Clinical Focus

Comparing the Effects of Speech-Generating Device Display Organization on Symbol Comprehension and Use by Three Children With Developmental Delays

Andrea Barton-Hulsey,^a Jane Wegner,^a Nancy C. Brady,^a
Betty H. Bunce,^a and Rose A. Sevcik^b

Purpose: Three children ages 3;6 to 5;3 with developmental and language delays were provided experience with a traditional grid-based display and a contextually organized visual scene display on a speech-generating device to illustrate considerations for practice and future research in augmentative and alternative communication assessment and intervention.

Method: Twelve symbols were taught in a grid display and visual scene display using aided input during dramatic play routines. Teaching sessions were 30 minutes a day, 5 days a week for 3 weeks. Symbol comprehension and use was assessed pre and post 3 weeks of experience.

Results: Comprehension of symbol vocabulary on both displays increased after 3 weeks of experience. Participants 1 and 2 used both displays largely for initiation. Participant 3 had limited expressive use of either display.

Conclusions: The methods used in this study demonstrate one way to inform individual differences in learning and preference for speech-generating device displays when making clinical decisions regarding augmentative and alternative communication supports for a child and their family. Future research should systematically examine the role of extant comprehension, symbol experience, functional communication needs, and the role of vocabulary type in the learning and use of grid displays versus visual scene displays.

Recent advances in technology have provided clinicians more options than ever before to support a child's acquisition of language using speech-generating augmentative and alternative communication (AAC) systems. Access to speech-generating devices (SGDs) is less of a barrier than it was just 6 years ago when the first speech-generating application (app), Proloquo2Go (Origin Instruments, Grand Prairie, TX) was introduced on mainstream mobile technology (Sennott, 2011). Developers of dedicated SGDs and apps continue to refine variables such as display permanence, layout, cohesion, number of symbols, size, location, and color that influence the visual organization

of symbols for communication. These display components are suggested to play an important role in a child's success in language learning and productive use of an SGD (Reichle & Drager, 2010; Wilkinson, Light, & Drager, 2012); however, more experimental research is needed to determine how using these displays affects learning outcomes (Reichle & Drager, 2010). Children who use AAC systems are a heterogeneous population of individuals who may have differences in receptive language, attention, and visual perception that may impact learning and use of the different displays. This article describes the learning and use of symbol vocabulary on a traditional grid-based display and a contextually organized visual scene display (VSD) in three children with developmental and language delays. Implications for clinical decision making via dynamic assessment strategies to determine the most appropriate SGD display for a young child are discussed. Additional implications of SGD display feature design and future research directions concerning SGD displays are discussed.

Children with developmental disabilities present with a range of profiles of communication ability (Mundy & Gomes, 1997). For children with limited speech, augmentative

^aDepartment of Speech-Language Hearing: Sciences and Disorders, University of Kansas, Lawrence

^bDepartment of Psychology, Georgia State University, Atlanta

Correspondence to Andrea Barton-Hulsey: abarton@gsu.edu

Andrea Barton-Hulsey is now in the Department of Psychology at Georgia State University.

Editor: Joe Reichle

Associate Editor: Cynthia Cress

Received October 20, 2015

Revision received March 15, 2016

Accepted September 11, 2016

https://doi.org/10.1044/2016_AJSLP-15-0166

Disclosure: The authors have declared that no competing interests existed at the time of publication.

communication systems, particularly SGDs, introduced during early intervention and preschool can support language development and expressive communication (Brady, Thiemann-Bourque, Fleming, & Matthews, 2013; Kent-Walsh, Binger, & Hasham, 2010; Ronski et al., 2010). Children's language comprehension skills at the start of intervention may vary widely. In the development of both listener and speaker in communicative exchanges, Ronski and Sevcik (1988) suggest that children's language comprehension skills are naturally an essential component.

Effective intervention using an SGD must establish conditional relationships between the symbolic medium on the display and its referents. An SGD using visual-graphic symbols may serve both as an input mode for comprehension of vocabulary and object names as well as an output mode for communication (Ronski & Sevcik, 1996). Experience with an SGD using symbol vocabulary a child does not yet comprehend may facilitate comprehension of those object names (Brady, 2000). When a child with a developmental disability is learning to use an AAC system, the primary focus of intervention should be on modeling the use of the SGD so that the child may comprehend and use it for productive communication (Ronski & Sevcik, 2003). Comprehension could be a significant factor contributing to the varying success of children in learning to use an AAC system. With recent advances in technology, AAC intervention with young children has an added component to consider: What is the impact of the language organization of the AAC system display on a young child's comprehension and use of symbols?

Over the past 10 years, organizational options for symbols on SGDs have expanded. SGDs have traditionally presented symbols in a grid-based array in which symbols, photographs, line drawings, or printed words are displayed in rows and columns. Selecting a symbol activates speech output for a prestored message or word. Symbols in a grid-based display may be organized on one page or may have levels of navigation embedded in the display by word type or category (e.g., actions, animals, people, toys). Elements on a grid display may appear decontextualized so that the child using the SGD can create novel messages regardless of the communication context they are in (e.g., book reading at home or art class at school).

It has been suggested that visual scene displays can replicate language-learning contexts by visually portraying real-life contexts experienced by children (Light & McNaughton, 2012). Symbol vocabulary is positioned within these contexts (e.g., birthday party, room at home, classroom) to enhance language learning and use. With the introduction of VSDs, there is also significant variability in how VSDs are used with very young children. VSDs may be created with real and/or personal photographs in which parameters of hotspots on the picture activate a certain social message when pressed. Other VSDs may use a color image that is a replica of a room or setting where communication frequently occurs. Objects in the room may provide a spoken word or message when pressed to communicate the object name, action, or a social phrase associated with that

communication context. Visual scene displays have recently become popular with very young children, with the primary claim that VSDs provide a shared context between the child and communication partner to enable a greater exchange of social information and reduce cognitive demands associated with symbol learning (Blackstone, 2004; Light & McNaughton, 2012). Wilkinson and Light (2011) found that in a group of typically developing college students, human figures attracted more attention within a VSD than nonhuman objects presented within the display. On the basis of these findings, the authors speculated that young children's attention to symbols on the SGD may be supported by using VSDs that involve human images. It is clear that grid-based displays and VSDs offer features that may differentially support children's symbol learning when beginning to use an AAC system. Further research is warranted to examine whether placing symbols in a referential and visually representative context aids the child in acquisition of those language concepts for communication more readily than in a traditional grid display.

