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The Acquisition of Functional Sign Language by Non-Hearing Impaired Infants

by

Kerri Haley-Garrett

A thesis submitted in partial fulfillment
of the requirements for the degree of
Master of Arts in Applied Behavior Analysis
College of Graduate Studies
University of South Florida

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Debra Mowery, Ph.D.
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ABSTRACT

Research shows that young children, typically developing with no developmental delays, hearing impairments or visual impairments, can acquire sign language to communicate their wants or needs prior to their ability to communicate through spoken language. However, much of the research reviewed focused on whether it was normative for young children to use signs or symbolic gestures to represent objects, make requests, or to express other wants or needs. In addition, many of the studies reviewed lacked scientific rigor and were primarily anecdotal in that much of the data relied on parent reports of his/her child's production of signs or symbolic gestures.

The present study expanded upon the procedures of Thompson, McKerchar, and Dancho (2004) by teaching more complex signing repertoires using different training procedures. This study examined the acquisition of functional sign language by typically developing infants, ranging in age from 10 months to 14 months, using a training program which consisted of three components. The three components of intervention included a 30 minute group class once per week, an intensive or "booster" 1:1 session twice per week, and parent led training in the participant's home environment.

During intervention a variety of concept items such as toys, pictures, books, and real objects were presented to represent the signs were utilized. A multiple baseline

design across pairs of behaviors was employed to assess experimental changes in signing repertoires during the intervention conditions.

All participants demonstrated zero rates of signing during baseline and showed an increase in their signing repertoires during intervention phases.

Chapter One

Introduction

Language is the way human beings communicate with each other. It is more than just expressing your thoughts through sounds and words. Language encompasses much more and is a way for people to express themselves as well as receive information from others. Language can be expressed through spoken words, gestures, and written communication. The development of language begins at birth when a baby cries to communicate his need to be fed, held, and changed. Across the life-span, language develops and becomes more elaborated and sophisticated as an important and functional part of the behavioral repertoire.

Language development is important for many reasons. Without language a person would not be able to communicate with others, comprehend what others are communicating, and be able to learn with greater efficiency. Language is an area of development that can indicate future success in school. Language is also important for social development. Once a child understands the words for objects, events, and actions, he can use a system of symbols to stand for the objects around him; he can reflect on people, places, and things in his world; and he can communicate his needs, feelings, and ideas in order to exert control over his life (Papalia & Olds, 1995).

The overall maturation of the speech centers is behind that of the motoric centers at birth, and the development of the speech centers proceeds at a slower pace (Bonvillian, Orlansky, & Novack, 1983). Motor control of hands matures before motor control of

speech in young children. Infants, whether hearing impaired or not, normally initiate their symbolic communication in the gestural mode rather than the verbal mode. For example, most parents teach their children at a young age to wave bye-bye when leaving or when somebody else is leaving. Young children also learn to shake their head yes or no without much effort given by their parents to teach these gestures. Other symbolic gestures young children typically learn to make are holding their arms up to show that they want to be picked up, pointing to objects they want, or blowing to indicate something is “hot”. Many young children learn symbolic gestures as a result of routines and games such as pat-a-cake with their parents. For example, young children learn the symbol for spider through the nursery rhyme “Itsy Bitsy Spider”. Symbolic gestures show that even before children can talk, they understand that objects and concepts have names and that they can use symbols to refer to the things and happenings in their everyday lives (Papalia & Olds, 1995). Signing can be a normal part of language development and an extension of these common signs that parents teach (Acredelo & Goodwyn, 2002). This makes learning sign language as a means of communicating at a very young age a valuable alternative for communication with infants and young children prior to the development of verbal language.

Teaching sign language to non-hearing impaired children in the first two years of a child’s life has been shown to be a significant advantage to increasing a parents’ communication with their children earlier than they could with spoken language. (Acredelo & Goodwyn, 1996; Garcia, 1999).

Literature Review

Acredolo & Goodwyn (1988) investigated the use of nonverbal gestures or signs by infants as a means of communicating with persons within their environment. Their purpose was to document the natural development of nonverbal gestures by normal infants to communicate their wants and needs. Two experiments were conducted within their research. In the first experiment the researchers interviewed mothers of thirty-eight 16-18 month old infants about their child's nonverbal communication development. They discussed what nonverbal gestures their child was demonstrating and if they believed the gesture represented something. If a gesture met specific criteria (the gesture had to be described as occurring in the same form repeatedly and the behavior had to include one gestural component) then the gesture would be placed into one of five categories based on the function. The categories included object signs, requests, attributes, replies, and events. They did not utilize any pointing gestures to request something or to communicate yes and no or waving for goodbye.

The results showed that 148 gestures met their criteria, therefore, signifying that symbolic gesturing is commonly utilized by young children to communicate with those around them. Eighty-seven percent of the children used at least one gesture, and the mean per child was four (range 0-16). The following gestures were noted to be the most commonly used; object signs for flower, dog, and horse; request signs for out and up; attribute signs for hot and all gone; and reply sign for "I don't know".

The second study by Acredolo and Goodwyn (1988) was longitudinal and examined both verbal and nonverbal development of sixteen 11-month old infants. The mothers were required to attend an orientation prior to the child's 11-month birthday and

kept weekly records of their child's verbal and nonverbal language development from the age of 11 months until they were 20 months of age. The mothers were asked to document any form of symbolic gesturing whether or not it seemed communicative. In addition, they were asked to document any new words that the child verbalized throughout the week. During the monthly visits to the participant's home the researchers would pick up the completed sheets, answer questions, and when needed, determine if a gesture would qualify as representative.

The children were assessed at 17 months, 20 months, and 24 months of age to measure the verbal vocabulary size and to interview the mothers on the child's signing behaviors. The assessment at 17 months consisted of a videotaped session in the lab to evaluate whether the children would naturally imitate the gestures produced by an adult. The experimenter presented 12 items while calling the child by name and stating "look at this". The experimenter produced the gesture three times with 10 second intervals in between. If the child imitated the gesture at least one time before the next object was shown, credit was given. The child did not have to produce an exact replication of the gesture to be credited as the main goal was to determine whether the child naturally imitated the gesture, without being prompted to do so. The assessment at 20 months consisted of a review of the diary entries that were kept by the families and interviews with the families to clarify any questions they had regarding the signing behavior of the children documented in the diaries. In addition, the families were given one week to complete a questionnaire designed to determine verbal vocabulary size. Finally, a follow up was conducted in the families' home at 24 months to assess the children's verbal vocabulary size. Several assessment scales were utilized including the Mental

Development Inventory (MDI) of the Bayley Scales of Infant Development. The families were given the identical questionnaire to complete that they completed during the 20 month assessment to determine verbal vocabulary size.

The results of experiment two showed that as with the first experiment, the mothers of all 16 infants in the study stated that their infants demonstrated the use of gestures to communicate. The parents reported that the gestures the children used appeared to evolve from everyday interactions and through the child's connection between an action and item or experience. Finally, the results supported the researcher's hypothesis that children who learn and use gestures to symbolize objects or wants and needs have earlier verbal language development.

Several case studies have been conducted to determine if teaching non-hearing impaired children sign language increases their rate of language acquisition. Bonvillian, Orlansky, and Novack (1983) examined the sign language acquisition of 10 non-hearing impaired children and one child with a severe bilateral hearing impairment. At least one parent in each child's household was hearing impaired and the primary mode of communication was American Sign Language (ASL). However, signed English was frequently used and most of the parents verbally communicated to their children as they signed, although the spoken language was often not clear and was difficult to understand. The children were also exposed to spoken English through other family members, friends, and through watching television. The primary mode of communication within each participant's home was ASL. This study also looked at the child's motor milestones related to development of a child's spoken language. The research indicated that the

processes of speech and motor development occurred in a synchronized manner in that progress in speech often occurred after a child completed a spurt in motor development.

At the beginning of the 16-month study, the seven children ranged in age from 4-10 months with a mean age of five months. The children were visited in their home once every 5-6 weeks by three experimenters. The experimenters observed and recorded the children's motor skills and their expressive and receptive sign language vocabularies. During these observations, in which structured and unstructured activities were videotaped, the parents were asked to encourage their children to produce as many signs as possible. The structured videotaped records consisted of a 2-minute "normal play" and a 3-minute "communication period". The experimenters endeavored to unobtrusively videotape the children's sign communication and parent-child interactions for the remainder of the hour observation time period. The parents were also asked if their child had reached any new motor milestone since the preceding visit. During the time between the experimenter's visits the parents kept detailed sign language records of their child's language development. The developments in sign language acquisition were verified during the experimenters' subsequent home observation. The experimenters did not include non-ASL signs such as pointing gestures in their calculations of the child's signed vocabulary size.

Results of this study indicated that the participants achieved in sign language the corresponding spoken language milestones several months in advance of the norm. The average age at which the participants produced their first recognizable sign was 8.5 months, with most (6 of 11) of the children producing their first sign by 9 months. The age of the child at the initial sign production ranged from 5.5 months to 10 months. The

rate of acquiring new signs increased quickly in these children. The children's age ranges varied from 11 to 17 months and at the mean age of 13.2 months the children had an average of 10 signs in their repertoires. Compared to the children in this study, children learning to speak often don't reach the equivalent spoken language milestones until 2 to 3 months later. At eighteen months old there was a significant increase in the number of signs the children had in their vocabulary. They had a mean sign language vocabulary of 49 signs. These results indicated the children reached their motor milestones on average with the norm while showing accelerated development in the language milestones. The participants frequently reached sign language proficiency several months in advance of the corresponding speech and language milestones.

Goodwyn, Acredolo, and Brown (2000) conducted a longitudinal study to evaluate the effects of infant signing on verbal language development. In addition, the researchers examined whether teaching baby signs to hearing children delayed their verbal language development. The participants included 103 11-month old infants. The participants were randomly assigned to one of three groups, sign training, nonintervention (control) group, and a verbal training (control) group. The groups were comparable at the start of the study in terms of gender and birth order of the children, their ability to vocalize or speak words, and their parents' education level and/or socioeconomic levels. The sign training (ST) group was given instructions to encourage symbolic gesturing in the child by modeling basic gestures and pairing the gesture with the verbal equivalent. The nonintervention control (NC) group did not receive any instructions or training and were not privy to the researcher's purpose. The purpose of the NC group was to compare the language development of children receiving the sign

training and those who did not. A second control group was employed as the researchers discovered that since the ST group main focal point was on the child's language development and that without a control for "training effects" it would be hard to evaluate the benefits to language development of the ST groups over NC group. A second control group, the verbal training (VT) group, was instructed to promote the development of verbal language by labeling (verbally naming) as many things throughout the day during their communications with their child.

