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Baby Sign's Developmental Benefits

Alaina Ramstad
ramstada@csp.edu

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Baby Sign's Developmental Benefits

Alaina Ramstad

Concordia University, St. Paul

MA in Education: Early Childhood Education

ED 590 Course Instructor: Dr. Kelly Sadlovsky

Second Reader: S. Wueste, MAED – ECE Faculty of Practice

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Abstract

In the past few decades, the use of intentional gesture to communicate with infants, known as Infant Sign or Baby Sign, has jumped in popularity as a means to get infants communicating earlier in life (Barnes, 2010). Baby Sign has been adopted into many families, care centers, and schools with a strong focus on the potential language benefits to be found in its use (Seal & DePaolis, 2014; Kirk, Howlett, Pine & Fletcher, 2013). This paper sought to discover what, if any, other developmental benefits could be gained for infants through the use of Baby Sign. A synthesis of current Baby Sign research was conducted in order to answer this question. This paper found that, along with some verbal language advancements, Baby Sign has the potential to aid in social development and stronger bonding with caregivers (Góngora & Farkas, 2009; Vallotton, 2012a; Karsten, Foster, Decker, & Vallotton, 2017). Social and emotional development being extremely critical, especially in infancy, Baby Sign could prove useful in assisting infant educators to bond with students.

Keywords: Baby Sign, Infant Sign, Language Development, Social Development

Chapter One: Introduction

Parents and teachers share a common goal: wanting what is best for the children in their care. In this time of parenting websites and constant social media updates, it is nearly impossible for any parent to miss the rise in popularity of Baby Sign (also called Infant Sign) (Pizer, Walters, & Meier, 2007). Over the last few decades, the latest practice in childcare and at home has been the use of sign language signs in communicating with infants too young to express themselves verbally. A cursory glance into the parenting literature at bookstores or online will provide dozens of books, DVDs, and CDs that offer to teach parents (or teachers) the signs to use and how to implement a sign program with infants of any age (Seal & DePaolis, 2014).

What is Baby Sign?

Baby Sign can best be defined as an intentional, parent-directed use of symbolic gesture. Symbolic gestures are gestures and movements done with the intent to communicate with someone nonverbally. The gestures typically show meaning in the form of the gesture itself. (Goodwyn, Acredolo, & Brown, 2000; Góngora & Farkas, 2009). In example, a small child using two hands to imitate opening a book when requesting to be read to is using a symbolic gesture. Baby Sign, therefore, is the intentional and encouraged use of symbolic gestures for key words in infants and toddlers too young to communicate verbally (Pizer et al., 2007; Mueller, Sepulveda, & Rodriguez, 2014). It is important to note that Baby Sign is primarily done with infants and toddlers who are typically developing and hearing, not with infants who are Deaf, as Baby Sign is not a complete sign language (Mueller et al., 2014; Barnes, 2010).

The Scope of the Investigation

The literature easily accessible to parents and teachers regarding the potential benefits of Baby Sign show many discussions of benefits such as earlier and stronger cognitive

development, earlier spoken language development, larger vocabularies, and even higher standardized test scores later in life (Barnes, 2010; Goodwyn et al., 2000; Hoecker, 2016). However, many of these claims have only slight correlational research backing with no strong links toward an actual cause and effect relationship (Barnes, 2010). While parents may take the social media anecdotes and product descriptions at face value, it is the job of infant teachers to do more in depth research before implementing a Baby Sign program in the classroom.

In order to determine what developmental benefits Baby Sign may provide, the best place to start would be to look at what parents are hoping to gain for children in the use of Baby Sign. One of the most commonly cited reason for using Baby Sign in the home is the potential improvement in parent-child communication (Pizer et al., 2007). Other common reasons are a desire for some of the claimed effects of infant sign, such as faster spoken language acquisition and larger vocabularies. There are even some claims that the use of Baby Sign has the potential to lead to bilingualism, given that many Baby Sign programs use modified or exact signs taken from American Sign Language (ASL) (Barnes, 2010).

A look into the research behind possible language development benefits would therefore be the best place to start. Studies regarding language development and Baby Sign were reviewed for the results as well as the limitations in terms of generalizability. Within this area, this paper also looked into a common worry about Baby Signing, namely whether there exists a delay of spoken language acquisition caused by the use of Baby Sign.

An infant with better language skills would theoretically be able to use those skills to converse with parents and teachers more easily. Children better capable of expressing themselves could lead to less frustration from caregivers who otherwise would be unable to understand the wants or needs of the child (Vallotton, 2009). Less frustration on the part of the

caregiver as well as less frustration on the part of the child, who is able to get the message across quickly and easily with Baby Sign, has the potential to engender closer bonds between caregiver and child due to mutual understanding (Vallotton, 2009; Pizer, Walters, & Meier, 2007). The effects of Baby Sign on social emotional development was reviewed based on this potential connection. This included not just how Baby Sign could benefit the relationships between parents and infants or teachers and infants, but also how Baby Sign could be used to benefit an infant entering into society as a whole.

Conclusion

The field of early childhood education seeks to provide the best in developmentally appropriate practice in order to give every young child the best start possible in life. With books, DVDs, and ads circulating that promote the use of Baby Sign with infants as a means of gaining a multitude of developmental benefits, early childhood educators must be cautious and informed before promoting or impeding its spread. If Baby Sign provides the language and social development benefits that are often claimed, then its use in infant classrooms would be an important new addition to the philosophies of infant teachers everywhere (Goodwyn, Acredolo, & Brown, 2000; Karsten, Foster, Decker, & Vallotton, 2017). The future of programming and practice in the education of infants and young toddlers would be filled with the use of Baby Sign in the classroom, and encouraging of its use in the home as well. The question, however, remains: What are the developmental benefits of using Baby Sign with infants?

Chapter Two: Review of Literature

Parents' and teachers' role is to help the infants in their care get the best possible start on the road to healthy development. In the last few decades, Baby Sign has been proposed as a language development tool that will lead towards earlier communication and larger vocabularies (Goodwyn, Acredolo, & Brown, 2000). However, most of the information that circulates around social media outlets did not address other potential developmental effects the use of signs could have (Barnes, 2010). In order to determine whether Baby Sign should become a widespread and supported educational tool, research was gathered on Baby Sign's potential effects within any developmental domains that apply. This paper sought to answer the question of what developmental benefits Baby Sign provides to infants.

Baby Sign and Development

Mueller, Sepulveda, and Rodriguez (2014) considered the research available on the effects of Baby Sign on development and sought to improve upon the research via a new study. Using a case study design, Mueller et al. (2014) used a single group of 11 infants and their parents (nine families total as one set of parents participated with two children) to test whether training parents in Baby Sign affected the overall development of the typically developing infants participating. In Mueller et al.'s (2014) study, the areas of development examined were communicative, social, physical, and cognitive development.

Of the 11 infants, six were female and five were male. The infants ranged in age from 6 months to 29 months, and had widely varying language environments (Mueller et al., 2014). Some families were monolingual English speakers while others were bilingual in Spanish and English, with differences in levels of language dominance (Mueller et al., 2014). All of the participants were typically developing as reported by parents and verified by pre-test assessment

and had no prior experience with the use of Baby Sign, with two exceptions (Mueller et al., 2014). These two exceptions were a set of twins who had a former expressive language delay diagnosis and had been involved in speech-language therapy previously which involved approximately five signs (Mueller et al., 2014). However, these two children's pre-test scores were within average limits for their age so they were still included in the study (Mueller et al., 2014).

To provide Baby Sign training to the parents of the participants, a five-week-long Baby Sign workshop was conducted in which parents were taught nearly 200 signs to use at home. This workshop also provided information on the definition of Baby Sign as well as the benefits that Baby Sign claims to possess (Mueller et al., 2014). During the first 30-45 minutes of each two hour single-day workshop class, parents were taught new signs relevant to the lives of infants and families (Mueller et al., 2014). The remainder of the two hours was spent having the parents use these new signs with the infant/s in order for the researchers to assist in any corrections to the sign forms or implementation that may have been necessary. Time was also provided over the course of the five-week workshop for parents to voice questions or concerns, and researchers addressed all that were brought forward in a thorough manner (Mueller et al., 2014).

A pre-test was conducted one week before the start of the Baby Sign workshop in which the infants were administered the Developmental Assessment of Young Children (DAYC) language battery (Mueller et al., 2014). The DAYC language battery was also given approximately six weeks following the last date of the Baby Sign workshop as a post-test (Mueller et al., 2014). Both the pre-test and the post-test were administered either in the child's home or in the speech-language pathology clinic at the University of Texas – El Paso.

The Wilcoxon signed-rank test was used to analyze the pre-test and post-test raw score differences (Mueller et al., 2014). The signed-rank test showed statistically significant improvement for all children in all four of the developmental categories being studied, namely communicative, social, physical, and cognitive (Mueller et al., 2014). Mueller et al. (2014) attribute the success of the Baby Sign workshop to the large number of signs taught to the parents (200), the length of the workshop, and the supportive environment that was cultivated between the researchers and the parents during the workshop. Due to the parents ability to pick and choose signs that would be the most natural and useful, the large amount of practice time provided with researchers available to correct errors, and the encouraged ability to voice questions and concerns at any time, parents were better able to integrate Baby Sign in a natural, less stressful way (Mueller et al., 2014).

This study was limited by its small sample size of only 11 children (Mueller et al., 2014). With so few participants, generalizability of the results to the general public became suspect. Additionally, the study lacked a control group to compare the results to. Therefore it was not possible to confirm that the developmental changes were not the result of a confounding variable, such as maturation (Mueller et al., 2014). However, the results of Mueller et al.'s (2014) study into the effects of Baby Sign training on the overall development of infants provided evidence of the potential benefits of Baby Sign use with infants. The limitations of the study restricted the generalizability of the results, thus requiring additional information before the question of developmental benefits could be decided. Baby Sign's primary goal is stated to be assisting in communication for preverbal infants (Pizer et al., 2007; Mueller et al., 2014; Barnes, 2010; Hoecker, 2016), therefore language development became an important starting point for research.

