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INCREASING THE VOCAL RESPONSES OF CHILDREN WITH AUTISM AND DEVELOPMENTAL DISABILITIES USING MANUAL SIGN MAND TRAINING AND PROMPT DELAY

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The purpose of this study was to determine the effect of manual sign mand training combined with prompt delay and vocal prompting on the production of vocal responses in nonvocal children with developmental disabilities. A multiple baseline design across participants verified the effectiveness of this intervention. All participants showed increases in vocal responses following the implementation of the independent variables.

Key words: autism, mand, manual sign language, prompt delay, vocal responding

Although the goal of many language training programs is to develop vocal verbal behavior, this can sometimes be a long and difficult process. In addition, the absence of vocal verbal behavior leaves minimally vocal children without an effective form of communication. Several studies have provided empirical support for the use of manual sign manding in producing a functional communication repertoire in the absence of effective vocal verbal behavior repertoires for children with developmental disabilities (see Schlosser & Wendt, 2008, for a review; Gregory, DeLeon, & Richman, 2009). A limited body of research has also suggested that manual sign language may facilitate the development of vocal responding, but these effects may be limited to those children who have already developed at least a modest vocal imitation repertoire and may not produce the same effect for children who do not already emit a variety of vocal responses (see Schlosser & Wendt for a review). Additional procedures, conducted in combination with the teaching of manual sign language, may therefore be necessary to facilitate vocal responding.

Prompt-delay procedures, used in combination with alternative forms of communication and mand training, have been demonstrated to increase the vocal verbal behavior repertoires of children with developmental disabilities (e.g., Tincani, 2004; Tincani, Crozier, & Alazetta, 2006). For example, Tincani et al. found a differentially higher percentage of vocal responses when prompt delay was used in combination with mand training using the picture exchange communication system (PECS) compared to when mands were reinforced immediately after the exchange of the

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picture symbol. The results of this and similar studies indicate that the use of various prompt-delay procedures in combination with alternative communication systems and mand training may be effective in increasing vocal responses for nonvocal individuals with developmental disabilities. The purpose of this study was to replicate previous findings related to prompt delay and vocal prompting while teaching an alternative functional communication repertoire using manual sign language.

METHOD

Participants and Setting

The participants attended a private, publicly funded school serving mostly children with developmental disabilities. Only children who failed to demonstrate a consistent or functional vocal responding repertoire participated in the study. Tony was a 4-year-old boy with autism. He manded for 15 items with manual signs without physical or gestural prompts when a desired item was present and the motivation for the item was strong. Ralph was a 4-year-old boy with Down syndrome. He manded for 10 items with manual signs without physical or gestural prompts when a desired item was present and the motivation for the item was strong. Nick was a 6-year-old boy with autism. He had a weak manual sign mand repertoire and required partial physical prompts or full physical prompts to produce signs. The instructor conducted all sessions in each participant's classroom.

Response Definition

The dependent variable measured in the study was the occurrence of unprompted and prompted vocal responses (including speech sounds, word approximations, or adult word forms). Unprompted vocal responses included any vocal responses emitted simultaneously with the manual sign, simultaneously with a gestural or physical prompt necessary to evoke the manual sign, or after the emission of a manual sign during the 5-s prompt delay. Prompted vocal responses included any vocal responses that occurred after a vocal prompt.

Recording and Calculation of Interobserver Agreement

The participants' instructors served as the response recorders for the dependent variables. Additional instructors were trained to record observations of the dependent variables simultaneously but independently for the purpose of determining interobserver agreement. A long table separated the data recorders to ensure independence of the recordings. During each trial, the instructor recorded data on the item manded, the prompt level necessary to evoke the manual sign mand, and the occurrence of any prompted or unprompted vocal responses. They recorded vocal responses by writing the phonetic spelling of each vocal response. The data recorded by the primary observer were then compared to those of the secondary observer. Interobserver agreement was calculated by dividing agreements by agreements plus disagreements and converting the ratio to a percentage. Interobserver agreement was conducted for 30% of all sessions. Mean agreement was 99% (range, 96% to 100%).

Design and Procedure

A multiple baseline design across participants verified the effectiveness of the independent variables (Baer, Wolf, & Risley, 1968).

