Research

The Effect of Aided Language Stimulation on Vocabulary Acquisition in Children With Little or No Functional Speech

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Purpose: To describe the nature and frequency of the aided language stimulation program and determine the effects of a 3-week-long aided language stimulation program on the vocabulary acquisition skills of children with little or no functional speech (LNFS).
Method: Four children participated in this single-subject, multiple-probe study across activities. The aided language stimulation program comprised 3 activities: arts and crafts, food preparation, and story time activity. Each activity was repeated over the duration of 5 subsequent sessions. Eight target vocabulary items were taught within each activity. The acquisition of all 24 target items was probed throughout the duration of the 3-week intervention period.
Results: The frequency and nature of the aided language stimulation provided met the criterion of being used 70% of the time and providing aided language stimulation with an 80:20 ratio of statements to questions. The results indicated that all 4 participants acquired the target vocabulary items. There were, however, variations in the rate of acquisition.
Conclusions: This study explores the impact of aided language stimulation on vocabulary acquisition in children. The most important clinical implication of this study is that a 3-week intervention program in aided language stimulation was sufficient to facilitate the comprehension of at least 24 vocabulary items in 4 children with LNFS.

Key Words: augmentative and alternative communication, augmented input, aided language stimulation, vocabulary acquisition, graphic symbols

Traditionally, the role of augmentative and alternative communication (AAC) systems for individuals with little or no functional speech (LNFS)—that is, persons who speak fewer than 15 intelligible words (Burd, Hammes, Bornhoeft, & Fisher, 1988)—has been as an output mode for expressing messages. While this is an essential role and the final outcome of AAC intervention strategies, the role of the listener is equally important. The comprehension of spoken language provides an essential foundation upon which language production competence can be built (Romski & Sevcik, 1993b).

Many AAC users have stable, functional speech comprehension and rely on AAC systems primarily as an expressive mode (Beukelman & Garrett, 1988). Children who use AAC systems for expressive communication may in the meantime be developing comprehension of the spoken language. For these AAC users, there are differences between the modalities of language, with the expressive modality being primarily visual (graphics and manual signs) and the receptive modality (auditory) being speech comprehension (Grove & Smith, 1997; Oxley & von Tetzchner, 1999; Smith, 1996, 1998; von Tetzchner & Grove, 2003). Other AAC users, however, have both the expressive and the receptive modalities being primarily visual (graphic and manual signs).

Children who use AAC systems as an output mode have generally two routes of understanding a message: either through the comprehension of speech or through the understanding of the AAC symbols. The latter group of users, who have limited comprehension of spoken language, acquire alternative communication forms independent of reference to speech (Romski & Sevcik, 1993a). The ability of an AAC user to use speech comprehension as a foundation for acquiring AAC systems is influenced by various factors (Romski & Sevcik, 1993b). The first factor is the ability to establish arbitrary relationships between words, objects, and events. If it is possible for the learner to establish such relationships, according to Romski and Sevcik (1988), then extant receptive language skills serve as a foundation upon which to build

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relationships between the AAC symbol and its referent. However, if the AAC user has poor speech comprehension abilities, the relationship between the AAC symbol and its referent is established through contextual cues in the communicative environment (Romski & Sevcik, 1988).

There has been little investigation into the interaction between speech comprehension and the acquisition of graphic symbols (Romski & Sevcik, 1996; von Tetzchner et al., 1996), as the emphasis of AAC intervention has been on expressive language skills (Nelson, 1992; Romski & Sevcik, 1993a; Roth & Cassatt-James, 1989). The task of developing comprehension skills with an AAC user poses certain challenges (Light, 1997). To begin with, while the AAC user hears spoken input and forms hypotheses about the meanings of words, there are few opportunities to test these hypotheses and receive feedback about the use of the words. In addition, adults who interact with AAC learners are unsure about the appropriate levels of input and usually base the level of input on the AAC user's output abilities. This may result in adults over- or underestimating the AAC user's comprehension skills.

Speech comprehension is particularly important in predicting the rate of acquisition of graphic symbol comprehension (Franklin, Mirenda, & Phillips, 1996; Romski & Sevcik, 1996). Romski and Sevcik (1996) found that in a longitudinal study of a group of youths with mental retardation, speech comprehension abilities appeared to be a predictor of progress during intervention. Even minimal speech comprehension skills may facilitate the acquisition of vocabulary items, according to Franklin et al. (1996). These researchers found that participants (age 7–21) with severe cognitive impairments who were able to identify pretest objects were more successful on object-object and object-symbol matching than those who were unable to identify at least half of the pretest objects.

The role of graphic symbols in facilitating comprehension of messages, either of the spoken language or of the AAC symbols, is an area that needs further exploration. The use of augmented input strategies is one type of instructional technique used in teaching graphic symbols to AAC users. Augmented input refers to the incoming language or communication which includes speech that is augmented with the AAC system either aided or unaided (Romski & Sevcik, 1988). Augmented input has many argued advantages, including the provision of a model of how the communication system can be employed, and of real-world experience in which the meaning of symbols and their functions can be demonstrated. The primary objective of augmented input is to provide a model for the use of graphic symbol as a viable communication mode. This input also provides the opportunity for language mapping. In addition, it facilitates greater symmetry between the expressive and receptive modes of an AAC user (Light, 1997). Finally, the use of augmented input implies that the AAC system is an acceptable and encouraged way of communicating (Romski, Sevcik, & Adamson, 1997) and the input from communication partners should be in modes that the individuals use and are expected to use later for expression (Goossens', Elder, & Crain, 1992; Romski & Sevcik, 1993a).

The literature frequently cites aided augmented input strategies such as Aided Language Stimulation (Beukelman & Mirenda, 2005; Elder & Goossens', 1994; Goossens', 1989; Goossens' et al., 1992; Romski & Sevcik, 2003), System for Augmenting Language (SAL; Romski & Sevcik, 1992, 1993a, 1993b, 1996), Natural Aided Language developed specifically for individuals with autism (Cafiero, 2001), Aided Language Modeling (Drager et al., 2006), and Aided AAC Modeling (Binger & Light, 2007). While the focus of this article is specifically the aided language stimulation strategy, brief descriptions of all the above-mentioned aided strategies are provided as an overview (for a more comprehensive overview of the strategies, see Binger & Light, 2007; Drager et al., 2006).

Aided language stimulation can be implemented by a person, such as a teacher, therapist, parent, or aid, and refers to pointing to picture symbols in conjunction with ongoing language stimulation (Goossens', 1989; Goossens' et al., 1992; Goossens', Jennings, & Kinahan, 2000). The basic premise or assumption regarding aided language stimulation is that it is an input strategy aimed at increasing receptive language abilities (Goossens' et al., 2000). Goossens' et al. (2000) suggested that the therapist should provide aided language stimulation according to certain criteria that were based on the authors' clinical experience and not empirical investigation. The first is providing input that has more comments than questions (with a statement-to-question ratio of 80:20), therefore providing more input and not emphasizing output or expression from the child. Secondly, aided language stimulation should be provided 70% of the time (Goossens' et al., 2000). This means that the therapist, when using a spoken word represented as a symbol on the overlay, concomitantly points to the appropriate symbol at least 70% of the time.

