A Comparison of Prompting Strategies to Teach Intraverbals to an Adolescent with Down Syndrome

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Prompting procedures combined with transfer of stimulus control have been shown to be effective in teaching intraverbals, including identifying items within a class and answering “wh” questions (Ingvarsson & Hollobaugh, 2011; Ingvarsson & Le, 2011; Luciano, 1986; Watkins, Pack-Teixeira, & Howard, 1989; Valentino, Shillingsburg, & Call, 2012). Ingvarsson and Hollobaugh found that tact-to-intraverbal (i.e., a picture prompt) transfer of stimulus control was more efficient than echoic-to-intraverbal (i.e., an echoic prompt) transfer of stimulus control in teaching responses to intraverbal “wh” questions to three preschool-aged boys with autism. Although both prompting procedures were effective, the tact-to-intraverbal condition produced a faster rate of acquisition.

In a follow-up study, Ingvarsson and Le (2011) compared prompting procedures for establishing intraverbal responding (i.e., question answering) in four boys with autism. The authors compared vocal and picture prompts with three participants and textual, vocal, and picture prompts with one participant. All prompting procedures were effective in establishing intraverbal responding; however, vocal prompts resulted in the fewest trials to criterion for all four participants during the initial prompt comparison. The results were more ambiguous for the second comparison. Thus, the Ingvarsson and Hollobaugh

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(2011) and Ingvarsson and Le studies provide consistent evidence that multiple prompt types can be effective but inconsistent evidence about the conditions under which each prompt type might prove more efficient.

The literature on teaching intraverbals to individuals with Down syndrome (e.g., Bauer, Jones, & Feeley, 2014) is very limited. In addition, prior studies comparing tact (i.e., picture-based) and echoic (i.e., vocal) prompts to teach intraverbals have yielded inconsistent results, warranting replication, as correctly answering “wh” questions can improve conversation skills within a natural environment, consequently providing more natural reinforcement for utilizing language skills.

Thus, the purpose of this study was to systematically replicate the Ingvarsson and Hollobaugh (2011) study and to extend their research by comparing the effectiveness and efficiency of picture or echoic prompts presented on an iPad to in vivo picture or echoic prompts in teaching “wh” questions with an adolescent girl with Down syndrome.

Method

Participant

A 14-year-old Caucasian female with a diagnosis of Down syndrome, referred to by the pseudonym “Sarah,” served as the participant. Sarah was in the 8th grade and attended a self-contained special education classroom for students with severe academic delays in grades 4 through 8. A Wechsler Intelligence Scale for Children, Fourth Edition (Wechsler, 2003) indicated Sarah’s full scale IQ to be 40. Additional diagnostic information is available from the first author upon request. Sarah was able to engage in 3–4 exchange conversations with her peers and teachers. She was also able to state how she was feeling (e.g., “I am tired because I stayed up late.”) and briefly discuss activities that had previously occurred (e.g., “I went to the pool this weekend.”). She was also able to state her likes and dislikes, direct her peers to complete actions, and ask her peers and teachers simple questions, but generally was unable to answer questions that others posed. Sarah’s parents had specifically expressed concern over her inability to answer “wh” questions.

Sarah’s parents provided informed consent for participation and video recording. Sarah also signed an assent document. The study was approved through the Institutional Review Board process and included standard practices to protect participant rights (e.g., videos were coded for anonymity, data were kept in a locked filing cabinet or on a password locked computer).

Setting

All sessions were conducted in a small office connected to the participant’s classroom. Before the study began, Sarah completed non-related work tasks with her teacher (the first author) in the office with the camera present to increase her familiarity with the office and to reduce her reactivity to the camera. Sarah and the first author were the only people present during sessions.

Materials

Color photos (approximately 13 cm by 18 cm) were presented on laminated cardstock or as the only image on the iPad screen during each picture trial. The iPad echoic prompt condition involved a video of the teacher providing an echoic prompt.

Measurement and Interobserver Agreement

Event data were collected on independent correct responses emitted within 5 s to targeted “wh” questions (see Table 1). Two first-grade teachers made a list of possible correct responses for each question to determine the range of responses that would be deemed correct or incorrect. Efficiency was determined by calculating the number of trials to criterion (i.e., four correct responses per session for three consecutive sessions) for each prompt type. Two independent

Table 1 “wh” question sets by prompting strategy

Question Sets	
iPad echoic to intraverbal	Who tells and writes about the news? What do you use to call someone? Where do you learn to read and write? When do you wash your hands? When do plants grow?
In vivo to echoic	Who helps people in a store? Where do you wash dirty clothes? What do you do at a restaurant? When do you eat breakfast? Where do you go camping?
In vivo tact to intraverbal	Where do you drive the car? Who keeps your school clean? When do you go to the doctor? What is at the mall? When do you wear a seatbelt?
iPad tact to intraverbal	Who paints and draws pictures? When do you call the fire department? What do you eat soup from? When do trees grow new leaves? Where do you get dressed?
Best treatment	What does a baby drink from? When does a rooster crow? Who goes and fights in a war? What do you measure with? Where do you bake a cake?