Much of the research to date on the use of VSDs has been conducted with typically developing children. Drager, Light, Speltz, Fallon, and Jeffries (2003) investigated the role of VSDs with 2-and-a-half-year-old children without developmental disabilities. Symbols were arranged on a VSD within a context in which they would naturally occur. When 2-and-a-half-year-old children participated in learning sessions using a grid versus a VSD, they more readily learned the vocabulary in the VSD (Drager et al., 2003). The learning sessions consisted of asking the child to find a symbol on a visual scene display, then correcting the child if he or she was wrong by showing the child how to find the correct symbol. If the child was correct, a short play period was awarded. In another study by Light et al. (2004), 4- and 5-year-old children without developmental disabilities accurately located symbols arranged in a VSD and grid display equally well. The learning sessions in this study were similar to those used with the 2-and-a-half-year-olds by Drager et al. (2003). In a third study using a similar teaching strategy, 3-year-old children without disabilities learned the symbols within the VSD at a faster rate than in the grid display (Drager et al., 2004). In a fourth study, 23 children, 24–27 months of age and 33–36 months of age without developmental disabilities were taught to use a VSD (Olin, Reichle, Johnson, & Monn, 2010). Children ages 33–36 months were initially better able to identify symbols on the VSD. The younger participants were able to learn the symbols on the VSD but required a greater number of sessions compared with the older children.

While these studies have provided an important first step in our understanding of how children without developmental disabilities use extant language skills to identify symbols in a grid display versus a VSD, we have little understanding of how children with developmental and language delays use VSDs as a language learning context and mode of expressive communication during language intervention. Children who are typically developing and

have a working lexicon may locate symbols more readily in a context they understand because of their extant language comprehension skills and ability to generalize their knowledge to a meaningful picture. However, for children who do not have a developed lexicon or comprehension of language concepts within a particular context, it is unclear whether the schematic arrangement of a VSD provides an advantage.

Furthermore, contributions from developmental psychology have informed our understanding of the age at which children are first able to understand that a scale model is a representation of a larger life-size replica. The work of DeLoache (1989, 1991, 2000) and DeLoache and Burns (1994) provides evidence that children under 3 years of age do not readily understand that a scale model of a room is a symbolic representation of a life-size room. In a study to determine the ability of young children to use a scale model as a representation of a room, children were first shown where a toy was hidden using a scale model. The children were then shown a life-size room using bigger but the same type of objects and locations (e.g., sofa, lamp, Snoopy doll, and pillow) and were asked to find the toy. Children under 3 years of age were rarely able to find the toy, suggesting that they could not use the scale model as a representation of the larger room (DeLoache, 1991). This study raises important questions about the use of a VSD for children who have developmental or language delays. The language support that VSDs claim to provide may not be as salient as we think (Reichle & Drager, 2010).

We do know that very young children and school-age youth are able to learn to use symbols in a grid display for communication (Kent-Walsh et al., 2010; Ronski & Sevcik, 1996; Ronski et al., 2010; Jackson, Wahlquist, & Marquis, 2011). Using an arbitrary symbol set of lexigrams (Rumbaugh, 1977) in a grid display, Ronski and Sevcik (1996) taught 13 youths with moderate and severe intellectual disabilities to use an SGD with a grid display for communication. This intervention was provided using the System for Augmenting Language (SAL; Ronski & Sevcik, 1996). The SAL consisted of four components: (a) a speech-output communication device, (b) a symbol vocabulary (lexigrams), (c) a communication partner that provided symbol input and encouraged communication attempts, and (d) communication partner training. A number of other studies involving children with developmental disabilities have found successful symbol learning outcomes for children using the strategy of aided input, a key component of the SAL (Elder & Goossens, 1994; Ronski & Sevcik, 1996; Ronski et al., 2010; Ronski, Sevcik, Robinson, & Bakeman, 1994; Ronski, Sevcik, & Wilkinson, 1994; Solomon-Rice & Soto, 2014). Research to date has not examined differences in learning iconic symbols that represent nouns versus less iconic symbols that represent nonnoun vocabulary within the context of a VSD. Questions remain concerning the additional support that a contextual arrangement of symbols using a VSD provides to learn noniconic symbols, particularly with very young children as they are developing language.

Clinicians today must evaluate a number of available features on SGDs during the assessment process with a child and their family. A dynamic assessment approach is one that can be used to evaluate a child's response to a particular SGD, display design, and vocabulary organization when trying to determine the best SGD for a child and the child's family to use. Dynamic assessment allows a clinician to teach a child to use an SGD while evaluating the child's response to the instruction. An informed decision can be made about the features and design that uniquely support a particular child's language and communication needs.

One successful model of language instruction within the natural context of a classroom is the Language-Focused Curriculum (LFC; Rice & Wilcox, 1995). The LFC allows the child's attention to be drawn to targeted linguistic forms during contextually based conversation and discourse in the classroom throughout the school day. Dramatic plays within the curriculum allow the child to direct their own play, narratives, and interest while the adults in the classroom can use facilitative language strategies to enrich the child's language learning. Language is thereby embedded in familiar routines the child can act out, allowing the child to expand syntactic and semantic knowledge within a familiar setting (Bunce, 1995). A dramatic play routine is composed of four major components: (a) the schema, (b) the roles, (c) the props, and (d) the verbal exchanges. The schema is the topic or context of the play itself. Common dramatic play schemata are princess/prince fantasy settings, a grocery shopping trip, or a cooking or restaurant schema. The roles of the dramatic play are the particular characters that each child embodies or acts out with props during play within a particular context. A child may choose to act as a princess or prince, grocery cashier or shopper, or chef. Props necessary for carrying out the particular schema are critical to the dramatic play. Dress-up clothing, grocery cart, cash register, pretend food for a shopping trip or cooking, and kitchen supplies would all be appropriate items for the dramatic play schemas mentioned. Additional puppets, dolls, or other characters are also appropriate. Facilitative verbal communication exchanges are a final critical component of dramatic play as described in the LFC. Language strategies such as recasting (e.g., child says "me sit" and adult responds "I want to sit"); expansion (e.g., child says "more" and adult responds "more juice"); modeling appropriate sentence forms; and event casts such as parallel talk, running narrative of the child's actions while playing, or self-talk that describes what the adult talking is doing, are all employed during intervention using dramatic play. Dramatic play allows children to first observe another person act out a script, and in turn, act it out themselves (Bunce, 1995). This observation is quite similar to aided input in the AAC intervention: The child is allowed to observe visual and spoken symbol-referent relationships (i.e., language) in a meaningful context with the expectation they will comprehend and produce them. In such a setting, the child is consistently exposed to a meaningful context throughout the intervention to acquire and build their language skill.

Current Study

The outcomes of three children's symbol learning on both a grid display and VSD are described to illustrate considerations when making decisions about the SGD display features during dynamic assessment. Further considerations for practice and research needs in AAC intervention with young children are discussed. Three children between 3 and 5 years of age with developmental delays and limited speech ability were given daily teaching sessions with a traditional grid display and a VSD using aided input teaching strategies within dramatic play routines. Three questions were addressed for each participant: (a) After 3 weeks of daily experience with 12 vocabulary items on a grid display and a VSD, are there differences in the number of vocabulary words comprehended in each display? (b) Is there a difference in expressive communication using symbols in a grid display versus a VSD within a dramatic play routine? (c) Does a VSD facilitate greater learning of nonnoun (less iconic) symbol vocabulary than a grid display?

