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Using Voice Output Devices to Increase Initiations of Young Children With Disabilities

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A multiple baseline study evaluated the effects of using voice output devices to facilitate communicative initiation behaviors of 2 young children who were developmentally delayed and nonverbal. Data were collected during snack time on specific communication behaviors. Both children increased their specific initiations. In addition, unclear initiations and adult prompted communication behaviors decreased when the voice output devices were used. Comparisons with a typically developing peer suggested the voice output device enabled both children to increase their specific initiated communication behavior closer to that of the peer. Results support the use of augmentative voice output devices with young nonverbal children. Areas for future research to more thoroughly evaluate the potential utility of voice output devices are noted.

A considerable amount of investigatory attention has focused on determining what communicative behaviors constitute intentional communication of pre-linguistic children who are normally developing (Ogletree, Wetherby, Westling, 1992; Wetherby, Cain, Yonclas, & Walker, 1988; Wetherby & Rodriguez, 1992; Yoder, Warren, Kim, & Gazdag, 1994). Intentional communication can be defined as a purposeful attempt to gain an object, carry out an action, or obtain the attention of others. Furthermore, intentional communication can be prompted by other communication partners or initiated by the individual child. Initiations also can be used to obtain a social response. As illustrated by the transactional model of parent-child interaction (Yoder & Warren, 1993), children who initiate communication more clearly and frequently are more likely to obtain a facilitative communication response from an adult. For young children who are developmentally delayed and nonverbal, however, initiating communication can be problematic. For example, some children may wait for a communication partner to meet their needs, and some children may use inappropriate behaviors in an attempt to communicate.

Nonverbal children who use augmentative communication devices have additional problems when dealing with illocutionary (intentional) communication. These problems include difficulty with illocutionary communication signals such as alternating eye gaze, persistent signaling, waiting for a response from the listener, changing the signal quality, ritualizing communicative forms, and ceasing signal production in displaying satisfaction when the goal is met (Reichle, Halle, & Drasgow, 1998).

Augmentative communication devices, specifically voice output devices, recently have been used successfully with nonverbal individuals of various ages (Datillo & Camarata, 1991; Iacono & Duncum, 1995; Schepis, Reid, & Behrman, 1996). These devices can enable an individual to initiate communication and to become an interactive communication partner. Although current leaders in the field of augmentative communication recommend the use of voice output devices early in life (Kangas & Lloyd, 1988; Weitz, Dexter, &

Moore, 1997), published research on use of these devices with children under the age of 3 is limited.

Several potential advantages to using an augmentative voice output communication device have been noted (Mustonen, Locke, Reichle, Solbrack, & Lindgren, 1991). First, use of a voice output device lessens the communication burden on the listener. Unlike other alternative communication systems, augmentative voice output devices easily can be understood by those who are not familiar with the child. Second, voice output allows individuals to communicate with others without first having to gain their attention through other means such as signing or gesturing. Consequently, augmentative voice output devices may facilitate the ease with which an individual initiates interactions. The use of voice output communication devices also may help enhance comprehension of spoken language. Pairing the graphic symbol and spoken word may result both in better comprehension of the spoken word and better use of it as a symbol (Reichle et al., 1998). A third advantage is that messages can be stored on the augmentative voice output device. These messages can be prerecorded to meet the needs of an individual across situations for a variety of speech functions.

Advances in the development of voice output communication devices encourage their implementation at a very early age. Availability of a voice output device can allow young children opportunities to respond in a contingent manner to the social signals of their communication partners. In turn, communication partners may respond consistently to the actions of the augmentative communication user, further reinforcing the augmentative communication behavior and resulting in frequent and spontaneous interactions (Reichle et al., 1998).

The present study was designed to evaluate the effects of voice output devices on the communicative initiation behaviors of two young children who were developmentally delayed and nonverbal. As part of the evaluation, effects of the devices also were compared to the initiation behavior of a typically developing peer in the same setting.