The child's verbal and gestural/sign development was assessed at 11, 15, 19, 24, 30, and 36 months. Each child's baseline vocal language was obtained at 11 months using a 5-second time-sampling method during free-play sessions between the child and his/her mother. The observers documented whether the child vocalized during these free-play sessions. Interviews of the parents were conducted by phone every two weeks to assess whether their child exhibited any verbal language or gestural communication without prompting or elicitation from the parent. In addition, the children were observed in the lab setting at the same intervals. Various standardized language measures including the MacArthur Communicative Development Inventory (CDI), Sequenced Inventory of Communicative Development (SICD), Receptive and Expressive One Word Picture Vocabulary tests, Mean Length of Utterance (MLU), and Phonemic Discrimination Task were conducted to evaluate the child's receptive and expressive language skills.

The results of the study showed that the mean number of symbolic gestures acquired by the children in the ST group was 20 (the range was 10 to 60) compared to only 5 gestures in those children where no special efforts were made to encourage symbolic gesturing. The authors compared the language scores between the children in

the VT group and those in the NC group to see if simply having parents involved in a language intervention program would aid language development. The results show that the VT group did not notably do better than the NC group on any of the language measures. The authors examined whether symbolic gesturing facilitated verbal language development in the ST group compared to the NC group. The results show that the ST group consistently outperformed the NC group at all ages measured in regards to receptive and expressive language tests. Twenty-four month old baby signers were on average talking more like 27 or 28 month olds, more than a three month advantage over the NC children. Thirty-six month old baby signers were on average talking like 47 month olds, putting them almost a full year ahead of the NC children. In addition, the ST children were putting together longer sentences. These results indicate that symbolic gesturing helped promote early verbal language acquisition in the children who were part of the study.

Goodwyn and Acredolo (2000) conducted a follow-up study with the original children in the aforementioned study to determine if the children who were part of the ST group do better than the children in the NC group in regards to their language development. Nineteen of the 32 ST children and 24 of the 37 NC children participated in the follow-up study during the summer following their second grade year (eight years of age). The children were assessed using the WISC-III measure, and the results indicated that the ST children continued to surpass the NC children. Specifically, the full IQ, verbal IQ, and performance IQ scores of the ST children were 114, 116, and 109 compared to that of the NC children 102, 103, and 101. The mean score of the ST children was 114, which is at 75th percentile compared to the mean score of 102, which is at 53rd percentile

of the NC children. This is an average of 12 points higher in IQ on the WISC-III. This demonstrated that children who learn to communicate through symbolic gesturing or baby signs develop language skills earlier than children who did not receive the sign training.

Holmes and Holmes (1980) analyzed the language acquisition of a non-hearing impaired child of non-hearing impaired parents. The parents, who were skilled in sign language, communicated with “Davey” through spoken English and signed language simultaneously from the time of his birth. The parents documented Davey’s communicative language from 6 months until 17 months of age and compared his spoken language to that of 18 normally hearing children’s acquisition of spoken language. Davey communicated his first 10 spoken words at the age of 13 months compared to that of the Nelson group, which had a mean age of 15.1 months. Davey’s first 50 spoken words were acquired by 16 months of age compared to that of the Nelson group, which had a mean age of 19.6 months of age. The results of this case study indicated that teaching sign language concurrently with spoken English to a hearing child of hearing parents did increase the rate of acquisition of spoken language.

Daniels (1994) conducted a study to determine if teaching non-hearing impaired children sign language simultaneously with English increased their receptive English vocabulary. The participants included 60 African American children who attended one of four pre-K classes. According to kindergarten placement tests that were given prior to the study, there was no significant difference in the scores among the students.

Two of the four classrooms received signed instruction at the same time as spoken English at the start of the school year. The other two classes received no signed

instruction. The ASL instruction was given in a naturally occurring approach without particular concentration given to the signed language. The teachers utilized sign independent of spoken English to communicate about one quarter of the time, English only about one quarter of the time, and ASL and English simultaneously about half of the time. The teachers introduced signs by labeling objects and activities throughout the classroom while verbalizing the words at the same time. In addition, the children were taught the alphabet in spoken English as well as in ASL.

The Peabody Picture Vocabulary Test Revised (PPVT-R) was given to the four pre-K classrooms to conclude if signed instruction increased the children's rate of English language acquisition. Daniels (1994) showed that the children who received signed instruction, in addition to spoken English, obtained scores which were 15 points higher than those children who did not receive the ASL intervention.

One method of training sign language shown to be effective was described in the research by Thompson, McKerchar, and Dancho (2004). Three typically developing children, ranging in age from six months to thirteen months participated in a study to determine whether delayed physical prompting and reinforcement were effective in teaching sign language to infants.

Prior to the study the children did not demonstrate any consistent verbal or signed language. The children were trained to request items or activities that the infants' parents or teachers identified as preferred. For the two 13 month old females the sign for "please" was chosen as a request for a variety of favored toys. The sign "more" was chosen as a request for an additional bite of food for the six month old male participant. The sessions

were conducted in a small therapy room in the children's day care. They were five minutes in length and conducted one to three times per day, five days per week.

During the initial baseline sessions the identified reinforcer was presented to the child according to a time based schedule, independent of the child's behavior. When the sign training was initiated, the children were physically prompted to produce the target sign after a 5-second delay and the designated reinforcer was delivered following prompted signs. If the child produced an approximation to the sign the experimenter physically prompted him/her to produce the sign correctly. If the child produced the sign independently the reinforcer was provided immediately. The subsequent prompt was delivered 5 seconds after removal of the toy or consumption of food. The delays to the physical prompt were gradually increased from 5 seconds to 4 minutes or until high levels of independent signing were maintained. During the reversal to baseline condition the procedures were similar to baseline phase, except that the schedule of reinforcer delivery was based on the mean interresponse time (IRT) from the last five sessions of sign training condition.

A reversal design was utilized to compare the data from baseline and sign training conditions. The results of this study indicated that sign training with delayed physical prompting and reinforcement in three typically developing infants is effective in producing independent signing. In less than four hours of training with the six month old participant, independent signing was produced. For the 13 month old female participants, independent signing was produced after less than two hours of training. This shows that sign training may be attained with minimal effort by caregivers.

Summary/Statement of Purpose

In summary, research shows that young children, typically developing with no developmental delays, hearing impairments, or visual impairments, can acquire signed language to communicate their wants or needs prior to their ability to communicate through spoken language. Much of the research reviewed investigated whether it was normative for young children to use signs or symbolic gestures to represent objects, make requests, or to express other wants or needs. Many of the studies examined the effect of sign language on hearing children's language development as compared to children who were not taught sign language to communicate. These studies indicated that sign language aids the development of language in typically developing children. Many of the studies reviewed lacked scientific rigor and were primarily anecdotal in that much of the data relied on parent reports of his/her child's production of signs or symbolic gestures.

The present study proposes to replicate the findings of the study previously conducted by Thompson et al. (2004) on the effectiveness of specific methods of training on young children acquiring sign language. The previous study found that delayed physical prompting and reinforcement were effective in producing signing in three young children. However, a limitation of this study was that the children were taught only one sign. This study expanded upon the procedures of Thompson et al. (2004) by teaching more complex signing repertoires using different training procedures.

The present study examined the acquisition of functional sign language by non-hearing impaired infants ranging from 10 months to 14 months of age. The research investigated whether these young children learned sign language to communicate

important things such as whether they were hungry or thirsty or if they wanted to have a book read to them, take a bath, or needed a diaper change.

Chapter Two

Method

Participants

Three children between the ages of 10 months and 14 months of age, who were registered in a Tampa Bay area play group, were identified for this study. The participants were identified through the teachers' recommendation, at a community program where parents and infant children engage in structured and unstructured social activities. The participants consisted of two males and one female. The participants were typically developing with no developmental delays, hearing impairments or visual impairments reported. At the beginning of the study, Dylan was 10 months, Derek was 12 months old, and Gracie was 14 months old. Each participant communicated primarily with one word verbalizations and through limited gestures or signed communication. Dylan had spoken two words, "dada", and "mama". Symbolic gestures or signed communication consisted of waving "bye-bye". Derek had spoken two words as well, "dog" and "mama". He also waved "bye-bye", and pointed to objects that he wanted. Gracie had spoken several words including, "hi", "hat", "mama", "dada", "pop-pop", "quack-quack" and "moo" for cow. She used several gestures to communicate including waving for "bye-bye", shaking head "no", and raising her arms to be picked up. All three participants had previously participated in a children's play group with their parents. Gracie and Derek had no prior exposure to baby signs, and Dylan had limited exposure.

After the participants were identified by the teacher, written informed consent was obtained from the parents/guardians of the participants prior to conducting this study, consistent with USF Institutional Review Board (IRB) approved procedures.

Setting

This study was conducted at Gymboree Play and Music, which is located in Clearwater, Florida. Gymboree is a children's learning program, which was created by child development professionals in 1976. The program offers numerous classes including Gymboree play, fitness fun, yoga, music, arts, and Baby Signs: Sign, Say, and Play. The Gymboree play classes are divided into seven levels according to age. The curriculum was designed to focus on the developmental age and stage that the child is working on including sensory exploration, cause and effect, imaginary play, emotional/social, physical, problem solving, early listening, and language skills. These classes use brightly colored slides, ramps, bridges, tunnels, mini-trampolines, balls, balance beams, etc., to encourage children's participation. The activities are designed to improve the child's cognitive, social, emotional, and physical development.

The sessions were located in a room which is adjacent to the main play area. The children were allowed to have access to the room prior to the beginning of the study to control for potential confounds due to a novel environment. The parents of the participating children were also present during all sessions. The parents of the participants were asked that the same parent participate in all sessions so that the conditions remained consistent across each of the sessions. The room was approximately 7.62 x 3.66 meters with five large windows on three walls. Three of the windows faced the main play area, which was adjacent to the training room. The room contained a

countertop area with cabinet, some toys on top of the cabinet, and a tall plastic bin with drawers which held art supplies, a radio/cd player, a tall garbage can, a table and chairs, and a large mat in the center of the room where the sessions took place.

A video camera was set up on the garbage can and facing the children, their parents, and the teacher. It was turned on before the children entered the room and turned off after the children left the room. The children and their parents were seated on the floor across from the teacher with the child facing the camera. The camera had a cloth draped over it to decrease reactivity to being videotaped. Parents of the children participants were asked to complete a consent form for videotaping.

Dependent Variables and Measurement

The dependent variable in this study was the frequency of target signs produced. The definition of an acceptable sign included any approximation of the targeted sign that the child made to communicate something they wanted, needed, or requested to see. The goal was not for the child to produce an exact replication or imitation of the sign being taught. Rather it was to show that they can demonstrate a sign or gesture to communicate a request or represent an object. The specific topography for signs is noted in Appendix A.