Method

Participants

Three children with diagnosed developmental disabilities and expressive language delays were seen for 3 weeks. Two children were male (age = 5;3 and 3;6). One child was female (age = 4;2). Although no formal cognitive assessment was done, all children qualified for special education preschool services under the category of significant developmental delay and were receiving services within a special education preschool classroom at least 4 days per week, provided by the local public school district. All of the children's families spoke English. Children were recruited in a Midwestern city through announcements in local newspapers, letters sent to local agencies serving children with developmental disabilities, and the local public school system.

Participant 1

Participant 1 (P1) was 5;3 at the time of the study and had a diagnosis of mitochondrial disease. He lived at home with his mother, father, and two older brothers. He attended a public special education preschool program 4 days a week for one-half of the day each day. At school he received individual speech and language services 4 days a week to total 1 hour, and group speech and language services 4 days a week to total 1 hour. He had just begun use of a Tech/Speak 32 SGD (AMDi, Farmingdale, NY) provided by his school within 1 month prior to the study. The SGD had 32 symbol locations arranged in a grid display and used digitized speech output. This communication system was used only at school. He did not use any form of AAC to communicate when at home. P1's gross motor movement and muscle support for ambulation was limited. He was not able to walk, but was able to move around the room by crawling and could sit upright to see and access the SGD used in the study. A key guard was placed over the touchscreen SGD to isolate the boundaries of each

symbol so that he could access them without activating multiple symbols. Key guards are often used clinically for persons who possess the fine motor skill to directly select a symbol on a touch screen, but have gross motor impairments that result in the unintended activation of symbols other than the one desired for communication.

Participant 2

Participant 2 (P2) was 3;6 at the time of the study. He was diagnosed with apraxia of speech and pervasive developmental disorder (PDD). He lived at home with his mother, father, older sister, and an older brother. He attended a half-day, public special education preschool program 4 days per week. At preschool he received individual speech and language services 4 days a week for 30 minutes each day, and group speech and language services one time per week ranging from 30 to 60 minutes. P2 had just begun use of a Springboard SGD (Prentke Romich Company, Wooster, OH) provided by his school one week prior to the study. The Springboard used the Minspeak symbol system arranged in a six-location grid display with a four-location dynamic activity row at the top of the screen. It had a computer touchscreen that P2 used to directly access the symbols for communication. Digitized voice output was produced when a symbol was pressed. This SGD was used at school and brought home each day. P2's mother reported that he had not yet used the Springboard for communication at home, but did spend time each day exploring the vocabulary of the device by pressing each symbol independently. P2's mother reported that his speech-language pathologist at school used the Springboard with him for input in all settings. P2 was ambulatory and had no motor impairments that kept him from directly selecting the touchscreen of the SGD used in the study.

Participant 3

Participant 3 (P3) was 4;2 at the time of the study. She was diagnosed with apraxia of speech and developmental delay. She lived at home with her mother, father, older brother, and older sister. She attended a full-day special education preschool program through the local public school district 4 days per week. She received individual speech and language services two times a day for 15–20 minutes, and group speech and language services one time a week for 15–20 minutes. P3 had no prior experience using an SGD but did use the Picture Exchange Communication System (PECS; Pyramid Educational Consultants, New Castle, DE) at school. P3 used no formal AAC system or SGD at home. P3 was ambulatory and had no motor impairments that kept her from directly selecting the touch screen used.

Preassessment

Both formal and informal assessment measures were administered with each child prior to experience with the SGD displays. The Preschool Language Scale-4 (Zimmerman, Steiner, & Pond, 2002) assessed the children's receptive and expressive language skills. The MacArthur Communicative

Development Inventory: Words and Gestures (CDI; Fenson et al., 1993) was completed by each child's mother to document the number of words and gestures the participants currently understood versus the number of words and gestures both understood and used. This inventory was then used to determine unknown vocabulary to be used in the study for each child. Children had a range of receptive language skills and vocabulary knowledge (see Table 1 for a descriptive comparison of each child's age, diagnoses, and performance on the PLS-4 and MacArthur CDI).

An inventory of forms and functions of communication adapted from Wetherby and Prizant (1996) was used to describe the children's communication without an SGD. This observation provided a descriptive communication profile for each child beyond what was assessed by standardized measures. The investigator video-recorded a 15-min observation of each child and his or her mother playing together at home for later review. The children largely used eye gaze, physical manipulation, pointing, head nods, facial expression, and vocalizations to communicate a range of intended messages. Some common functions of their communication were to request objects and actions, protest, greet others, comment, or provide an answer to a request (see Table 2 for a descriptive profile of each child's form and corresponding function of communication).

In order to decide whether to use the smaller, more portable Dynavox system (the MT4 with a smaller touchscreen display, 8.25 × 6 in., Tobii Dynavox, Pittsburgh, PA), or the larger Dynavox system (the DV4 with the larger touchscreen display, 12 × 9 in.; Tobii Dynavox), children were assessed to determine the size of the icons they could discriminate. Children were asked to touch a known symbol (e.g., ball) when shown 54 other symbols in a grid display. This size symbol best represented what would be required of participants to find a symbol within the VSD used. P2 and P3 were able to discriminate one icon out of 54 grid-based icons on the MT4; thus, the MT4 was used. P1 was not able to discriminate one out of 54 icons on the MT4, but was able to discriminate one out of 54 icons on the DV4; thus, the larger DV4 was used for intervention.

Vocabulary and Symbol Set Design

Six nouns and six nonnouns were chosen for each child by the investigator (first author) and the child's parent

Table 2. Participant forms and functions of communication

Participant	Form of communication	Function of communication
P1	Eye gaze	Request object
	Physical manipulation	Request action
	Distal pointing	Protest
	Head nod/head shake	Request social routine
	Facial expression	Greeting
	Vocalization	Comment, provide information or answer
P2	Eye gaze	Request object
	Physical manipulation	Request action
	Distal pointing	Protest
	Head nod/head shake	Request social routine
	Facial expression	Greeting
	Vocalization	Request permission
	Word approximation	Showing off
	One-word utterance	Comment
	American Sign Language	Request information, provide information or answer
P3	Eye gaze	Request object
	Physical manipulation	Request action
	Distal pointing	Protest
	Head nod/head shake	Greeting
	Facial expression	Requesting permission
	Crying/whining	Showing off
	Vocalization	Comment
	Word approximation	Request information
	One-word utterance	Provide information or answer
	American Sign Language	Provide information or answer

so there would be a range of vocabulary available for the child to use (nouns, verbs, adjectives, pronouns). Although no formal ratings of iconicity were done, nouns appeared more iconic, as they looked like their referents used during teaching sessions. Nonnoun vocabulary appeared less iconic, as these symbols represented concepts that were not concrete objects, and therefore could not look like a particular referent (i.e., *there*, *another*, *who*). Using symbols that represented each vocabulary type represented in a grid display versus a VSD allowed the investigator to evaluate any benefits the language context a VSD may provide to symbol learning of vocabulary beyond nouns.