METHOD

Participants

Participants in this study were Oliver and Palmer, two nonverbal boys with identified special needs. At the beginning of the study Oliver was 28 months and Palmer was 24 months of age. Oliver had a diagnosed chromosome abnormality and Palmer had a diagnosis of Angelman Syndrome. On the Early Intervention Developmental Profile (Rogers & D'Eugenio, 1981) Oliver was functioning cognitively in the 16 to 19 month range and Palmer was functioning cognitively in the 6 to 8 month range. Oliver's receptive communication skills were 20 to 23 months, however, his expressive communicative skills were 6–8 months. Palmer, on the other hand, had receptive communication skills in the 6 to 8 month range, and expressive communication skills in the 3 to 5 month range. Oliver communicated primarily by pointing to objects or by gesturing (e.g., motioning for ''come here'', patting the floor for ''sit down'', or waving his arm toward an out of reach object). He also used a grunting sound to gain the attention of adults. Oliver could move around the classroom by crawling. Although he appeared to enjoy playing with domestic play materials and he could sequence multiple steps in a play scheme, he spent much of his time observing peers in his environment. Palmer commando crawled (pulled himself on his stomach using his arms) to move around the classroom and when he approached others he smiled in apparent attempts to gain their attention. He cried when he appeared to be upset or unhappy. Primarily, Palmer performed single actions on objects, such as hitting a switch to activate a toy or rolling a ball, and he required support to maintain a seated position so he could interact with materials.

Oliver and Palmer were chosen for the study because they had low levels of communicative initiation behaviors during the snack time routine. For comparison, the communicative behaviors of Maxwell, a typically

developing classroom peer, were recorded. Maxwell was 18 months of age at the beginning of the study and he used a variety of two-word utterances to communicate his wants and needs.

Setting

The study took place during snack time in an inclusive classroom of 10 children between the ages of 18 months and 3 years. Five children in the classroom had developmental delay and five children were typically developing. Classroom staff consisted of an early intervention teacher, a speech-language pathologist, an occupational therapist, and an adapted physical education teacher.

Augmentative Communicative Assessment

Prior to intervention, both participants were assessed by a speech-language pathologist and an early intervention teacher. The assessments provided information about each child's motor and visual skills, which was used to identify an appropriate augmentative communication device for the intervention. Oliver's assessment showed he could use an isolated finger to activate a 1 ½″ × 1 ½″ button, and he could make choices from a field of at least 8 pictures. Thus, the Alpha Talker (available from Prentke-Romich) a device with a small switch and the capacity to accommodate additional pictures was selected for Oliver. Palmer, on the other hand, needed to use his whole hand to activate a device, and he could only make a selection from a field of two. Thus, for Palmer, a Dual Rocking Lever Switch (available from Enabling Devices), which had a large surface area separating each picture, was selected. On both children's augmentative communication device, Picture Communication Symbols (available from Mayer-Johnson) were used. These symbols were colored pictures with a white background.

Behavior Definitions

For this study, communicative behavior was defined as any behavior directed toward another person in an attempt to gain attention or obtain an object. Communicative behaviors were coded as either: (a) specific communicative behaviors, (b) unclear communicative behaviors, or (c) prompted communicative behaviors. The distinctions among the categories were made by observer judgments based on the following definitions. *Specific communicative behaviors* were defined as communicative responses associated with a clear, distinguishable objective (i.e., the particular intent of the child's communicative act was clear to the observer). Clarity was indicated by response specificity (e.g., a specific sign or unambiguous vocalization or gesture) or by consistent association of the response with a particular object. Scoring of specific communicative behaviors was independent of adult reactions to the child's behavior. For example, a specific communicative behavior could be scored even if the adult's head was turned and the adult failed to respond to the child's request. *Unclear communicative behaviors* were defined as responses judged to be communicative attempts, but were not clearly or immediately interpretable. That is, the behavior did not refer to a particular objective. As with specific communicative behaviors, the topography of unclear communicative behaviors could be signs, gestures, or vocalizations. *Prompted communicative behavior* was defined as any specific communicative behavior that followed a verbal or visual prompt from an adult.

Observation

All sessions were recorded and scored from videotape. Baseline data were collected across 7 sessions for Oliver, and 13 sessions for Palmer. Seven intervention sessions were conducted with Oliver before Palmer's intervention sessions began. Data were recorded in 30-second intervals during 20-minute sessions. Each behavior was recorded one time during each 30-second interval, on a partial interval basis. The absence of target behaviors was scored on a whole interval basis. Data were collected over a 4-month period. Target behaviors were coded as described earlier (i.e., specific initiations, unclear initiations, prompted, or no response).

Observations were conducted by two staff

members who worked with the children. Observers were trained using written instructions and practice observation sessions. Reliability checks were conducted during 23% of the sessions, including both experimental conditions for both children. Interobserver agreement was determined by dividing the number of agreements by the number of agreements plus disagreements, multiplied by 100. Interobserver agreement percentages for Oliver were 95% (range of 93% to 100%) for specific initiated responses, 97% (range of 95% to 98%) for unclear responses, and 95% (range of 90% to 100%) for prompted responses. Palmer's interobserver agreement percentages were 93% (range of 88% to 100%) for specific initiated responses, 87% (range of 80% to 98%) for unclear responses, and 91% (range of 83% to 95%) for prompted responses. Maxwell's interobserver agreement percentages were 94% (range of 90% to 97%) for specific initiated responses, 74% (range of 73% to 75%) for unclear response, and 89% (range of 85% to 92%) for prompted responses.