Baby Sign and Language Development

Mothers are often very verbally responsive to infants' communicative bids, whether those attempts include any form of gesture or not (Akhtar, Dunham, & Dunham as cited in Olson & Masur, 2013). It had been found that infants who gestured frequently and/or began to gesture earlier in life tended to develop larger vocabularies (Brooks & Meltzoff as cited in Olson & Masur, 2013). Baby Sign holds the potential to be useful to developing language by promoting more and varying verbal communication between infant and parent (Rollins as cited in Olson & Masur, 2013). Olson and Masur (2013) pursued the idea of gesture invoking more verbal communication.

The research question that guided Olson and Masur's (2013) nonexperimental comparative study was whether the communicative bids of infants in three different contexts that did or did not contain gesture elicited different responses from the infants' mothers. The three communicative contexts were: proto-declarative (the infant commented on something), proto-imperative (the infant requested something), and ambiguous (potentially unclear what the infant was referencing or for what purpose) (Olson & Masur, 2013). The mother-infant dyads were videotaped for 18 minutes while interacting. During this time period, target objects meant to be temptations to communicate were presented (Olson & Masur, 2013). If the infant did not notice or comment in some way on the target objects, the mothers were instructed to ignore the target object as well. To test the proto-declarative context, two toys were placed on a shelf where the infant could not reach the toys and made to move around and draw attention. For the proto-imperative context, mothers gave the infant two objects that were difficult for the infants to operate independently, thus making it more likely that the infant would request help. In the ambiguous context, a bottle of bubbles and a ball were placed on shelving units that were out of

reach of the infant. These two objects were deemed likely to make it non-obvious what an infant's communicative intent was (Olson & Masur, 2013).

The participants in Olson and Masur's (2013) study were 30 mothers and infants; all of the infants were 13 months of age. Twenty-seven of the dyads were Anglo-American, while the remaining three were one each African American, Asian American, and Hispanic. In terms of the maternal demographics, 29 of the 30 participants claimed to live with the child's father, and 21 of the participant mothers had college or higher degrees (Olson & Masur, 2013). All of the dyads were native English speakers with no familial history of language or learning difficulties. All of the infants had expressive vocabularies of 65 or fewer words with an average of 13.03 words known per child, and also had been observed demonstrating the ability to point (Olson & Masur, 2013).

A communicative bid was recorded for any of five behaviors. These behaviors were: vocalizations (laughter, crying, fussing, and vegetative noises were not included), looks towards the target object, obvious searching to locate the target object (such as if the target object was making noise), looking towards the mother's face, and gestures (specifically pointing, object extending, or open-handed reaching) (Olson & Masur, 2013). The recorded communicative bids were then divided into the categories of gestural and nongestural. In the three seconds that followed a communicative bid, the infants' mother was observed to determine her response (Olson & Masur, 2013). Maternal responses were sorted into three categories: none (the mother made no response), nonverbal response (a response that did not include words), and verbal response. Nonverbal responses included vocalizations (that were not words), looking at the child's face, gestures, physical responses (such as hugging the child or smiling), and looking at the target object (Olson & Masur, 2013). Verbal responses were broken down into one of four

categories: object labels (a label of the target object), action labels (labeling a relevant target action), internal state labels (labeling the internal state of the mother and/or infant), or nonlabels (for verbal responses that did not fit into the other three categories) (Olson & Masur, 2013).

At the conclusion of the study, 29 of the 30 infants that participated produced both gestural and nongestural bids. The overall response rates as well as the verbal response rates did not differ in a statistically significant fashion across the three contexts (Olson & Masur, 2013). It was found upon comparison of the bids within the response categories that mothers provided verbal responses more frequently when infants used gesture than when the infants did not gesture (Olson & Masur, 2013). Moreover, mothers were almost twice as likely to use a word label when the infants used gestural bids.

The homogenous nature of the participants created difficulty in generalizing the results of the study. Also, these results could only be applied to older infants as all of the participating infants were 13 months of age. The vocabulary outcomes of the infants were not studied, thus any effects of gestural versus non-gestural communicative bids on language acquisition cannot be determined. Still, Olson and Masur's (2013) study illustrated that gestural bids were more likely to generate verbal word labels from mothers, which in theory would have an effect on the infants' vocabularies.

Baby Sign is an intentional form of gesture meant to assist infants in developing verbal language and communicating with others (Goodwyn et al., 2000). Gesture in general, as shown by Olson and Masur (2013) created more verbal labeling in mother-infant dyads. With this information, the possibilities of using Baby Sign's symbolic gestures to assist in language development became more plausible. A next step in research was in fact a look back at a study done thirteen years earlier to determine Baby Sign's effect on language acquisition.

In 2000, Goodwyn, Acredolo, and Brown implemented a longitudinal quasi-experimental study meant to test the effects of symbolic gesture (later called Baby or Infant Sign) on verbal language development. Goodwyn et al.'s (2000) work continues to be a landmark in research of Baby Sign's effects on infants. Goodwyn et al. (2000) sought to follow sign's effects on development from 11 months through 36 months of age to ascertain if any differences between children remained as the children aged beyond infancy, especially in regards to language acquisition and development.

103 infants participated in the study (Goodwyn et al., 2000). All were from a majority middle-class region in Northern California. All 58 boys and 45 girls participating in the study were within one week before or after of being 11 months of age at the start of the study (Goodwyn et al., 2000). Children were excluded who had routine exposure to any language other than English, or who had had six or more ear infections so far in life. Fifteen percent of participants had household incomes below middle-income status while the rest were middle class. Ninety percent of the participants were Caucasian with the remaining children being African-American (three children), Asian-American (seven children), and Hispanic (five children) (Goodwyn et al., 2000).

Goodwyn et al. (2000) failed to specify the procedures taken to assign each child to the groups within the study, which lead to this study's label as quasi-experimental. However participants were assigned, three groups were formed. The groups were the Sign Training group (ST) with 32 members, the Non-intervention Control group (NC) with 39 members, and the Verbal Training group (VT) with 32 members (Goodwyn et al., 2000). The three groups were compared on demographic variables (including sex, parental education, birth order, and family income) and baseline language measures (including a maternal report of verbal vocabulary and a

measure of vocalization frequency during a short play session) (Goodwyn et al., 2000). None of these comparisons yielded any significant differences between the groups (Goodwyn et al., 2000).

The ST group was encouraged by the researchers to promote the symbolic gesturing of the infant via modeling it, while also pairing the gesture with the verbal word (Goodwyn et al., 2000). The VT group was created in order to confirm any positive results found in the ST group were not due to the extra focus on language the parents would have due to the training with the researchers (Goodwyn et al., 2000). The NC group were not informed of the nature of the study in any way, and were not told any information on symbolic gesture, Baby Sign, or even the focus of the study. The NC group was included in order to compare the ST and VT groups progress in verbal language development to children without any form of language training (Goodwyn et al., 2000). In the beginning of the study, the ST group was given a set of target gestures to learn in the hopes that, having learned to successfully implement the given signs, the ST group parents would then begin creating additional symbolic gestures to use. Similarly, the VT group were encouraged to verbally label as many actions and items in the infants' life as possible (Goodwyn et al., 2000).

All three groups were brought to the lab for different language tests at 11, 15, 19, 24, 30, and 36 months of age. These sessions were videotaped and the videotapes were reviewed and analyzed using a variety of language measures. At 11 months of age, infants were filmed during free-play with their mother and, using a time-sampling procedure, it was counted during how many 5 second intervals of the play session the infant vocalized (Goodwyn et al., 2000). Also at 11 months, the MacArthur Communicative Development Inventory (CDI) was administered with the goal of measuring expressive vocabulary. At 15 months of age, mothers updated the CDI

and the infants participated in the Sequenced Inventory of Communicative Development (SICD) to assess receptive and expressive language skills (Goodwyn et al., 2000). At 19 months of age, the toddler version of the CDI was done by mothers, and the infants participated in the SICD again (Goodwyn et al., 2000). At 24 months, infants were administered the Receptive- and Expressive-One-Word-Picture-Vocabulary Tests (ROWPVT and EOWPVT). This test was also administered at 30 and 36 months. The Mean Length of Utterance and Longest Utterance were transcribed from a free play session recorded at 24 months of age (Goodwyn et al., 2000). Additionally, every two weeks from the beginning of the study, a researcher and a parent participated in a phone call interview that investigated whether target gestures were being used each day.

Results of the various measures were first compared between the VT group and NC group to test whether training effects were a cause for concern. The groups were compared between both composite scores as well as scores from each age (Goodwyn et al., 2000). No statistically significant differences were found between these two groups (Goodwyn et al., 2000). The remaining results focused on comparisons between the scores of the ST group and the NC group. In terms of receptive language, the difference in score between the groups approached statistical significance in favor of Baby Sign at 15 months, was statistically significant at 19 months as well as 24 months, and, while there was a difference in favor of the ST group at 30 and 36 months, the difference failed to be statistically significant (Goodwyn et al., 2000). In regards to expressive language, a significant difference favoring the ST group was found at 15, 19, and 24 months of age, with differences present at 30 and 36 months that came close to statistical significance in favor of the ST group (Goodwyn et al., 2000). In terms of the

composite scores for all of the ages for both receptive and expressive language, there was a statistically significant difference found in favor of Sign Training (Goodwyn et al., 2000).

A large limitation to this study was found with the lack of information on the division of the infant participants into the three test groups. Without knowledge of whether there was random assignment or not, it is difficult to rule out the possibility of confounding variables. Additionally, while there were a large number of participants, the participants were a largely homogenous group in terms of household income and racial identity (Goodwyn et al., 2000). The lack of diversity in participants makes generalizability of the results suspect. Finally, while the researchers hoped that parents would branch out from the target gestures taught at the beginning of the study to use with the infants, there was no proof provided about whether or not this direction was followed, or to what extent.

