ask for assistance in the community and home, order in restaurants and stores, and provide personal information during emergency situations. When using fast-food restaurants, she relied on pointing and adults who accompanied her to intercept cashier questions and rephrase them into yes/no questions for her to answer.

Jackson was a 20-year 8-month-old young man who had been diagnosed with Down syndrome and a severe intellectual

disability (IQ 36; *Stanford-Binet Intelligence Scale, Fourth Edition*). He was described as quiet and reluctant to interact with peers and staff. He worked at a job-training program cleaning rooms and equipment in a preschool setting. He was able to carry money independently for making purchases. In the area of communication, Jackson attempted to use one-word verbalizations paired with gestures. He was encouraged to make eye contact, hold his head up, and increase his volume while communicating. His communication needs included staying on a topic, requesting help, using single words, and using a system to augment his verbal skills. At fast-food restaurants, he nodded or shook his head to answer yes/no questions, pointed to items on the display board, or turned to an adult assistant to place his order.

Chris was a 21-year 4-month-old young man with a diagnosis of Down syndrome, a moderate intellectual disability (IQ 50; *Wechsler Adult Intelligence Scale, Third Edition* [Wechsler, 1997]), and a documented history of hearing loss. He wore a hearing aid in his left ear. Chris was described as a very likeable and personable student who had many friends. He read survival words, grocery words, and restroom signs, and he made purchases using the next-dollar strategy. He was employed 2 to 3 days per week bussing tables, sweeping floors, cleaning bathrooms, and taking out trash at a local restaurant. He demonstrated excellent community skills, was able to ride the city bus independently from school to work, and, according to his classroom teacher, "demonstrated immense pride" in his independence. Concern was expressed for his decreasing use of verbal skills, which were described as regressing from two- to three-word attempts to one-word utterances. These one-word utterances were often unintelligible, and he became frustrated, failed to initiate or attempt to maintain conversation, mumbled, and became "silly" when uncomfortable with communication demands. When ordering at fast-food restaurants, he pointed to the display boards and held up his fingers to indicate the meal combination of choice (i.e., he held up one finger to indicate the Number 1 combination of a Whopper sandwich, medium French fries, and medium drink at Burger King).

Settings and Instructional Arrangements

We conducted instructional sessions individually at the apartment or school-based setting. An isolated workroom was available in the school-based program, and we used an office area in the apartment setting. Within each setting, a laptop computer was placed on a desk in front of the student. The AAC device was placed to the left of the computer, and the instructor sat to the right of the student. The instructor provided intermittent reinforcement and error correction, advanced the computer program based on student use of the AAC device, and changed overlays for the AAC device to correspond with the restaurant depicted on the computer-based program. The instructor used a clipboard for collecting data, and a digital video camera was positioned to the left of the desk to collect reliability data. We conducted generalization sessions in three fast-food restaurants: McDonald's, Hardee's, and Wendy's. These restaurants were selected due to their frequent use by the participants and availability in the community. School staff members took the students to the generalization settings via private automobiles or the city bus.

Materials and Equipment

We used a Dell Latitude laptop computer to deliver instruction. We used a Sony digital video camera to make video recordings for the computer-based instructional program and a Sony digital camera to make still photographs of items and cashiers in the fast-food restaurants. Video recordings were burned to a compact disk and stored on the hard drive of the laptop computer. Still photographs and voice recordings were stored directly in the software program Hyperstudio 4.0 (Roger Wagner Publishing, Inc.), which was used to create and deliver the instructional computer-based program. The computer-based program used the video recordings, still photographs, and voice recordings to simulate ordering at the three fast-food restaurants. Photographs were taken and video recordings were filmed at three actual stores in the students' community using store employees. We conducted observations and manager interviews across nine stores to identify multiple exemplars (Chadsey-Rusch & Halle, 1992) of question formats used by cashiers and represented through the CBVI program (see Table 1).