General procedure. The instructor selected six target mand items for each participant based on a preexperimental assessment that indicated that the participants frequently declared motivation for the items (e.g., reached for the item or looked at it). The items included edible items, toys, and movies. Sessions were conducted twice per day and consisted of 50 trials during which the target items were presented in a random rotation. Each trial began with the instructor holding a desired item at the participant's eye level to signal the availability of reinforcement. If the participant did not declare motivation for

the item within 5 s, the instructor withdrew the item and presented the next item in the rotation. If the participant declared motivation for the item (e.g., looked at it or reached for it) but did not emit a manual sign mand within 5 s or signed incorrectly, the instructor initiated a prompt sequence for the manual sign that began with a gestural prompt. If a gestural prompt was not effective in evoking the manual sign, the instructor provided a physical prompt 2 s later. The reinforcement period lasted for 30 s for activities or until the item was consumed for edible reinforcers. If the participant had refused to take the putative reinforcer after declaring motivation and emitting the manual sign, the instructor would have withdrawn the item. This never occurred during the study. If the participant did not declare motivation and signed for something other than the item displayed, the instructor withdrew the item and displayed the next item in the rotation. If the participant emitted only a vocal response without a manual sign, the instructor did not deliver the reinforcer and initiated the prompt sequence for the manual sign. This ensured that vocal responses that would not control the behavior of a listener (e.g., speech sounds) were not strengthened independent of a manual sign, which was necessary for functional communication.

Baseline. During this condition, if the participant declared motivation for an item and emitted the target manual sign mand within 5 s of the item's presentation, the instructor delivered the item immediately while saying the name of the item.

Prompt delay and vocal prompt. During the prompt-delay and vocal prompt condition, when the participant demonstrated motivation for the item and signed, the instructor did not immediately deliver the reinforcer; instead, a 5-s prompt delay occurred. If the participant emitted a sound without the sign, the instructor implemented the prompt sequence for the manual sign and then the 5-s prompt delay began. During the 5-s delay, if the participant emitted any vocal response, it resulted in delivery of the manded item immediately. If the participant did not vocalize during the prompt delay, the instructor said the name of the desired item as a vocal prompt and waited 2 s for a response. If a vocal response occurred within 2 s, the instructor delivered the desired item. If no vocal response occurred, the instructor re-presented the vocal prompt two additional times. The instructor delivered the manded item immediately after the occurrence of a vocal response following any of the vocal prompts. If no vocal response occurred, the instructor delivered the desired item at the end of the sequence of presentations of three vocal prompts.

RESULTS AND DISCUSSION

Figure 1 displays the effects of prompt delay and vocal prompts on the number of vocal responses across baseline and treatment conditions for the three participants. The pattern of responding across participants verifies the effectiveness of the treatment methods for all participants. The treatment produced an increase in the number of vocal responses that accompanied the manual sign mands for all participants. Tony's mean responding showed a threefold increase in unprompted vocal responding resulting from the prompt-delay procedure with additional vocal responses resulting from vocal prompts. Both Ralph's and Nick's manual sign mands were accompanied by very few vocal responses during baseline, but demonstrated substantial increases in unprompted vocalizations during treatment. The greater benefit to Tony may have been the result of his more complex prebaseline vocal repertoire.

The findings of this study support the conclusion that prompt delay and vocal prompting can be implemented with manual sign language to produce an increase in vocal