The 12 symbols represented words that each parent reported their child did not understand or use before the

Table 1. Participant descriptive information.

Participant	CA	Diagnoses	PLS-4 standard scores		MacArthur	
			Receptive	Expressive	Understands	Understands and says
P1	5;3	Mitochondrial disorder	57	50	356/424	0/396
P2	3;6	Apraxia of speech, pervasive developmental delay	67	59	276/424	27/396
P3	4;2	Apraxia of speech	78	50	367/424	3/396

Note. P = participant; CA = chronological age in years;months; PLS-4 = Preschool Language Scales, 4th edition; MacArthur = MacArthur Communicative Development Inventory: Words and Gestures; Understands = number of words child understands; Understands and says = number of words child understands and says.

study, according to the MacArthur CDI. Because P3 knew most of the vocabulary solicited by the MacArthur CDI, words that her parent reported she did not understand but were still age and context appropriate and not included within the MacArthur CDI were used for her vocabulary set. P1 and P2 used the same 12 target vocabulary words; P3 used five of the same target words. P3 used vocabulary targets that had similar semantic meaning to targets used by P1 and P2 but were unknown (e.g., P3 used *coin* instead of *penny*, the target for P1 and P2).

Each child's vocabulary consisted of the 12 vocabulary words represented by the same symbols in the grid display and in the visual scene display during daily sessions. The same symbols were used in each display condition so that the visual arrangement of symbols would be the only difference between displays. The arrangement of symbols for the VSD condition appeared less integrated than on current VSD technology. This study was done at a time when VSD technology was emerging, and VSDs were created manually by combining individual symbols on a background to create the language-learning context (see Figures 1 and 2 for an example of a grid display and VSD used). Symbols are labeled in the grid display according to their vocabulary referent for purposes of the reader here; however, no written label was used with the symbol when displayed on the device in either display.

Each child completed a preassessment to determine whether they could identify any of the 12 symbol vocabulary items indicated as unknown by their mother prior to experience with the SGD displays. Each SGD display was presented with the voice output turned off so it would not speak the label of each symbol as the child touched it. The investigator asked the child to "touch (name of the

symbol)" for each of the 12 symbols. The child's initial response was recorded as correct or incorrect. For each child, the grid display was assessed first, followed by the VSD. P1 identified three nouns on the grid display and one non-noun on both the grid display and VSD prior to experience with either display. P2 identified two nouns on the grid display, and the same two nouns on the VSD, plus one additional noun on the VSD but not the grid display prior to experience. P3 did not identify any symbols on either display. While P1 and P2 were reported to have no comprehension of these vocabulary items, their limitation in expressive speech may have impacted their mothers' perception of their vocabulary comprehension. Given that P1 and P2 did not consistently identify all symbols across both displays, it was deemed appropriate to move forward with these symbols as target vocabulary during teaching sessions.

Setting and Context of Symbol Experience

Setting

Teaching sessions took place 5 days a week, 30 minutes a day for 3 weeks in either the home of the participant or in the university clinic. All preassessment descriptive information concerning the participants was collected prior to teaching sessions.

Context

Dramatic play routines provided the context for 30-min sessions with the grid displays and VSDs. Dramatic play routines were adapted from *Building a Language Focused Curriculum for the Preschool Classroom, Volume II: A Planning Guide* (Bunce, 1995). To determine what dramatic plays interested the child most, the investigator provided the

Figure 1. Participant 1 grid display. Symbols represent the following vocabulary words: top row, left to right: man, lady, good, you; middle row, left to right: coffee, penny, there, another; bottom row, left to right: sweater, donkey, hurt, who. Reproduced with permission from Tobii Dynavox. Copyright 2016, all rights reserved.

Figure 2. Participant 1 visual scene display. Week 3: Farm. Reproduced with permission from Tobii Dynavox. Copyright 2016, all rights reserved.

child's caregiver with a list of dramatic plays to rate from most to least interesting to their child (e.g., birthday party, circus, farm, cooking). The top five dramatic plays were reviewed for each child, and a different one was assigned to each week. P1 and P2 used the context of baseball, a grocery store/kitchen setting, and a farm setting for Weeks 1, 2, and 3 respectively. P3 used camping, a grocery store/kitchen setting, and a farm setting for Weeks 1, 2, and 3 respectively.

Stimuli

Communication System

A Dynavox Systems MT4 SGD (Tobii Dynavox) was used to present vocabulary in a grid display and VSD during intervention sessions for P2 and P3. P1 used a Dynavox Systems DV4 SGD with a 12-location key guard attached during sessions for both displays. The MT4 and DV4 were chosen for the following reasons: (a) none of the children had experience using symbols from the DynaSyms symbol set for communication prior to the study, (b) the Dynavox systems allowed for easy creation of visual scene displays that other dynamic display systems did not allow at the time, (c) The Dynavox communication systems were lightweight and portable to allow easier and more efficient use during naturalistic play, and (d) Dynavox systems were commonly used at the time of this study in clinical settings by children who required SGDs. The Dynavox MT4 weighed approximately 3 pounds, 5 ounces; was $8.25 \times 6 \times 2.25$ in. in size; and used a 6.4-in. active matrix color TFT-LCD touch screen to activate the icons. The MT4 ran on a Windows CE operating system. The DV4 weighed approximately 5 pounds, 13 ounces; was $12 \times 9 \times 3$ in. in size; and used a 12.1-in. active matrix color TFT-LCD touch

screen to activate the icons. The DV4 also ran on a Windows CE operating system.