All the previously mentioned aided augmented input strategies have two components in common, namely augmenting input and providing a model for vocabulary expansion (Drager et al., 2006). Aided augmented input requires using ongoing natural speech while pointing to and labeling key graphic symbols on an AAC device as described in aided language stimulation (e.g., child points to the graphic symbol BLOCKS and the adult says *play with blocks* while pointing to graphic symbols PLAY and BLOCKS). The strategies are all based on the premise that observation of graphic symbols being used extensively by others in natural interactions provides the individual with the opportunity to establish a mental template for the combination and recombination of symbols, in a generative manner, in order to interact or communicate during an activity. The techniques are based on the way natural speakers learn to understand language and are therefore intended to teach language to an AAC user in a natural way. The use of a naturalistic setting implies that the instructions are embedded within the activities of daily life. There is opportunity for joint experience in a routine that can facilitate the development of communication (Beukelman & Mirenda, 1998, 2005).

The differences between these strategies lie in the specific procedures for implementation. The SAL comprises five components (Romski & Sevcik, 1996), including a speech communication output device, appropriate vocabulary items,

naturalistic communicative exchanges, the provision of feedback, and, finally, the provision of resources to the participants. The SAL differs from aided language stimulation in two ways (Beukelman & Mirenda, 1998, 2005). Firstly, in the SAL, the use of an electronic speech-generating device is critical to intervention (Romski & Sevcik, 1992, 1993b, 1996). Secondly, the techniques used are much simpler than the elaborate procedures used in aided language stimulation. Natural aided language (Cafiero, 2001) merged aided language stimulation with naturalistic learning by implementing the visual language system in a reinforcing environment. Aided language modeling, a term coined by Drager et al. (2006), is based on the commonalities of the SAL, natural aided language and aided language stimulation. However, it specifically uses pointing with the index finger to referents in the environment followed by pointing to the graphic symbol while simultaneously naming the referent. Finally, aided AAC modeling as described by Binger and Light (2007) encompasses any model of AAC use given to the person with LNFS by the partner during interaction. In their study, the authors specifically investigated the effect of providing preschoolers with two-symbol combination models (e.g., sequentially touching the graphic symbols for *dog* and *milk* on the AAC system, naming the pictures, and then verbalizing a sentence such as "The dog spilled the milk") on the participants' ability to produce symbol combinations.

Studies that have investigated the impact of these augmented input strategies will be discussed in terms of the description of augmented input provided and the effect of the strategy on graphic symbol learning. The impact of the SAL on language development has been researched and documented by Romski and Sevcik (1992, 1996). The results of the SAL project indicated that all the students learned to use lexigram symbols and combine them with gestures or vocalizations and thereby make requests and comments, answer questions, and perform other functions. AAC users' understanding of verbal messages during interaction can be enhanced by augmented input (Romski, Sevcik, & Cress, 1996; Romski, Sevcik, Robinson, & Bakeman, 1994). A more detailed description of the augmented input provided to 13 youths with mental retardation is provided in the study by Sevcik, Romski, Watkins, and Deffenbach (1995). The mean frequency of the augmented input provided was 9.3%, while a significant main effect was found for the number of lexigrams used, with 90.8% of the utterances containing only one lexigram and 9.2 % using multiple lexigrams. However, there was a trend to increasing multiple lexigram utterances over the 2-year-long study.

Cafiero (2001) described the natural aided language approach and the improved receptive, expressive vocabulary and positive behavior that the approach produced in an adolescent with autism and challenging behavior. While the study provides a rich description of how the strategy was provided, it does not report data on the frequency of the provision of natural aided language. Drager et al. (2006), on the other hand, described the frequency of aided language modeling as occurring four times for each item during each intervention session. The dependent variable in the multiple-baseline study included probes on comprehension of graphic stimuli, verbal stimuli, graphic and verbal stimuli, and symbol production. The findings indicated that aided language modeling was effective in increasing the participants' symbol comprehension and elicited symbol production in two preschoolers with autism. This increase was maintained although performance on symbol production lagged behind the rate of responses on symbol comprehension.

Studies on the effect of aided language stimulation on language development have been limited primarily to a few studies including case studies and single-subject designs (Basil & Soro-Camats, 1996; Binger & Light, 2007; Bruno & Trembath, 2006; Goossens', 1989; Harris & Reichle, 2004). Goossens' (1989) first reported the successful use of a multicomponent intervention package that included aided language stimulation with a 6-year-old girl with cerebral palsy. The intervention using aided language stimulation extended over a period of 7 months and seemed to result in more frequent and interactive use of the symbols. An increase in natural speech also emerged. It is, however, difficult to ascertain the isolated effect of the aided language stimulation on the results. Harris and Reichle (2004) conducted a multiple-probe-design study to investigate the impact of aided language stimulation on children with moderate cognitive disabilities. The frequency of aided language stimulation occurred four times per target item per session. The dependent variable in the study included comprehension probes on graphic symbol, spoken label, and a combination of both stimuli as well as production measures. The probes on the spoken and graphic stimuli only were similar to those used in the Drager et al. (2006) study and involved matching a line drawing to an object and an exclusively spoken label to an object. The results of their study also indicated increased and maintained symbol comprehension and production by all 3 participants following the implementation of the aided language stimulation program. In a pilot study conducted by Bruno and Trembath (2006), a week-long aided language stimulation program was found to increase the syntactic performance of most of the 9 participants, with greater gains evident for the users of manual communication boards compared to the users of dynamic display speech-generating devices.

The effect of aided AAC modeling on the expression of multisymbol messages by preschoolers who use AAC was investigated by Binger and Light (2007). The aided AAC models were provided a minimum of 30 times within each 15-min session. The findings of the multiple-probe study was that 4 of the 5 participants demonstrated consistent gains as well as the long-term use of these combinations and generalizations to new play routines.

While these studies provide support for the use of aided augmented input, there is considerable variation in terms of the reporting of the frequency of augmented input. For example, some studies demonstrated an effect with mean frequencies of 9.3% (Sevcik et al., 1995); other studies reported a positive effect with only 4 exposures (Drager et al., 2006; Harris & Reichle, 2004), while others utilized 30 exposures (Binger & Light, 2007) per session. The measures used to determine the effects of these intervention strategies included matching a line drawing to an object and an exclusively spoken label to an object in the probes (Drager et al., 2006; Harris & Reichle, 2004), while other studies that assessed

comprehension used matching of line drawings and spoken labels to graphic symbols in their probes (e.g., Binger & Light, 2007). One could argue that the latter studies probed recognition of the perceptual similarities of the teaching and probing stimuli rather than actual comprehension of the concepts being taught. The commonalities in the above augmented input strategy studies are that (a) the interventions were provided individually to each participant, (b) the target items in these studies tended to be mainly nouns, and (c) the augmented input strategies were provided mostly in relation to the target items, with the ongoing interaction limited to primarily spoken input.