The results of Goodwyn et al.'s (2000) landmark study into the effects of symbolic gesture/Baby Sign on long-term infant and toddler verbal language development showed significant differences between children with and without Baby Sign exposure when the children were under two years old (Goodwyn et al., 2000). After the age of two, the differences were still present but became less significant. This pattern was also shown in another study which looked into the effects of Baby Sign on the acquisition of spoken words done by Seal and DePaolis (2014).

This nonexperimental secondary data analysis was completed using previously recorded video of infants interacting with mothers that was originally taken for a study of spoken language acquisition (Seal & DePaolis, 2014). Upon review of the other study, it was discovered that some of the infants who had participated had been using Baby Sign at home. Eight of these infants' families gave permission for the videos and data from the previous study to be used in a

new study, as well as eight infants who had not been exposed to Baby Sign but had a similar number of taped sessions to be reviewed (Seal & DePaolis, 2014).

All 16 of the infants were 9 months of age with no known developmental concerns (Seal & DePaolis, 2014). Nine participants were girls and seven were boys, and all were from monolingual native English-speaking homes (Seal & DePaolis, 2014). As the previous study did not focus on the use of Baby Sign, there was no information about the frequency of sign's use in the home or what signs were used. Seal and DePaolis (2014) chose not to request this information from the families during the consent-seeking process as it was deemed to create too many problems in matching the signing children with other children who did not sign.

The purpose of Seal and DePaolis's (2014) study was to compare when children who were or were not exposed to sign first demonstrated the ability to express 4 words, 10 words, and 25 words verbally (Seal & DePaolis, 2014). This information would be used to determine whether children who were exposed to Baby Sign were able to verbalize first words faster than those who were not (Seal & DePaolis, 2014). Each child was recorded for a half-hour of interaction with the child's mother at one-, two-, and finally four-week intervals until either the child spoke 25 different words within a half-hour session or the child became 18 months old (Seal & DePaolis, 2014).

The manual activity of the infants that occurred along with vocal productions was coded to determine if the infants exposed to Baby Sign produced more manual activity with vocalizations than those that were not exposed (Seal & DePaolis, 2014). Additionally, the lab data from the original study was used to determine the dates at which each of the children reached the 4-, 10-, and 25-word milestones. For those children who did not reach the 25-word milestone before reaching 18 months of age, a conservative estimate was created for when the

child would most likely reach this milestone by adding 30 days to the child's last recorded session (at 18 months of age) (Seal & DePaolis, 2014).

In the comparison of the amount and type of manual activity used between the signing and non-signing infants, no statistically significant differences were found (Seal & DePaolis, 2014). Additionally, there was no statistically significant difference between the groups in terms of when the infants reached the 4-word milestone (Seal & DePaolis, 2014). There was a strong trend towards the Baby Signing infants reaching the 10-word milestone before the infants that did not sign, but it was not statistically significant either (Seal & DePaolis, 2014). There was not a significant difference between the groups in terms of reaching the 25-word milestone, though more infants in the Baby Sign group reached 25 words before the end of the study than did infants who did not use sign (Seal & DePaolis, 2014).

This study had multiple limitations that lessen the impact of the results presented. First, the sample size was small, leading to a difficulty in generalizing the results to the public. Secondly, the videotaped interactions between the infants and parents were not created with the use of Baby Sign in mind, therefore little to no information was known about the specifics of how sign was used in the infants' homes (Seal & DePaolis, 2014). It is possible that the infants who were reported as using Baby Sign at home used it only rarely, or perhaps only one or two signs. Mothers and infants were also not encouraged to use sign during the recorded interactions since sign was not what the original researchers were studying, therefore any sign production during the videotaped sessions was coincidental (Seal & DePaolis, 2014).

Seal and DePaolis (2014) concluded that, though there was evidence of the infants who used Baby Sign at home acquiring spoken words faster than non-signing infants, the differences were not statistically significant enough to make a case for the use of Baby Sign as a language

development tool. In combination with the information brought forward by Goodwyn et al. (2000) that stated that the differences in spoken language acquisition between signing infants and non-signing infants primarily disappear by the time the children turn two years old, any benefits Baby Sign may have for language development do not appear to be long-term.

Baby sign and interference with verbal language development. When Baby Sign's effect on language development was researched, there were often concerns found about whether the use of Baby Sign might delay verbal language development (Vallotton, 2012b; Seal & DePaolis, 2014). Vallotton's (2012b) nonexperimental correlational study sought to discover whether the encouragement of symbolic gesture/Baby Sign's use in infants would negatively effect the use of manual pointing. Manual pointing in infancy and early toddlerhood has been shown to be linked to oral language skills in the preschool age group (Row & Goldin-Meadow as cited in Vallotton, 2012b; Iverson & Goldin-Meadow as cited in Vallotton, 2012b). If Vallotton (2012b) found that Baby Sign negatively impacted infants use of manual pointing, a case could be made that it could negatively effect verbal language development in the long-term by stifling an important early language development tool.

Ten infants between four and 11 months of age at the beginning of the study were chosen from an infant classroom located at the University of California (Vallotton, 2012b). The participants were 7 girls and 3 boys who were all typically developing as well as hearing (Vallotton, 2012b). All of the participants attended the infant classroom four days per week for three hours each day and were filmed for five minutes at a time while naturally interacting with caregivers (once during freeplay and once during snack time) (Vallotton, 2012b). Each infant was observed an average of 42 times over the course of the study (Vallotton, 2012b). All of the

infant classroom teachers utilized Baby Sign while communicating with the infants in the care center (Vallotton, 2012b).

Event-based second-by-second coding was used to record every gesture the infants made during each videotaped interaction with caregivers (Vallotton, 2012b). Both the occurrence of a symbolic gesture as well as the referent of the gesture were recorded, however only the occurrence of manual pointing was recorded, not the referent. This occurred due to the fact that the Baby Sign itself shares its name with its referent, while pointing does not (Vallotton, 2012b). Multi-level growth modeling was used to create a basic growth trajectory based on the child's age (Vallotton, 2012b).

Vallotton (2012b) found that infants' use of Baby Sign did slightly suppress manual pointing in interactions with caregivers due to the ability to be more specific using a sign than merely pointing at a referent. This suppression of manual pointing reversed itself between the ages of 16 and 18 months (Vallotton, 2012b). This was speculated to be due to the infants growing oral language abilities causing a drop in the need for Baby Sign to be understood, while manual pointing reemerged as an aid to verbal language (Vallotton, 2012b). A major limitation of this study was that no data was collected regarding the participants oral language skills and development, which left questions regarding the potential causes of the suppression and reemerging of manual pointing unanswerable within the study (Vallotton, 2012b). Limitations of the study also included the small sample size of ten infants and the limited population to which the results can be applied (namely, infants who are often exposed to Baby Sign and encouraged to use it) (Vallotton, 2012b).

Vallotton's (2012b) findings did not support the idea that the use of Baby Sign with infants had any long-term negative effects on the use of manual pointing. Thus, the positive

effects of manual pointing remained intact if infants were exposed to Baby Sign. While none of the previous research showed any long-term oral language gains to be found via the use of Baby Sign with infants, it was deemed important to look into if Baby Sign could be used to assist in smaller language skills, such as speech segmentation.

Baby sign and speech segmentation. Mueller and Acosta (2015) researched the effects of using Baby Sign on an infant's ability to segment a new word from running speech. In the quasi-experimental study, infants were presented with nonsense words to be segmented from running speech under three conditions in order to determine if either of the three conditions proved superior in assisting the infants to segment speech (Mueller & Acosta, 2015). The participants in this study were 8 boys and 9 girls within the age range of 6 months and 0 days and 6 months and 30 days (Mueller & Acosta, 2015). All infants were typically developing, had not been suspected or diagnosed as having any medical conditions or genetic abnormalities, and had English as the primary language at home (Mueller & Acosta, 2015).

The experiment consisted of a familiarization phase and a testing phase. During the familiarization phase, infants sat on the parents' lap in a clinic room with a computer screen that played one of three videos (Mueller & Acosta, 2015). Each video corresponded to a condition of the study and was meant to familiarize the infant to target and control nonsense words (Mueller & Acosta, 2015). The conditions were a Sign Only video (the video only showed the actor's torso and arms/hands while the actor read two different familiarization passages), a Face Only video (the video only showed the actor's face and neck while reading two familiarization passages), and a Sign + Face video (the video showed the entire upper body of the actor while the actor read two familiarization passages) (Mueller & Acosta, 2015). Infants were shown the video for one of these conditions at random before being brought to the testing area, which

consisted of a small room with all white walls and two speakers on opposite walls. Parents were given headphones playing classical music to negate the possibility of interference with the infants choices during the testing phase (Mueller & Acosta, 2015). After a research assistant drew the infants attention to the midline between the two speakers, a toy above one of the speakers was used to draw the infant's attention towards it (Mueller & Acosta, 2015). Once the infant's attention had been drawn, one of the two nonsense test words or one of the two nonsense control words were played continuously through the same speaker until the infant looked away for a period of two seconds, or 30 seconds had elapsed (Mueller & Acosta, 2015). After each of the four nonsense words were played, the infant and parent moved back to the familiarization phase to be familiarized with a different set of words until the dyad had been through all of the conditions (Mueller & Acosta, 2015).

Two *t*-tests were run to compare the orientation times for each condition (Mueller & Acosta, 2015). The only statistically significant difference between the orientation times of the control and familiarized words was during the Face Only condition (Mueller & Acosta, 2015). The experimenters learned that three of the infants participating in the study had been exposed to Baby Sign prior to the study, and so these infants' data was run through a separate *t*-test to determine whether Baby Sign exposure affected speech segmentation in any of the conditions (Mueller & Acosta, 2015). It was found that infants who had been exposed to the use of Baby Sign were able to use the Sign Only condition to segment speech at the same effectiveness as the Face Only condition (Mueller & Acosta, 2015). Mueller and Acosta (2015) therefore concluded that babies who were familiar with Baby Sign could use signs to segment speech in the same way as non-signing babies use faces (Mueller & Acosta, 2015). However, this information about Baby Sign was not an intentional part of Mueller and Acosta's (2015) study, and therefore more

research must be done with Baby Sign as an intentional piece before firmer conclusions can be drawn (Mueller & Acosta, 2015).

