

TEACHING EFFECTIVE HAND RAISING TO CHILDREN
WITH AUTISM DURING GROUP INSTRUCTION

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We taught 3 children with autism to raise a hand or keep both hands down depending on their status (e.g., having heard a target word, possessing a specific item) using modeling, prompting, and reinforcement. All 3 children acquired accurate hand-raising skills in response to progressively more difficult discrimination tasks during group instruction. The implications for preparing children for general education settings are discussed.

Key words: autism, conditional stimulus control, group instruction, hand raising

A significant portion of instruction in early elementary school occurs in group settings, which can be challenging for children with autism due to difficulties with attending, initiating responding, and social interactions (Dawson & Faja, 2008). To ensure that children with autism benefit to the greatest extent possible from academic integration, active responding in small-group instruction should be directly targeted (Carnahan, Musti-Rao, & Bailey, 2009). To succeed in small-group instruction, students must have acquired the targeted academic responses and also must

be able to respond effectively when an instructor poses a question to the group. The student must indicate whether he or she can provide an answer to the teacher's question (i.e., raise a hand) or not (i.e., keep hands down). Failure to raise a hand when one could answer means a missed opportunity for reinforcement or error correction, whereas raising a hand when one has no subsequent response to provide could be embarrassing or disruptive to ongoing instruction.

Recent studies have directly examined strategies for teaching children with autism to answer questions, which Skinner (1957) referred to as *intraverbals* (Finkel & Williams, 2001; Goldsmith, LeBlanc, & Sautter, 2007; Ingvarsson & Hollobaugh, 2010). However, each of these studies targeted responding in an individual instructional format, whereas most general education students encounter this kind

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of task in a group format. Furthermore, accurately responding to an instructor's question posed to a group is under conditional stimulus control. For example, answering the question "Who has the green circle?" would be under the stimulus control of both the question (the discriminative stimulus, S^D) and the possession of the green circle (the conditional stimulus). Thus, the purpose of the present study was to use a discrimination training procedure that included rules, modeling, and reinforcement to teach three children with autism to raise a hand only when they could provide an accurate response.

METHOD

Participants and Setting

Three boys with diagnoses of autism served as participants. Edgar (10 years old), Justin (9 years old), and Nathan (8 years old) received approximately 25 hr per week of intensive behavioral intervention at the same center-based program and were preparing to transition to different general education classrooms within the year. Each child had extensive receptive, imitative, mand, tact, intraverbal, and instruction-following repertoires. At the time of the study, Edgar, Justin, and Nathan had met 79%, 98%, and 96%, respectively, of the verbal and social milestones in the criterion-referenced Verbal Behavior Milestones Assessment and Placement Program (Sundberg, 2008). Despite these relatively substantial repertoires, each child consistently failed to raise his hand during group instruction when he could provide a correct answer to the teacher's question.

The center-based program was housed in the upper level of a private day-care center. The facilities included several classrooms, a gymnasium, a kitchen, bathrooms, an outdoor playground, and a front lawn. Sessions occurred in a classroom that was divided into two areas. One section contained three tables and three chairs that faced a whiteboard for individual and group academic instruction. The other

section housed a computer, books, a television, and several toys for social programming and scheduled reinforcement periods.

Dependent Variables and Measurement

Group instruction tasks. The experimenter presented three types of tasks in the form of questions during group instruction. The group consisted of the three participants only. The three tasks required progressively more difficult discriminations, with the third task constituting the educationally relevant target that these children would likely encounter in their future classroom settings. The first task involved reporting the possession of an item. Each child received an opaque bag with one item inside and was instructed to look inside. The next instruction was to raise a hand if the requested item was in the bag. The experimenter then queried "Who has the [item]?" for one of three items on each trial. In this auditory-visual conditional discrimination, the experimenter's question served as the auditory S^D , and the item in the bag served as the visual conditional stimulus for the hand-raise response. The second task involved reporting having heard a "secret word." In each trial, the teacher whispered a target word to one child and a greeting to the other two children. The experimenter then told the children to raise a hand if they had just heard the secret word. In this auditory-auditory conditional discrimination, the experimenter's question served as an auditory S^D , and the recent whisper served as the auditory conditional stimulus, both of which were presented in close temporal proximity. The third task, which was the most difficult and most educationally relevant, involved providing intraverbal and tact responses to factual questions (e.g., "What animal has a tail and four legs?"; "What is this [with picture]?"). During group instruction, the experimenter asked the children to raise a hand if they "knew the answer" to the question. In this successive conditional discrimination, the experimenter's question served as an immediate auditory S^D , but the conditional stimulus would have been presented during prior learning.