The current study, however, differed from the above studies in three ways. Firstly, while aided language stimulation was provided for the target items, ongoing activity-based aided language stimulation was also provided throughout the session. Secondly, the aided language stimulation was provided in a group format. The group format rather than a one-on-one format was selected for a variety of reasons including that (a) it ensured that the same treatment was applied across participants, (b) it is more consistent with current clinical practice, and (c) it was postulated that this format would facilitate cooperative learning through social interactions (Johnson, Johnson, Holubec, & Roy, 1984) and incorporate the principle of using natural communication environments and highly contextualized settings (Paul, 1990), which is advocated in the literature as a preferred communication instruction (Beukelman & Mirenda, 2005; Calculator, 1988; Calculator & Jorgensen, 1991; Romski & Sevcik, 1988). Thirdly, this study intended to determine comprehension of the target vocabulary items (which comprised primarily adjectives) by probing use of spoken word–object matching, which was in a different stimuli mode than that of the intervention stimuli. The approach in the current study differs from previous studies in that the dependent variable did not involve the use of picture symbols at all.

The aim of this study was therefore to develop, implement, and describe an aided language stimulation program and determine its effect on the acquisition of target vocabulary items of 4 children with LNFS. This was accomplished by (a) determining the vocabulary abilities of the 4 participants prior to the implementation of the aided language program by obtaining baseline measures of the target vocabulary items, and (b) implementing the aided language stimulation program with the 4 participants over a 3-week period and determining the effect of the aided language stimulation program on the participants' acquisition of the target vocabulary items.

Method

Participants

The study was conducted at a school for learners with cognitive impairments. The participants had to comply with the following selection criteria: (a) They were identified as having LNFS (fewer than 15 intelligible words) by the school speech therapist; (b) they fell within the age range of 8.0–12.1 years to ensure that the group would find similar activities motivating; (c) they had passed a hearing screening comprising an otoscopic examination, tympanometry, and pure-tone air conduction testing at 500, 1000, 2000, and 4000 Hz at 20 db HL (American Speech-Language-Hearing Association, 1985); (d) they were able to select, with 90% accuracy, a line drawing within a field of four target symbols, arranged in a 2 × 2 array, in response to a spoken label; and (e) they were not able to identify the target vocabulary items as tested by the researcher. This was established by testing the children on 3 separate days. The child was asked to point to an item in response to a spoken question, such as "Show me the [target item]." In addition, both the parents and teacher confirmed that the child did not understand the target vocabulary items, by rating the child's understanding of the target vocabulary on an informal checklist. This provided social validation of the baseline measures. Four participants met the selection criteria, and their parents consented to their participation in the study.

Table 1 provides a description of the participants. All the participants were diagnosed as having either cerebral palsy or Down syndrome, resulting in severe dysarthria and poor speech intelligibility. The participants were all second-language English speakers and had been attending the English medium school for a minimum of 4 years. They received all their academic and other instructions in English while at school. The teachers and speech therapist described them as coping with their academic tasks in English. None of the participants had received prior AAC intervention.

Experimental Procedures

Design. The research design utilized was a single-subject, multiple probe across three activities replicated across 4 participants (Horner & Baer, 1978). The intervention (i.e., aided language stimulation) program was applied in a group format to all 4 participants simultaneously. This allowed the replication of the intervention on 4 participants. For the purpose of this study, the intervention was provided over a 3-week period. A total of 24 target vocabulary items were taught during the intervention. However, in accordance with the simultaneous replication design, assessments, baselines, and probes of each participant were done individually, providing individual data for each treated participant in terms of his or her acquisition of the target vocabulary items to test for the effect of the intervention. For this study, the independent variable was the aided language stimulation provided to a teaching criterion of five sessions, and the dependent variable was the number of target items correctly identified when responding to verbal stimuli.

General Procedures

Settings. The intervention sessions were implemented at the school, in a small room adjacent to the occupational therapist's office. The room was painted white and contained a small table and five small plastic chairs. The room controlled for visual and auditory distractions. The intervention was provided to all 4 participants simultaneously in a group format. All 4 participants were seated in a semicircle in front of the communication board, with the therapist seated to the side of the communication board to enable eye contact

TABLE 1. Description of participants.

Criteria	Participants			
	A	B	C	D
Age (years)	8.5	10. 1	8.1	12.1
Gender	Male	Female	Female	Female
Diagnosis	Cerebral palsy	Cerebral palsy	Cerebral palsy	Down syndrome
Grade	2	2	2	2
Boarding school	Stayed on school days	Stayed on school days	Stayed on school days	Did not stay at boarding school
Attending school	4 years	5 years	4 years	5 years
Home language	Zulu	Sepedi	Sepedi	Sepedi
Physical status	Right hemiplegia with greater involvement of the lower extremities. Able to direct select.	Right hemiplegia with more involvement of the upper extremities Able to direct select.	Right hemiplegia with more involvement of the upper extremities. Able to direct select.	Physically able-bodied, except for difficulties with gross and fine motor skills during some functional activities reported by the occupational therapist. Able to direct select.
Activities of daily living	Independent in terms of eating, dressing, and walking.	Independent in terms of eating, dressing, and walking.	Independent in terms of eating and walking. Required some assistance with fine motor skills for dressing.	Independent in terms of eating, dressing, and walking.
Speech characteristics	His speech was intelligible to familiar partners and less so to unfamiliar partners. His speech included substitutions and omissions.	Her speech had frequent misarticulations and was characterized by substitutions and omissions. She had difficulty with lip closure and was unable to produce bilabials, resulting in speech with a vowel-like quality.	Her speech was unintelligible to both familiar and unfamiliar partners. Her misarticulations comprised primarily omissions.	Her speech was intelligible to familiar partners and less so to unfamiliar partners. Her speech included substitutions and omissions. Her tongue mobility was compromised, which resulted in a tongue thrust with the associated impact on her speech intelligibility and characteristics.
Hearing screening	Passed	Passed	Passed	Passed
Identification of line drawings	19/20	18/20	20/20	19/20
Reynell Expressive Scale	11	15	9	15
Reynell Receptive Scale	36	40	34	31
PPVT	15	18	10	20

Note. For Reynell scales and Peabody Picture Vocabulary Test–Revised (PPVT), raw scores are listed.

with the participants and access to the communication board. This strategy enhanced the consistency of the aided language stimulation input across the 4 participants.

Preassessment phase. Once the participants were identified, preintervention language assessment measures were conducted to describe the participants' language abilities. These included the Reynell Developmental Language Scale (Reynell & Huntley, 1985) and the Peabody Picture Vocabulary Test—Revised (Dunn & Dunn, 1981). The participants' raw scores on these language measures are provided in Table 1.

Baseline. Prior to the commencement of the intervention, three consecutive baseline measures for all the 24 target vocabulary items for each participant were conducted utilizing the probe test. The 24 target vocabulary items were the same for all participants and were selected because 80% of the words were available on the composite vocabulary lists outlined by Yorkston, Dowden, Honsinger, Marriner, and Smith (1988), and the remaining 20% allowed for interactive use within the activity, which is paramount for children learning the use of the AAC system (Goossens', 1989).