Signs were chosen based on the curriculum *Baby Signs: Sign, Say, & Play* (Acredolo & Goodwyn, 2002). The Baby Signs program incorporates practical and baby friendly signs from American Sign Language (ASL) and combines them with signs that babies and parents have created themselves and have found to be functional (Acredolo & Goodwyn, 2002). Because young infants have limited motor coordination they are not able to produce a lot of the difficult hand shapes of ASL. Baby Signs are intended to be a temporary bridge for non-hearing impaired children until they are able to verbally

communicate; the signs are designed to be simple to perform for the children as well as their parents (Acredolo & Goodwyn, 2002). The signs for this study were chosen from the Baby Signs curriculum which included signs for mealtime, bedtime, bath time, getting dressed, pets, and at the park. Mealtime signs include; eat, drink, more, milk, bib, cereal, and all done. Bedtime signs include stars, moon, book, light, love, and sleep. Bath time signs include; water, bubbles, bath, duck, frog, and toothbrush. Getting dressed signs include; shoes, socks, coat, comb, hat, pants, and diaper. Pet signs include, cat, dog, fish, bird, turtle, and bunny. The final category of signs, at the park, includes butterfly, ball, slide, flower, swing, and tree. Each week the six signs from each content area were taught to the child and his/her parent by a teacher, experienced in working with young children, during the 30-minute regularly scheduled classes. The teacher used a variety of concept items such as toys, pictures, books, and real objects to represent the signs that were introduced in each class. In addition to the 30-minute weekly group sign class, the teacher and the parents focused on two target signs from each content area to teach the children.

Data Collection and Interobserver Reliability

Each child participated in 30-minute sessions one day per week for six weeks. The sessions were led by the teacher during regularly scheduled classes in the training room. During all experimental sessions, event recording was used to measure the dependent variable (Appendix B). Each session was videotaped. A data sheet was designed for use in measuring the dependent variable during assessment sessions (Appendix: C). Data sheets and videotapes were kept in a locked cabinet in the office of the principal investigator. At the conclusion of the study, data sheets and videotapes were transferred to locked filing cabinets at USF, in a controlled access environment.

Each child also participated in two 5-minute intensive or “booster” sessions, once per week, for six weeks. During these “booster” sessions, event recording was used to measure the dependent variable (Appendix D). These sessions were also conducted by the teacher in the training room and focused on two signs from the current week’s content area. The target signs were chosen based upon interviews with the parents and the teacher to determine which signs were most functional and useful for the children and parents. A total of 12 target signs were taught to the participants.

Measures of dependent variable were also conducted for five-minutes following the booster session, in the training room, using the protocol for prompting signs (Appendix E). The assessment period was held in the same room as the class sessions. During these sessions, data was collected by the trained observer using a data sheet (Appendix C).

In addition, the same parent who participated in the program-based session practiced with his/her child the two target signs at home. The parent was provided with a handout of the current week’s lesson to refer to as she practiced with her child at home. The parents were also provided with a data sheet to record each time the child produced a sign to communicate with them (Appendix F).

Data were recorded by direct observation by the principal investigator. Data were taken during all sessions. Data were scored as demonstrated if the child produced a sign during the sessions or not demonstrated. A tally was given in a corresponding box for each demonstration of the sign. In addition, data were taken on whether the child produced the sign as a result of a teacher prompted response (V) or if the child initiated the sign independently (I) without any prompting from the teacher. A teacher prompted

response would include when the teacher stated, “What is this?” or “What do you want?” or “How do you say ___”?

The interobserver agreement was obtained by dividing the number of agreement intervals by the number of agreement intervals plus disagreement intervals and multiplying by 100 (Cooper, Heron, & Heward, 1987) in at least 30% of the sessions for each of the participants across the experimental sessions. When it was not possible for the observer to be present, the video-tapes were reviewed and subsequently scored by the observer. The interobserver reliability data collector was a Board Certified Behavior Analyst and trained researcher, blind to the experimental predictions and unaware of the hypothesis, but familiar with the signs being taught and experienced in working with children between six months and eighteen months of age. The videotapes scored were chosen based upon a random assignment determined by a table of random numbers.

Social Validity

Social validity was assessed using a questionnaire which was administered to the parents of the participants following the completion of the study (Appendix G). This was intended to measure the appropriateness of the procedures, the social importance of the goals, and the social importance of the effects (Wolf, 1978).

Experimental Procedures

Teacher training. Prior to data collection, training was conducted to ensure the teacher conducted experimental sessions according to prescribed protocols. The principle investigator provided a training session with the teacher and session guidelines were outlined and given to the teacher to follow during each session. (Appendix H, I, J) as well as the protocol for prompting sequence for teaching signs (Appendix K). Training

consisted of direct instructions on baseline and intervention session procedures and the operational definitions of the targeted behaviors; role-plays demonstrating examples of target behaviors; and guided feedback on session procedures. A teacher who was experienced in working with young children conducted the sign language sessions. The teacher completed the IRB-approved foundation courses in Human Subjects Protection to ensure they met the IRB criteria. In addition, to ensure all participants meet the IRB approved procedures, the reliability observer also completed the IRB-approved foundation course.

Baseline. Baseline sessions consisted of 10-minute observations of each child in the training room. Baseline sessions were designed to establish the child's ability to communicate through signed language. The teacher used a variety of concept items such as toys, pictures, books, and real objects to represent the signs that were introduced in each class. Prior to the beginning of each session, the teacher gathered the twelve concept items or real objects which represented the twelve target signs being taught. For example, a picture of someone eating, goldfish, a pillow for sleep, a book, bubbles, a toy slide, diaper, a toy dog, a toy frog, a ball, a hat, and a toy bunny. These props were placed around the mat located in the center of the room. The video camera was turned on prior to the children and their parents entering the room. Sessions consisted of the presence of the teacher and the principal investigator in the room as well as the parent to ensure consistency across all sessions. The teacher then let the parents know they could bring the children into the training room. The parent brought the child into the room and sessions began.

Once in the room, the child was free to move about the room and play with any toys or objects he/she wanted. The teacher followed the child to where he/she was playing in or near and then followed the protocol for prompting signs (Appendix E). If no interactions with the toys were initiated by the child, the teacher brought a toy to the child and then followed the prompting sequence. If the child continued to play with a toy after it had been assessed, the teacher removed the item and presented a new toy. Prompts were presented one at a time and included the following three prompts: “What is this?”, “How do you say ____?” and “Show me what ___looks like.” The questions or prompts were given in a systematic manner and through the natural flow of the child’s play until all twelve target signs were probed. The teacher waited 10 seconds for the child to respond to the first question or prompt. If there was no response after 10 seconds, then the teacher asked the next question in the prompting sequence until all prompts were given for all 12 target signs, waiting 10 seconds between each prompt. Once a target sign had been probed (for a total of three times) that sign was checked off to ensure the teacher did not probe for the same sign again during that session. During baseline no consequences were given for demonstration of a sign or gesture.

Treatment. Following the establishment of baseline data, the second condition was introduced. There were three components of intervention during the treatment phase. The first intervention consisted of a series of six 30-minute sessions based upon Baby Signs: Sign, Sign, & Play program (Acredelo & Goodwyn, 2002). The sessions were designed for the parent and the child to attend together during regularly scheduled classes. The sessions utilized music, books, and the Beebo Signing Bear. In addition, the teacher used a variety of concept items such as toys, pictures, books, and real objects to

represent the signs that were introduced in each class. Each week the teacher introduced a new content area. The content areas included signs for mealtime, bedtime, bath time, getting dressed, pets, and at the park. Each content area included five or six signs which were taught by the teacher to the child and his/her parent. During all training sessions, consequences for the demonstration of a sign or approximation of a sign were verbal praise (e.g., “that’s right, cat”, “great job”, “you did it”, etc.), affectionate touch (e.g., hugs, kisses, pat on the back, etc.), and giving the child the item that he/she requested or showing him/her the item labeled. The teacher followed the prompting sequence for teaching new signs during all training sessions (Appendix K).

Once the participants were in the training room, the teacher, children, and their parents gathered around a mat located in the center of the room. Each session followed the same general format. The sessions began with a song to welcome the children to the class (e.g., “Sign, Say, & Play”), for approximately three minutes in duration. Next, the teacher reviewed the signs taught in previous sessions, if applicable. The teacher then led the children in a sensory-motor activity (e.g., hitting large drum) and free play with the concept items, which represent the content area being taught, for approximately three minutes in duration. Next the children and their parents participated in circle time for approximately seven-minutes, which included the teacher using music designed for the current week’s content area and the Baby Signs Beebo Sign Language Bear to introduce the signs. While the music was playing the teacher verbalized the sign being taught, modeling it at the same time for the participants and their parents. The signs were repeated numerous times throughout the activity. The BeeBo Bear was used by the teacher to model the signs while the teacher stated the word being taught. Another song

(e.g., “Baby takes a bath”) was played which focused on the signs being taught (e.g., bath, bubbles, water, etc.). The next activity included the teacher guiding the children to play with a variety of real objects (e.g., bucket filled with water with bubbles and duck to represent bath time concepts) while showing the children each object with the sign and pairing the sign with the verbal word equivalent. This activity was approximately seven-minutes in duration. The class then proceeded to the next activity, which was approximately five-minutes in length, in which the children and their parents gather around the mat and the teacher read a book which focused on the current content area (e.g., My Bath Time Signs). The teacher read the book and when she got to a content sign she modeled the sign and verbalized the sign. Another song was played which focused on the current content area signs. Throughout the song the teacher again modeled and verbalized the sign. The last part of the session was approximately five-minutes in duration and included a final review of the signs learned by stating the sign while modeling the sign and showing the real object associated with the sign. The class used repetition to teach and reinforce the signs being taught.

If the child chose not to participate and instead wandered to another activity, the parents continued with the class. The child was prompted at one-minute intervals to return to the mat area. If the child did not return to the mat area after three prompts the teacher or the parent would go to the child and guide him/her back to the mat area. Sessions were discontinued if the child demonstrated behaviors consistent with fatigue, hunger, or over stimulation that could not be calmed within five minutes.

In addition, each child participated in two five-minute intensive or “booster” session per week for six weeks. The sessions were conducted on the same day with a

five-minute break in between sessions. These sessions were conducted by the teacher to each participant and focused on two target signs. These signs were chosen from the current week's content area. These sessions occurred in the training room, on a predetermined day, prior to the next class session. The target signs were chosen based upon interviews with the parents to determine which signs were most functional for the family. The teacher used the same concept items that were utilized in the regularly scheduled classes such as toys, pictures, books, and real objects to represent the target signs being taught. The signs were taught by modeling the sign while the child was looking (if needed, state, "____ look at me/this") at the teacher. The sign and the word for the sign were always presented concurrently. In addition, the concept item, which represented the sign being taught, was shown to the child. The child was allowed 10 seconds to imitate the sign. If there was no response after 10 seconds then the teacher repeated the above procedures and then gently took the child's hands and helped the child make the sign. The teacher repeated the above procedures for half of the session (approximately two and a half minutes). The second target sign was taught in the same manner for the remainder of the session (approximately two and a half minutes).