The AAC device used during the study was a 7 Level Communicator (Enabling Devices). During CBVI and generalization sessions, students used touching to directly select photographs on the device to indicate choices and to answer questions presented by cashiers. We chose to use a device with voice output capabilities based on research indicating positive attitudes toward users when voice output was employed (Lilienfeld & Alant, 2002; Schepis & Reid, 1995; Schepis, Reid, Behrmann, & Sutton, 1998). This device was selected based on (a) volume capabilities that could be heard in a noisy restaurant, (b) intelligibility, (c) number of cells (choices), and (d) portability. This AAC device had seven available levels with 1 to 16 cells per level. For the study, we used overlays with 8 available cells. We made individual overlays for each student for each of the three fast-food restaurants (three overlays per student, nine overlays for the study). Prior to the study, we interviewed parents, the participants, and teachers to determine food and drink preferences for each student. Chris ordered a variety of hamburgers, medium french fries, and a medium Coke. Jackson's and Cathy's parents requested that they order only grilled chicken sandwiches and water due to their diet plans. Individual overlays (see Figure 1) contained photographs of actual food and drink items to be ordered at specific restaurants, a photograph of the student eating at the restaurant (to represent the response "here"), and a photograph of the manual sign from *Signing Exact English* (Gustason & Zawolkow, 1993) to represent, "thank you." Food and drink photographs varied per overlay by presenting the logos of each

TABLE 1. Example of Stimulus, Response, and Voice Output Requirements for Fast-Food

Stimulus: Cashier question/action	Response: Cell/photo selection on AAC device	Voice output of AAC device
	Wendy's (Cathy and Jackson)	
"Is this for here or to go?"	Student eating at Wendy's	"Here"
"May I take your order?"	Chicken sandwich with Wendy's wrapper	"Grilled chicken sandwich"
	Wendy's drink cup	"Water"
Give tray of food/drink	Boardmaker sign language symbol for "thank you"	"Thank you"
	McDonald's (Chris)	
"What can I do for you?"	Quarter pounder sandwich with McDonald's wrapper	"Quarter pounder with cheese"
	Medium french fry container from McDonald's	"Medium french fry"
	McDonald's drink cup	"Medium Coke"
"Is that for here or to go?"	Chris eating at McDonald's	"Here"
Give tray of food/drink	Boardmaker sign language symbol for "thank you"	"Thank you"
	Hardee's (Cathy and Jackson)	
"Hi, can I help you?"	Chicken sandwich with Hardees's wrapper	"Big chicken sandwich"
	Hardee's drink cup	"Water"
"Is that for here or to go?"	Student eating at Hardee's	"Here"
Give tray of food/drink	Boardmaker sign language symbol for "thank you"	"Thank you"

fast-food restaurant on wrappers and drink cups. We created these overlays using the software program Boardmaker (Mayer-Johnson, Inc). This involved inserting digital photographs of food and drink items and of the students eating at the fast-food restaurant ("here") from the digital camera's 3.5-inch disk into Boardecisionmaker. Order and position of photographs remained consistent across the three different overlays per student. We preprogrammed the voice recordings for each overlay for each student using the levels available on the AAC device (see Table 1).

Purchases at the fast-food restaurants were paid by giving the cashier a single bill ($10 or $20 bill) that was sufficient for paying for the order. The bill was kept in a wallet with a zipper enclosure. During CBVI and generalization sessions, the participants responded to the video simulation and computer prompts or cashier requests for money by removing the single bill from the wallet. The participant would place change from the cashier during generalization or from the instructor during CBVI back in the wallet.

General Procedure

The current study replicated the procedures and CBVI program applied by Mechling et al. (2005). The participants received individual instruction through CBVI that incorporated a 3-s constant time delay (CTD) procedure. CBVI occurred 3 to 4 mornings a week and lasted approximately 10 to 15 min (depending on student responses), with delivery of three trials (one trial per restaurant) per session. Criteria was reached using CBVI when each student performed correctly 100% unprompted across three trials for three consecutive sessions using 3-s delay trials.

Generalization Probe Procedures

We took generalization probe measures one time for each participant in each of the three fast-food restaurants prior to the first participant's receiving CBVI. We took probe measures again in the community following CBVI with each participant

FIGURE 1. Sample overlay for ordering at McDonald's using the augmentative and alternative communication device.

prior to instruction with the next participant. Data served to measure generalization and maintenance of skills when only CBVI was used; therefore, no prompts were provided in the restaurant. The participants traveled together to each fast-food restaurant, one restaurant per day (3 days per condition). The order for visiting the restaurants was selected by the participants.