Probes. The probe test, used to establish the baseline, was also used to individually probe each participant's acquisition of all 24 target vocabulary items. The probes were conducted on Monday, Wednesday, and Friday of each of the 3 weeks of intervention, after the implementation of the session, to measure the acquisition of the target vocabulary items. Each participant was probed individually and outside the context of providing aided language stimulation. The probes involved matching the spoken label to an object to probe whether the participant understood the required

concepts. The spoken label-to-object matching probe aimed to determine the comprehension of the actual concepts taught. The probes comprised 24 objects that represented the target items (Dada, 2004). Each target item had three distracting stimuli or foils. The objects were arranged in one row of 5 objects approximately 10 cm apart from each other. One object served as the target object, and 4 served as foils. The researcher randomly assigned the position of the object choices. The participant was asked a question such as "Which one is different?" and was required to point to the corresponding object. The participants had five spoons in view. Four spoons were silver, and one was plastic. See Table 2 for a description of the probes for the arts and crafts activity. A correct response consisted of the participant independently pointing to the object corresponding to the researcher's spoken word within 10 s. Standard general feedback (i.e., "Okay, let's continue") was provided. The participants were not required to name the target items.

Intervention. The technique of aided language stimulation used in this study refers to the researcher simultaneously pointing to symbols on a communication board in conjunction with providing ongoing spoken language stimulation (Goossens', 1989; Goossens' et al., 1992). Hence, the researcher pointed to the graphic symbol within 1 s of the spoken input. The aided language stimulation provided did not involve the use of AAC devices because the participants did not have previous AAC intervention and therefore did not have access to AAC devices.

Three activities were identified for the purpose of this study, namely arts and crafts, food preparation, and story time (Dada, 2004). The arts and crafts activity involved making a picture of a sheep. The second activity was making pudding, and the final activity was a retelling of the story "Goldilocks and the Three Bears" (Daley, 1993). Both the arts and crafts as well as the food preparation activities were single project activities, in which the entire group of participants collaboratively assembled one project. This meant that the group collectively made a picture of the sheep or a bowl of pudding. A communication board for each activity was developed (see Figure 1), based on principles outlined by Goossens' et al. (1992). Each communication board measured 50 cm × 70 cm and was made of black cardboard 5 mm in thickness. The boards were laminated in a matte finish. After lamination, two strips of Velcro were placed on each board.

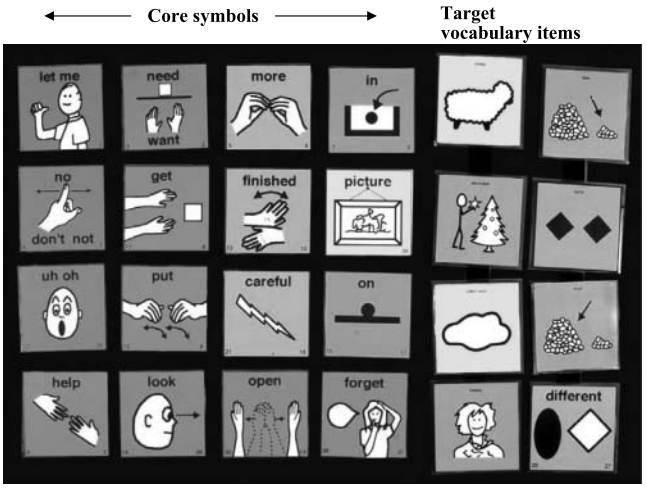
Each communication board contained 16 core symbols that were permanently fixed onto the board. Each communication board had 8 additional target vocabulary items or symbols. The target vocabulary items were removable and could be attached to the strips of Velcro during the demonstration of the activity. The symbols used were black-and-white line drawings from commercially available Picture Communication Symbols using the Boardmaker software program (Mayer-Johnson, 1985), and each measured 10 cm × 10 cm. Each symbol had the corresponding written gloss, in English, above the picture. Each symbol had a colored background depending on the category of the words, as suggested by Goossens' et al. (1992).

The intervention (i.e., the aided language stimulation program) was implemented by a speech, language, and hearing therapist with a master's degree. The intervention sessions

TABLE 2. Examples of probes used in arts and crafts activity.

Vocabulary item	Note	Target Item	Foil 1	Foil 2	Foil 3	Foil 4	Probe question
Sheep		Toy sheep	Toy horse	Toy cow	Toy goat	Toy chicken	Show me the sheep.
Cotton wool		Cotton wool	Cotton on cotton reel	Piece of chiffon material	Rubber hair band	Cotton tipped applicator (cotton bud)	Show me cotton wool.
More	Identical glass bottles were used with onion seeds.	Glass bottle with most amount of onion seeds (three quarters full)	Glass bottle with onion seeds (one quarter full)	Silver fork	Different colored, empty, small, glass bottle	Plastic fork	Which one has more?
Less	Identical glass bottles were used with onion seeds.	Glass bottle with no onion seeds	Glass bottle with onion seeds (one quarter full)	Color pen	Plastic spoon	Silver spoon	Which one has less?
Decoration	Containers were plastic and the same shape.	Square container with painted flowers	White, square container with no flowers painted	Blue, square container with no painted flowers	Brown, square container with no painted flowers	Smaller brown, square container with no painted flowers	Which one has decorations?
Same	Child had to point to both the round, plastic spoons	Round, plastic dessert spoon	Round, plastic dessert spoon	Silver teaspoon	Plastic teaspoon	Long silver teaspoon	Which ones are the same?
Messy	Same texture and color of napkin.	Paper napkin with wet paint on it	Torn paper napkin	Plain paper napkin, square	Crumpled paper napkin	Plain paper napkin folded in half (triangle)	Which one is messy?
Different	Silver teaspoons were the same size.	Plastic teaspoon	Silver teaspoon	Silver teaspoon	Silver teaspoon	Silver teaspoon	Which one is different?

FIGURE 1. Communication board for the arts and crafts activity. The Picture Communication Symbols ©1981–2008 by Mayer-Johnson LLC. All rights reserved worldwide. Used with permission.



were conducted in the mornings and lasted between 15 and 25 min per day. Each activity was implemented for a week or 5 consecutive days (intervention phase), that is, five sessions teaching criteria. Thereafter, the next activity was introduced and the previous activity ceased (postintervention phase). Each activity had 8 target vocabulary items. During each session, the participants were exposed to each target vocabulary item three to five times. The target vocabulary items included a limited number of nouns (3/24), with the remainder being primarily adjectives (e.g., *messy, decorated*).

The aided language stimulation was provided in a group format to all 4 participants simultaneously, enabling all 4 participants to receive the same intervention. The entire activity involved the provision of aided language stimulation, with the therapist pointing to the available symbols on the communication board while providing ongoing spoken language stimulation. The ongoing aided language stimulation provided was limited by the steps involved in completing the task (arts and crafts and food preparation activities) or the story line (story time activity), as well as the vocabulary available on the communication boards. The additional symbols available (examples shown in bold type below) on the communication board also enabled the therapist to ensure that all the participants were engaged in the activity (e.g., "**Look** here, we are **put**ting **on** the **cotton wool**" or "**Uh oh!** Don't **forget** [child's name] to **put on** the glue"). The therapist did not proceed with the activity until all the participants were engaged and looking at the board. All the sessions were videotaped. The video recordings were focused on the therapist and the communication board in order to capture data on the intervention provided, with the goal being enhanced procedural fidelity.