The use of Baby Sign with infants, according to Mueller and Acosta's (2015) research, had the potential to provide more assistance with infants ability to segment new words from running speech. The ability to segment speech assists infants in building up vocabularies (Jusczyk as cited in Mueller & Acosta, 2015), which is important for the acquisition of language. Infants ability to segment speech to locate familiarized words shows not just a language skill, but also a cognitive skill as it is a sign of the use of memory. Another usage of cognitive development that could be benefited by the use of Baby Sign would be the making of inductive inferences, as Graham and Kilbreath (2007) studied.

Baby Sign and Cognitive Development

Infants and young children will use the name provided to an object to infer characteristics about the object (Gelman & Coley as cited in Graham & Kilbreath, 2007). Graham and Kilbreath (2007) sought to study whether infants would also accept Baby Signs as names of objects and use those symbolic gestures to inductively infer nonobvious properties of those objects. Additionally, Graham and Kilbreath were interested in if the age of the infant would affect the acceptance of the Baby Sign name for an object. This true experiment involved 97 infants between the ages of 14 to 15.5 months, and 75 infants between the ages of 21 and 22 months (Graham & Kilbreath, 2007). All of the infants came from English-speaking homes and were majority Caucasian. The participants socioeconomic statuses were varied (Graham & Kilbreath, 2007). For each age group, the infants were randomly assigned to one of the three test groups. These groups were: the no label group (in which no label was assigned to the objects), the novel gesture group (in which a noniconic gesture was assigned to the objects), and the novel

word group (in which a novel, nonsense word was assigned to the objects) (Graham & Kilbreath, 2007).

While the infant sat in the parents' lap, an experimenter introduced an object and would demonstrate the target property (i.e. rattling) six times. The introduction would either include no label, a novel gesture, or a novel word depending on which group the participant had been randomly assigned to (Graham & Kilbreath, 2007). The infants were then allowed to explore the target object for ten seconds before the experimenter took the target object out of reach and presented a test object with the same label (if applicable) (Graham & Kilbreath, 2007). The infants were then allowed to explore the test object for 20 seconds. Test objects were a high similarity object (an object that looked very similar to the target object), a low similarity object (an object that looked somewhat similar to the target object), and a dissimilar object (an object that looked little to nothing like the target object and also did not possess the target nonobvious property) (Graham & Kilbreath, 2007).

Infants were shown and allowed to explore all of the test objects and it was recorded whether the infants attempted to illicit the target nonobvious property in the test objects (Graham & Kilbreath, 2007). There were also three conditions involved in the study. In the baseline condition, neither the target object nor the test objects possessed a nonobvious property. In the predicted condition, the target object and the test objects (except for the dissimilar object) possessed the same nonobvious property. In the unpredicted condition, the target object had the nonobvious property and the test objects did not (Graham & Kilbreath, 2007). Each infant was tested in all three of the conditions.

Graham and Kilbreath (2007) found that 14 month old infants used the novel gestures and the novel words equally in order to infer the nonobvious properties of the objects. Twenty-two

month old infants, however, were far more likely to accept the novel word as having inductive potential than to attempt inferences based on a gesture. The finding that infants age out of the use of symbolic gesture is in line with the findings of Goodwyn et al. (2000) as well as Seal and DePaolis (2014) and Vallotton (2012b). While the study did have a relatively large number of participants, the participants were fairly homogenous, with most being Caucasian and English-speaking. This limitation made it more difficult to generalize the results of the study to the public. Additionally, there was the possibility of parental interference that may have gone unnoticed by the experimenters since the infants were seated on the parents' lap for the duration of the study.

Graham and Kilbreath's (2007) study provided evidence that up to a certain age, infants would use Baby Sign in the same manner in which spoken words are used while investigating the world. However, once infants began to adopt more spoken words, the infants began to reject Baby Sign as a primary means of exploration and communication (Graham & Kilbreath, 2007; Vallotton, 2012b). If the effects of Baby Sign did not last in the long-term in language and cognitive development, is there a reason to use Baby Sign with infants? To answer this, it was deemed beneficial to look to the recorded uses of Baby Sign according to parents who utilized it with infants in daily life (Pizer, Walters, & Meier, 2007).

Baby Sign, Societal Acceptability, and Infant Social-emotional Development

In Pizer et al.'s (2007) descriptive case studies, three families in Central Texas who chose to implement Baby Signing with infants discussed the reasoning behind the choice to sign. All three families stated that the primary reason for using Baby Sign was to foster clearer communication with their infants (Pizer et al., 2007). All of the parents were of European American descent except for one who was ethnically Hawaiian. One of the infants was the

youngest of three siblings while the other two were only children. All three of the fathers held professional positions of work, while the mothers did not work outside of the home. The children's spoken language development was typical for their ages and none had any prior ASL knowledge or contact with any members of the Deaf community (Pizer et al., 2007).

The infants were videotaped in hour-long sessions during meal times and play times in interactions with family members (Pizer et al., 2007). Also, a researcher conducted casual interviews throughout the visits to gain additional information about the infants' signing. Infants were recorded at two or three different points, with recordings being at least 1.5 months apart, the earliest age of recording was 15.5 months, and the latest being 21 months of age (Pizer et al., 2007). The researchers main focus was on the functions of the signs used by the infants, and whether the signs were used in a way that lines up with the goal of clearer communication as stated by the infants' parents (Pizer et al., 2007).

The videotaped sessions were watched and coded for what function the signs used served, as well as whether the sign was spontaneous from the infant or if an adult preceded the infant's sign by doing the sign or speaking the word the sign represented (Pizer et al., 2007). It was found that nearly all of the signs fell into one of four categories: politeness formulas, displays of knowledge, requests, or labels (Pizer et al., 2007). Request signs (signs that asked a parent to provide something) were the most frequent for all three of the infants, however politeness formulas (i.e. *please* and *thank you*) and labels were also frequently used (Pizer et al., 2007). The parents of all three infants encouraged signing for requests. It was also found, during the casual interviews as well as the videotaped sessions, that signs were being utilized for more than simply communication.

Socially Acceptable Behaviors

In multiple examples drawn from both videotaped sessions and the casual interviews done by Pizer et al. (2007), infants use of the signs symbolizing requested items became a prerequisite to receiving those objects. Examples included one of the infants wanting a drink but not receiving it until she signed both *drink* as well as *please* (Pizer et al., 2007). In all similar cases, the parent clearly understood what the child wanted, but still required the child to sign the request before receiving it. In this case, regardless of the parents' claims of using Baby Sign for clearer communication, in reality, Baby Sign was being utilized as a socialization tool (Pizer et al., 2007).

According to the interview conducted by Pizer et al. (2007), one of the participants, Rebecca, prior to learning Baby Sign, would hit a parent on the arm whenever she wanted to read a book. Rebecca's parents knew exactly what being hit on the arm meant, meaning that the clearness of Rebecca's communication was not an issue. However, her parents taught her to sign for a book and to use the politeness formula *please* when she wanted to read (Pizer et al., 2007). Exchanges like these were frequent in Pizer et al.'s (2007) case studies for all three infants, either seen in the videotaped sessions or described by the infants' parents. One of the infants named Kai was described as making a high pitched whining sound whenever he wanted more of something before his parents taught him the sign for more. After spending a few days encouraging him to use *more* instead of whining, Kai stopped making the high pitched sound in those circumstances (Pizer et al., 2007).

This set of case studies is limited in generalizability due to the small number of participants and the generally homogenous nature of the participants. Nearly all of the parents were European American in ancestry and all were of a socioeconomic stature that allowed one

parent to stay at home while the other worked outside the home. This information limited the ability to apply the results to the general public. Additionally, since this study was more descriptive in nature, there lacks a control group to know if the infants were behaving in a more socially appropriate manner than an infant who was not exposed to Baby Sign.

The use of Baby Sign as a means of teaching socially appropriate behaviors at young ages can be considered a developmental benefit since part of healthy social development is learning societal rules and regulations for behavior. As with Kai and his high pitched whine, Thompson, Cotnoir-Bichelman, McKerchar, Tate, and Dancho (2007) attempted to teach Baby Sign to two infants as a means to stop the infants from whining, as Kai's parents taught him *more* in order to stop his whine (Pizer et al., 2007). In Thompson et al.'s (2007) single-subject experimental study, Thompson et al. used a delayed model, physical prompts, and reinforcement to teach certain Baby Signs to two infants, while whining behaviors were placed on extinction.

The participants in Thompson et al.'s (2007) study were two infants attending a full-day infant and toddler program who were typically developing. One of the participants was ten months of age and chosen for this study because he was reported as crying frequently when he was not receiving attention in class (Thompson et al., 2007). The other participant was nine months of age and was chosen because he was reported as frequently crying when not being held (Thompson et al., 2007). Experimental sessions were held in a small therapy room containing a one-way observation window. These sessions lasted 5 minutes at a time and were held between one and four times per day, five days per week (Thompson et al., 2007). The sessions were scheduled in such a way that there was not interference with the participants' daily routines (Thompson et al., 2007). A baseline test was performed that mimicked the conditions that whining was reported in (not receiving attention in class and not being held, respectively) to

gather data on how much whining was taking place. After the baseline test, Baby Sign training began (Thompson et al., 2007).

Sign training was accomplished by the researcher modeling the sign that the infants were being trained to use (for the first infant, the ASL sign *please*, for the second infant, the ASL sign *more*). If the infant performed the modeled sign within five seconds of the prompt, the infant received the desired reward (i.e. attention from the teacher or being picked up). If the infant did not perform the modeled sign within the five second period, the researcher physically prompted the infant to create the sign (Thompson et al., 2007). Once the infants were successfully making the signs independently and frequently, the researchers stopped the sign training and observed whether the children would continue to use Baby Sign as frequently as when the infants were prompted to do so. After a period of roughly ten sessions without Sign training, the training was reintroduced to see at what levels the infants would return to using Baby Sign, if at all (Thompson et al., 2007). The amount of crying and/or whining that occurred during the experimental sessions while utilizing Baby Sign was recorded.