Experimental Conditions

Baseline. The classroom was labeled with Picture Communication Symbols (PCS) placed at child eye level in each center. These symbols were used to identify the center and the materials within the center. Miniature symbols for each center also were placed on choice boards so children could choose among play centers and play materials. Oliver used choice boards to select among centers, and he used PCS on single and multiple message devices within each center for various speech functions (e.g., call for attention, request assistance). Palmer also used the choice boards, but he needed object cues paired with the PCS to help him choose between centers. For example, to make a choice between the kitchen and block centers, Palmer was presented with the PCS for both centers and a plate to represent the kitchen center along with a Lego to represent the block center. Both children demonstrated an understanding of causal relationships (Wolery & Wolery, 1992) as evidenced by various play behaviors in the classroom.

The snack routine was the targeted activity. In this routine, a succession of items was placed within view of the children, thereby allowing them to request materials using their most sophisticated form of communication. Snack sessions followed the same routine: children arrived at the table, washcloths were offered to wipe hands, bibs were offered, bowls were placed on the table, and the snack entree container was presented. All items were in view of the children, but out of reach. Adults paused to allow children to initiate communication when given the visual prompt (i.e., items being placed on the table). If no communicative attempt was made, adults provided a verbal prompt (e.g., ''I have bowls''). If no communicative attempt was made the adult provided an additional opportunity for the child to request (i.e., ''Who wants a bowl?''). To provide choices between items (e.g., color of washcloth, bowl, spoon, bib) the adult offered two items and children could express their preference. Adults interacted frequently with the children, modeling appropriate vocal language and sign language. After children ate their snack entree, individual bags of cookies, cups, and a container of cheerios were placed on the table in view of the children but out of reach. Children were given items on request. When children made any unclear communicative attempt (eye gaze, reach toward group of items), the adult held up two items with the intent of prompting the child to make a choice. Each child had multiple opportunities to request each item over the 20-minute snack session. As children finished with an item, they gave the item back to the staff person before going to another item or leaving the table.

Augmentative device use. Classroom conditions were the same during both the baseline and intervention condition except when the voice output device was introduced. At the start of the intervention, Oliver was presented with an 8-picture Alpha Talker displaying 3-inch pictures and programmed with vocabulary to interact during the snack routine. The device was given to him when he arrived at the table to begin the snack routine. The same strategies used to prompt Oliver's communicative behavior during the baseline condition

also were used during the intervention condition. If Oliver did not make a specific communicative behavior when prompted, the prompting sequence was expanded and the teacher modeled activating the device within the natural context of the snack routine. During intervention, Oliver progressed to a 16-picture overlay (on a 32-grid) with 1.25-inch pictures (sessions 16–18) and then to a 20-picture overlay (on a 32-grid) with 1.25-inch pictures (sessions 19–22). Oliver did not use this device during any other activity of the day.

Palmer used the two location Dual Rocking Lever Switch with the vocabulary for ''drink'' and ''cookies''. Because of the limited vocabulary, Palmer's device was presented after he indicated being finished with his snack entree (e.g., by pushing away his bowl or refusing to eat more). For the intervention, Palmer was given one cookie or one sip of drink per request. Initially, objects were placed behind the device paired with the pictures. He did not use this device during any other activity of the day.

Experimental Design

A multiple baseline design across two participants was used. In addition, probe data on the communicative behavior of the typical peer were collected for seven sessions across the study.

RESULTS

Baseline. Specific initiations occurred during 16% of baseline observation intervals for Oliver. His specific initiation behaviors included sign language and sign approximations, handing objects to adults to gain assistance or indicate termination, and shaking his head yes or no. Oliver's unclear initiations occurred during 19% of the intervals (Figure 1), and prompted communicative behaviors during 24% of the intervals. Oliver's unclear behaviors included grunts, unclear reaches, and eye gaze. His prompted behaviors included prompted reaches and prompted gestures. For Palmer, specific initiations occurred during 4% of the observation intervals. Palmer's initiated behaviors included shaking his head no and pushing items away. Palmer's unclear initiations occurred during 37% of the intervals, and prompted communicative behaviors during 24%. Palmer's unclear communicative behaviors included eye gaze, vocalizations (vowel sounds), or unclear reaches. Palmer's prompted behaviors included prompted vocalizations, prompted gestures, and prompted reaches.