Procedure

Symbol Experience

Each participant was seen for 3 weeks, 5 consecutive days of the week, for a total of 30 min focused on learning to use the 12 vocabulary items on each display for communication. The grid display and VSD were available every day during two consecutive 15-min segments of dramatic play. The investigator alternated the order of presentation of the grid display and VSD daily. The symbols on each display were taught to the child using the same aided input strategy in a dramatic play routine each day. The investigator used augmented input to model the use of the symbols in each display for communication. The essential components of augmented input include the use of an electronic voice-output communication device, encouragement but not requirement to use the device, and the primary investigator's use of the device to augment their spoken input to the child with symbol input (Ronski & Sevcik, 1992, 1996, 2003; Ronski et al., 2010). Language learning opportunities were provided with each dramatic play routine by the investigator acting out a script relevant to the target vocabulary and using real-life props to create the play context. Language teaching strategies such as modeling simple sentences, parallel talk (talking alongside the child to describe their play; e.g., investigator says "you have two apples!" as the child picks up two apples), and self-talk (describing one's own play; e.g., investigator says "go donkey!" while making a toy donkey walk) were used by the investigator (Bunce, 1995). Expectant pauses lasting at least 3 s were used to encourage use of the SGD by the child. Session outlines were made for each dramatic play routine that contained the description

of the setting/schema, props, target vocabulary, and sample scripts with instructions for each session. The primary investigator (first author) used this session outline daily to ensure that all components of the dramatic play context and intervention strategies were being administered using the same procedure across participants (see Appendix A for an example session outline).

To control for equal amounts of symbol input given to children in both the VSD and grid display conditions, each of the 12 vocabulary items were modeled by the investigator 10 times per 15 min of play using each display. One of two graduate students in speech-language pathology observed each session and kept a written tally of each incident in which the interventionist gave the child input from a specific symbol. The observer alerted the investigator when she had reached 10 models for each symbol by holding up a card with the name of the symbol written on it. The investigator could look to the observer during play to see the displayed cards with the symbol names on them that still needed input given. All sessions were video-recorded.

P3 the only child who differed in her amount of experience with each symbol. P3 had consistent difficulty attending to two 15-min play periods with each display. To increase the quality of her experience, P3's sessions were shortened to 10 min per display and only five models per symbol after Week 1.

Data Collection and Coding

Assessing Symbol Comprehension

After 3 weeks of experience with the grid display and VSD, comprehension of the symbols in each condition was assessed. After the final session of Week 3, an additional 15 min was spent assessing the child's comprehension of each target vocabulary word using the SGD symbols. The voice output component of the SGD was turned off so that so the child would not be reinforced as to the correctness of his or her response. The interventionist asked the child to "touch ____". Positive reinforcement such as "good job" or "you're doing great" was given after each response. Children were given no feedback as to the correctness of their responses. The symbols were presented in a random order to the child, with each symbol probed at least twice. If the child correctly identified a symbol two consecutive times, the symbol was not further probed and was marked as comprehended. If the child incorrectly identified a symbol two consecutive times, the symbol was not probed again and was marked as not comprehended. If the child identified the symbol correctly one time and incorrectly another time, the symbol was probed a third time. The child's third response was then used to record their knowledge of the symbol and marked as comprehended if correct, and not comprehended if incorrect. P3 was again an exception to this procedure. The quality of P3's responses and her ability to attend declined if she was asked to point to a symbol multiple times for assessment. Therefore, each symbol was probed only once. Her initial response was used to document each symbol as comprehended or not.

Reliability

A graduate student was present along with the investigator at the pre- and postassessment sessions to record participant responses. Both the investigator and the graduate student kept an independent tally of participant responses for each symbol probe. Reliability was calculated by dividing the total agreements by the total number of agreements plus disagreements. The reliability for marking symbols as learned for P1 on the grid display was 94% and on the VSD was 92%. For P2, the reliability for marking symbols as learned on both the grid display and VSD was 100%. For P3, the reliability for marking symbols as learned on both the grid display and VSD was 100%.

Assessing Symbol Use

Use of symbols by each child was coded during sessions with each display to evaluate any differences in how each display was used and perceived purpose behind the child's activation of symbols. The investigator and another graduate student coded symbol use on each display during each session for all three children. Symbol use was defined as: *exploration* (if the child consecutively activated three or more symbols in a random order with no perceived communicative intent; nonverbal cues such as eye gaze, gesture, or movement toward an object); *natural speech* (if the child used speech to approximate a target vocabulary word); *imitation* (if the child activated a symbol immediately following the investigator's model); *initiation* (if the child activated a symbol not used immediately before by the investigator and there was perceived communicative intent; nonverbal cues such as eye gaze, gesture, or movement toward an object); and *answering* (if the child used a symbol to respond to a question asked by the investigator). In Table 3, each code used to quantify children's use of symbols in each SGD display condition is defined.

Table 3. Codes used to define children's use of the speech-generating device (SGD).

Code	Definition
Exploration	Child consecutively activates three or more symbols in a random order with no perceived communicative intent (nonverbal cues, such as eye gaze, gesture, or movement toward an object).
Natural speech	Child uses speech to approximate the target vocabulary word represented on the SGD.
Imitation	Child activates a symbol immediately following the investigator's model.
Initiation	Child activates a symbol not used immediately before by the investigator, and there was perceived communicative intent (nonverbal cues, such as eye gaze, gesture, or movement toward an object).
Answering	Child uses the SGD to respond to a question asked by the investigator during play.

Reliability

Reliability was obtained for the recording of symbol productions. Nine intervention sessions (three per participant, or 20% of each participant's intervention sessions) were independently reviewed on a video recording by the investigator and a graduate student researcher to obtain inter-observer reliability for the coding of symbol use. Reliability was calculated by dividing the total agreements by the total number of agreements plus disagreements. Reliability for P1 was 81%, reliability for P2 was 81%, and reliability for P3 was 100%.

Results

Comprehension of Symbols

Figure 3 represents each child's pre- and postassessment performance on probes of symbol comprehension for noun and nonnoun vocabulary on the grid display and the VSD. Children were able to identify symbols on the grid and VSD displays equally well after 3 weeks of experience with both displays. A Wilcoxon signed-rank test was done to compare differences in symbol comprehension on the grid display and the VSD before and after teaching sessions. At preassessment, there were no significant differences in the median number of symbols identified by children on the grid display versus the VSD, median difference = 1, $z = -0.447$, $p = .655$. After 3 weeks of symbol experience with both displays, children showed increased comprehension for symbols in both displays. Children made average gains of six symbols on both the grid display and VSD. Again, there were no significant differences in the median number of symbols identified by children on the

grid display versus the VSD, median difference = 1, $z = -0.816$, $p = 1.00$.

There were differences noted for gains in noun versus nonnoun vocabulary pre to post symbol experience. Children made greater gains in noun vocabulary (mean increase on grid display = 4.00, mean increase on VSD = 4.33) than non-noun vocabulary (mean increase on grid display = 2.00, mean increase on VSD = 1.67). Regardless of display, more noun vocabulary was comprehended than nonnoun vocabulary.