It was found that both of the infants using Baby Sign whined less frequently and in a lower intensity than in the baseline test (Thompson et al., 2007). The infants also returned to using whining to get what was desired when the researchers were observing during the break in Baby Sign training. However, once Sign training was reestablished, the infants returned to the higher frequency of signing (Thompson et al., 2007). Whining and crying behaviors diminished greatly while infants were frequently independently signing the model signs (Thompson et al., 2007).

A large limitation of Thompson et al.'s (2007) study lies in its two participants. Results from so small a study are unable to be successfully generalized to the public. Additionally, little

demographic information was included in the study. Without this information, there could be additional confounding variables based on something such as race or educational history of the parents (Thompson et al., 2007). Even without this demographic information, the idea behind the study and findings within the study provided a useful set of results. As in Pizer et al.'s (2007) study, Baby Sign was shown in Thompson et al.'s (2007) research to be useful in teaching socially appropriate communication techniques.

The teaching of socially appropriate behavior is important to the infant's development into a functioning member of society. These social behaviors are directly connected to the socioemotional development that infants undergo. As Baby Sign can be used as a tool for teaching socially appropriate behavior in infancy (Pizer et al., 2007; Thompson et al., 2007), it is possible that other social-emotional benefits could be derived from using Baby sign with infants.

Baby Sign, Socioemotional Development, and Parental Relationships

One of the most important relationships in an infants' life is the relationship to their parent/s. This relationship creates the first sense of attachment and what relationships are supposed to be. Kirk, Howlett, Pine, and Fletcher (2013) sought information on whether the use of Baby Sign would affect the relationship between mothers and infants. Specifically, Kirk et al. (2013) studied whether the use of Baby Sign affected the mother's awareness of the child's mental states. This awareness is also referred to as mind-mindedness (Kirk et al., 2013). In this correlational secondary data analysis, Kirk et al. (2013) used videotaped free play and snack time interactions between mothers and infants from a previous study into Baby Sign's effect on language development to analyze the differences in mind-mindedness between those that signed and those that did not.

Eighteen participants were randomly selected from the previous study. Nine of these participants did not use Baby Sign and nine did. Each set of mother and infant were filmed four separate times when the infant was at the ages of 10, 12, 16, and 20 months old (Kirk et al., 2013). Videotaped sessions were 20 minutes in length, with ten minutes occurring during free play and ten minutes occurring during mealtime (Kirk et al., 2013). The videos were coded first for maternal speech (the frequency and duration of any utterances made by the mother) and those utterances were then placed into one of five categories. These categories were: appropriate mind-related comments, inappropriate mind-related comments, encouraging autonomy, imitations, or other (Kirk et al., 2013). Appropriate mind-related comments were those comments that correctly described what the infant was thinking, feeling, or wanting in that moment. Inappropriate mind-related comments were those that were inaccurate in the descriptions provided. Comments that encouraged autonomy were any comments that encouraged the child to act independently. Imitation was coded as any time the mother repeated the infant's utterances, without any corrections. The category of other contained any utterance that did not fit within the other available categories (Kirk et al., 2013). Sessions were also coded for changes in infant object-directed action as well as changes in infant's direction of gaze, for which mothers were coded based on whether the mothers responded to those changes or not (Kirk et al., 2013).

After comparing the interactions between mothers and infants who used Baby Sign and those who did not, Kirk et al. (2013) did not find any statistically significant difference in terms of overall mind-mindedness between the two groups. However, some differences were found that were considered positive changes to the mothers' interactions with the infants using Baby Sign (Kirk et al., 2013). Mothers in the Baby Sign exposed group were more responsive to

changes in the infant's object-directed actions as well as the changes in the direction of gaze (Kirk et al., 2013). This suggests a stronger appreciation for the autonomy and desires of the infant from the mothers who used Baby Sign, which is a central theme to maternal mind-mindedness (Kirk et al., 2013). Another sign of the use of Baby Sign promoting mother's understanding of infant autonomy was that the mothers in the Baby Signing group encouraged significantly more independent actions than did non-signing mothers (Kirk et al., 2013).

The generalizability of Kirk et al.'s (2013) study must be scrutinized, as there were only 18 participants and the nine who had been trained in Baby Sign had been trained in the context of a scientific study. Thus, the training may have been significantly different than an infant and mother who were trained in the outside world would receive (Kirk et al., 2013). There was also evidence that the mothers in both groups of the study were already producing the maximum average amount appropriate mind-related comments before the original study took place. Therefore the addition of Baby Sign would not be able to create any addition appropriate comments (Kirk et al., 2013).

Mother-infant interactions. Kirk et al. (2013) found that, though Baby Sign did not necessarily promote all aspects of maternal mind-mindedness, it did provide a boost to certain facets. The use of Baby Sign was linked with mothers promoting autonomy and following more closely with the desires of the infant (Kirk et al., 2013). Autonomy and self-regulation are important aspects of social development. Maternal mind-mindedness is not the only way in which Baby Sign may affect the mother-infant relationship, and through it, social development. Góngora & Farkas (2009) also studied the relationship of Baby Sign to the mother-infant dyad, however the focus was not on mind-mindedness, but on synchronic interactions.

Góngora and Farkas (2009) designed the study to be quasi-experimental, longitudinal, descriptive, and comparative in nature. The goal was to discover the influence of the use of Baby Sign on the synchronic interactions of mother-infant dyads (Góngora & Farkas, 2009). To this end, 14 mother-infant dyads were recruited during regular pediatrician visits. All of the infants were between the ages of 5 and 9 months old at the beginning of the study, and biologically related to, and living with, their mother (Góngora & Farkas, 2009). All of the mother-infant dyads were of middle or upper-middle socio-economic status and resided in Santiago, Chile. All infants were typically developing and the mothers possessed no known psychological conditions (Góngora & Farkas, 2009).

The mother-infant dyads were randomly assigned to the Baby Signing group or the control group. The dyads were observed and videotaped during free play three times over the course of the study. Each observation lasted 15 minutes and took place immediately following enrollment in the study, between the ages of 12 and 14 months, and between the ages of 18 and 20 months old (Góngora & Farkas, 2009). Following the first observation, which served as a baseline, the Baby Signing group were introduced to a Baby Sign program that encourages the use of symbolic gestures/Baby Signs by modeling signs with infants while also using the corresponding words verbally (Góngora & Farkas, 2009). The mothers first attended a workshop that took place two times approximately one week apart. In the first workshop session, the mothers were educated on the Baby Sign program and taught its workings. In the second workshop session, the mothers were given the opportunity to practice Baby Signing (Góngora & Farkas, 2009). Following the workshop, a member of the research team visited the participants in the home every 15 days until the infant turned 18 months old (Góngora & Farkas, 2009). The

control group attended two talks that focused on language development. These talks refrained from any mention of using sign (Góngora & Farkas, 2009).

The AIT Grid, an observational tool developed to be used to evaluate early interactions between infants and mothers, was used to assess the interactions of the dyads (Góngora & Farkas, 2009). Interactions were coded as synchronic only if one member of the dyad initiated the interaction and the other followed it, both members of the dyad showed an intentional search of interaction with the other member, the interaction modes of the two members matched, the affective tone was positive, and the goal of the interaction was the interaction itself (Góngora & Farkas, 2009).

It was found that the mother-infant dyads in the Baby Sign group had a statistically significant increase in the frequency of visual and tactile synchronic interactions (Góngora & Farkas, 2009). This was theorized to be due to the visual nature of Baby Sign (the mother and infant must be observing each other frequently in order to not miss any signs being used) as well as the importance of hands in regards to using sign (Góngora & Farkas, 2009). In theory, mothers who were watching the infant more frequently (due to the use of Baby Sign) would be able to notice more moments ripe for interaction, thereby interacting more often with the child and exposing that child to more social contact and language (Góngora & Farkas, 2009).

The small sample size of Góngora and Farkas's (2009) study leaves the results difficult to generalize. Additionally, the participants were homogenous in socioeconomic statuses as well as places of residence. More research would need to be completed to confirm the results of this study before the findings could be seriously considered in terms of early childhood programming (Góngora & Farkas, 2009). However, the results do hint at the possible social development benefits Baby Sign may have in terms of maternal relationships. Vallotton (2012a) was also

interested in the effects of Baby Sign on the relationship between mothers and infants, and designed a quasi-experimental study in order to test the outcomes of this combination.

Maternal attunement. Specifically, Vallotton (2012a) studied how the use of Baby Sign effected mothers' attunement and responsiveness to children, as well as if Baby Sign had any effect on the mothers' perception of the child as stressful. The participants in the study were 29 families (16 in the Baby Sign group and 13 in the control group) with infants at least 10 months of age at the beginning of the study (Vallotton, 2012a). 62% of the families were monolingual Spanish speakers while 24% were monolingual English speakers, and the remaining were bilingual. The majority (84%) of families identified as Hispanic, Latino, or Mexican and the rest identified as Caucasian. The majority of the families had only one working adult, typically the father (Vallotton, 2012a). The infants were 17 boys and 12 girls, all of which were not yet able to combine two or more words in their primary language at the start of the study (Vallotton, 2012a).

Random assignment to the Baby Sign or control group was done at the level of the Early Head Start provider (Vallotton, 2012a). There were seven Early Head Start sites to which the various participant families belonged, and the sites were randomly assigned to one of the two groups. All of the families from those sites became part of whichever group the Early Head Start site they attended was assigned (Vallotton, 2012a). The intervention for the Baby Sign group was conducted in the families' homes with both mother and child present. Following the first data collection (Time 1), the Baby Sign families were asked whether there was any interest in trying Baby Sign and provided materials (a two-page laminated Baby Sign explanation, a set of ten refrigerator magnets with a drawing and explanation of a sign on each) in order to do so (Vallotton, 2012a). The researchers also explained and demonstrated the use of Baby Sign

during this time. Three months following the Time 1 data collection, the Baby Sign families were assessed regarding the use of Baby Sign in the home. During this mid-point data collection, Baby Sign families were offered a set of additional Baby Sign magnets, and a story-book that utilized Baby Signs (Vallotton, 2012a). Approximately 3 to 4 months following the mid-point, a final data collection (Time 2) was taken (Vallotton, 2012a). The same data collection points were used for the control group families, however, the phrase Baby Sign or signing of any kind was not used. The control group was instead given an explanation of symbolic gesture and discussed whether the child did any symbolic gesturing (Vallotton, 2012a).