Augmentative device use. During intervention, while using the voice output device, an increase in the percentage of intervals in which Oliver made specific initiations increased to 41%. His specific initiated voice output use accounted for 37% of the specific initiation intervals, and his initiated gestures accounted for remaining 63% of the intervals. As indicated previously, the number of pictures available to Oliver on his device increased over the course of intervention. As more pictures were added, Oliver's specific initiations remained at an increased level relative to baseline. Oliver's unclear initiated behaviors decreased to 5% and his prompted behaviors decreased to 18%, relative to baseline.

When Palmer used the voice output device, the percentage of intervals in which he made specific initiations increased to 27%. Palmer's specific initiated voice output device use accounted for 71% of his specific initiations intervals, and his initiated gestures accounted for the remaining 29%. Palmer's unclear initiated behaviors decreased to 20% of the intervals and his prompted behaviors remained similar to baseline levels at 22% of the intervals.

Results for typical peer. Forty-one percent of Maxwell's observable behaviors were specific initiations. His initiated behaviors were predominately verbalizations and initiated gestures. Fifteen percent of the intervals for Maxwell included unclear initiated behavior and 24% of the intervals included prompted communicative behaviors. Maxwell's unclear communicative behaviors included unclear vocalizations, and reaches. His prompted communicative behaviors included vocalizations, prompted reaches, and prompted ges-