Upon entering the restaurant, the participants were directed to an area away from the counter to prevent modeling, but they were able to select their own seating preference. Each participant was taken to the counter one at a time to prevent modeling. When a participant was the next person in line, the instructor told him or her, "It's your turn to order" and waited 3 s for the participant to initiate a response. The instructor placed the AAC device on the counter to the right of the cash register and to the front left of the participant and delivered the attentional cue, **"**You may use this to order, if you like." The device contained an overlay specific to the student and to the restaurant (see Figure 1) with preprogrammed voice output. Table 1 describes the stimulus, response, and voice output requirements for one restaurant. Participants were scored on the following motor steps:

1. touch cell with photograph of sandwich selection,
2. touch cell with photograph of french fries (Chris only),
3. touch cell with photograph of drink selection,
4. touch cell with photograph of student eating at restaurant ("here"), and
5. touch cell with photograph of symbol for "thank you" from *Signing Exact English*. The sequence was different for Wendy's restaurant, where the cashier asked, "Is this for here or to go?" before requesting the food order. Students selected photographs in sequence on the overlay for Wendy's restaurant but selected Cells 2 through 4 before Cell 1 for McDonald's and Hardee's (see Table 1).

Students could perform each step correctly, perform each incorrectly, or not respond. Incorrect responses included touching an incorrect cell. *No response* was defined as failing to touch a cell. *Correct response* (unprompted correct) was defined as touching a correct cell within 3 s of a cashier's ques-