Use of Symbols During Teaching Sessions

A post hoc analysis of children's use of symbol vocabulary during teaching sessions was done to note any differences in how symbols were used in the grid display versus the VSD during the 3 weeks of symbol experience. Figure 4 shows the frequency of each child's symbol productions across functions of answering, imitating, initiating, and exploring during 3 weeks of teaching sessions on each display. No child used natural speech to communicate any target vocabulary words. When evaluating use of vocabulary, it should be noted that P1 and P2 used the grid display and VSD relatively more than P3 during sessions. P1 used the grid display for 274 total productions and the VSD for 174 total productions, P2 used the grid display for 240 total productions and the VSD for 225 total productions, and P3 used the grid display for only six total productions, and the VSD for 12 total productions. When reviewing each participant's results to note the frequency of different types of productions used, P1 and P2 followed similar patterns of use in that the majority of their symbol productions on either display were for initiating communication, and both displays were used less for imitating and answering. P3 was the only

Figure 3. Symbols comprehended pre- and postassessment across participants. P3's data are based on a single probe for comprehension of each symbol.

Figure 4. Frequency of symbol productions across 3 weeks of teaching sessions. P3's data are based on limited productions on either display.

participant who showed differential use of the grid and VSD for initiating versus imitating and used the grid display one time to initiate and the VSD eight times; the grid display and VSD were each used three times to imitate during sessions. These findings should be interpreted with caution given the limited use of either display for communication by P3.

Discussion

Given the advances in technology over the past 10 years, clinicians are faced with a number of features available within SGD displays that may differentially support language learning. The current study highlights one method using dynamic assessment strategies that may provide valuable information about a child's response to particular SGD features. Three children's comprehension of symbol vocabulary before and after 3 weeks of experience with a grid-based display and a contextually organized VSD on an SGD were examined. Daily sessions of symbol experience using augmented input within the context of dramatic play routines were provided using a grid display and VSD. After 3 weeks of symbol experience, each child comprehended between seven and nine symbols on the grid display and seven or eight symbols on the VSD. Noun vocabulary was comprehended more readily than nonnoun vocabulary both the grid display and VSD. P1 and P2 followed similar patterns of use for each display, but P3 had limited use of either SGD display. The dynamic assessment methods used in the current study allowed a child's response to instruction to be evaluated with each SGD display being both the input mode for comprehension and the output mode for communication (Ronski & Sevcik, 1996) during language learning. Dynamic assessment methods may provide additional insight when making decisions about an appropriate AAC system to use to support language

development. In addition, in the current study, the use of symbol vocabulary the children did not comprehend may have facilitated learning and aided in the dynamic assessment process by ensuring children were learning new vocabulary in each display and were not biased from prior symbol experience (Brady, 2000).

Clinical Implications

Dynamic Assessment

Using a dynamic assessment strategy such as the one described in this study can provide a clinician with information about a child's preference for an SGD display, the ease of learning vocabulary for a particular SGD display, and whether the SGD display provides support for easier learning and/or use of particular vocabulary. In this study, there were no significant differences found in comprehension of vocabulary in either display; however, P1 used the grid display 100 more times than the VSD during the 3 weeks of sessions. This difference was larger than the differences found for P2's and P3's use of the grid display versus VSD. The use of a grid versus a VSD to display symbol vocabulary is an individual decision practitioners must make, and can be informed by assessing performance pre and post experience with each display. Dynamic assessment strategies capitalize on a child's extant comprehension, symbol experience, and functional communication needs during the decision-making process. Comparing performance within the same child on two different SGD displays ensures that the ultimate decision being made is unique to that child's communication skills and continued developmental needs.

Symbol Vocabulary and Context

Although VSDs have been suggested to provide a more salient context for language learning, postassessment

findings from these three children suggest that the type of display was not a key variable associated with differential comprehension of single word vocabulary within these dramatic play contexts. All three children made gains in comprehension of noun and nonnoun symbol vocabulary from pre- to postassessment. Children did have differential performance for learning nouns versus nonnouns that was consistent across displays. The VSD did not generally provide a more salient context for the learning of less iconic symbols (i.e., nonnouns). Less iconic vocabulary were equally difficult to learn to pair with their visual-graphic referent, regardless of the display. Although iconicity ratings of the specific symbols used were not assessed as part of this study, future studies should consider exploring the degree to which symbol iconicity may or may not be impacted for nonnoun vocabulary using a VSD, and whether this improvement makes a difference in symbol learning and use for young children.

Meaningful associations were made during play between the symbols and referents on each display, regardless of the arrangement of symbols. These findings support those of Namy, Campbell, and Tomasello (2004), who concluded that if symbol-referent cues are consistent and reliable, children will specifically attend to them as signifying a naming event and will continue to do so as novel symbolic acts by their communication partner occur. The dramatic play routines provided multiple opportunities for the investigator to use each display condition for naming events via the teaching strategy of aided input. Across the three children described here, the context of a dramatic play provided adequate opportunity to observe symbol learning and use across both SGD display types that is representative of natural communication contexts. The inclusion of natural play contexts during dynamic assessment sessions when making decisions about SGD display types can provide a consistent setting to evaluate learning and performance in young children.

Communication Partners

A component, in addition to the display type that was not directly addressed with these three children, is the child's immediate communication partners (i.e., parents, teachers, speech-language pathologist). These partners are critical in supporting the learning and use of an SGD. In this study, the investigator (first author) served as the primary communication partner; however, parents should and can be taught to support their child's language development (Ronski et al., 2010). When working with a family to choose an appropriate augmentative communication system, input from the child's team is a critical component. A child's communication partners must be able to fluently navigate an SGD when providing aided input. Decisions must be made alongside the child's primary communication partners in order to determine a system that will be used and not abandoned because it is too difficult to navigate. Daily sessions for 3 weeks may not be a feasible amount of time for practitioners to directly provide assessment sessions; however, parents and teachers may be taught to facilitate dynamic assessment sessions such as the ones provided in

this study. Information can be gathered by parents and teachers and reported back to the team. By involving parents and teachers, the choice of SGD display is truly a team decision and may increase use and support from other team members in the long run to benefit the child. In this study, the play context changed weekly (e.g., farm, baseball, grocery), as did the visual scene display to match that context. The symbols within the grid display remained in a consistent location across weeks of intervention. This reorganization of symbols is an inherent feature of VSDs, depending on communication context. For many communication partners, the consistent location of the symbol may be necessary in order to reduce the operational demands of navigating the SGD while teaching language concepts. A dynamic assessment strategy using the same vocabulary in different display layouts may support AAC decision making alongside family members and teachers.

Many VSDs today come with preprogrammed scenes of specific areas of the home, community, or school. It is important to consider a child's experience within each of these settings, cultural differences, and communication needs within those contexts when making decisions about using a VSD with a child. For example, many VSDs containing vocabulary relevant to communication at school use a traditional classroom image with desks in rows and a chalkboard at the front of the room. If a child's classroom is not arranged similarly, which many preschool classrooms are not, a child may not readily identify with this VSD and context. Furthermore, it is important to consider the vocabulary available within a VSD versus a grid display. Access to a range of vocabulary including nouns, adjectives, prepositions, and social phrases will be different depending on the type of display chosen. Access to appropriate vocabulary is critical for language growth using an SGD, so it is important to consider how vocabulary is organized within either display to maximize the child's language growth without placing limitations on the vocabulary available to him or her.