If at anytime the child chose not to participate and instead wandered to another activity, the parents continued with the class. The child was prompted at one-minute intervals to return to the mat area, however, the child was not required to participate. At times, the teacher or the parent would go to the child and guide him/her back to the mat area.

The third component of intervention included the parent practicing with his/her child the two target signs, for the current week, at home. The parent was provided with a

handout of the current week's lesson to refer to as she practiced with the child at home. The parents were provided with a data sheet to document their practice sessions with their child and to record each time the child produces a sign to communicate with them (Appendix F). The parent was asked to practice using the two target signs at home during naturally occurring opportunities (e.g., for target signs including bath and water, the parent would use the opportunity to teach the sign during bath time) using the following procedures: modeling the signs, while the child is looking at them, while pairing the sign with the word verbally. The parents were given session guidelines to follow (Appendix L). In addition, the concept item which represented the sign being taught was shown to the child. The child was allowed 10 seconds to imitate the sign. If there was no response after 10 seconds then the parent repeated the above procedures and then gently guided the child's hands and helped the child make the sign. They repeated this sequence at least three times.

Experimental Design

A multiple baseline across pairs of behaviors was used to demonstrate that the children learned signs as measured by the dependent variable. Baseline data were obtained on separate behaviors (demonstration of target signs) on all three participants. Once stabilization of baseline data was obtained by all three participants, the treatment was applied to the first pair of behavior (training of content area one signs). Upon the stabilization of treatment of the first pair of behavior, the second pair (training of content area two signs) was applied to all three participants (Budd, 2003; Kazdin, 1982). Again, following the stabilization of the second pair of behavior treatment was applied to the

third pair of behavior. This continued until the six pairs of behavior were trained for all three participants.

Chapter Three

Results

The current study evaluated whether young children can learn many functional signs to communicate through a training program which consisted of three components. Baselines lasted two sessions prior to implementation of the treatment sessions, which lasted 12 sessions. Data gathered from direct observation during the training sessions are presented.

Figure 1 presents a multiple baseline design across behaviors for participant one, Dylan, during baseline and intervention. Intervention one consisted of the Sign, Say, & Play class, which was taught in a group setting. Intervention two consisted of the “booster” sessions, which were conducted in a 1:1 format. During baseline, for all content areas, Dylan demonstrated a stable baseline condition with a zero rate of signing for each of the target signs presented. Following baseline in content area one, during intervention one, Dylan showed no change. Although he did not demonstrate the targeted signs for that content area, he demonstrated other signs taught in that content area, “all done” and “milk”. This is not reflected in the data as for the purposes of this study we were concerned with only the two target signs, “eat” and “more” for each content area. During intervention two he demonstrated an increase in the target signs. When the second pair of behaviors, content area two, were introduced and trained, the data did not show an effect. It is unclear as to why there was no effect during this intervention. During intervention one, for content area three, there was an increase in signs demonstrated. During

intervention two, in the same content area, Dylan's target behavior showed an upward trend. Data for content areas four, five, and six were not obtained due to Dylan not participating in the training sessions due to various personal reasons.

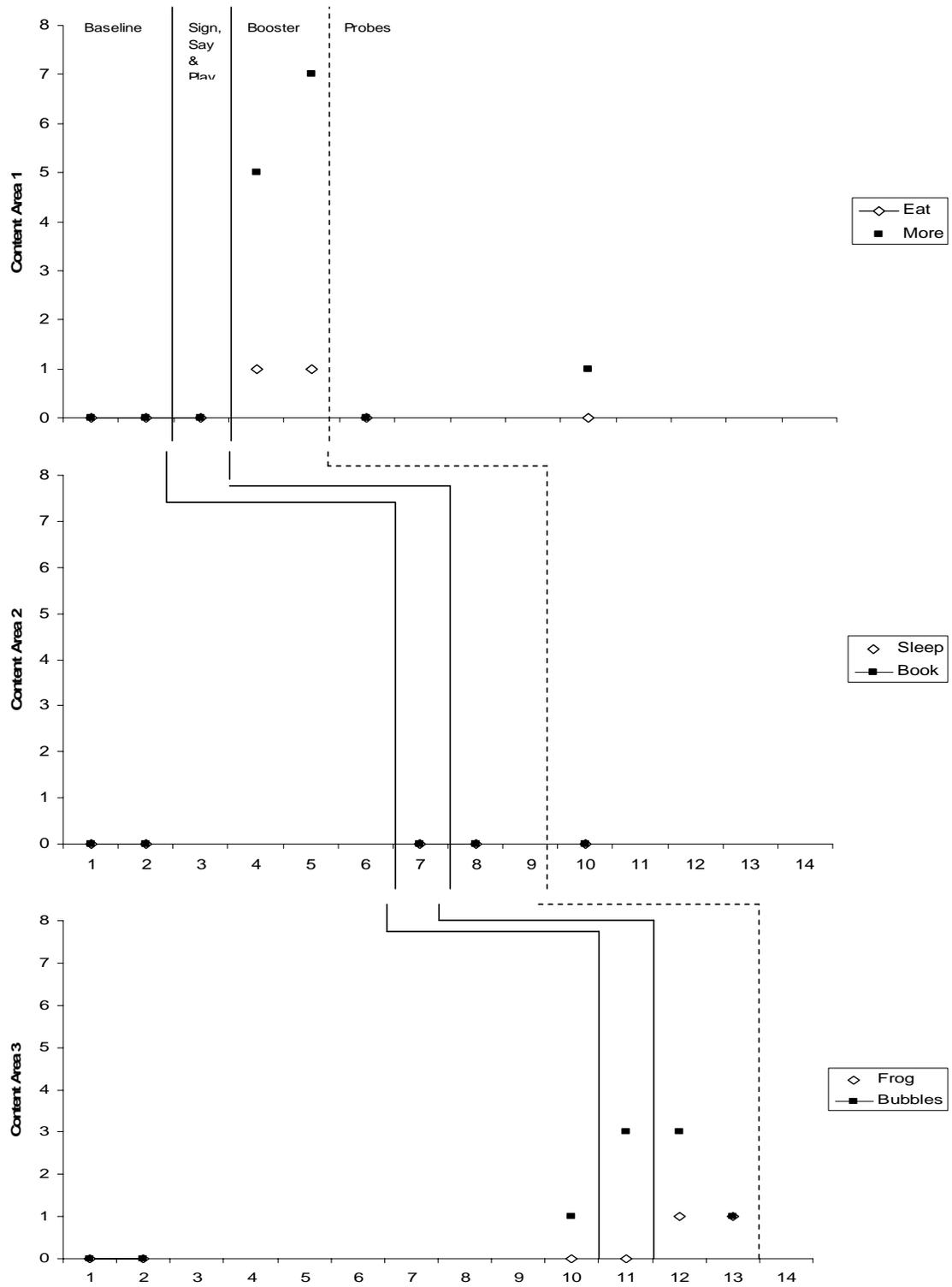


Figure 1. Multiple baseline across pairs of behaviors for participant one, Dylan.

Figure 2 represents a multiple baseline design across behaviors for participant two, Derek, during baseline and intervention. Intervention one consisted of the Sign, Say, & Play class, which was taught in a group setting. Intervention two consisted of the “booster” sessions, which were conducted in a 1:1 format. During baseline for all content areas Derek demonstrated zero rate of signing for each of the target signs presented. Following baseline in content area one, during intervention one, Derek showed no change. However, during intervention two he demonstrated an increase in the target signs. When the second pair of behaviors, content area two, were introduced and trained the data did not show an effect. It is unclear as to why there was no effect during this intervention. During intervention one, for content area three, Derek showed no change. During intervention two, in the same content area, Derek showed an upward trend. Due to holiday vacations there was a two week lapse between training sessions for content area three and four. When content area four signs were introduced the data did not show an effect. However, during the booster sessions, 16 and 17, there was an upward trend in the target sign for “diaper”. Due to time constraints, the final two content areas were introduced consecutively in the group class, Sign, Say & Play. Derek did not receive the individual booster sessions for these content areas. Derek showed no change in the target behaviors for these content areas.

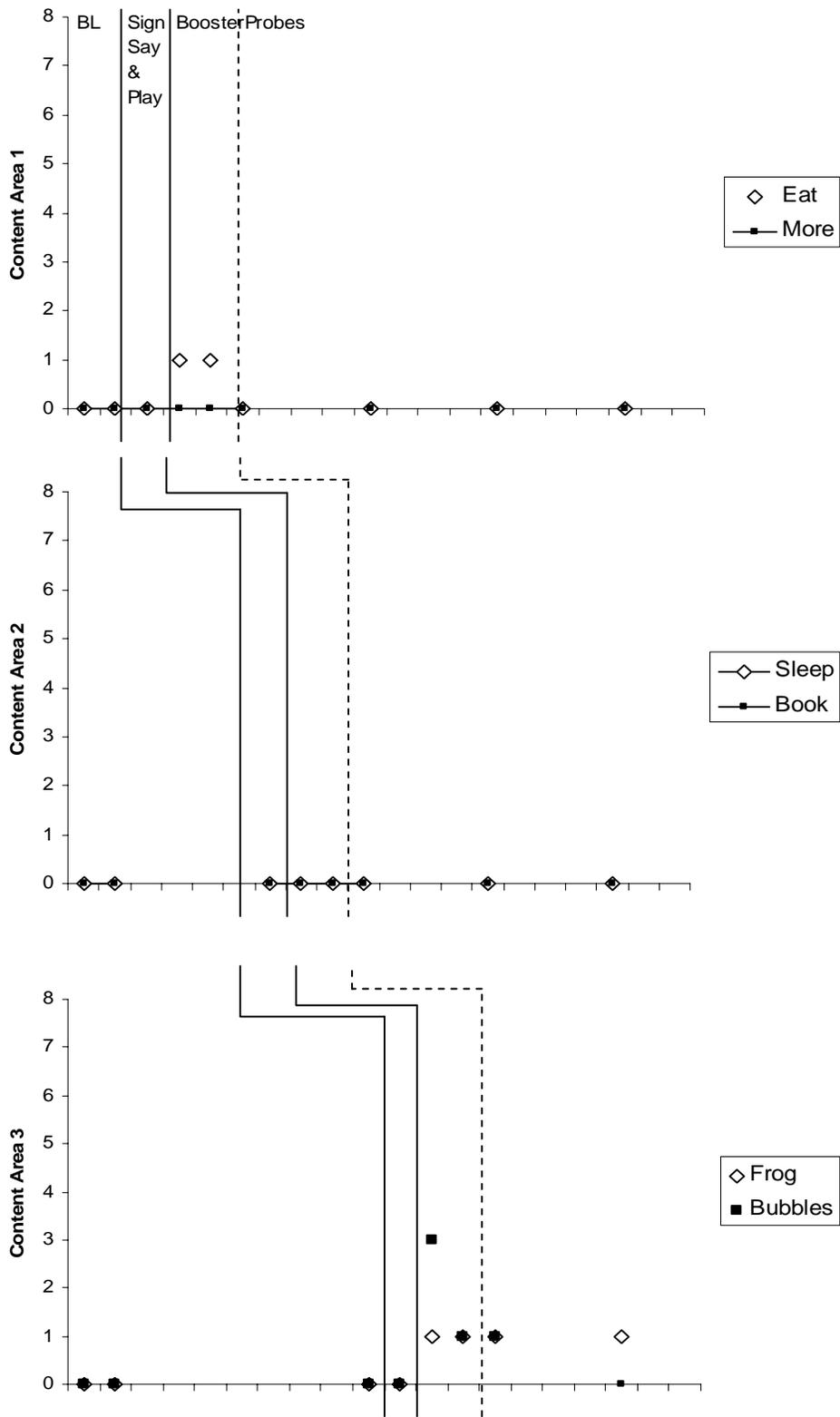


Figure 2. Multiple baseline across pairs of behaviors for participant two, Derek.