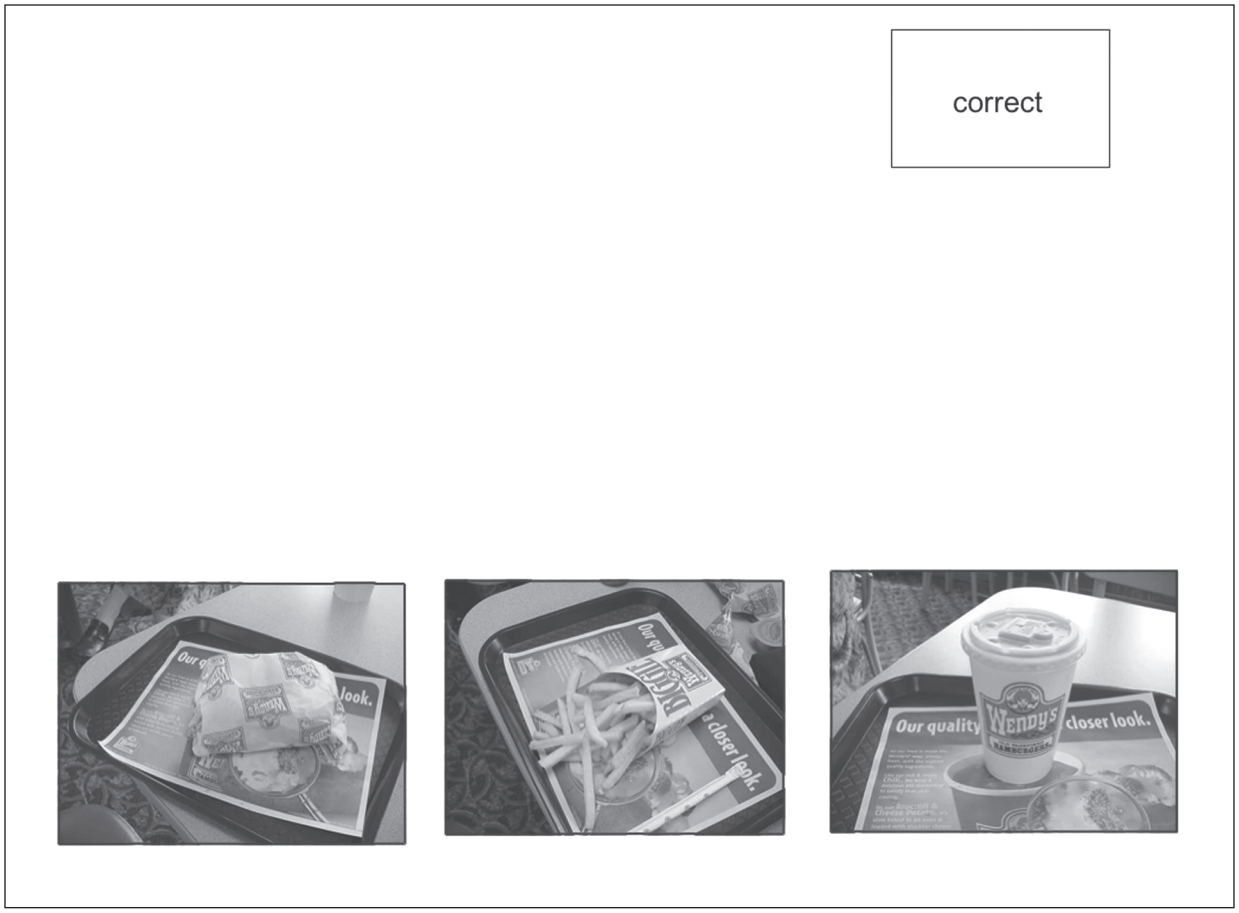

FIGURE 2. Hyperstudio "card" to verbally and visually deliver the controlling prompt to touch sandwich, french fry, and drink photographs on the AAC device for ordering at the fast-food restaurant.

tion or within 3 s of completing a prior step ("thank you"). Incorrect or no response resulted in the instructor holding up a 3″ × 5″ index card with the correct written response. The card was held so that only the cashier could read it. Procedural errors (cashier failed to ask a question such as, "Is this for here or to go?") were followed by the instructor holding up an index card prompting the cashier, "Ask if this is for here or to go." This procedure was used to avoid prompting student responses during measures of generalization and maintenance.

Students received nonspecific verbal praise at the end of the ordering session for general attending and attempts to order. Eating, drinking, and socializing served as natural reinforcement for each student.

After each participant reached criteria with CBVI, the participants returned to each fast-food restaurant and followed the described procedure to measure generalized use of the AAC device. These sessions served as additional baseline probe measures for the participants who had not yet received CBVI. We evaluated the participants who reached criteria with CBVI and completed the generalization condition for skill maintenance during later generalization probe sessions at fast-food restaurants.

Computer-Based Video Instruction

We implemented CBVI with the first participant following the first probe condition at the three fast-food restaurants. The instructor gained the student's attention and delivered the task direction, "Let's practice ordering at Hardee's using the device." CBVI procedures closely replicated those of Mechling et al. (2005). CBVI began with the student watching a video segment of a familiar adult entering the fast-food restaurant and walking to the counter. A video segment then showed the cashier asking the first question, "May I take your order?" (see Table 1), followed by a still photograph of the cashier on the computer screen paired with a recorded voice asking the first question and "waiting" on the screen for the answer.

Intervention began with a 0-s delay and remained at 0 s until the student reached 100% correct wait responses after the computer prompt for one session (three trials per session). All controlling prompts were delivered by the computer program and included photographs of the correct answer appearing on the computer screen after a 0-s delay and paired with the correct verbal response (e.g., photograph of Wendy's cup paired with a recorded voice saying, "water"; see Figure 2).

Correct responses after the prompt were defined as the student touching the correct cell on the AAC device. Four cells were present for Cathy and Jackson and five cells were present for Chris. In response to the cashier's opening question ("May I help you?" or "May I take your order?"), the instructor prompted the participants to touch two to three cells in sequence from left to right on the device (i.e., Chris touched sandwich type, french fries, and drink selection). In response to the question, "Is this for here or to go?" the student touched the cell containing a picture of him- or herself eating at the restaurant. Students were prompted by a still photograph and voice recording to touch the "thank you" photograph and cell after receiving the tray from the cashier.