During all three data collections, the mothers were asked about both her own and her child's Baby Sign usage. In order to be recorded as using a particular sign, the mother needed to name the sign when asked what signs were used with their child as well as be able to demonstrate the sign. Mothers were also required to name and imitate any signs the child was capable of producing in order for that sign to be recorded (Vallotton, 2012a). In the data collections at Time 1 and Time 2, semi-structured play sessions were constructed and the mother-infant dyads were videotaped completing the sessions. Toys were provided for these play sessions, and mothers were instructed to play with the child as normal (Vallotton, 2012a). The play sessions were coded for changes in affect by mother and by child, cues made by the infant, and the maternal response to the cue. The children's cues were sorted into one of three categories: a bid for social interaction, a request for something (not including attention), or distress (Vallotton, 2012a). Finally, the Parenting Stress Index was administered to the mothers in order to determine their perception of the child at the Time 1 and Time 2 data collections (Vallotton, 2012a).

Vallotton's (2012a) study yielded some interesting results. It was found that the children with larger Baby Sign vocabularies were associated with greater attunement by the mothers to the child's affect (Vallotton, 2012a). However, a limitation to this finding was that the children's sign vocabularies were maternally reported. Therefore, this result could be attributed to the idea that mothers who are better attuned to their child notice more signs (Vallotton, 2012a). It was also found that infants signing more initiated more responsiveness in the mother to distress cues (Vallotton, 2012a). A final interesting finding from this study was that mothers in the Baby Sign group were significantly more likely to consider the child as reinforcing their role as a parent, which reduced stress by 25 points on the Parenting Stress Index (Vallotton, 2012a). This result was consistent with past research that indicated that caregivers of children who communicate more clearly tend to feel more satisfied in their relationships with those children (Goldberg as cited in Vallotton, 2012a).

The results of Vallotton's (2012a) study could ultimately be affected by the lack of individual-level random assignment. Since all attendees of each Early Head Start site were put in the same group, it was possible that these groups of participants shared some common experience that was unknown to the researchers, thus affecting the results. The reliance on parental report was also a limitation on this study, as parents are not homogenous in the choices of where to place focus, and also, memories have the possibility to be faulty (Vallotton, 2012a). The results of the study, however, did show the potential benefits Baby Sign could have in regards to maternal attunement and a lessening of stress in the relationship between mothers and infants. These results raised an additional question regarding maternal involvement with Baby Sign. Did the addition of Baby Sign into the parenting lives of mothers and fathers have any effect on the stress levels of the parents?

Baby Sign and parental stress. Parental stress is an important factor for research into the benefits of Baby Sign due to the fact that parents who are highly stressed have a tendency to interact less frequently with children (McBride & Mills as cited in Howlett, Kirk, & Pine, 2011). As mentioned above, verbal interaction is important in the development of language (Rollins as cited in Olson & Masur, 2013). Furthermore, less interaction between parents and infants has been shown to negatively affect the formation of secure attachments (Isabella & Belsky as cited in Howlett et al., 2011). If Baby Sign were to cause significant stress in parents then any benefits it may have would need to be weighed against its serious potential consequences.

A study performed by Howlett, Kirk, and Pine (2011) pursued the question of whether attending a Baby Sign workshop and utilizing Baby Sign caused additional stress to parents. This correlational study involved participants who were recruited from a wide variety of places including gesture classes, internet sites, toddler groups, and community organizations (Howlett et al., 2011). The participants were 91 boys and 87 girls between the ages of 3 months and 36 months of age, who either had attended gesturing classes or had attended classes that promoted other activities. Each of these groups (gesturing and non-gesturing) contained 89 children. A great deal of demographic information was collected to ensure the two groups were not significantly different. These demographics were: maternal working hours, family income, maternal education, and number of siblings (Howlett et al., 2011). There were no significant differences between the two groups in any demographics collected except number of siblings. It was found that children with siblings were more likely to attend Baby Sign classes, and also first-born children were more likely to attend the gesture classes (Howlett et al., 2011). These demographical differences were taken into account when analyzing the results of the study (Howlett et al., 2011).

The parents (all mothers) completed the Parenting Stress Index (PSI) in order to determine self-reported levels of stress. It was found that mothers in the gesturing group were more stressed than those in the non-gesture group (Howlett et al., 2011). When adjustments were made regarding the demographical differences explained above, the gesturing mothers' overall stress scores were significantly higher than the non-gesturing mothers. These results have multiple possible explanations. Howlett et al. (2011) suggested that mothers who decided to attend gesturing classes may have had higher stress already and chosen to attend the Baby Sign class in order to alleviate that stress. However, without baseline tests, it is impossible to determine if the mothers were in high levels of stress prior to the Baby Sign class (Howlett et al., 2011). The lack of a baseline test is a severe limitation on the results of this study, as it cannot be determined whether the gesturing workshops were the cause of the mothers' stress. Additionally, the parents all attended various gesture classes whose content and teachings were unknown to the researchers. Thus there was the possibility of ineffective teaching strategies being employed in the gesture classes, which could have caused some of the stress.

The results of Howlett et al.'s (2011) study were cause for some concern regarding parental stress. Having seen those results, Mueller and Sepulveda (2014) conducted a single group case study into the effects of a Baby Sign workshop as well as Baby Signing itself on parental stress. The goal of the study was to inspect the effect that Baby Sign had on the stress levels of parents (Mueller & Sepulveda, 2014). To that end, a five-week workshop was conducted during which approximately 200 signs were taught to parents. The participants were nine families (11 children total) with some having more than one parent attending the workshop (Mueller & Sepulveda, 2014). The community in which the study was conducted was

predominantly Hispanic. The children ranged in age from 6 months to 29 months old. All but one of the mothers in the study were first-time mothers (Mueller & Sepulveda, 2014).

The parents were encouraged to use the signs demonstrated in daily routines, and also urged not to feel pressure to use every sign that was taught, but instead to pick out the signs that were felt to be the most useful in the family (Mueller & Sepulveda, 2014). Following the completion of the workshop, parents were given a survey consisting of 14 items (3 questions answered on a scale, 9 open-ended questions, and 2 yes or no questions). The information gained via these surveys was compiled to find the results of the study (Mueller & Sepulveda, 2014).

One hundred percent of the families stated that the workshop was not stressful, and 8 out of 9 of the parents also stated that using Baby Sign was not at all stressful. The other parent answered that using sign was slightly stressful (Mueller & Sepulveda, 2014). Within the open-ended questions, any stress reported was described as being attributed to feeling that the child was not paying attention. But this stress was claimed to be negated by researchers' assurances that the child was indeed paying attention (Mueller & Sepulveda, 2014). These results suggest that a positive and supportive environment within the Baby Sign workshop has a positive effect on potential parental stress.

Parents also reported that a reason the workshop and using Baby Sign itself was not stressful was due to researcher's encouragement to only use the signs that the parents felt were useful. This, parents claimed, allowed the parents to feel that perfectly all 200 signs was not necessary, and thus felt more relaxed in mastering the signs were felt to be the most useful (Mueller & Sepulveda, 2014). Multiple parents also claimed, in the open-ended question regarding reasons why the parents did not find using Baby Sign stressful, that using Baby Sign

increased communication with the child (Mueller & Sepulveda, 2014). Parents reportedly observed increased eye contact and focus in the child, both of which are important skills for early language development (Owens as cited in Mueller & Sepulveda, 2014).

With a sample size of only nine families, the generalizability of the results of Mueller and Sepulveda's (2014) study were uncertain. With no control group included, it cannot be determined whether there was not an additional confounding variable involved. Some of the results could be attributed, not to Baby Sign itself, but to parents being involved in a language-centered workshop in general. Finally, all of the data was self-reported by the parents, who could remember data incorrectly or choose to misrepresent themselves and their child/ren (Mueller & Sepulveda, 2014).

Mueller and Sepulveda's (2014) study provided a workshop to the participants in which the researchers offered a supportive environment for learning and implementing Baby Signing in the participant families. In Howlett et al.'s (2011) study, participants in the gesturing group had attended classes the participants had selected independently, which left the researchers blind to the quality of the classes that were attended. More research is needed in order to determine the effects of Baby Sign classes and Baby Sign on parental stress, perhaps involving some examination of the quality of Baby Sign classes being offered to the general public.

Vallotton's (2012a) study showed a link between Baby Sign, maternal attunement, and a less stressful relationship between mother and infant. These results would positively affect the socioemotional development of an infant, as less stress and better maternal attunement would promote secure attachment between the dyad (Vallotton, 2012a). This information aligned well with Kirk et al.'s (2013) findings of a link between Baby Sign use and the mother's ability to follow along with the child's wants, as well as Góngora and Farkas's (2009) discovery that Baby

Sign promoted synchrony between mother-infant dyads in terms of visual and tactile interactions. Howlett et al.'s (2011) study raised some concern over the potential for additional stress to be instigated when parents attended Baby Sign workshops, however Mueller and Sepulveda's (2014) study found no such link. Mothers and fathers are not the only caregivers with whom many infants interact on a frequent basis. Many infants now attend child care programs in which teachers may use Baby Sign with the children. Would Baby Sign use have effects on these social relationships as well?

Baby Sign, Socioemotional Development, and Extra-familial Caregivers

Vallotton (2009) took a question similar to that of Kirk et al.'s (2013) study, but focused on non-parental caregivers. In this nonexperimental comparative study, Vallotton (2009) queried whether frequency of Baby Signing, variety of Baby signs, or Baby Sign use as a whole affect the responsiveness of the care infants receive from extra-familial caregivers. This study was conducted with 10 infant and 18 caregiver participants (Vallotton, 2009). The caregivers consisted entirely of university undergraduate students in child development working as caregivers 6 hours per week to fulfill an internship requirement (17 female and one male). The infants (7 females and 3 males) were enrolled in the childcare program at the university, and were between the ages of 4 months and 19 months of age over the course of the study (Vallotton, 2009). The childcare taught all of its caregivers to use Baby Sign along with speech during all routine interactions with infants, thus making it an ideal setting for research into the effects of Baby Sign.