observers collected data from randomly selected video recorded sessions for 50 % of the intervention phase, 50 % of the best-treatment phase, and 100 % of the generalization phase. Trial-by-trial measurement and interobserver agreement (IOA) was calculated by dividing the number of trials with agreement by the total number of trials for each session (Cooper, Heron, & Heward, 2007). Mean IOA during the intervention phase was 95.5 % (range, 60–100 %) and 100 % for both best-treatment and generalization phases.

Treatment fidelity was assessed via a task analysis for each condition that included accurate presentation of the question, accurate time delays, use of correct prompting procedures, and accurate delivery of behavior-specific praise. Treatment fidelity was calculated by dividing the number of steps the experimenter completed correctly during a session by the total number of steps that should have been completed for that session (Cooper et al., 2007). Treatment fidelity averaged 99.9 % (range, 97–100 %) for the comparison phase and 100 % for the best-treatment and generalization phases. Two independent observers scored fidelity for 53 % of prompt condition, 50 % of the best-treatment condition sessions, and 100 % of the generalization sessions. Trial-by-trial interobserver agreement was calculated for fidelity observations by dividing the total number of agreements by the total number of agreements and disagreements for all steps of a session and multiplying by 100 % (Cooper et al.). Mean IOA for treatment fidelity observations was 99.7 % (range, 97–100 %).

Preference Assessment

A paired-stimulus preference assessment (Fisher et al., 1992) was conducted using pictures to represent items. The assessment included items nominated by teachers and parents (e.g., teacher praise, skittles, gummy bears, tokens, high fives, M&M's). The participant was allowed to sample each item before the preference assessment was conducted and received each item or experience contingent upon selection. A total of 15 trials were conducted during one session. Teacher praise was selected most frequently, so praise was provided for correct responding throughout all conditions.

Experimental Design

An adapted alternating treatments design was used to compare the effectiveness and efficiency of the prompting strategies (Kennedy, 2005; Sindelar, Rosenberg, & Watson, 1985). Before each session, a differently colored table cloth unique to the condition was placed on the table to enhance condition discriminability. Each condition was semi-randomly alternated in blocks of four across sessions until the criterion was met for all conditions. A best-treatment phase was implemented in which the most efficient prompting procedure was used to teach correct responding to a set of five new unknown “wh” questions.

Procedures

Pre-Experimental Assessments and Baseline A pre-assessment comprised of “wh” questions” derived from the *Assessment of Basic Language and Learning Skills-*

Revised (Partington, 2010) was conducted. All of the “wh” questions could be prompted by both a picture and an echoic prompt. A panel of two first-grade and two second-grade teachers independently reviewed all questions for age appropriateness and all of Sarah’s answers for reasonableness and accuracy. The pre-assessment was conducted to identify unknown “wh” questions from the list. Each question was presented randomly three times over five sessions. The exact response for each question was recorded. The participant was praised for participation in the assessment but no feedback was provided for correct or incorrect responses. Only those questions that were answered incorrectly for all three trials were considered unknown and were included in the final question set.

Pretest A pretest was conducted to ensure the participant could display a correct listener response and echo the correct answer for all questions in the question set. Possible responses to unknown questions were presented one at a time in both picture and verbal form during two sessions; picture prompts were randomly selected to be presented in the first session, echoic prompts in the second. The target response was presented in picture form, alongside a distractor picture. The participant was instructed to emit a listener response, “Show me the ____.” This preparation differs from Ingvarsson and Hollobaugh (2011) who used a tact trial instead of listener. However, the participant generally exhibited tact-listener interdependence. Echoic questions were randomly presented in a second session. The participant was instructed, “Say ____.” Verbal praise was provided for correct responses; incorrect responses were ignored. If the participant was unable to correctly point to or echo a response, that question was omitted from the question set. Unknown questions then were randomly assigned to one of four conditions or the final best-treatment condition (see Table 1). Each condition consisted of five “wh” questions with one trial per session; the mastery criterion was 4/5 correct independent responses per session. Data from the pre-assessment were used to establish baseline levels; therefore, baseline levels for all items in all conditions were zero and were graphed as the baseline performance.