Data Analysis for Aided Language Stimulation Input

The videotapes of the aided language stimulation sessions were transcribed verbatim by the researcher and analyzed in relation to the three measures, which monitored the intervention fidelity. These were (a) the frequency of the aided language stimulation, calculated by dividing the number of times aided language stimulation was provided by the total number of opportunities for aided language stimulation multiplied by 100 (an opportunity was described as the use of a spoken word that had a corresponding symbol on the communication board); (b) the nature of the aided language stimulation, which refers to the ratio of statements to questions for each session; and (c) the total number of times the researcher used the target vocabulary item and simultaneously pointed to the symbol on the communication board during each session.

Interobserver Agreement

Dependent measures. An observer watched and independently recorded responses for 20% of each probe session. Interobserver agreement was calculated on a point-by-point basis (Kazdin, 1982) by dividing agreements by agreements plus disagreements and multiplying by 100. A probe was scored as an agreement when both the therapist and the observer recorded the same responses. Interobserver agreements were between 95% and 100% for the participants.

Procedural fidelity. Procedural fidelity data were collected for all of the intervention sessions. All the transcriptions were rated by an external rater who was an honors student in AAC. The transcripts were compared to the tapes and rated in terms of the accuracy of the transcriptions and the measures of intervention fidelity, namely the frequency of aided language stimulation, the nature of aided language stimulation, and the number of times the target item was used in a session. Interobserver agreement was calculated on a point-by-point basis (Kazdin, 1982) by dividing agreements by agreements plus disagreements and multiplying by 100. Interrater reliability measures were between 90% and 95% for the accuracy of the transcriptions and between 90% and 100% for the intervention fidelity measures.

Data Analysis for Acquisition of Target Vocabulary Items

Each of the 4 participants' acquisition of the target vocabulary items was assessed using the probe test. The responses were noted and plotted graphically.

Results

Description of the Aided Language Stimulation Input

Table 3 provides an overview of the nature of the input provided in all three activities.

It is evident that the frequency of aided language stimulation and the statement-to-question ratio meet the criteria specified by Goossens' et al. (2000) of 70% and a ratio of 80:20, respectively. While these criteria are clinically accepted as making up aided language stimulation, they have not been empirically tested. It appears that there was a slight improvement across the activities in terms of the frequency of the aided language simulation activity. The frequency of

TABLE 3. Nature of aided language input for the various activities.

	Arts and crafts activity					Food preparation activity					Story time activity				
	Sessions					Sessions					Sessions				
Criteria	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Frequency of aided language stimulation	76%	85%	85%	84%	87%	85%	86%	85%	92%	87%	90%	93%	93%	89%	85%
Nature of aided language stimulation	86:14	91:9	91:9	89:11	91:9	92:8	91:9	93:7	96:4	94:6	97:3	93:7	94:6	96:4	95:5

Note. Frequency of aided language stimulation was determined by dividing the number of times aided language stimulation was provided by the total number of opportunities for aided language stimulation multiplied by 100. Nature of aided language stimulation is the ratio of statement to question.

the aided language stimulation for the arts and crafts activities ranged from 76% to 87%, followed by the food preparation activity, which ranged from 85% to 92%, and finally the story time activity, which ranged from 85% to 93%.

Acquisition of Target Vocabulary Items

Figures 2, 3, 4, and 5 illustrate the performance of the participants over the training period. While the aided language stimulation was provided in a group format to ensure consistency of the treatment across the participants, the results of the intervention are presented individually for each participant. Although the probes were conducted on all 24 target vocabulary items, the graphs are separated by the vocabulary for a particular activity.

In the first activity, arts and crafts, all 4 participants presented with a stable baseline, and when the intervention was introduced there was a change in performance. During the intervention phase, Participants A, C, and D obtained 0/8 for the first probe (Week 1, Day1) and Participant B obtained 1/8. This increased during the second probe (Week 1, Day 3) to 3–5/8 for Participants A, B, and C, with Participant D still scoring zero. On the final probe (Week 1, Day 5), Participants A and C obtained 8/8, and Participants B and D scored 6/8 and 3/8, respectively. During the postintervention phase (Weeks 2 and 3), all the participants obtained either 7/8 or 8/8.

In the second activity, food preparation, the baseline was still considered stable despite the participants once scoring 1/8, as the changes only occurred when the treatment was introduced (Schlosser, 2003). All 3 participants obtained 1/8 on Probe 1 (Week 2, Day 1). This increased to 5/8 or 6/8 on Probe 2 (Week 2, Day 3) and to 7/8 or 8/8 on Probe 3 (Week 2, Day 5) for all the participants except Participant B, who still obtained 6/8. During the postintervention phase (Week 3, Day 1 to Week 3, Day 5), Participant A obtained 8/8, while Participants B, C, and D obtained 7/8.

During the third activity, story time, all the participants presented with a stable baseline, with Participants A, C, and D obtaining 1/8 and Participant B obtaining 2/8 and returning to 0/8. During Probe 1 (Week 3, Day 1), all the participants obtained 0/8. This increased to 5 and 6 on the second probe (Week 3, Day 1) and 7/8 on the third probe (Week 3, Day 5). There were no postintervention data collected for this activity.