Limitations and Future Research Directions

This study was conducted at a time when VSDs were an emerging technology. VSDs today are created not only to support single word vocabulary, but also to encourage the production of multiword and social phrases within a specific context such as a classroom, restaurant, or a home setting of a kitchen or bedroom. Today, VSDs often consist of hybrid displays (Gevarter et al., 2014) in which the visual scene context consists of hotspots that, when activated, open a grid display of a limited number of vocabulary symbols. Future work should examine the utility of such displays for very young children with a range of comprehension skills to better understand the role VSDs play in developing symbol comprehension and whether they provide support beyond traditional grid displays. Further research should critically examine the amount of support VSDs provide very young children in language learning.

The context of dramatic play was found to support the learning of symbols in both display conditions; however,

the only fidelity ratings done across teaching sessions were to count the number of times a target symbol was modeled for the child to ensure equal symbol experience. While Appendix A details the procedures followed by the investigator each session, future research studies should include fidelity ratings of teaching sessions to ensure that there are no differences between teaching sessions that may impact the child's use of the SGD.

The children described here were taught the same 12 symbols on both a grid display and a VSD. The comparable outcomes of learning for both SGD displays could be a product of carryover effects. When designing future research studies, potential carryover effects should be controlled for so that stronger conclusions can be made about the role of a display feature in symbol learning and use. Display design could include two sets of equivalent symbols matched for vocabulary level and iconicity allocated to each display condition.

Future studies could also explore questions related to the amount of symbol input necessary for symbol learning during naturalistic aided input intervention. Children in this study were given 10 models per 12 symbols during a 15-min session. Clinicians and researchers alike should consider the amount of time the child has to process input and respond naturally during teaching sessions using aided input. Too much modeling may reduce the opportunities a child has to respond using the SGD, but too little modeling may not provide enough support for a child's symbol learning on the SGD.

The methods used in this study demonstrate one way to inform individual differences in learning and preference for SGD displays when making clinical decisions regarding AAC supports for a child and their family. Future research should systematically examine the role of extant comprehension, symbol experience, functional communication needs, and the role of vocabulary type in the learning and use of grid displays versus VSDs. By continuing to explore the benefits and limitations of SGD displays, we can make informed decisions when introducing an SGD to a young child during an important time in his or her language development and maximize his or her potential for language growth and expressive communication.

Acknowledgments

This research was supported in part by a Pardee Augmentative and Alternative Communication Fellowship awarded to the first author, and resources from the Pardee Augmentative and Alternative Communication Laboratory at the University of Kansas. This manuscript is based on data collected for a master's thesis by Andrea Barton-Hulsey as part of the requirements for the M.A. degree in Speech-Language Pathology at the University of Kansas.

References

Blackstone, S. W. (2004). Visual scene displays. *Augmentative Communication News*, 16, 1–4.

- Brady, N. C.** (2000). Improved comprehension of object names following voice output communication aid use: Two case studies. *Augmentative and Alternative Communication*, 16, 197–204.
- Brady, N. C., Thiemann-Bourque, K., Fleming, K., & Matthews, K.** (2013). Predicting language outcomes for children learning augmentative and alternative communication: Child and environmental factors. *Journal of Speech, Language, and Hearing Research*, 56, 1595–1612. doi:10.1044/1092-4388(2013/12-0102)
- Bunce, B.** (1995). *Building a language-focused curriculum for the preschool classroom: A planning guide* (Vol. 2). Baltimore, MD: Brookes.
- DeLoache, J. S.** (1989). Young children's understanding of the correspondence between a scale model and a larger space. *Cognitive Development*, 4, 121–139. doi:10.1016/0885-2014(89)90012-9
- DeLoache, J. S.** (1991). Symbolic functioning in very young children: Understanding of pictures and models. *Child Development*, 62, 736–752. doi:10.2307/1131174
- DeLoache, J. S.** (2000). Dual representation and young children's use of scale models. *Child Development*, 71, 329–338. doi:10.1111/1467-8624.00148
- DeLoache, J. S., & Burns, N. M.** (1994). Early understanding of the representational function of pictures. *Cognition*, 52, 83–110. doi:10.1016/0010-0277(94)90063-9
- Drager, K. D. R., Light, J., Carlson, R., D'Silva, K., Larson, B., Pitkin, L., & Stopper, G.** (2004). Learning of dynamic display AAC technologies by typically developing 3-year-olds: Effect of different layouts and menu approaches. *Journal of Speech, Language, and Hearing Research*, 47, 1133–1148.
- Drager, K. D. R., Light, J. C., Speltz, J. C., Fallon, K. A., & Jeffries, L. Z.** (2003). The performance of typically developing 2-1/2-year-olds on dynamic display AAC technologies with different system layouts and language organizations. *Journal of Speech, Language, and Hearing Research*, 46, 298–312.
- Elder, P. S., & Goossens, C.** (1994). *Engineering training environments for interactive augmentative communication: Strategies for adolescents and adults who are moderately/severely developmentally delayed*. Birmingham, AL: Southeast Augmentative Communication Conference Publications.
- Fenson, L., Dale, P., Reznick, J. S., Thal, D., Bates, E., Hartung, J., . . . Reilly, J. S.** (1993). *The MacArthur Communicative Development Inventories: Words and gestures*. San Diego, CA: Singular Publishing Group.
- Gevarter, C., O'Reilly, M. F., Rojeski, L., Sammarco, N., Sigafos, J., Lancioni, G. E., & Lang, R.** (2014). Comparing acquisition of AAC-based mands in three young children with autism spectrum disorder using iPad® applications with different display and design elements. *Journal of Autism and Developmental Disorders*, 44, 2464–2474.
- Jackson, C. W., Wahlquist, J., & Marquis, C.** (2011). Visual supports for shared reading with young children: The effect of static overlay design. *Augmentative and Alternative Communication*, 27, 91–102.
- Kent-Walsh, J., Binger, C., & Hasham, Z.** (2010). Effects of parent instruction on the symbolic communication of children using augmentative and alternative communication during storybook reading. *American Journal of Speech-Language Pathology*, 19, 97–107. doi:10.1044/1058-0360(2010/09-0014)
- Light, J., Drager, K., McCarthy, J., Mellott, S., Parrish, C., Parsons, A., . . . Welliver, M.** (2004). Performance of typically developing four- and five-year-old children with AAC systems using different language organization techniques. *Augmentative and Alternative Communication*, 20, 63–88.