When needed, the first author provided *in vivo picture prompts* by silently presenting a color photo picture prompt by holding it in front of the participant’s face. *iPad picture prompts* consisted of silently presenting an iPad displaying the picture in front of the participant’s face. *In vivo echoic prompts* were delivered by speaking the exact desired response (e.g., “doctor,” if that was the required response). *iPad echoic prompts* utilized the iPad to play a recording of the first author verbalizing the exact desired response (e.g., the first author said “policeman,” in the recording, if that was the required response). The iPad or visual stimuli were presented approximately 45 cm in front of the participant’s face during prompt delivery.

Intervention Eight sessions were conducted each day with four sessions occurring in the morning and four sessions occurring in the afternoon. Fifteen minutes separated each session. During this time, the participant went back to her special education classroom and continued following the classroom schedule.

Prompt Comparison During the first session of each prompt condition, each question assigned to the condition was presented and was immediately followed by the prompt (i.e., 0-s delay) for three trials. Behavior-specific praise was provided upon correct

responding for each trial; incorrect responses and no responses received no reaction. In subsequent sessions for each prompting condition, each question assigned to the condition was randomly presented once with a 5-s constant delay. For any correct response, behavior-specific verbal praise was provided (e.g., “You are right! A fire-fighter does put out fires.”), and the next question was presented. Contingent upon incorrect/no responses within 5 s, a condition-specific prompt was delivered. If an incorrect or no answer occurred following the first prompt, a second condition specific prompt was delivered.

If a correct independent response did not occur during the initial presentation of the question, two teaching trials immediately followed the two prompting trials. During the first teaching trial, the question was presented and a prompt immediately followed (i.e., 0-s delay). If a correct response occurred, behavior-specific praise was provided, and the second teaching trial was presented using a 5-s constant prompt delay. If a correct response did not occur during the first teaching trial, the second teaching trial utilized an immediate prompt (i.e., 0-s delay). During the second teaching trial, behavior-specific praise was provided upon correct responding; otherwise, the author remained silent and moved to the next question in the set.

Best-Treatment Condition After the mastery criterion (i.e., four correct responses per session for three consecutive sessions) was achieved for each question set in each condition, the best-treatment prompting strategy (i.e., iPad echoic) procedures were used to teach correct responding to a set of five new questions. Procedures during the best-treatment condition were identical to the intervention condition procedures using a new set of questions that were obtained from pre-assessment data (i.e., also 0 correct responses during pre-assessment).

Generalization A generalization phase was conducted immediately following the best-treatment phase with both the iPad question sets. A classroom paraprofessional, who was an observer during the prompt comparison condition, delivered the questions within the special education classroom with other students present. Correct responses given within 5 s were praised; incorrect responses were ignored until the 5-s delay ended and the next trial began.

Results and Discussion

Results are shown in Fig. 1. During the prompt comparison phase, the mastery criterion was achieved fastest in the iPad conditions followed by the in vivo conditions. The iPad echoic condition was slightly superior in trials to mastery criterion. During the best-treatment phase, iPad echoic produced results with a new set of “wh” questions similar to the prompt comparison phase. The mastery criterion was again achieved very rapidly.

The question sets from both iPad conditions was used to probe generalization during two separate sessions. The participant achieved 80 % accuracy on the iPad echoic prompt question set and 100 % accuracy on the iPad picture prompt question set during the generalization probe.

Fig. 1 Number of correct responses obtained using each of the prompting strategies during baseline, prompt comparison, best treatment, and generalization phases

The current study replicated and extended previous research (Ingvarsson & Hollobaugh, 2011) by including a new population (i.e., an adolescent female with Down syndrome), by comparing four prompt strategies, by including multiple types of “wh” questions, by using pre-assessment data as baseline data, by not providing feedback on responses during the pre-assessment, by randomizing question presentation, and by eliminating the word “say” from the echoic prompt conditions. The participant quickly acquired responses to specific “wh” questions.

One limitation of this study was including only one participant with a specific disability. Thus, additional replication is warranted. Even though individuals with intellectual disability respond favorably to ABA interventions (Davis & Rehfeldt, 2007), future research should include participants of different ages and disability groups. The current study included technology-based prompting in response to the proliferation of technology in educational settings. However, there did not appear to be significant differences between the technology-based and live-prompting strategies. An additional limitation is that the technology prompting may have been less efficient than live prompting since the trainer was present to control the iPad during sessions. It may be beneficial to conduct future research to teach intraverbal behavior with stand-alone apps versus live instruction in terms of outcomes, cost, and time.

Compliance with Ethical Standards All procedures performed in the study were in accordance with the ethical standards of the University of West Florida IRB process and the Behavior Analyst Certification Board® (2016) *Professional and Ethical Compliance Code for Behavior Analysts*. Informed consent (as stated above) was obtained from the participant’s parents. Assent was obtained from the participant.

Conflict of Interest The authors declare that they have no conflict of interest.

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