Discussion

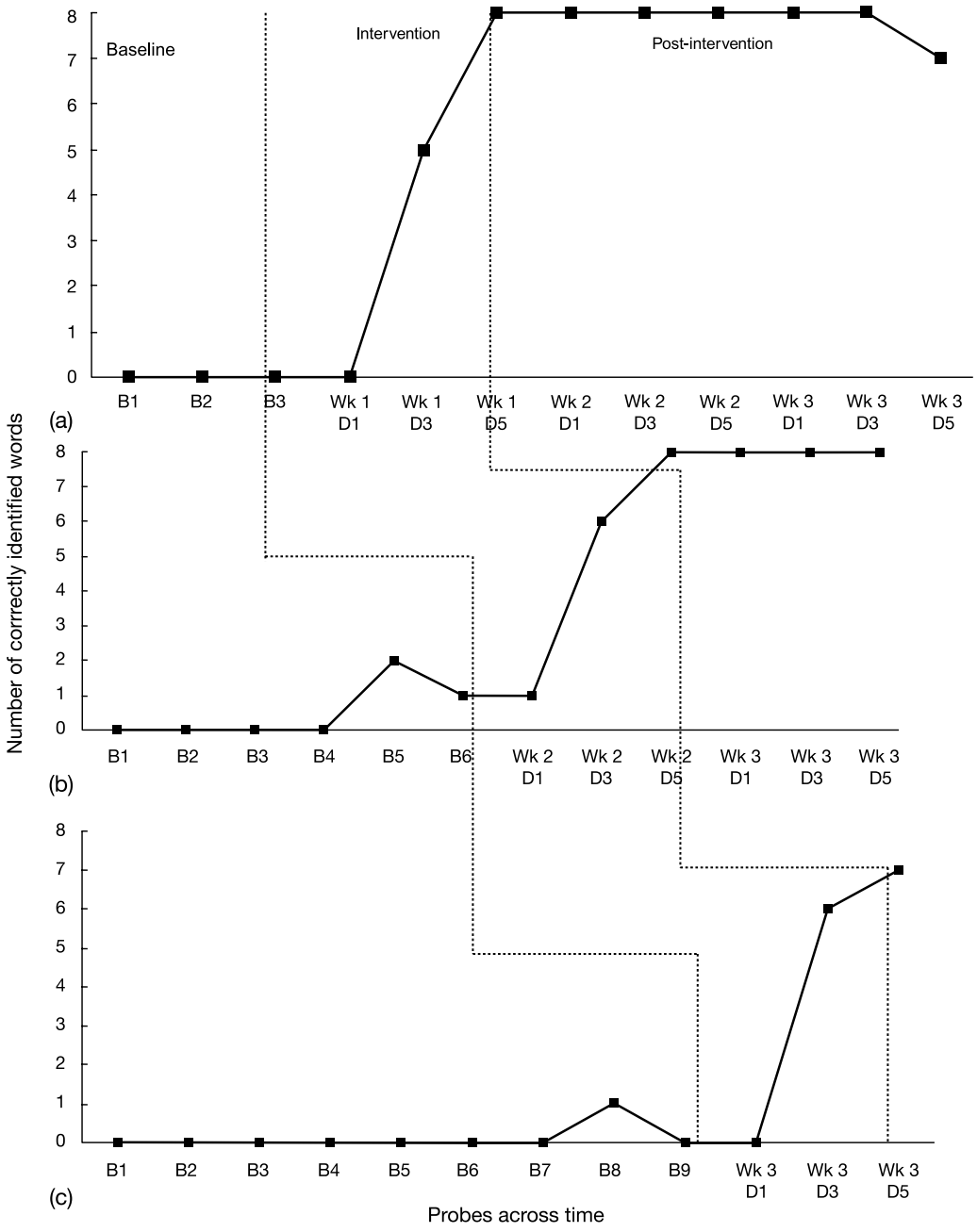
Aided Language Stimulation Input

The findings of this study indicate that the nature and frequency of the aided language provided met the criterion used in clinical settings (Goossens' et al., 2000). The frequency suggested is 70%, which is far higher than the 9.3% level found to also be effective by Sevcik et al. (1995). The issue of what constitutes an ideal frequency is an area that needs further exploration and discussion. It should also be evaluated in the context of whether the effect of augmented input is being evaluated on comprehension of the verbal stimuli or graphic symbol learning. The slight improvement in frequency of aided language stimulation evident from Table 2 may be attributed to the activities allowing for increasingly better provision of the aided language input. The aided language stimulation provided was determined by the activity, the steps involved in completing the activity, and the vocabulary available on the communication board, and was therefore not scripted. The repetitive nature of the story used in the story time activity, in particular, could possibly allow for easier provision of aided language stimulation (Goossens' et al., 2000). This argument is supported by teachers trained in aided language stimulation who have reported that they experienced the most difficulty using aided language stimulation with the arts and crafts activity board (Dada & Alant, 2005).

Acquisition of Target Vocabulary Items

It is evident from Figures 2–5 that the introduction of the aided language stimulation program facilitated the acquisition of the target vocabulary items for that activity. This performance was maintained during the weeks when aided language stimulation ceased for that particular activity. It is postulated that the augmented input played a facilitatory role in the acquisition of the target vocabulary items for a variety of reasons. A possible explanation is that the aided language stimulation program was rich in contextual learning due to its activity-based nature, which provides an impetus for language learning. Theorists suggest that learning is facilitated through social interaction or processes (Vygotsky, 1978) and through the active participation of the child, and commences at the student's point of understanding—thereby encouraging the child's full participation. These are important

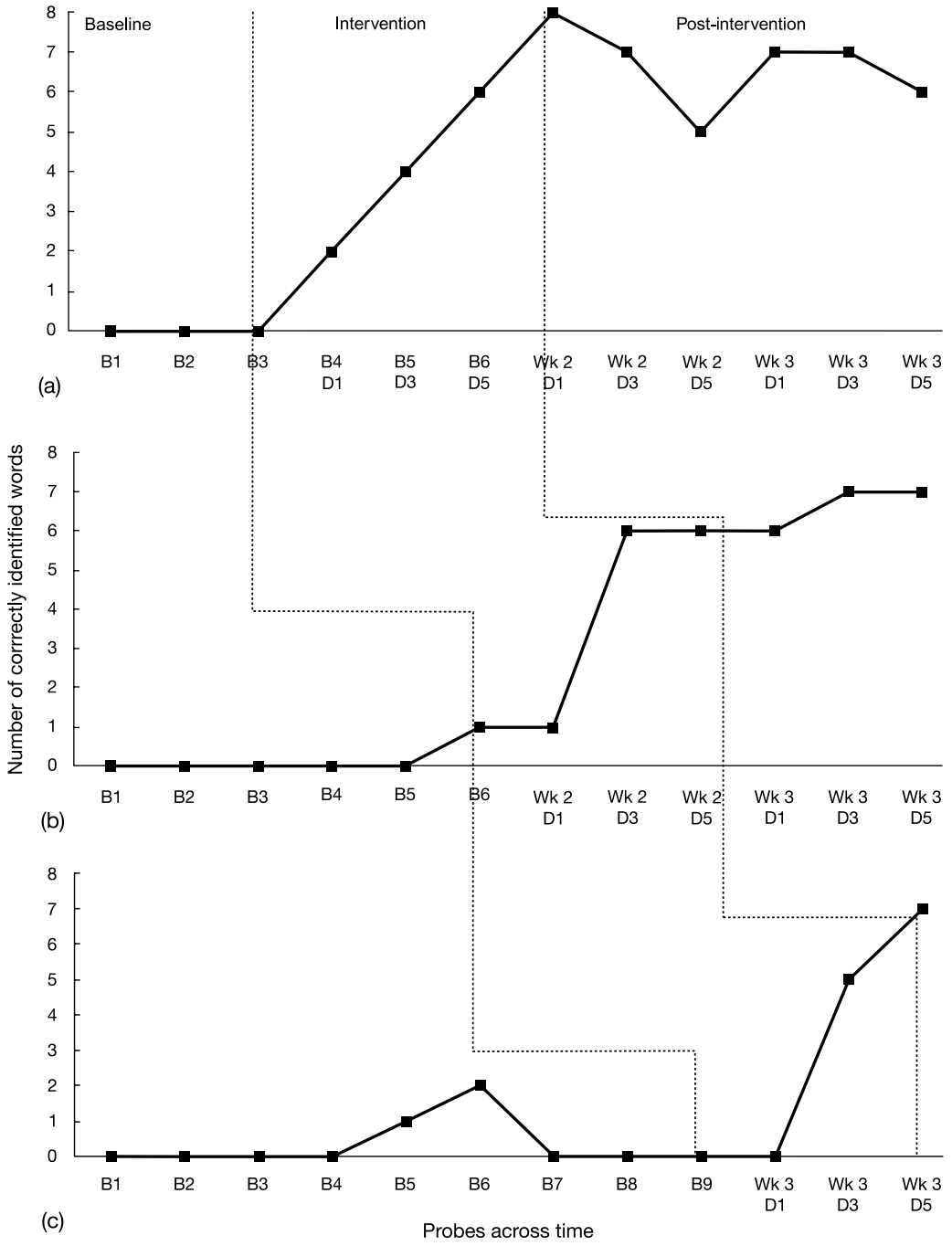
FIGURE 2. Participant A's responses in (a) the arts and crafts activity, (b) the food preparation activity, and (c) the story time activity.



conceptual foundations for learning, and it has been argued that activity-based intervention is strongly aligned toward these concepts (Bricker & Cripe, 1992).