- Light, J., & McNaughton, D.** (2012). The changing face of augmentative and alternative communication: Past, present, and future challenges. *Augmentative and Alternative Communication*, 28, 197–204. doi:10.3109/07434618.2012.737024
- Mundy, P., & Gomes, A.** (1997). A skills approach to communication development: Lessons learned from research with children with developmental disabilities. In L. Adamson & M. A. Ronski (Eds.), *Research on communication and language disorders* (pp. 107–132). New York, NY: Brookes.
- Namy, L. L., Campbell, A. L., & Tomasello, M.** (2004). The changing role of iconicity in non-verbal symbol learning: A U-shaped trajectory in the acquisition of arbitrary gestures. *Journal of Cognition & Development*, 5, 37–57.
- Olin, A. R., Reichle, J., Johnson, L., & Monn, E.** (2010). Examining dynamic visual scene displays: Implications for arranging and teaching symbol selection. *American Journal of Speech-Language Pathology*, 19, 284–297. doi:10.1044/1058-0360(2010/09-0001)
- Reichle, J., & Drager, K.** (2010). Examining issues of aided communication display and navigational strategies for young children with developmental disabilities. *Journal of Developmental and Physical Disabilities*, 22, 289–311. doi:10.1007/s10882-010-9191-3
- Rice, M. L. & Wilcox, K. A.** (1995). *Building a language-focused curriculum for the preschool classroom, volume 1: A foundation for lifelong communication*. Baltimore, MD: Brookes.
- Ronski, M. A., & Sevcik, R.** (1988). Augmentative and alternative communication systems: Considerations for individuals with severe intellectual disabilities. *Augmentative and Alternative Communication*, 4(2), 83–93.
- Ronski, M. A., & Sevcik, R. A.** (1992). Developing augmented language in children with severe mental retardation. In S. Warren & J. Reichle (Eds.), *Causes and effects in communication and language intervention, volume 1* (pp. 113–130). Baltimore, MD: Brookes.
- Ronski, M. A., & Sevcik, R. A.** (1996). *Breaking the speech barrier: Language development through augmented means*. Baltimore, MD: Brookes.
- Ronski, M. A., & Sevcik, R. A.** (2003). Augmented input: Enhancing communication development. In J. C. Light, D. R. Beukelman, & J. Reichle (Eds.), *Communicative competence for individuals who use AAC: From research to effective practice* (pp. 147–162). Baltimore, MD: Brookes.
- Ronski, M., Sevcik, R., Adamson, L., Cheslock, M., Smith, A., Barker, R. M., & Bakeman, R.** (2010). Randomized comparison of augmented and nonaugmented language interventions for toddlers with developmental delays and their parents. *Journal of Speech, Language, and Hearing Research*, 53, 350–365.
- Ronski, M. A., Sevcik, R. A., Robinson, B. F., & Bakeman, R.** (1994). Adult-directed communication of youth with mental retardation using the system for augmenting language. *Journal of Speech, Language, and Hearing Research*, 37, 617–628.
- Ronski, M. A., Sevcik, R. A., & Wilkinson, K. M.** (1994). Peer-directed communications of augmented language learners. *American Journal on Mental Retardation*, 98, 527–538.
- Rumbaugh, D. M.** (1977). *Language learning by a chimpanzee: The Lana Project*. New York, NY: Academic Press.
- Sennott, S.** (2011). An introduction to the special issue on new mobile AAC technologies. *SIG 12 Perspectives on Augmentative and Alternative Communication*, 20(1), 3–6.
- Solomon-Rice, P. L., & Soto, G.** (2014). Facilitating vocabulary in toddlers using AAC: A preliminary study comparing focused stimulation and augmented input. *Communication Disorders Quarterly*, 35, 204–215.
- Wetherby, A., & Prizant, B.** (1996). Toward earlier identification of communication and language problems in infants and young children. In S. Meisels, & E. Fenichel (Eds.), *New visions for developmental assessment* (pp. 289–312), Arlington, VA: Zero to Three and National Center for Clinical Infant Programs.
- Wilkinson, K. M., & Light, J. C.** (2011). Preliminary investigation of visual attention to human figures in photographs: Potential considerations for the design of aided AAC visual scene displays. *Journal of Speech, Language, and Hearing Research*, 54, 1644–1657. doi:10.1044/1092-4388(2011/10-0098)
- Wilkinson, K. M., Light, J. C., & Drager, K.** (2012). Considerations for the composition of visual scene displays: Potential contributions of information from visual and cognitive sciences (Forum Note). *Augmentative and Alternative Communication*, 28, 137–147. doi:10.3109/07434618.2012.704522
- Zimmerman, I. L., Steiner, V. G., & Pond, R. E.** (2002). *Preschool Language Scale, Fourth Edition (PLS-4)*. San Antonio, TX: Harcourt.

Appendix A

Typical Session Outline

Dramatic play theme: FARM

Target vocabulary: man, lady, coffee, penny, sweater, donkey
good, you, who, there, another, hurt

Props: pretend farm animals (horse, cow, donkey, chickens, pig), coffee mug, coins, pretend barn, table, dolls of man and woman, clothing items for dolls (sweater), felt for garden, vegetables for garden

Upon entering the room, the investigator will introduce the theme by telling the child “today we are going to pretend that we are at the farm.” The communication system will next be shown to the child and the investigator will explain “we will use this to help us talk about the farm.” If interested, the child will be allowed to independently explore the device for no longer than 2 minutes. If the child does not immediately show interest in the device or any of the toys, the investigator will direct the child to play with a particular toy or prop in the room, modeling communication about it on the communication system in a similar method as the examples below. After each vocabulary item has been modeled 10 times on the device, the investigator will no longer provide modeling for the child. The investigator will then direct the child’s attention to vocabulary items and props that have not been targeted 10 times by incorporating that particular vocabulary item into the child’s current play.

Sample interventionist lines for target vocabulary:

MAN, LADY, WHO

“It is time to pick vegetables. Here is the man [MODEL MAN and point to the man doll].” *pause*

“Here is the lady [MODEL LADY].” *pause* “Who [MODEL WHO] should pick vegetables? The man [MODEL MAN] or the lady [MODEL LADY]?” The investigator will pause and give the child time to respond on the speech generating device (SGD). If the child does not respond, the investigator will make a choice (man or lady) by using the SGD and continue play.

DONKEY, THERE

“Look at the donkey [MODEL DONKEY].” “I put the donkey [MODEL DONKEY] in there [MODEL THERE].” *Investigator points inside the barn.* The investigator will pause for the child to see. The investigator should pick up the lady and model “lady” [LADY]. “Where do you want the lady [MODEL LADY]? In there [MODEL THERE]?” *Investigator points inside the barn.* The investigator should allow time for the child to respond.

All other vocabulary will be modeled in a similar way and pause time will be given for the child to respond on the communication system. The communication system will be made available and placed in reach and sight of the child throughout the entire session so they may spontaneously use it.