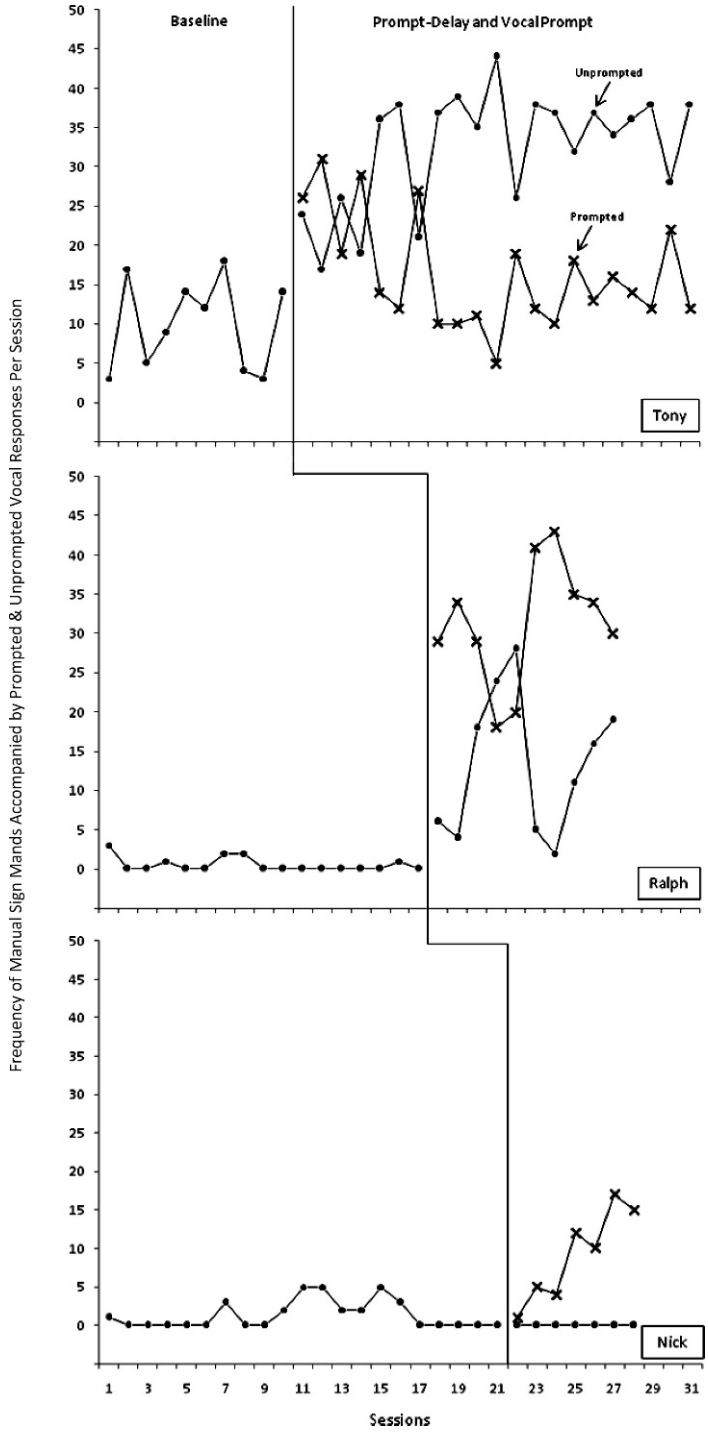

Figure 1. The frequency of manual sign mands accompanied by prompted and unprompted vocal responses per session.

responses in children with developmental disabilities who emit few vocal responses. This study did not support concerns that manual sign language may suppress vocal responses in minimally vocal children with developmental disabilities. Moreover, the combination of manual sign language and vocal responses increased the likelihood that the verbal behavior of the children in this study would effectively control the behavior of a listener. For example, some listener behavior may come under better control of the manual sign, and others may respond more effectively to the vocalization. Further, an increase in vocalizations provides an operant level from which to shape a more extensive verbal and vocal repertoire. These findings extend the benefits of prompt delay to alternative communication in the form of manual sign language. The results of this study serve as a systematic replication of the findings demonstrated with PECS (Tincani, 2004). Although it could be argued that a similar effect could have been achieved without manual sign language, the addition of sign language ensured that a functional communication repertoire was acquired as speech production was targeted for improvement. Specific to this issue, measurements of changes from speech-sound productions to word approximations demonstrated that Tony acquired five different word approximations, Ralph acquired seven, and Nick failed to acquire any word approximations. This modest but important outcome increased the likelihood that the participants' vocal responses along with contextual stimuli may have begun to control the behavior of listeners. The limitations of the study include the fact that there was no measurement of the response outside the experimental session and the small number of participants included in the study. Another possible limitation includes the time interval per opportunity difference between baseline and intervention. However, it is highly unlikely that participants would have vocalized after receiving the reinforcer during baseline. Collectively, these findings add to a growing literature that supports behavior-analytic methods for teaching vocal verbal skills to children with disabilities.

REFERENCES

Baer, D., Wolf, M., & Risley, T. (1968). Some current dimensions of applied behavior analysis. *Journal of Applied Behavior Analysis*, *1*, 91–97.

Gregory, M. K., DeLeon, I. G., & Richman, D. M. (2009). The influence of matching and motor-imitation abilities on rapid acquisition of manual signs and exchange-based communicative responses. *Journal of Applied Behavior Analysis*, *42*, 399–404.

Schlosser, R. W., & Wendt, O. (2008). Augmentative and alternative communication intervention for children with autism. In J. K. Luiselli, D. C. Russo, W. P. Christian, & S. M. Wilczynski (Eds.), *Effective practices for children with autism: Educational and behavioral support interventions that work* (pp. 325–389). New York: Oxford University Press.

Tincani, M. (2004). Comparing the picture exchange communication system and sign language training for children with autism. *Focus on Autism and Other Developmental Disabilities*, *19*, 152–163.

Tincani, M., Crozier, S., & Alazetta, L. (2006). The picture exchange communication system: Effects on manding and speech development for school-aged children with autism. *Education and Training in Developmental Disabilities*, *41*, 3–15.

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