Furthermore, research suggests that vocabulary acquisition is highly dependent on experience (Watkins & DeThorne, 2000), indicating that vocabulary comprehension and production are linked closely to environmental experience, interactions, and exposure. Environmental experience plays an important role, according to Light and Lindsay (1991), in developing our models of the world. Such models are actively constructed based on experiences and encounters, and they allow us to anticipate events that will occur next. Our internal models are the source of our knowledge and are constructed gradually from experiences. Persons with LNFS have different experiences and a potentially restricted knowledge base, due to the limited experiences or opportunities that are available to them (in terms of the participant's personal experiences and his or her individual models of the world),

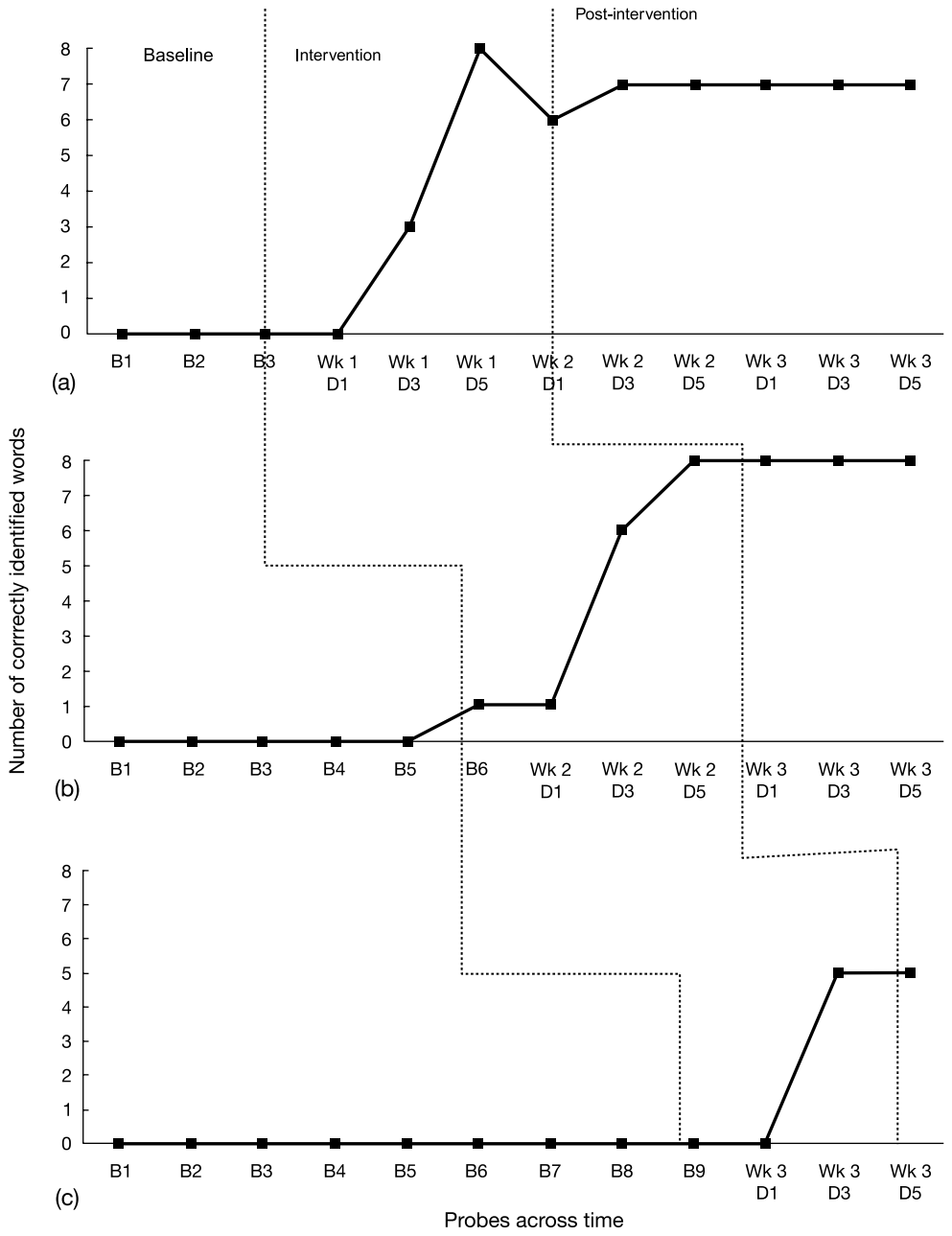
FIGURE 3. Participant B's responses in (a) the arts and crafts activity, (b) the food preparation activity, and (c) the story time activity.



which could be a contributing factor in the rate of vocabulary acquisition. Another factor discussed in the literature is that many children who acquire AAC are able to fast map, which would account for the rapid acquisition of the targets by some participants (Hunt-Berg, 1996; Romski, Sevcik, Robinson, Mervis, & Bertrand, 1996; Sevcik & Romski, 1986). Thus, when the child hears a new word in the presence of an unknown object, he or she immediately maps the novel name onto the novel object (Mervis & Bertrand, 1994). This allows children to map the meanings of new words at a rapid rate, even with little exposure to the new words.