Accuracy of the hand-raise or hands-down response was determined for each child based on his own performance during an individual assessment conducted prior to baseline and every 2 weeks during intervention. During the initial assessment, the experimenter asked 40 questions from the center's curriculum to identify a list of questions that only one of the three children could answer correctly (i.e., every trial included one accurate hand-up and two hands-down responses). Fifteen new questions were presented during two subsequent assessments that were conducted during the intervention to identify new questions that only one child could answer for upcoming sessions.

Target behaviors. The dependent measure was the percentage of accurate responses to hands-down and hand-up opportunities in a session. Data were collapsed across participants to obtain a group mean accuracy for each target. A trained observer scored an accurate response to a hands-down opportunity if the child kept both hands in his lap when he did not possess the target item, had not heard the secret word, or had not previously acquired the factual answer. Any lifting of either hand under these conditions constituted an inaccurate response to a hands-down opportunity. An accurate response to a hand-up opportunity was scored when a child raised only one hand to at least shoulder level when he possessed the target item, had heard the secret word, or had previously acquired the factual answer. Keeping hands down, raising both hands, or raising the hand below the shoulder level constituted an inaccurate response to the hand-up opportunity.

Interobserver agreement and procedural integrity. A second independent observer scored 50% of sessions. Point-by-point interobserver agreement was calculated by dividing the number of agreements by agreements plus disagreements and converting the resulting ratio to a percentage. An agreement was defined as both observers scoring every child's response on a specific trial identically. Mean agreement across baseline and

training sessions was 97% (range, 85% to 100%). An observer used a checklist to score procedural integrity for 10% of sessions. Sessions were scored for the following: (a) presence of all necessary materials, (b) appropriate provision of items or secret word for the trial, (c) presentation of the questions, (d) prompts and reinforcement when appropriate to the condition, (e) inclusion of hands-down and hand-up trials for every child in every condition, (f) presentation and prompt for choral responding of the rule, and (g) experimenter's responses to correct and incorrect responses during intervention. The mean procedural integrity score across sessions was 96% (range, 93% to 100% across participants).

Procedure and Experimental Design

A concurrent multiple baseline design across tasks was used to evaluate the effects of discrimination training on accuracy of responding during group instruction. Sessions generally lasted less than 10 min and consisted of a total of 27 trials, with nine trials of each task. Each set of nine trials included six hands-down responses per child and three hand-up responses per child. The set of nine trials for a task was presented consecutively, but the order of task presentation in each session was randomly determined.

Baseline. The experimenter responded to the child's responses to the question with a general statement (e.g., "That was fun, let's do another"). Children who raised a hand were not called on, and no programmed reinforcers or prompts were delivered.

Discrimination training. Before each session, the experimenter read the rule, "If you know it or have it, raise your hand; otherwise wait for another question," to the group twice, and the group repeated the rule chorally. The experimenter then asked the first question and allowed 5 s for the participants to respond. The experimenter praised accurate hand-up and hands-down responses enthusiastically. When the correct response was a hand raise, that