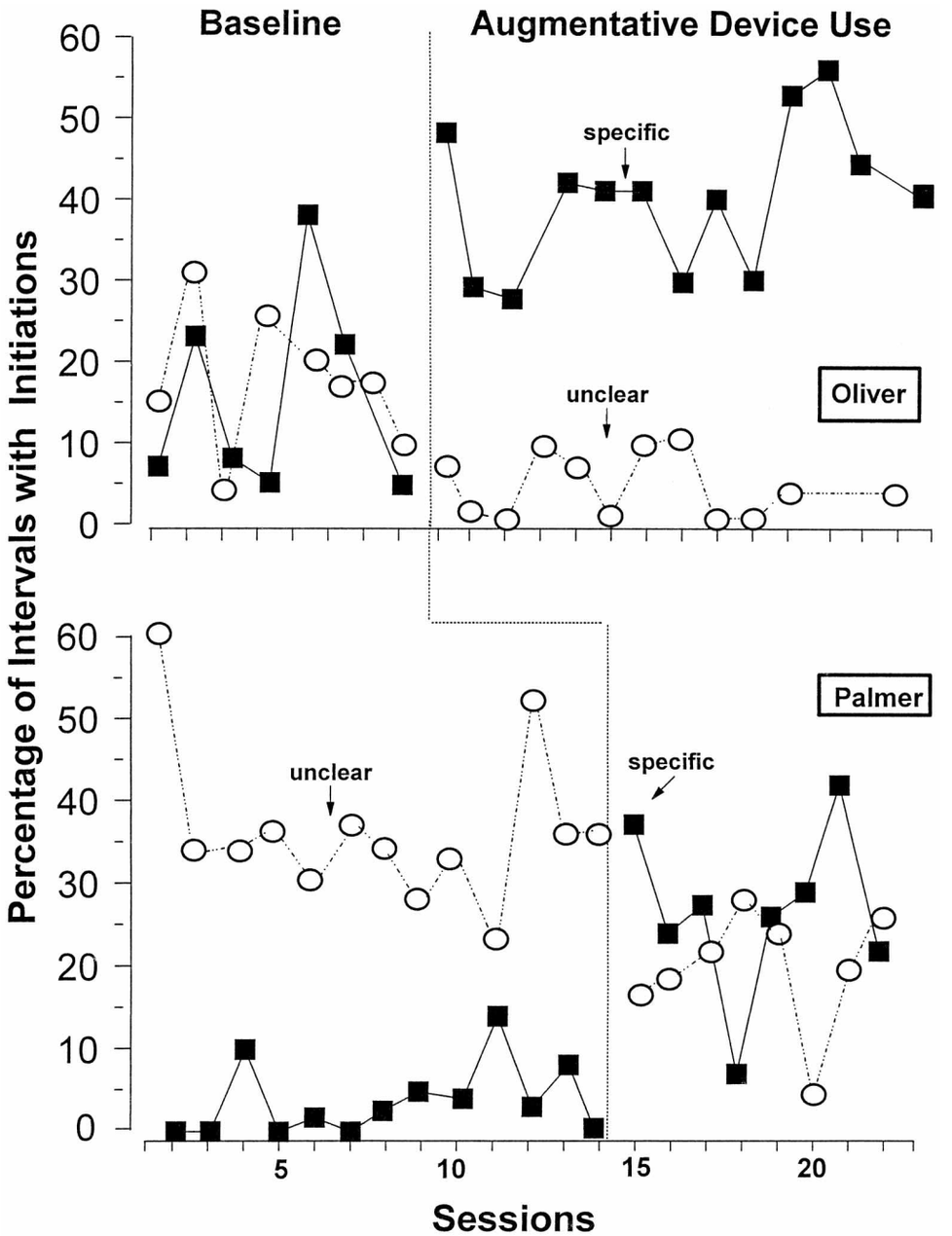

Figure 1.
Percentage of intervals with specific & unclear initiated communicative behavior during each session for both participants during each experimental condition.

tures. Twenty percent of the intervals for Maxwell were scored as no response.

DISCUSSION

Results of this study suggest that use of augmentative voice output communication devices within the natural environment was effective in increasing communicative initiations of two non-verbal young children with disabilities. Introduction of the devices and modeling device use within natural environments and routine activities was accompanied by increases in specific initiations of communicative requests during the snack time routine for both participants. Participants did not receive outside speech therapy and no remarkable changes were made in the classroom or reported in the home during the intervention period. Participants also received no formal training in use of the augmentative voice output communication device other than the modeled use of the device by classroom staff.

Data collected on a typically developing verbal child in the same setting served as a reference point for comparison of the two non-verbal participants. Over the course of the study, the specific initiated communicative behaviors of both Oliver and Palmer moved closer to the specific initiated communicative behavior of the typically developing peer, Maxwell.

Results of this study further collaborate and expand the results of previous research. Romski and Sevcik (1992) reported that 13 ambulatory male youths were more successful when initiating communications while using the System for Augmenting Language (SAL) than without it. Similar results have been reported by Goossens, Crain, and Elder (1992) and Burkhart (1993) who worked with preverbal and nonverbal preschoolers.

In our study, gains in specific initiated communicative behaviors involving augmentative voice output device use were accompanied by some increase in specific-initiated gestures and sign language use. Overall increases in the specific-initiated gestures or sign language behaviors varied across the two children. Individual differences in increases in each child's specific gesture and sign language initiations may be explained by the participants' different cognitive and fine motor skills. Oliver's fine motor skills were commensurate with his developmental functioning, whereas Palmer's fine motor skills were somewhat delayed in respect to his developmental functioning. Another potential influence on Oliver's gesture and sign language communicative behavior was his family's interest and use of sign language. In the school setting, sign language was used consistently with all children, but Oliver's family also was persistent in their use of sign language and signed with him in the home. Use of the augmentative communication voice output device did not decrease the amount of gesture or sign language communicative behavior in either participant.

During the intervention, neither child demonstrated an increase in unclear vocalizations or verbalizations. This finding may be due to both children's potential diagnosis of oral apraxia (oral motor planning problems). Our data collection system allowed grunts and fussing (not screaming or crying) to be coded as vocalizations, however during intervention, our data suggest the grunts and fussing were abandoned for more sophisticated communication. The short duration of the study (4 months) may not have allowed enough time for increases in vocal behavior to be observed.

The methodology of this investigation does not allow a refined analysis of the degree to which increases in specific initiations occurred. One possible explanation is that increases were due to an overall increase in the amount of initiation attempts of a specific nature. Another possibility, however, is simply the increased clarity of unclear initiations, that is (i.e., existing unclear initiations may have become more easily understood when the voice output device was used). Nevertheless, the amount of increase in specific initiations, relative to baseline, suggests that total initiations increased during intervention in contrast to changes that were due solely to increased clarity of unclear initiations due to clearer voice output responses. Although both outcomes can be desirable in terms of increased

communicative initiations, future research seems warranted to more precisely evaluate the changes that occur. In addition, future research to evaluate the utility of voice output devices in a wider variety of typical classroom routines also seems warranted.

The use of augmentative communication devices enabled the participants in our study to initiate communication and become more interactive communication partners. The augmentative voice output communication device was understood easily by others in the environment and enabled the participants to communicate without having to first gain the attention of the communication partner. It should also be noted, however, that the results may not be generalized to all non-verbal two year olds. A particular limitation of this study is the single replication involving only two participants. Nevertheless, in light of the promising results of this investigation, further research seems warranted on the use of augmentative communication voice output devices with other non-verbal children.

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