Interactions between caregivers and infants were videotaped in 5 minute periods during routine classroom moments. Each infant was observed interacting with between 3 and 5 individual caregivers over the course of the study (Vallotton, 2009). Caregiver responsiveness

was measured using an observational tool consisting of 17 responsive behaviors. Each behavior was rated on a scale of one to seven (one being almost never and seven being almost always). In terms of coding, gestures (Baby Signs included) were defined as communicative and intentional physical behaviors performed within an interaction (Vallotton, 2009). Each gesture was categorized as either a conventional gesture or a Baby Sign, and a time marker was placed when it was performed. Gestures were also categorized into one of four types: initiation, continuation, imitation, or reply. Initiations were gestures not preceded by any other gestures within the past five seconds. Continuations were gestures preceded by a different gesture made by the same individual within a five second period. Imitations were gestures preceded by the same gesture done by a different individual within a five second period. Replies were gestures preceded by a different gesture performed by a different person within a five second period (Vallotton, 2009).

It was found that when infants used Baby Sign to respond to caregivers' gestures, the infants received greater responsiveness from the caregiver (Vallotton, 2009). It was also found that caregiver's responsiveness in terms of Baby Sign changed depending on the age of the infant. When an infant was younger, a greater variety of signs elicited more responsive caregiving (Vallotton, 2009). However, when looking at an older infant, signing frequency was the determinant for more responsive caregiver interactions (Vallotton, 2009). These results were theorized to be related to the novelty of Baby Signs at certain points in development. When an infant is young, the Baby Signs learned are often novel and interesting to a caregiver; the caregiver is more likely to notice a new sign. However when the infant is older, the caregiver would be used to the signing and would tend to focus more on the frequency of signs (Vallotton, 2009).

The small sample size and wide variety of infant ages were limitations on the generalizability of the results of Vallotton's (2009) study. Additionally, the dedication of the caregivers to using Baby Sign was not typical for the average infant and caregiver learning Baby Sign. Therefore, the results may not be replicated if the study were repeated in a setting with more average dedication (Vallotton, 2009). Another limitation lay in the lack of data on the infants' verbal language development over the course of the study. Verbal language development and use could affect the effects of Baby Sign on the responsiveness of the caregivers.

Emotional regulation. Vallotton's (2009) work with extra-familial caregivers and Baby Sign provided information about the way in which Baby Sign effects the relationships an infant develops with the caregivers while in childcare. Responsive care builds trust which assists in social development. Childcare is often viewed as a place for developing social skills for use in later life, and one of the critical socioemotional skills is emotional regulation. This skill involves noticing, labeling, and managing emotional reactions to stimuli as the reactions occur (Karsten, Foster, Decker, & Vallotton, 2017).

In the descriptive case study, Karsten et al. (2017) observed the ways in which infants and toddlers in a Baby Signing classroom utilized signing in making emotional regulation attempts. The participants in this research were 17 children ranging from 11 months to 26 months of age. The children attended a university-based laboratory childcare that provided half-day care with a relationship-based approach. All teachers intentionally used Baby Sign during all daily routines which held the potential for the children to get upset (Karsten et al., 2017). Very few demographic details are recorded in this research, which is a limitation in terms of the generalizability of the results. It was also unclear how long the researchers spent observing the

children in total, as it was unrecorded in the report. However, the researchers spent time observing the infants and toddlers and recording when the participants used emotional regulation strategies via Baby Sign, as well as when the infants and toddlers used emotional regulation strategies via spoken words (Karsten et al., 2017).

Karsten et al. (2017) found that the infants and toddlers utilized Baby Sign in a variety of ways and situations in order to emotionally regulate. Many infants signed to initiate comforting routines, such as signing for a teacher to sing a particular song during a diaper change. The children would also produce signs signifying important people in their life to initiate reassurance (Karsten et al., 2017). In example, if a child signed *Mom* or *Dad*, the child would be reminded when their parent was expected to return to pick the child up. Some of the toddlers would also use signs as a reminder to themselves about their own behavior. An example of this was when a child would sign *wait* while the children were waiting for permission to go outside as a reminder of what behavior was expected (Karsten et al., 2017).

Through numerous observations, Karsten et al. (2017) discovered that infants under 18 months of age used an average of 2.2 emotional regulation strategies by way of Baby Sign when they were upset, but only an average of 0.5 verbal strategies (Karsten et al., 2017). This trend played out on a smaller scale with the toddlers (between 18 months and 26 months of age) with 2 Baby Sign regulation strategies occurring for every 1.3 verbal strategies used (Karsten et al., 2017). While these results are interesting, the small homogenous sample size and lack of information regarding demographics and observation specifics make it difficult to generalize the results to the public. However, assistance for infants in emotional regulation is a socioemotional benefit to the use of Baby Sign that would be useful for children well into adulthood.

Conclusion

Baby Sign has been promoted in the general public as a language development tool that can assist infants in communicating earlier and forming larger vocabularies (Goodwyn et al., 2000). Research was gathered with the purpose of discovering what developmental benefits Baby Sign may possess, in order to determine if it should be a promoted educational tool by teachers. Language, cognitive, and socioemotional development effects were researched along with connected issues such as the potential for Baby Sign to increase parental stress, which would negatively impact infant development. With this information, the question of what developmental benefits Baby Sign may have can be answered. The following chapter provides a detailed synthesis of the evidence gathered from these studies in order to better understand the data and how the information can be used to draw conclusions about Baby Sign's effects on infant development and whether Baby Sign should be a supported educational tool for infant teachers.

Chapter Three: Research Summary and Conclusions

As Baby Sign has grown in popularity with parents and teachers alike, the question of the developmental benefits of using sign with infants has become increasingly important (Barnes, 2010). Researchers have, intentionally or by serendipity, explored many areas of development in which the use of Baby Sign could have effects. This information can be used by teachers to answer questions from parents about whether or not the parents should use Baby Sign. In order to safely advocate the use of Baby Sign, teachers must have access to information regarding if and how Baby Sign affects infant development.

Baby Sign and Development

Through a review of the literature that exists about Baby Sign's effects, a few specific domains have been shown to be affected when infants are taught to use it to communicate. While Mueller et al. (2014) claimed that development in four different categories was improved via Baby Sign's use, the lack of a control group to compare the results to leaves the results on shaky ground. The improvements in the 11 infants participating could have easily been due to maturation as opposed to Baby Sign (Mueller et al., 2014). Beyond that study, research has shown potential developmental benefits in three main domains. These domains were language, cognitive, and socioemotional development.

Baby Sign and Language Development

Baby Sign affected both language development itself as well as the already existent mechanisms by which infants learn language. Parents, mothers specifically, were shown to respond to infants more frequently if the infant used gesture when making a communicative bid (Olson & Masur, 2013). Furthermore, infants who were exposed to Baby Sign were able to use both signs and faces to segment new words from running speech, whereas non-signing infants

were only able to use faces (Mueller & Acosta, 2015). As language exposure is a key component of language learning, gesture and Baby Sign's promotion of verbal input by parents, and provision of an additional means of speech segmentation, gave infants who use sign an advantage in terms of vocabulary exposure (Olson & Masur, 2013; Mueller & Acosta, 2015).

In terms of Baby Sign's effects directly on language development, a few key findings were discovered. Infants who utilized Baby Sign and were observed and tested multiple times over the course of 25 months displayed higher expressive and receptive language scores than did non-signing counterparts (Goodwyn et al., 2000). Moreover, Seal and DePaolis (2014) found a trend of signing infants attaining word-count milestones earlier than those infants who did not sign. In total, two of the ages at which receptive language was tested reached statistical significance, and for expressive language, significance was reached at three ages (Goodwyn et al., 2000). The trend of earlier attainment of words as well as the remaining expressive and receptive language tests did not reach statistical significance, however all of the test results did favor the signing infants (Goodwyn et al., 2000; Seal & DePaolis, 2014). Baby Sign's ability to assist in the development of language as a whole in any increment could be viewed as a positive effect in terms of the developmental benefits of using Baby Sign, especially at the ages for which these tests showed statistical significance.

Some parents expressed concern over Baby Sign potentially disrupting verbal language development, as theoretically the infants could choose to rely on signing rather than speaking to be understood (Pizer et al., 2007; Seal & DePaolis, 2014; Thompson et al., 2007). One of the first deictic gestures learned by infants is pointing, which is linked to language development in all infants regardless of signing (Vallotton, 2012b). In research that explored whether Baby Sign suppressed manual pointing, it was found that signing did stifle pointing somewhat for a period

of time. This effect ceased as the infant grew older and developed more spoken language (Vallotton, 2012b). Also, Goodwyn et al.'s (2000) study showed that infants who used Baby Sign showed faster development of language than did those who received verbal language training or no training at all.

Baby Sign and Cognitive Development

Making inferences regarding the nonobvious properties of objects tends to be accomplished by children via the receipt of name labels for those objects (Graham & Kilbreath, 2007). The names provided signify membership to groups that the children may already have knowledge of. In a study of 172 infants, Graham and Kilbreath (2007) found that younger infants would use both gestures as well as verbal labels to infer properties of objects. Older infants, on the other hand, gave preference to spoken labels (Graham & Kilbreath, 2007). This information, though in a different area of development, aligns with both Goodwyn et al.'s (2000) and Vallotton's (2012b) research in that younger infants tended to accept or benefit from gesture and/or Baby Sign more often than did older infants. Though a small item in the large domain of cognitive development, gesture's ability to provide a name label to new objects for younger infants benefits infants via allowing more ways in which to identify a new item, which could help with making connections between object categories easier.