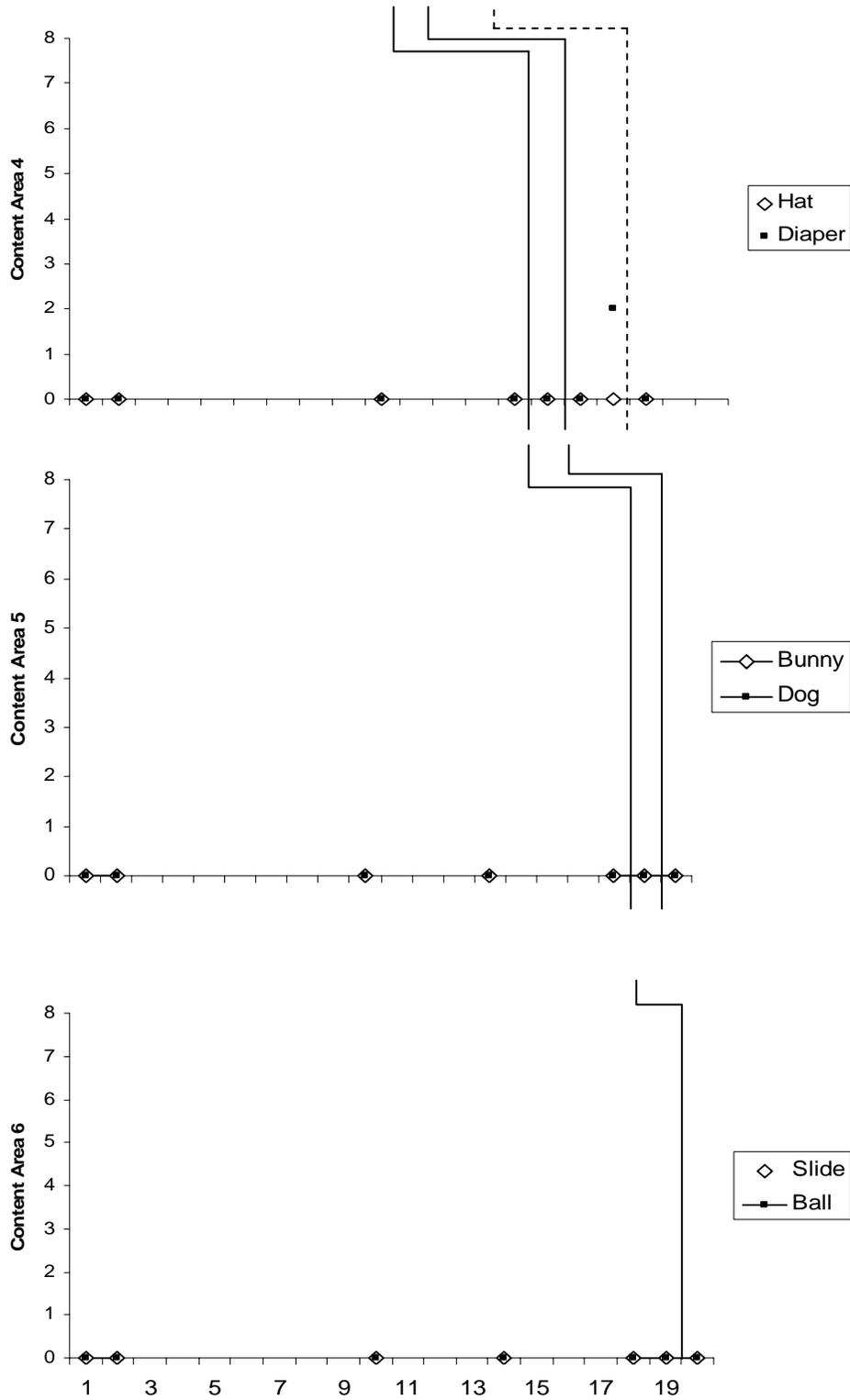


Figure 2. Continued.

Figure 3 presents a multiple baseline design across behaviors for participant three, Gracie, during baseline and intervention. Intervention one consisted of the Sign, Say, & Play class, which was taught in a group setting. Intervention two consisted of the “booster” sessions, which were conducted in a 1:1 format. During baseline for all content areas Gracie demonstrated zero rate of signing for each of the target signs presented. Following baseline in content area one, during intervention one, Gracie showed no change. However, during intervention two she demonstrated an increase in the target signs. Gracie was not present for the Sign, Say, & Play class, session seven, when the second pair of behaviors, content area two, were introduced and trained. Although she was present for the booster sessions in the same content area, eight and nine, the data did not show an effect. This data may be a result of Gracie not participating in the Sign, Say, & Play session prior to the “booster” session. During intervention one, for content area three, Gracie showed an increase in the target signs. During intervention two in the same content area Gracie showed a slight downward trend. Due to holiday vacations there was a two week lapse between training sessions for content area three and four. When content area four signs were introduced the data did not show an effect. However, during the booster sessions, 16 and 17, there was an upward trend in the target sign for “hat” and “diaper”. Due to time constraints, the final two content areas were introduced consecutively in the group class, Sign, Say & Play. Gracie did not receive the individual booster sessions for these content areas. Gracie showed an increase in the target behaviors “slide” and “ball” for these content areas.

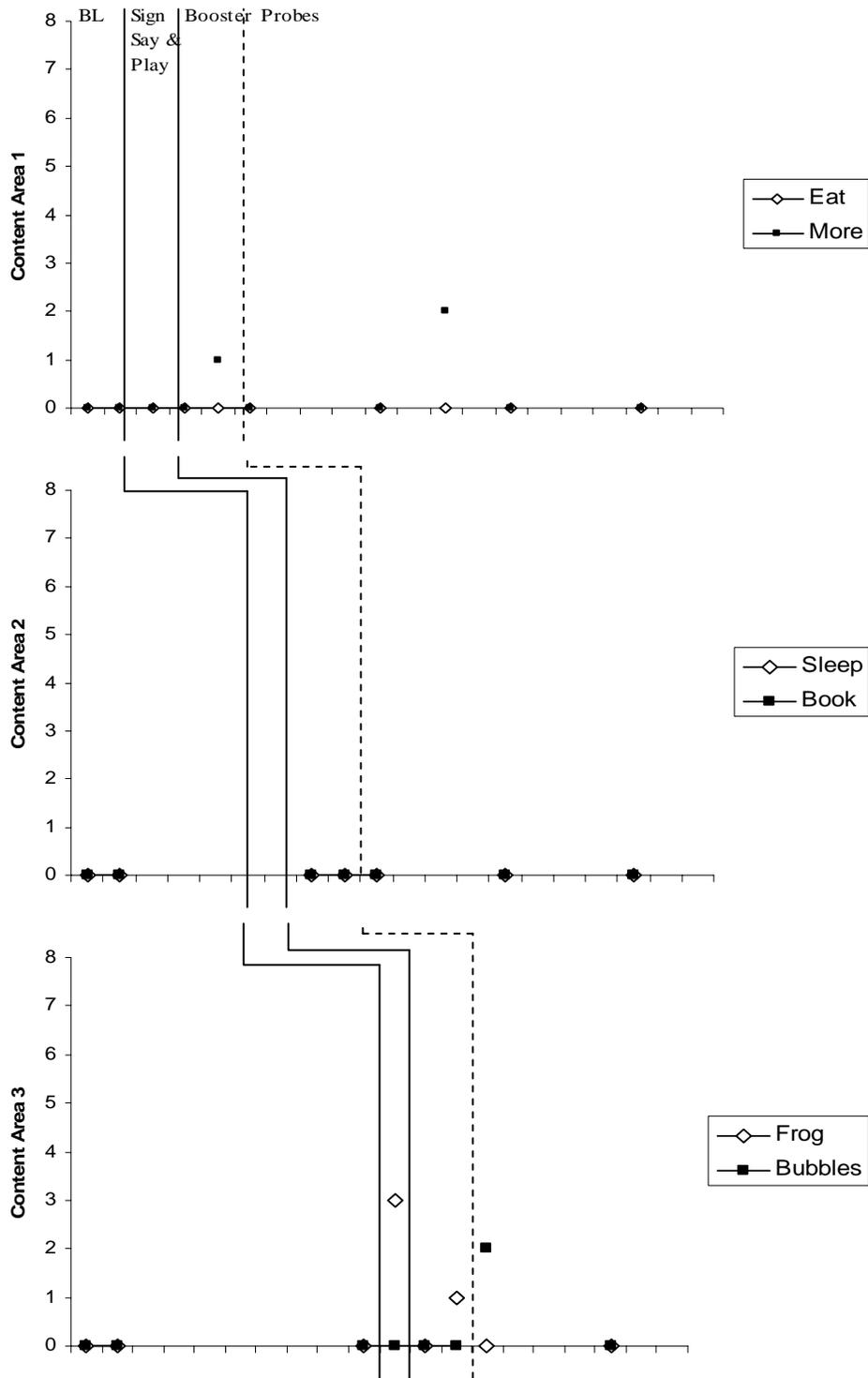


Figure 3. Multiple baseline across pairs of behaviors for participant three, Gracie.