Following 0-s delay trials, CTD trials implementing a 3-s delay interval were provided following cashier questions or receiving change from the cashier. Using the CTD procedure, the instructor recorded a participant's response as follows:

1. unprompted correct (initiating and completing the motor response of touching a correct cell on the AAC device within 3 s of a question or receiving the tray before delivery of the controlling prompt by the computer);
2. unprompted incorrect (incorrect motor response within 3 s of a question or receiving the tray);
3. prompted correct (correct motor response after the computer prompt);
4. prompted incorrect (incorrect motor response after the computer prompt); and
5. no response (failure to initiate a motor response within 3 s of the computer prompt).

An unprompted or prompted correct motor response was followed by the instructor advancing the computer-based program to the next screen (video and still photograph). Unprompted incorrect motor responses or no responses were followed by the instructor advancing the program to a screen presenting the controlling prompt. Prompted incorrect motor responses or no response after the prompt was followed by the instructor gesturing to the correct cell (photograph) on the AAC device.

Experimental Design

We used a multiple-probe design (Tawney & Gast, 1984) across the three participants to evaluate the effectiveness of CBVI in teaching the use of an AAC device to answer questions and make requests in fast-food restaurants. Use of the AAC device was taught through CTD and CBVI. Three experimental conditions consisted of generalization probes in natural settings (three fast-food restaurants) prior to and immediately following CBVI, and maintenance probes across the natural settings. The initial probe condition was followed by CBVI with the first participant. When criteria (100% correct unprompted across three sessions, three trials per session) were reached by a participant, we took generalization probe measures again within the natural settings (the three fast-food restaurants) and then followed with CBVI with the next participant. Maintenance checks were made in subsequent generalization probe sessions. This format—generalization probe and CBVI—continued until criteria were reached by each participant.

Reliability Measures

We collected interobserver agreement and procedural reliability data simultaneously on 33% of the CBVI sessions and 66.7% of the generalization probe and maintenance sessions. Videotapes were made during CBVI and independently evaluated by the reliability observer. The instructor and reliability observer were present during the probe sessions in the fast-food restaurants. Interobserver agreement was reported for each step of the task analysis (see Table 1) using a point-by-point method in which number of instructor and observer agreements was divided by number of agreements plus disagreements and multiplied by 100. Procedural reliability data were collected on the following instructor and computer behaviors:

1. delivering attentional cues;
2. ensuring attentional response;
3. delivering task directions;
4. advancing the computer program to the next screen, dependent on student responses;
5. correcting student errors (CBVI only);
6. positioning the AAC device for student use; and
7. providing intermittent verbal reinforcement.

Procedural reliability agreement was determined by dividing number of observed instructor behaviors by number of opportunities to emit behaviors and multiplying by 100 (Billingsley, White, & Munson, 1980).

Results

Reliability

Mean interobserver agreement was 96.2% across all participants and conditions, 96.5% for generalization sessions in the fast-food restaurants (range = 91.7–100), and 95.6% during CBVI (range = 92.3–100). Disagreement during generalization was due to sequencing errors (participant selected the correct cell on the AAC device but did so before the cashier asked a question), whereas disagreement during CBVI occurred between recording responses as correct before rather than after the prompt. Mean procedural agreement was 96.9% across all

participants and conditions, 98.4% for generalization sessions in fast-food restaurants (range = 85.7–100), and 93.5% during CBVI (range = 90.5 100). Procedural disagreement during CBVI was due to prompt delivery before 3 s and failure to advance the computer program to the correct screen following an unprompted correct response. Disagreement during probe sessions in the fast-food restaurants was due to cashiers' failing to ask questions. For example, during the second generalization condition, the cashier assumed that all three participants were eating at the restaurant and did not ask, "Is this for here or to go?" until prompted with a visual cue card by the instructor.

Effectiveness

Figure 3 shows the effectiveness of CBVI in teaching the study participants to use an AAC device to answer questions and make requests in fast-food restaurants. Data are reported for three conditions: generalization probe sessions in each of three fast-food restaurants, CBVI, and maintenance of skills. Results indicate that each participant acquired the necessary skills to communicate through AAC with cashiers in fast-food restaurants. Two of the three participants increased their correct use of the AAC device immediately following CBVI. Chris did not choose to use the AAC device during the first generalization probe session immediately following CBVI but instead reverted to holding up one finger to indicate his food choice and did not respond to the question, "Is this for here or to go?" He was taken back for an additional generalization probe condition without any further CBVI, where he performed 100% correctly across the three fast-food restaurants. During this condition, the instructor told him to use the device to order. In previous generalization conditions, the device had been placed on the counter and Chris was given a choice to use it, but he was not told to use it.