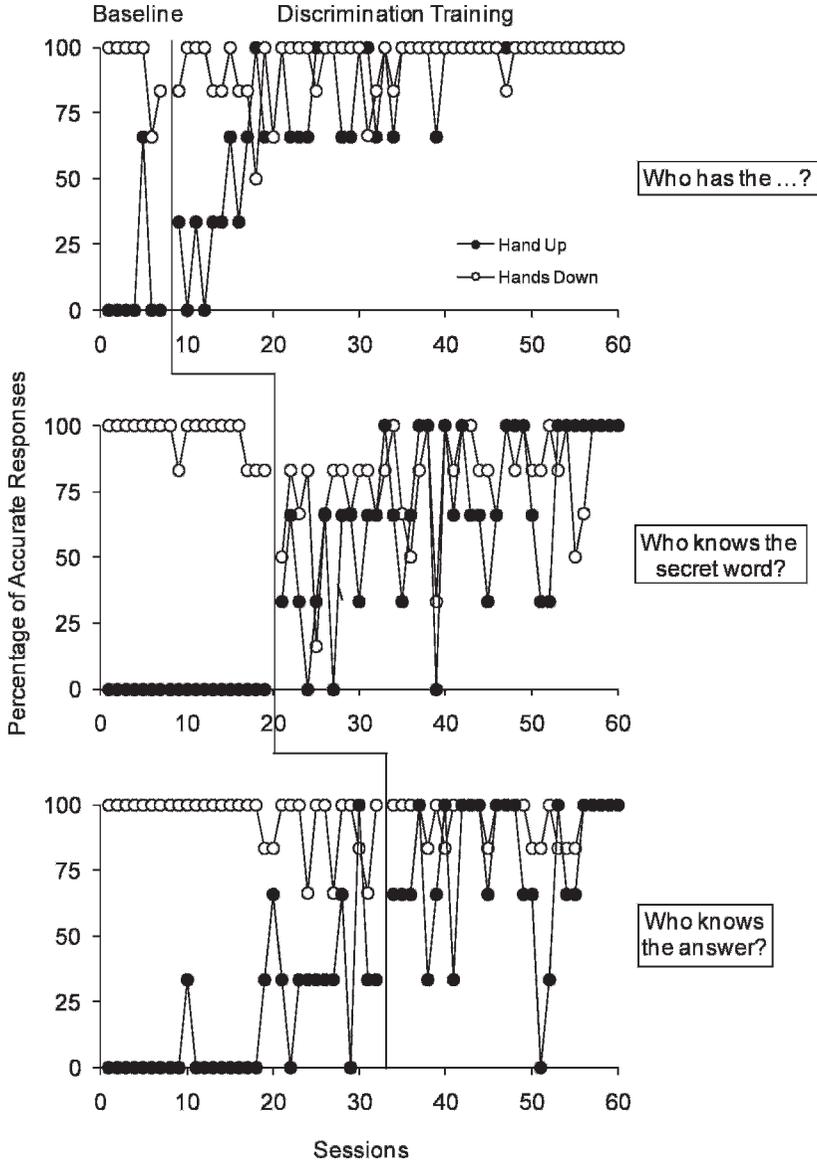


Figure 1. Percentage of accurate child responses to instructor questions across tasks. Filled circles designate trials in which the child had an item or could provide an answer (i.e., hand-up opportunities), and open circles designate trials in which the child did not have an item or could not provide the answer (i.e., hands-down opportunities).

participant stood and showed the item or reported the answer to the other students. After praising accurate responses, the experimenter responded to any inaccurate responses by stating the rule, modeling the accurate response, and providing a single rehearsal opportunity with feedback. If different children committed a hand-up error and a hands-down error on the same

trial, the hand-up error (i.e., he did not raise his hand but should have) was addressed first.

RESULTS AND DISCUSSION

Figure 1 depicts the percentage of accurate responses for the group across the three target skills. During baseline, each child usually sat

without raising his hand in response to questions regardless of status (e.g., possessing the item, having previously heard the word). This pattern of behavior resulted in a very high percentage accuracy of hands-down responses in baseline and multiple missed opportunities to participate. With the initiation of discrimination training, hand raises began to occur more frequently on hand-up opportunities. Hand raises also began to occur more frequently on the hands-down opportunities (i.e., errors), suggesting that the high baseline performance on hands-down represented nonresponding rather than accurate discrimination. The mastery criterion of three consecutive sessions with 100% accuracy for both responses was met in 29 sessions for the first task, 38 sessions for the second task, and 27 sessions for the third task. Interestingly, improvements in hand-up responses in the third task occurred while the intervention was implemented for the second task but before it was applied to the third. This pattern suggests some degree of functional interdependence or generalization between the second and third tasks as a result of a history with the intervention.

When children with autism participate in general education settings, they should be able to respond during small-group instruction to make the most of their learning opportunities (Carnahan et al., 2009). The present findings suggest that effectively responding to group instruction requires acquisition of basic academic information (e.g., tacts, intraverbals) as well as the development of conditional stimulus control over hand-up and hands-down responding. Prior to intervention, the participants had mastered various prerequisite instructional targets but failed to respond accurately when teachers presented the questions in a group context until hand raising was directly taught. The results suggest the importance of conducting both hand-up and hands-down learning trials to establish discriminated responding, rather than simply reinforcing hand raises on

every question (i.e., excessive hand raising during hands-down trials might be just as problematic as a complete lack of hand raising).

Future research might examine whether responding about private information (taught during the third task) could be learned readily without training on the first two skills. In addition, future research might explore whether more generalization might result from training with even more targets. Finally, we implemented discrimination training in a group instructional format to save the time that would have been required to conduct individual training with each participant before programming for transfer to group situations. Future research might investigate whether individual instruction might also be effective when other learners are not available for group instruction.

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