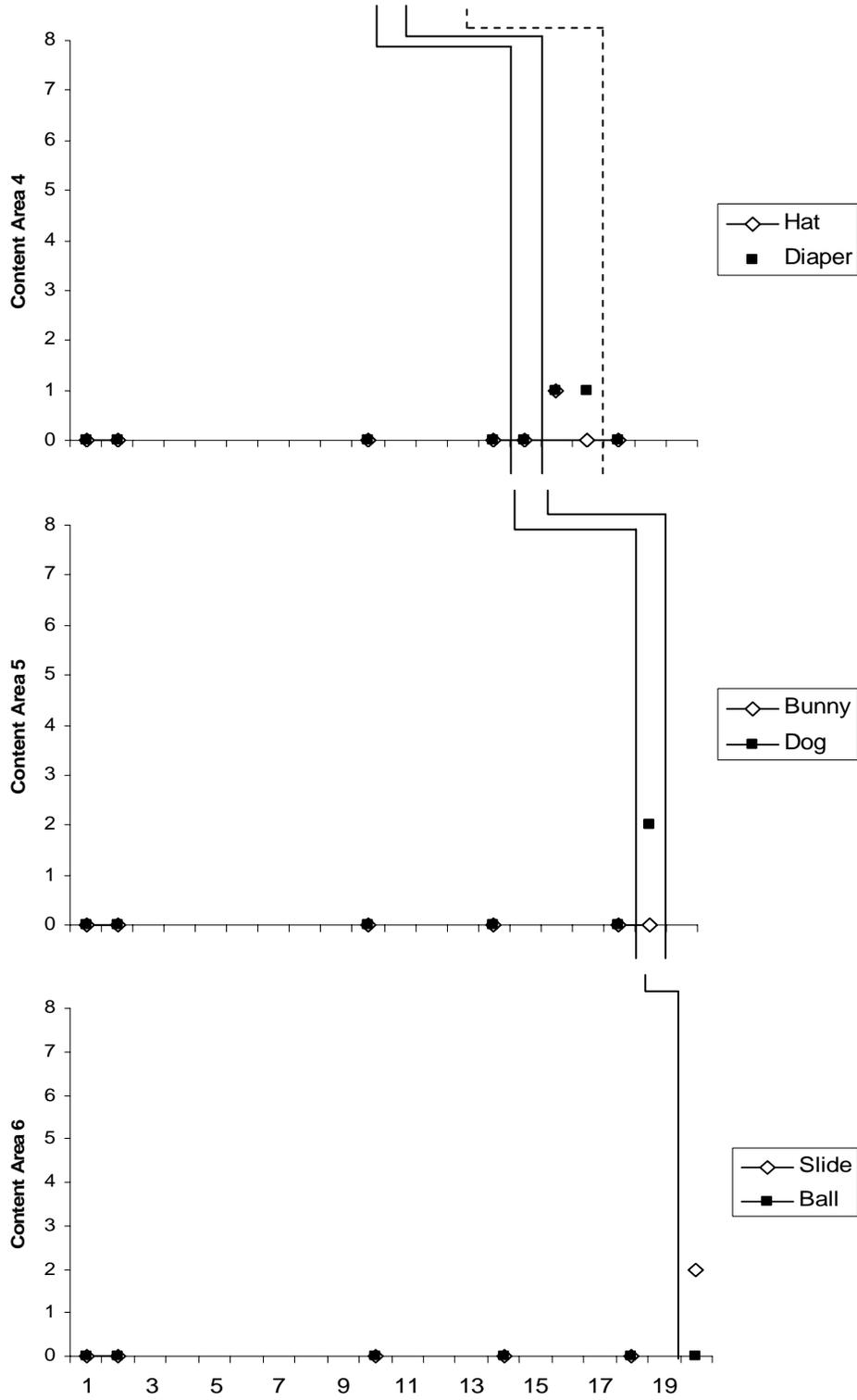


Figure 3.Continued

Interobserver Agreement

Interobserver agreement was assessed during 30% of the sessions for all three participants. Table 1 presents the mean percent observer agreement scores by dependent variable and child.

Table 1

Mean percentage of interobserver agreement scores for the dependent variable for each participant

<u>Dependent Variable</u>	<u>Dylan</u>	<u>Derek</u>	<u>Gracie</u>
Number of Signs Demonstrated	97%	88%	100%

Social Validity Ratings

Table 2 displays the results for the post intervention social validity ratings. The social validity data showed that the parents found the intervention to be appropriate, easy to use and socially significant.

Table 2

Post intervention social validity ratings by the parents using a Likert Scale

	<u>Parent of:</u>	<u>Dylan</u>	<u>Derek</u>	<u>Gracie</u>
<u>Appropriateness of the Procedures</u>				
This intervention was easy to use.		5	6	6
I would recommend this intervention to other parents.		5	6	6
<u>I liked the materials and procedures used in this intervention.</u>		5	6	6
<u>Social Significance of the Goals</u>				
It is important to increase a child's ability to communicate his/her wants and needs effectively.		6	6	6
It is useful to examine how children and parents can benefit from <u>learning sign language.</u>		6	6	6
<u>Social Importance of the Effects</u>				
I would use this intervention again because it has improved the quality of my interactions with my child		5	6	6
Signing has improved my child's communication skills.		5	6	6
Signing has decreased the overall frustration and tantrums my child exhibits.		4	5	5
<u>I have been able to incorporate signs into my child's daily routine.</u>		6	6	6

Note. 1= strongly disagree 2= disagree 3= slightly disagree 4= slightly agree 5= agree 6 = strongly agree

Chapter Four

Discussion

The purpose of this study was to evaluate the effectiveness of a sign language training program, which consisted of three components of intervention, for three non-hearing impaired children between the ages of 10 months and 14 months. The study showed that the intervention was effective in teaching multiple signs, which represents a more complex repertoire of signing than previously shown. In comparison to the previous literature, this study differs in design, procedures, and operational definitions of the dependent variable.

A multiple-baseline design across pairs of behaviors was used to demonstrate the effects and generalization of the treatment in an experimentally controlled manner. The controlled effects were determined by systematically introducing the intervention to different pairs of behaviors at different points of time to different participants, and showing the changes in behavior demonstrated after the intervention and not at prior times.

The results indicate that there was some experimental control with some limitations. The intervention was presented once baseline was stable for each of the participants. Overall, each participant showed an increased level of signed communication once the intervention was implemented. However, there was little change when signs were trained during intervention one, Sign, Say, & Play. Changes occurred promptly when pairs were trained in the intensive or “booster” sessions. For all three

participants, when content area two signs “sleep” and “book” were trained, the results showed no change in the target signs.

Three variables may have contributed to the data reflected during the training sessions for content area two signs for participant one, Dylan. His mother reported he had not napped prior to sessions seven, eight, and nine when the signs were introduced and trained. Dylan demonstrated signs of fatigue (restlessness, wandering, crying, etc.) and as a result session eight was discontinued after several minutes of training and session nine was not conducted. Another possible variable may have been that Dylan started walking with proficiency over the previous week, making it difficult to maintain his attention during sessions.

Participant three, Gracie, was not present for the Sign, Say, & Play class, session seven, when the second pair of behaviors were introduced and trained. Although she was present for the booster sessions in the same content area, eight and nine, the data did not show an effect. This data may be a result of Gracie not participating in the Sign, Say, & Play session prior to the “booster” session.

Three variables may have contributed to the data reflected during training for content area two signs for participant two, Derek. His mother reported that he currently was going through a phase in which he did not like going to bed to “sleep”. This may have impacted his desire to demonstrate the sign for “sleep” as he may have associated the sign with going to sleep, making it less reinforcing for him to use. In addition, his mother reported he had not napped prior to sessions eight and nine and as a result he demonstrated signs of fatigue (restlessness, wandering, etc.). Third, his grandmother was present during these sessions, which may have affected his level of attentiveness.

Limitations and Recommendations for Future Research and Practice

A number of limitations became evident over the course of this study. Some limitations were a function of the number of sessions that occurred each week as well as the duration of the sessions. Sessions only occurred twice per week. Having more frequent sessions would allow the participants to have more training sessions, thus may have had a larger effect on the targeted behaviors of interest. Future research should focus on increasing the number of treatment sessions per week as well as program for sessions over a longer period of time as this study was conducted with limited time constraints.

In addition, sessions may have been too long as indicated by loss of attention, signs of fatigue (rubbing eyes, crying, laying head down, wandering, etc.) from the participants. This may have been better controlled for by placing the children in a high chair or booster seat to increase their attention on the signs being taught. At the beginning of the study the older children (Gracie and Derek) were mobile, making it difficult to maintain their attention during sessions. By session 11 Dylan was beginning to walk, thus making it difficult to sustain his attention during sessions. In addition, anecdotally, a mother reported that although 5 minutes does not seem like a long time, however, it is when you are concentrating 5 minutes on one sign.

Another limitation was that there were many signs being taught concurrently to the children. Each week 5-6 signs from each content area was introduced and taught to the participants and his/her mother. Although, during intervention two, only two signs were targeted, there was a limited number of sessions and time to teach the signs (a total of three sessions before the next week's content area was introduced). This could be

another area in which future research could focus. Signs could be introduced and trained one at a time until each is demonstrated with proficiency before moving on to a second sign.

The parent's sessions at home are an integral part of the success of the children learning the targeted signs. This brings forth another limitation. It was difficult to ensure treatment control when sessions were conducted in the home environment. Several parents did not complete data or did not conduct treatment sessions consistently or frequently. It was reported by each of the parents that vacations, company over, and illness sometimes made it difficult to remember to do the sign training sessions. Subsequently, there is little data on the third agent of intervention to analyze. Future researchers may want to focus on parent compliance with treatment aspect of the current design.

In addition, when working with young children, such as the ones in this study, it becomes difficult to ensure work is occurring under optimal conditions. In addition, it is necessary to work around schedule variations. During several of the training sessions at least one of the participants showed signs of fatigue, hunger, or irritability and for one of the participants three of his sessions were either shortened or not conducted for these reasons. Another area of future research may include conducting training sessions in the participant's home so extraneous variables, such as hunger and fatigue can be better controlled. Anecdotally, participant three's mother reported that Gracie was much more receptive to the sign language sessions in the morning with no distractions.

Another limitation of this study was that the toys or props which represented the target signs being taught may not have been suitable. For example; the children were

given goldfish crackers when being taught “eat” and “more”. The intervals were spaced 10 seconds apart and the children did not have sufficient time to finish the first goldfish before being given the second goldfish. In addition, some of the toys or props did not appear to interest the children. A more extensive assessment to determine the most appropriate reinforcer for each participant may have helped in maintaining their attention to the signs being taught.