Prior to CBVI, none of the participants was able to correctly use the AAC device (0%). Cathy and Jackson looked at the instructor for assistance, and Chris held up one finger to indicate the Number 1 combination meal. Following CBVI, mean correct responding and requesting increased to 100% for Cathy and 75% for Jackson. Jackson responded correctly to questions from the cashier and ordered items correctly. He did not initiate saying "thank you" by using the device during any of the generalization sessions. His performance remained the same during the maintenance condition, which was conducted 55, 56, and 57 days after CBVI. We assessed Cathy's ability to maintain performance during two follow-up conditions. Her performance decreased to 50% and 75% for the first fast-food restaurant evaluated in the two maintenance conditions and then increased to 100% under each condition. Maintenance sessions for Cathy occurred 73 to 75 days and 101 to 104 days following CBVI. Maintenance data for Chris were limited to one fast-food restaurant due to time constraints but indicated 100% performance 58 days following CBVI.

Efficiency

We calculated measures of efficiency using the number of instructional trials to criteria with CBVI and the number of errors after the computer prompt. Interestingly, Chris required the least number of instructional trials (15) but did not generalize the skill to the community during the first generalization condition immediately following CBVI. Cathy required 42 instructional trials, and Jackson required 45 trials. Both demonstrated difficulty answering the question, "May I take your order?" On all three overlays, the cell and photograph for "here" was in the top left corner (first in sequence; see Figure 1); however, the cashiers for Hardee's *and* McDonald's asked, "May I take your order?" before asking, "Is this for here or to go?" (see Table 1), thus requiring the participants to select cells out of sequence on the AAC device.

Chris did not commit any errors after the controlling computer prompt, and Jackson only committed .05% errors (one error) during CBVI. Cathy committed 6% errors after the computer prompt. All errors occurred during the first eight trials of instruction, during which Cathy experienced difficulty in selecting the food and drink photographs on the AAC device following the visual and auditory prompt on the computer screen.

Discussion

The results from our study indicate that students with disabilities can be taught to use CBVI to independently order at fast-food restaurants with an AAC device. Prior to intervention, the participants appeared to be aware of their lack of communicative competence and relied on adult partners to verbally communicate their food requests and to answer cashier questions. With the exception of Chris, who required an additional generalization condition to respond, the participants immediately began to use the AAC device on their community visits to the restaurants.

Similar to the results of the Dyches et al. (2002) study, Cathy's attempts to verbalize increased at the fast-food restaurants while using the AAC device, and program staff members reported that she became more confident in her communicative attempts. Measures at the fast-food restaurants prior to CBVI indicated no attempts to verbalize. During generalization sessions in the community, Cathy verbalized "thank you" 66.7% of the time while touching the cell on the device. She also verbalized the phrase "here you go" as she handed money to the cashier 33.3% of the time following CBVI.

Schlosser (2000) noted the importance of ensuring that communicative partners do not respond to old forms of communication when teaching new forms. Chris had a reported long history of using the old form for ordering, which was to hold up one finger to indicate a Number 1 combo meal. Although effective when used with adult assistance, this method