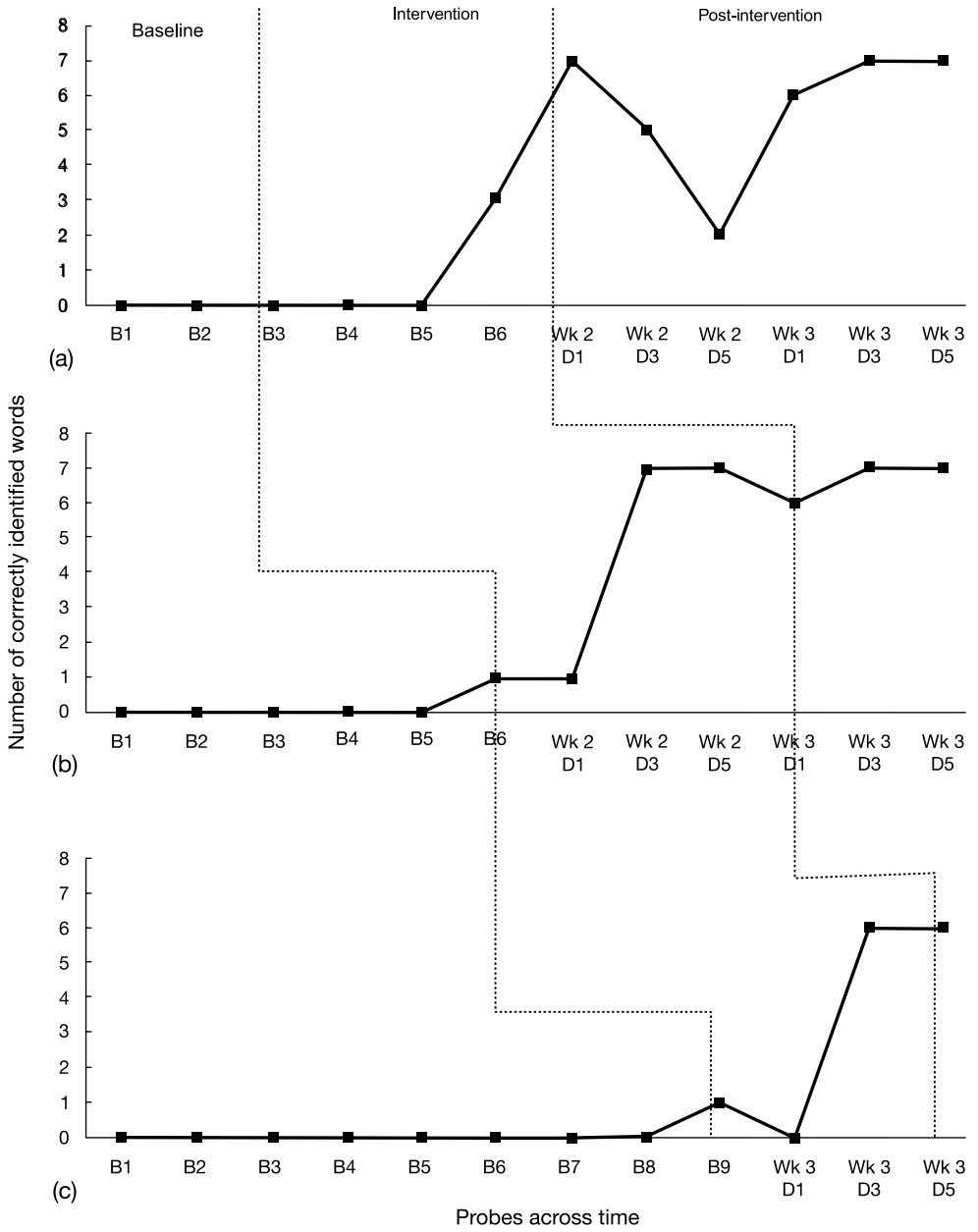
While Figures 2–5 indicate that the participants acquired most of the target vocabulary items, there are individual differences across participants. This may be attributed to a variety

FIGURE 4. Participant C's responses in (a) the arts and crafts activity, (b) the food preparation activity, and (c) the story time activity.



of factors, including each participant's niche. The concept of niche refers to one's ability to self-select into certain groups or contexts that match one's individual characteristics (Dada, Granlund, & Alant, 2006). A factor commonly discussed in the literature is the participant's speech comprehension ability. The literature argues that children or participants who have good speech comprehension abilities are more successful with picture-based language systems than are those who have poor or no language comprehension skills (Franklin et al., 1996; Romski & Sevcik, 1992, 1993a; Rowland & Schweigert, 2000; Sevcik & Romski, 1986, 1997). These studies generally found that participants with better speech comprehension skills acquired picture-based language systems better than their counterparts with poorer speech comprehension skills. The participants in the current study had varied but relatively good speech comprehension abilities, which may be a factor contributing to their performance. Sevcik, Romski, and Wilkinson (1991) argued that the comprehension of spoken language is evidence of functioning at a symbolic level, which enables the recasting of existing

FIGURE 5. Participant D's responses in (a) the arts and crafts activity, (b) the food preparation activity, and (c) the story time activity.



knowledge, both conceptual and linguistic, onto the picture-based language form. However, this does not imply that picture-based representation should be postponed until an individual demonstrates language comprehension skills.

One cannot conclude from this study that the incorporation of the aided symbol into the intervention was the key causative factor in the changes observed in the children's word-object matching abilities. Although the results are unambiguous in suggesting that the intervention was effective at establishing the matching behavior, the methodology used did not prove that this gain was only because of the inclusion of the aided input component of the intervention. The aim of the study was not to compare the effectiveness of aided language stimulation in relation to another intervention approach but to clearly document a process of aided language stimulation with 4 participants measuring specific vocabulary acquisition. It therefore cannot be ruled out that a well-constructed, targeted, spoken input intervention involving no visual symbol use would not have resulted in similarly effective learning.

Limitations of the Current Research

Caution must be taken in generalizing the results of this study to all children with LNFS. There are various limitations

that must be considered. First, the inclusion of 4 participants prevents widespread generalization. The inclusion criteria were quite specific in relation to participants having fewer than 15 intelligible words, being able to correctly identify line drawings, and not being able to identify target vocabulary to be taught in the study. Second, while the study provides a detailed description of the aided language stimulation used in the study, the design of the study does not allow for interpretations regarding the effectiveness of this approach in comparison with other intervention approaches for teaching vocabulary. The purpose of the study is to document the intervention approach and outcomes of using an aided language stimulation approach to teaching vocabulary.

A third issue that needs to be considered in the interpretation of data relates to the probes used in evaluating the target vocabulary taught. Although the intervention process involved augmenting oral language with graphic symbols displayed on a communication board, the probes used required word-object matching, which has advantages and disadvantages in the present study. While the use of the same teaching and testing stimuli (i.e., line drawings) would have produced more similar teaching and testing conditions, the task used can be described as that of matching rather than testing understanding of the specific vocabulary taught. Thus, in the current study, the stimuli used for teaching (line drawings) and testing (objects) differed in order to test specifically the understanding of the vocabulary taught.

Finally, the study was concerned with exploring the effectiveness of an aided language stimulation approach within group training, simulating a classroom context. This allowed for detailed description of the exposure of participants to the same aided language stimulation, but it does not allow for detailed documentation of how each individual child attended during the intervention process.

Future Research Directions

Future research on aided language stimulation and its effectiveness needs to be conducted by comparing outcomes of different approaches in teaching vocabulary to young children in a group context. The use of an alternative treatment design could be considered using equitable yet different and unrelated vocabulary sets during training to compare the effectiveness of these approaches. During this process, specific attention needs to be paid to the use of strategies to document that each child was attentive during the group intervention process. Finally, additional reflection on the types of stimuli used during the testing phase is important to ensure that not only matching between symbol and word is evaluated, but also comprehension of vocabulary taught.

The effect of variations in terms of the nature and frequency of aided language stimulation is an area that could also be further investigated. In this study, it was found that a 3-week intervention program using augmented language input between 76% and 93% of the time was sufficient to facilitate the comprehension of most of the 24 vocabulary items with 4 children with LNFS. Each participant acquired understanding of some of the vocabulary items during each intervention week. However, variations in the nature and frequency of the aided language stimulation provided during training would enhance understanding of minimum levels of augmented language input needed to facilitate change for specific populations and training purposes.

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