The requirement of videotaped sessions for reliability issues resulted in an additional limitation. Every effort was made to ensure the videotape recorder was concealed properly, however, in order to record the sessions the video recorder had to be placed in a low level location (garbage can), which was also in arms reach of the mobile participants. During several of the sessions the participant’s wandered over and touched the videotape recorder. This may or may not have affected the data. In addition, the videotapes showed only a limited range and when the children moved off the mat area they were often out of view. This may have affected the reliability data if a child produced a sign, but was not in video range, and the reliability observer was not able to observe and record the behavior of interest.

Additional studies should focus on expanding on the procedures of the present study to determine if there is generalizability. This may include increasing the number of participants, increasing the number of sessions, massing sessions, teaching multiple signs to criterion, using different therapists, and conducting sessions at home. In addition, another area to be investigated is whether children can use the signs appropriately when the opportunity is presented.

Conclusion

There are a limited number of studies that investigated methods of training procedures to teach sign language in a systematic and controlled manner. The present study supports previous literature that young children, typically developing with no developmental delays, hearing impairments or visual impairments can learn multiple signs in a sequence they were taught and in a controlled experimental design. This suggests children may be able to communicate their requests or needs at an earlier age when taught sign language.

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Appendix

Appendix A: Definitions of Target Signs

Content Area 1: Mealtime

**Eat:* Bring fingers and thumb, held together as if holding a small piece of food, tap the mouth several times; variation may be fingers or fingertips are brought to mouth

Drink: Bring thumb to lips, as if tipping an imaginary cup to the lips, as if drinking

Cereal: Form “O” with thumb and index finger

All done: Place palm(s) down, and move back and forth

**More:* The thumbs and fingertips of each hand are held together, and the fingertips or both hands tap together several times; variation may be fingertips of one hand tapping the other open hand, or placing open palms facing each other and clapping several times, or tapping closed fists or knuckles together

Milk: The sideways-held fist is opened and closed several times

Content Area 2: Bedtime

Stars: Wiggles fingers up high, with one hand or both

Moon: Raise palm high, make circles

Light: Open and close fists

Love: cross both hands across the chest, with palms facing in, or crossing arms across chest as if hugging self

**Book:* Open and close palms together

**Sleep:* Rest head on hand(s)

Content Area 3: Bath time

Water: The index, middle, and ring fingers are extended to form a “W” hand. The “W” taps the chin twice.

Duck: Place fingers to thumb, open and close, this may be held near the mouth facing out or near the face.

**Frog:* Move tongue in and out of mouth

Toothbrush: Move index finger across teeth

**Bubbles:* Fingers are brought to the thumb as if “catching” a bubble

Bath: Rub belly and chest with both hands, in an up and down motion

Content Area 4: Getting dressed

Socks: Slide index fingers back and forth

Shoes: Knock fists together, knuckles up

Coat: move the hands downward from either side of the neck to the chest

**Hat:* Pat head with one hand

Comb: Spread fingers, move through hair

**Diaper:* Pat hip area with hand

Content Area 5: Pets

Fish: Swim hand(s) away from body

Bird: Place finger to thumb by mouth and close like a beak

Turtle: With palm over dist, move fist in and out of “shell,” thumb first

**Bunny:* Wiggle two fingers on head like ears, may use one or both hands

**Dog*: Pat your thigh area as if calling a dog

Cat: The thumb and index finger come together at the upper lip and move outward and away from the face as if tracing whiskers on your cheek, may use one or both hands; variation may be stroking your cheek with one or all fingers across cheek

Content Area 6: At the Park

Butterfly: Link thumbs and wiggle fingers

Swing: Hold “ropes” and rock torso

Flower: “Sniff-sniff” as if smelling a flower

Tree: With elbow resting in palm, wave arm

**Slide*: Move hand in a swooping motion across the chest

**Ball*: Trace ball shape with hands or make throwing motion???

Signs with an asterisk next to it indicate target signs being taught in the booster sessions. Definition of an acceptable sign includes any approximation of the targeted sign that the child makes, independently to communicate something they want, see, need, et cetera. The goal is not for the child to produce an exact replication or imitation of the sign being taught. Rather it is to show that they can demonstrate a sign or gesture to communicate a request or represent an object.

Appendix B: Session Data Collection of Signs Demonstrated

Participant: _____ Rater: _____

Content Signs

Content Area: Mealtime Date/Session: _____

Name of Sign	Number of Prompts	Type of Prompts	Frequency
*Eat	Demonstrated Not demonstrated	I V	
Drink	Demonstrated Not demonstrated	I V	
*More	Demonstrated Not demonstrated	I V	
Cereal	Demonstrated Not demonstrated	I V	
All done	Demonstrated Not demonstrated	I V	
Milk	Demonstrated Not demonstrated	I V	

Content Area: Bedtime Date/Session: _____

Name of Sign	Number of Prompts	Type of Prompts	Frequency
Stars	Demonstrated Not demonstrated	I V	
Moon	Demonstrated Not demonstrated	I V	
Light	Demonstrated Not demonstrated	I V	
Love	Demonstrated Not demonstrated	I V	
*Sleep	Demonstrated Not demonstrated	I V	
*Book	Demonstrated Not demonstrated	I V	

Content Area: Bath time Date/Session: _____

Name of Sign	Number of Prompts	Type of Prompts	Frequency
Water	Demonstrated Not demonstrated	I V	
Duck	Demonstrated Not demonstrated	I V	
*Frog	Demonstrated Not demonstrated	I V	
Toothbrush	Demonstrated Not demonstrated	I V	
Bath	Demonstrated Not demonstrated	I V	
*Bubbles	Demonstrated Not demonstrated	I V	

Content Area: Getting dressed Date/Session: _____

Name of Sign	Number of Prompts	Type of Prompts	Frequency
Socks	Demonstrated Not demonstrated	I V	
Coat	Demonstrated Not demonstrated	I V	
*Hat	Demonstrated Not demonstrated	I V	
Comb	Demonstrated Not demonstrated	I V	
Shoes	Demonstrated Not demonstrated	I V	
*Diaper	Demonstrated Not demonstrated	I V	

Content Area: Pets Date/Session: _____

Name of Sign	Number of Prompts	Type of Prompts	Frequency
Fish	Demonstrated Not demonstrated	I V	
Bird	Demonstrated Not demonstrated	I V	
Turtle	Demonstrated Not demonstrated	I V	
*Bunny	Demonstrated Not demonstrated	I V	
Cat	Demonstrated Not demonstrated	I V	
*Dog	Demonstrated Not demonstrated	I V	

Content Area: At the Park Date/Session: _____

Name of Sign	Number of Prompts	Type of Prompts	Frequency
Butterfly	Demonstrated Not demonstrated	I V	
Swing	Demonstrated Not demonstrated	I V	
Flower	Demonstrated Not demonstrated	I V	
Tree	Demonstrated Not demonstrated	I V	
*Slide	Demonstrated Not demonstrated	I V	
*Ball	Demonstrated Not demonstrated	I V	

Teacher prompted response is defined as a prompt the child receives from the teacher to perform the targeted sign. Verbal (V) prompt would be counted when the teacher states, “what is this? Or “what do you want?” and the child responds by producing the sign.

Child initiated response (I) is defined as any approximation of the targeted sign the child makes independently. Signs with an asterisk next to it indicate target signs being taught in the individual booster sessions.

Appendix C: Assessment of Target Signs from Content Areas

Participant: _____ Date/Session: __/__/06 Teacher/ Rater: _____

Target Sign	Prompt 1: What is this?	Prompt 2: How do you say _____?	Prompt 3: Show me what ____ looks like.
More	+ / -	+ / -	+ / -
Eat	+ / -	+ / -	+ / -
Book	+ / -	+ / -	+ / -
Sleep	+ / -	+ / -	+ / -
Frog	+ / -	+ / -	+ / -
Bubbles	+ / -	+ / -	+ / -
Diaper	+ / -	+ / -	+ / -
Hat	+ / -	+ / -	+ / -
Bunny	+ / -	+ / -	+ / -
Dog	+ / -	+ / -	+ / -
Ball	+ / -	+ / -	+ / -
Slide	+ / -	+ / -	+ / -

Percentage of Signs Produced: /36 = %

- Present one prompt at a time, then allow the child an opportunity (10 seconds) to imitate the sign between prompts
 - Prompt 1: What is this?
 - Prompt 2: How do you say_____?
 - Prompt 3: Show me what _____ looks like.
- If child produces any approximation of the target sign, provide verbal praise and affection for 2-3 seconds
 - Document in the corresponding box (+) for correct responses
 - Document in the corresponding box (-) for incorrect or no responses
- If there was no response after 10 seconds then ask the next prompt question for the same sign, until the sign has been probed for a total of three times, waiting 10 seconds between each prompt, and then move on to the next target sign.
- Once the target sign has been probed (for a total of three times) that sign will be checked off to ensure the teacher does not probe for the same sign again during that session.

Appendix D: Session Data Collection from Booster Sessions

Participant: _____ Rater: _____

Content Area: Mealtime Date/Session: _____ I

Name of Sign			Type of Prompts	Frequency
*Eat	Demonstrated	Not Demonstrated	I V	
*More	Demonstrated	Not Demonstrated	I V	

Date/Session: _____

Name of Sign			Type of Prompts	Frequency
*Eat	Demonstrated	Not Demonstrated	I V	
*More	Demonstrated	Not Demonstrated	I V	

Content Area: Bedtime Date/Session: _____

Name of Sign			Type of Prompts	Frequency
*Sleep	Demonstrated	Not Demonstrated	I V	
*Book	Demonstrated	Not Demonstrated	I V	

Date/Session: _____

Name of Sign			Type of Prompts	Frequency
*Sleep	Demonstrated	Not Demonstrated	I V	
*Book	Demonstrated	Not Demonstrated	I V	

Content Area: Bath time Date/Session: _____

Name of Sign			Type of Prompts	Frequency
*Frog	Demonstrated	Not Demonstrated	I V	
*Bubbles	Demonstrated	Not Demonstrated	I V	

Date/Session: _____

Name of Sign			Type of Prompts	Frequency
*Frog	Demonstrated	Not Demonstrated	I V	
*Bubbles	Demonstrated	Not Demonstrated	I V	

Content Area: Getting dressed

Date/Session: _____

Name of Sign			Type of Prompts	Frequency
*Hat	Demonstrated	Not Demonstrated	I V	
*Diaper	Demonstrated	Not Demonstrated	I V	

Date/Session: _____

Name of Sign			Type of Prompts	Frequency
*Hat	Demonstrated	Not Demonstrated	I V	
*Diaper	Demonstrated	Not Demonstrated	I V	

Content Area: Pets

Date/Session: _____

Name of Sign			Type of Prompts	Frequency
*Bunny	Demonstrated	Not Demonstrated	I V	
*Dog	Demonstrated	Not Demonstrated	I V	

Date/Session: _____

Name of Sign			Type of Prompts	Frequency
*Bunny	Demonstrated	Not Demonstrated	I V	
*Dog	Demonstrated	Not Demonstrated	I V	

Content Area: At the Park

Date/Session: _____

Name of Sign			Type of Prompts	Frequency
*Slide	Demonstrated	Not Demonstrated	I V	
*Ball	Demonstrated	Not Demonstrated	I V	

Date/Session: _____

Name of Sign			Type of Prompts	Frequency
*Slide	Demonstrated	Not Demonstrated	I V	
*Ball	Demonstrated	Not Demonstrated	I V	

Appendix E: Protocol for Prompting Signs

Assessment of Signs Produced/Acquired

- Present one prompt at a time, then allow the child an opportunity (10 seconds) to imitate the sign between prompts
 - Prompt 1: What is this?
 - Prompt 2: How do you say _____?
 - Prompt 3: Show me what _____ looks like.
- If child produces any approximation of the target sign, provide verbal praise and affection for 2-3 seconds
- If there was no response after 10 seconds then ask the next prompt question for the same sign, until the sign has been probed for a total of three times, waiting 10 seconds between each prompt, and then move on to the next target sign.
- Once the target sign has been probed (for a total of three times) that sign will be checked off to ensure the teacher or principal investigator does not probe for the same sign again during that session.