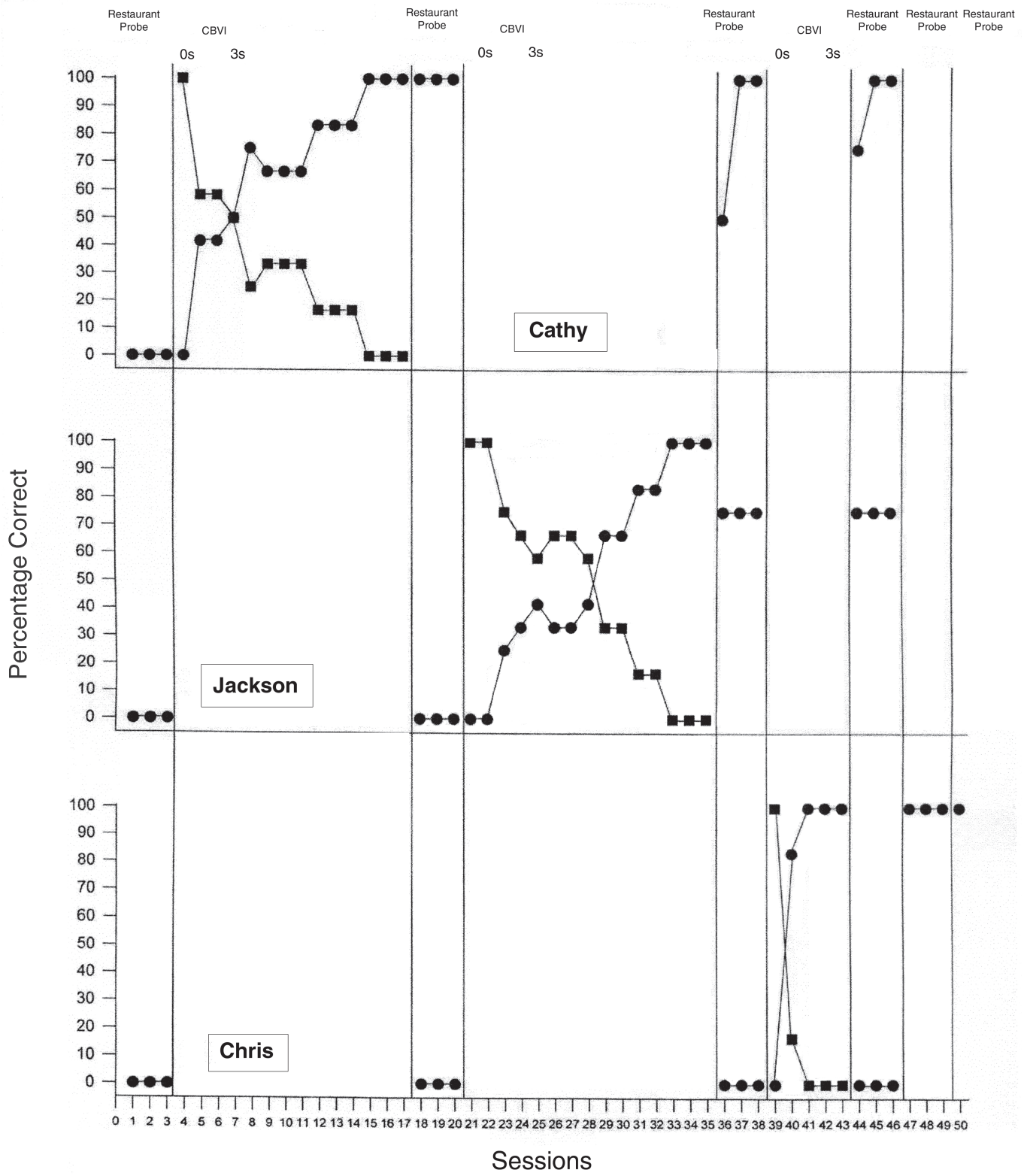

FIGURE 3. Graph of students' performance. *Note.* Circles = before the prompt; squares = after the prompt.

did not provide a means for him to independently make purchases, and not all restaurants had a number system. In addition, the number "1" did not always correspond with his preferred items of choice. Although Chris had experience using an AAC device, a limitation of this study may have been selecting a device for him rather than involving him in its selection. Providing such a choice might have increased his willingness to use the device during the first generalization session.

Although the AAC device was relatively inexpensive ($299.95) and had expandable capabilities (1–112 messages), a comment should be made about the functionality of such a system. Review of participants' Individualized Education Programs showed that at one time, recommendations had been made that each participant be provided with an AAC device; however, no system was in place, and these individuals continued to rely on adults to interpret and communicate their intents to others. We selected a system with voice output for the study based on reports of positive responses by communicative partners unfamiliar with users (Lilienfeld & Alant, 2002; Schepis & Reid, 1995; Schepis et al., 1998); however, if such devices were recommended but were not being used, one must question the functionality and desirability of such a device to the participants. Perhaps a "light-tech" device could better meet the needs of these young adults, which raises issues for future research on the functionality of communication devices equipped with voice output. Follow-ups to this study should include the feasibility of various systems for all participants and their desire to use them.