Appendix F: Parent Data Sheet

Child Name: _____ **Date(s):** _____

Target Sign One: _____

Summary of Training Sessions (include where sessions held i.e., home/kitchen; length of sessions, i.e., 12-12:15pm, etc.)

Frequency of Sign Produced (tally each time you observe your child make the sign)

Target Sign Two: _____

Summary of Training Sessions (include where sessions held i.e., home/kitchen; length of sessions, i.e., 12-12:15pm, etc.)

Frequency of Sign Produced (tally each time you observe your child make the sign)

Other Signs Produced:

Other Comments/Observations: (any new words your child is saying? any new milestones your child has reached?)

Appendix G: Social Validity Questionnaire

Name: _____

Date: _____

1=strongly disagree 2=disagree 3= slightly disagree 4=slightly agree 5= agree 6=strongly agree

Appropriateness of Procedures

1. This intervention was easy to use. 1 2 3 4 5 6
2. I would recommend this intervention to other parents. 1 2 3 4 5 6
3. I liked the materials and procedures used in this intervention. 1 2 3 4 5 6

Social Significance of the Goals

1. It is important to increase a child's ability to communicate his/her wants and needs effectively. 1 2 3 4 5 6
2. It is useful to examine how children and parents can benefit from learning sign language. 1 2 3 4 5 6

Social Importance of the Effects

1. I would use this intervention again because it has improved the quality of my interactions with my child. 1 2 3 4 5 6
2. Signing has improved my child's communication skills. 1 2 3 4 5 6
3. Signing has decreased the overall frustration and tantrums my child exhibits. 1 2 3 4 5 6
4. I have been able to incorporate signs into my child's daily routine. 1 2 3 4 5 6

Appendix H: Baseline Session Guidelines

Prior to the Beginning of each Session

1. The teacher will gather the real objects and concept items which represent the twelve target signs being taught and place them on the floor for the session. For example, a picture of a jug of milk, a picture of the sign for sleep, a book, bubbles, picture of a bathtub, a diaper, picture of shoes, a toy cat, a toy dog, a ball, a picture of a slide.
2. The camera will be turned on prior to the participants entering the room.
3. The teacher will then let the parents know that they can bring the children into the training room.

During the Session

1. Once in the room the parents will state, "Let's play".
2. The child will be free to move about the room and play with any toys or objects he/she wants.
3. The teacher will follow the child to where the child is playing and will prompt or ask a question from the protocol for prompting (Appendix: B).
4. The questions or prompts will not be given in a systematic manner. Rather they will be given through the natural flow of the child's play until all twelve target signs have been probed for.
5. The teacher will wait 10 seconds for the child to respond to the question or prompt.
6. If there was no response after 10 seconds then the teacher or principal investigator will ask the same question or prompt two more times and then will move on to the next target sign from the list.
7. Once the target sign has been probed (for a total of three times) that sign will be checked off to ensure the teacher or principal investigator does not probe for the same sign again during that session.
8. During baseline sessions no consequences will be given for demonstration of a sign or gesture.

Ending the Session

1. The teacher will end the session by stating, "It's time to go, let's say goodbye."
2. The teacher will then lead the children and their parents back to the waiting area and say goodbye.
3. The camera will be turned off after the children and their parents have left the room.

Appendix I: Treatment Session Guidelines

Prior to the Beginning of each Session

1. The teacher will gather the real objects and concept items which represent the signs being taught from the current content area and place them on the floor for the session. For example, for the content area bath time signs, a bucket of water, real bubbles, a rubber duck, a stuffed frog, and a toothbrush will be presented.
2. The camera will be turned on prior to the participants entering the room.
3. The teacher will then let the parents know that they can bring the children into the training room.

During the Session

1. Once in the room the teacher will invite the children and his/her parents to gather around a mat located in the center of the room.
2. Each session will follow the same general format.
3. The sessions will begin with a welcome song, “Sign, Sing and Play” (3-minutes in duration)
4. Then a review of previous week’s signs will be conducted, if applicable, as well as a sensory-motor activity and free play with concept items which represent the content area being taught (3-minutes in duration).
5. Circle time to include music designed for the current week’s content area and the BeeBo Sign Language Bear to introduce the signs. Teacher will verbalize the signs being taught while modeling them at the same time in a repetitious manner for the participants and their children. Another song (e.g., “Baby takes a bath”) will be played which focuses on the signs being taught (e.g., bath, bubbles, water, etc.) (7-minutes in duration).
6. Guided play activity with a variety of real objects (e.g., bucket filled with water with bubbles and duck etc., to represent bath time concepts) while showing the children each object with the sign and pairing the sign with the verbal word equivalent (7-minutes in duration).
7. Circle time book activity in which the children and their parents gather around the mat and the teacher will read a book which focuses on the current content area (e.g., My Bath Time Signs). The teacher will read the book and when she gets to a content sign she will model the sign and verbalize the sign. Another song will be played which will focus on the current content area signs. Throughout the song the teacher again will model the sign and verbalize the sign (5-minutes in duration).
8. Review of the signs learned by stating the sign while modeling the sign and showing the real object associated with the sign “It’s Time to Go” song will be played as everyone is saying their goodbyes (5-minutes).
9. During all training sessions, consequences for the demonstration of a sign or approximation of a sign will be verbal praise (e.g., “that’s right, cat”, “great job”, “you did it”, etc.), affectionate touch (e.g., hugs, kisses, pat on the back, etc.), and giving the child the item that she/he request or showing the item labeled.

Ending the Session

1. If the child chose not to participate and instead wandered to another activity, the parents continued with the class. The child was prompted at one-minute intervals to return to the mat area. At times, the teacher or the parent would go to the child and guide him/her back to the mat area. Sessions were discontinued if the child demonstrated behaviors consistent with fatigue, hunger or over stimulation that could not be calmed within a short period of time.

Appendix J: Treatment “Booster” Session Guidelines

Prior to the Beginning of each Session

1. The teacher will gather the real objects and concept items which represent the two signs being taught from the current content area and place them on the floor for the session. For example, for the content area bath time signs, a bucket of water, real bubbles, a rubber duck, a stuffed frog, and a toothbrush will be presented.
2. The target signs will be chosen based upon interviews with the parents to determine which signs will be most functional for the family.
3. The camera will be turned on prior to the participant entering the room.
4. The teacher will then let the parent know that they can bring their child into the training room.

During the Session

1. Once in the room the teacher will invite the child and his/her parent to gather around a mat located in the center of the room.
2. Each session will follow the same general format.
3. The signs will be taught by modeling the sign while the child is looking (if needed, state, “____ look at me/this”) at the teacher.
4. The sign and the word for the sign will always be presented concurrently.
5. The concept item, which represents the sign being taught, will be shown to the child.
6. The child will be allowed 10 seconds to imitate the sign.
7. If there was no response after 10 seconds then the teacher will repeat the above procedures and then gently take the child’s hands and help the child make the sign.
8. The teacher will repeat the above procedures for half of the session (approximately two and a half minutes).
9. The second target sign will be taught in the same manner for the remainder of the session (approximately two and a half minutes).
10. During all treatment sessions consequences for the demonstration of a sign or approximation of a sign will be verbal praise (e.g., “that’s right, cat”, “great job”, “you did it”, etc.), affectionate touch (e.g., hugs, kisses, pat on the back, etc.), and giving the child the item that she/he requests or showing the item they labeled.

Ending the Session

1. If the child chooses not to participate and instead wanders to another activity, the parents will continue with the class. The child will be prompted at one-minute intervals to return to the mat area, however, the child will not be required to participate. At times, the teacher or the parent would go to the child and guide him/her back to the mat area. Sessions were discontinued if the child demonstrated behaviors consistent with fatigue, hunger or over stimulation that could not be calmed within a short period of time.

Appendix K: Prompting Sequence for Teaching Signs

1. Independent: child responded and demonstrates the sign without prompting
2. Verbal and Model: model the sign while the child is looking at you (if needed, state, “___ look at me/this”) and always pair the verbal word equivalent while modeling the sign
3. Show a real object which represents the sign you are teaching and model the sign while saying the sign
4. Allow the child an opportunity (10 seconds) to imitate the sign
5. Physical: gently take the child’s hands and assist the child in making the sign
6. Repeat sequence repeatedly when teaching a new sign

Appendix L: Treatment Session Guidelines (Parent Led)

Prior to Sessions

1. The parent will be provided with a handout of the current week's lesson to refer to as they practice with their child at home.

During Sessions

1. The parent will be asked to practice using the two target signs at home during naturally occurring opportunities throughout the day. For example, if the target signs they are working on include bath and water then during bath time the parent would use the opportunity to teach these signs. Or while eating dinner, the parent will say, "eat" as they make the sign for eat as they are giving their child pasta. Or when it is time to change their child's diaper the parent may state, "It's time to change your diaper" while making the sign for diaper. As the parent is in the process of changing the diaper, repeatedly state, "diaper" as they are making the sign for diaper.
2. Model the signs, while the child is looking at the parent, while pairing the sign with the word verbally.
3. The concept item which represents the sign being taught will be shown to the child while saying the word and making the sign.
4. The child will be allowed 10 seconds to imitate the sign.
5. If there was no response after 10 seconds then the parent will repeat the above procedures and then gently take the child's hands and help the child make the sign.
6. They will repeat this sequence at least three times.
7. During these sessions consequences for the demonstration of a sign or approximation of a sign will be verbal praise (e.g., "that's right, cat", "great job", "you did it", etc.), affectionate touch (e.g., hugs, kisses, pat on the back, etc.), and giving the child the item that they request or showing them the item they label.