A further limitation of the study was a lack of choice-making opportunities in the restaurants. Food and drink preferences were indicated prior to the study, and the device and overlays were preprogrammed with one specific order for each restaurant. Furthermore, the device was only programmed to respond "here" to the question of where to dine. An opportunity to make active choices in response to such questions could enhance future research.

Dyches et al. (2002) discussed the importance of being understood by communicative partners. Results from our study indicate consistently accurate responses of cashiers to communicative attempts of the participants when using the AAC device. Cashiers correctly presented the requested food items 97.4% of the time. The exception was one visit to McDonald's, when Cathy ordered a chicken sandwich and was instead given a chicken salad. This example raises a further need for teaching strategies to students to use during communication breakdowns. Cathy did not protest or indicate to the cashier that she received an incorrect item, nor was her device programmed to communicate such an error. Chadsey-Rusch and Halle (1992) reported on the importance of teaching responses to "exceptions/potential errors" when teaching students to make requests. Teaching this skill follows the guidelines of teaching the general case (Horner, McDonnell, & Bellamy, 1986). Although the current study taught responses and requests based on general case programming, it did not include cells on the device that could be used to reject, question, answer general yes/no questions, or respond to cashier errors. Not identified in the initial evaluation of restaurants were questions such as, "Would you like to super size that?" These questions were spontaneously presented by cashiers during the study.

To keep variables constant across conditions and to avoid prompting in the generalization condition, we developed the card system for responding to participant or procedural errors. Although important for research purposes, this procedure prevented evaluation of the intervention to teach a more functional communication system whereby individuals could emit alternative responses when there was a communication breakdown.

In addition, AAC overlays presented photographs in the same cell position across restaurants, which may have affected the participants' ability to generalize use of the device when the sequence of questions varied. Evaluation of a more generative communication system taught through CBVI may require inclusion of a greater number of cells to allow spontaneity of responses and a variety of messages in response to different stimuli under different community conditions.

Finally, whereas the study followed recommended best practices for addressing generalization by providing multiple examples across three fast-food restaurants, measurement of generalization to untaught fast-food restaurants could enhance future studies. Furthermore, due to constraints of the research, the participants were only taught to use the AAC device in fast-food restaurants. Future evaluation of the effects of CBVI in teaching a truly "functional communication" system would require instruction and use of such a device across communicative environments.

The present study supports application of CBVI to teach functional skills to persons with disabilities when instruction must occur primarily in a simulated environment. Mechling et al. (2005) demonstrated the positive generalized effects of CBVI on verbal communication skills of three young adults with disabilities; the current study expanded the application of CBVI to an area not yet evaluated: promotion of generalized use of AAC within community settings.

Results of this study address the research gap in reported levels of generalization and maintenance effects of AAC interventions that was identified by Schlosser and Lee (2000) in their meta-analysis of the effectiveness of AAC. Systematic procedures used in our study further addressed the need for training researchers and clinicians in the use of available AAC interventions while providing multiple teaching examples through CBVI that follow recommended best practices for promoting generalization (Chadsey-Rusch, Drasgow, Reinoehl, Halle, & Collet-Klingenber, 1993; Day & Horner; 1986; Sprague & Horner, 1984).

Errors committed by participants, including Jackson's failure to say "thank you," indicate a possible direction for future research in which simulated CBVI would be combined

with in vivo instruction to remediate errors and to further enhance the effects of this procedure (McDonnell & Ferguson, 1988; Welch, Nietupski, & Hamre-Nietupski, 1985). As the technologies involved in CBVI improve and allow more advanced and accurate representations of real-life scenarios, and their use becomes more readily available to teachers and interventionists, researchers should further evaluate the impact of such practices to support individuals with disabilities across a range of environments and skills.

AUTHORS' NOTE

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