Baby Sign, Societal Acceptability, and Infant Social-emotional Development

The other domain in which benefits were found to the use of Baby Sign with infants was in socioemotional development. Parents were found to use sign as a means of teaching socially acceptable behaviors to replace inappropriate ones the infants were displaying (Pizer et al., 2007). Mothers whose infants used Baby Sign were found to be more responsive to certain behaviors in the infants (Kirk et al., 2013; Vallotton, 2012a). Infants using Baby Sign were

found to affect the ways in which mothers interacted with the infants. As parents with high levels of stress have been found to interact less with children, thereby endangering the chances of secure attachment (Isabella & Belsky as cited in Howlett et al., 2011), two studies were completed regarding the effects of Baby Sign on parental stress. These studies contained mixed results. Infant caregivers outside of the family were also found to be affected by the use of Baby Sign in terms of responsiveness of care. Finally, infants taught Baby Sign by the caregivers in childcare setting were found to use sign to aid in emotional regulation (Karsten et al., 2017).

Socially Acceptable Behaviors

While parents claimed that the primary goal in the use of Baby Sign was language development and clearer communication, there was another use that was shown through the interactions using sign with their children (Pizer et al., 2007). Parents tended to use Baby Sign in order to teach politeness formulas such as ‘please’ and ‘thank you’ (Pizer et al, 2007). Children who signed with parents and infants who were taught Baby Sign in a laboratory setting were found to be able to replace whining with signs for what the child wanted (Pizer et al., 2007; Thompson et al., 2007). This effect remained for as long as the relevant adults encouraged the signing behaviors (Thompson et al., 2007). Baby Sign’s ability to assist in the teaching of socially appropriate behaviors (such as politeness and not whining) is an important benefit to the socioemotional development of infants, as these skills are vital to entering into society as a whole.

Baby Sign, Socioemotional Development, and Parental Relationships

Most of the studies found in relationship to parents and the use of Baby Sign with infant children placed the focus on the mothers as opposed to fathers or other familial guardians. Mothers of infants who used sign were both more likely to engage in synchronic visual and

tactile interaction (Góngora & Farkas, 2009) as well as promote the child's autonomy via focus on the child's own actions as well as verbally suggesting independent action (Kirk et al., 2013). Mothers whose infants signed frequently were also more responsive to the infant's distress cues (Vallotton, 2012a). Increased synchronic interaction and responsiveness to distress cues both benefit the social development of infants via bolstering the ability to form secure attachment. Increased autonomy from the promotion of independent action by parents has benefits in society and individual socioemotional development, as more autonomous infants could feel more comfortable exploring the environment and meeting new friends.

Howlett et al. (2011) found that mothers who attended Baby Sign or gesture classes with their infant were significantly more stressed than those who did not. If Baby Sign were to cause significant stress in mothers or parents in general, it could cause negative effects to secure attachment and thus infant development. However, other studies have shown no such link between parental stress and Baby Sign (Vallotton, 2012a; Mueller & Sepulveda, 2014). In fact, Vallotton's (2012a) study showed that the use of Baby Sign reinforced mothers' role as a parent which lowered stress scores on the Parenting Stress Index. In Mueller & Sepulveda's (2014) study, a workshop that was designed to provide choice, positivity, and support, caused parents no self-reported stress, and only one parent reported slight stress in regard to the using of Baby Sign as a whole.

Baby Sign, Socioemotional Development, and Extra-familial Caregivers

Infants who used Baby Sign with extra-familial caregivers in childcare were found to use sign to initiate emotional regulation strategies, such as requesting comforting songs and reassurance from caregivers (Karsten et al., 2017). Caregivers were found to be more responsive to infants who used gestures as opposed to infants who did not (Vallotton, 2009). Younger

infants were found to gain more responsive care when using a larger variety of signs (Vallotton, 2009), and also used more than double the amount of signed emotional regulation strategies as compared to verbal strategies (Karsten et al., 2017). Older infants gained more responsive care with a higher frequency of signing (Vallotton, 2009), and used somewhat more signed regulation strategies than verbal strategies (Karsten et al., 2017). In both of these studies, the children were involved in Baby Sign with extra-familiar caregivers. Infants also received socioemotional benefits in both. Secure attachment is not just important in familiar relationships, but also in relationships with other caregivers with whom the child spends a great deal of time, such as childcare providers. Responsive care aids in the building of secure attachment. Emotional regulation is an important skill to learn that benefits children from infancy through the remainder of life, and the ability to begin instigating emotional regulation strategies when children are still preverbal will benefit their emotional development.

Conclusion

The use of Baby Sign has shown multiple benefits to infant development. There were sizable gains shown to be made in the areas of language development and social-emotional development (Goodwyn et al., 2000; Kirk et al., 2013), as well as some benefits shown to the area of cognitive development (Graham & Kilbreath, 2007). Some concerns were raised regarding the longevity of the benefits gained by using Baby Sign (Goodwyn et al, 2000). Additionally, the impact of the use of Baby Sign on parental figures was a potential concern (Howlett et al., 2011). However, in terms of the question of infant development, there are benefits to the implementation of a Baby Sign program (Goodwyn et al., 2000). Following will be a discussion of the future of Baby Sign research and how this information could inform future instructional practice.

Chapter Four: Discussion and Applications

The research regarding the developmental benefits of using Baby Sign with infants displayed some results pertinent to the question of if Baby Sign provides any developmental benefits. Three areas of development showed the most distinctive potential for benefits. Language development showed some gains in regards to influencing the amount of vocabulary infants hear (Olson & Masur, 2013), infants' expressive and receptive language abilities, as well as the tools infants can use to segment speech. In cognitive development, infants were able to use sign in the same way faces are typically used to infer properties of objects (Graham & Kilbreath, 2007). Finally, in social-emotional development, infants who signed tended to receive more responsive care than infants who did not sign, both from parents as well as extra-familial caregivers (Góngora & Farkas, 2009; Vallotton, 2009).

With this information in hand, it is important to look at the overall limitations of the studies from which these results arrived. Understanding where this research has fallen short will assist the early childhood education community in beginning new research into the benefits of Baby Sign in order to close the gaps, as well as to put the results that have been reported into perspective. Regardless of the limitations, the information that was gained from this research can be used to inform instructional practices among infant teachers now and in the future.

Limitations of the Research

There were a few limitations that were present in the majority of the research studies looked at. In 81.25% of the studies discussed above, the sample size was considerably small. The smallest within this group contained only two participants, and the largest of this group contained 30. Along with small sample sizes, many of the studies contained very homogenous samples. In most of the studies, the participants were almost exclusively Caucasian with the

exception of a couple in which there were a sizable number of Hispanic participants, and one single study in which the participants were relatively evenly split between Caucasians and Hispanics. The majority of studies had primarily English-speaking participants, and in some, Spanish-speaking. The socio-economic statuses (SES) of the participants were almost exclusively middle class, with one study focusing on lower SES infants.

Two of the studies in particular had troubles in the reporting of the research. Goodwyn et al. (2000) failed to describe the ways in which the infants were assigned to the groups in the study. Karsten et al., (2017) did not elaborate on the duration of time spent observing the children in the study nor did Karsten et al. provide much in the way of demographic information about the participant children. Without this information there is the potential for additional unthought-of confounding variables or other limitations that cannot be identified without the missing information.

Two other primary limitations of some of the studies were related to the groups studied or the subject that was originally being researched. In the research of Mueller et al. (2014), Pizer et al. (2007), Thompson et al. (2007), Mueller and Sepulveda (2014), and Karsten et al. (2017) there were no control groups created, and the lack of those groups leaves both questions regarding the results of the studies as well as information that could have been gained with the use of control groups that is unknown. For example, the results of the longitudinal studies could have been attributed to maturation rather than any Baby Sign intervention applied.

Future Research

An area of interest that could be explored was brought forward by Howlett et al.'s (2011) research into parental stress regarding Baby Sign. In this study, mothers who had attended or not attended Baby Sign or gesture classes were chosen as participants. However, there was no

information gathered on the type of gesture classes that were attended. A study that reviews the quality of currently offered Baby Sign courses might shed some light on how well parents are being taught about Baby Sign. Additionally, this information could be used by early childhood education centers that are interested in implementing a Baby Sign program to find a high quality class or workshop to send teachers to.

Since Pizer et al.'s (2007) research showed that, at least in terms of the three children involved in the case studies, Baby Sign tends to be used in the home for teaching socially appropriate behaviors and politeness formulas, it would behoove researchers to explore the effectiveness of Baby Sign as a socialization tool. For example, whether infants taught to use the signs *please* and *thank you* are more likely to utilize these politeness formulas when making requests. For a longer study under that same research question, an addition could also be whether the children, as the children grow older and stop using Baby Sign in favor of spoken words, continue to use verbal 'please' and 'thank you' with the same frequency that the children used it while signing. Also, a control group who verbally encouraged the utilization of politeness formulas could be included to compare to Baby Signing infants as a means of determining if either group used politeness formulas more consistently.

Future research could also include replications of the previous studies with improvements added. Additional research into whether Baby Sign classes cause parental stress, with pre-testing and post-testing would be a good place to start. Also, further research into both the speed of first words attainment and speech segmentation with Baby Sign exposure and use being an intentional factor rather than coincidental would provide more solid evidence towards the results of Seal and DePaolis's (2014) and Mueller and Acosta's (2015) studies. Many of the studies that focused on

parental involvement with Baby Sign tended to use mothers. Studies that brought in fathers as the participants would prove useful for those families where the mother is not present.

Goodwyn et al. (2000) claimed that while Baby Sign's effects are not long-term beyond the age of approximately two years old (at which time non-signing children's language scores begin to catch up), the period for which Baby Sign does provide higher scores is typically a period of frustration for infants. This is due to infants inability to express themselves verbally, and manual pointing tending to be unclear in terms of its referent and the desire of the child in regards to the referent. Using Baby Sign, an infant has the ability to be more specific about what the referent item is and thus may get less frustrated in terms of communication (Goodwyn et al., 2000). Research into the accuracy of this theory would provide excellent insight into the usefulness of Baby Sign for infants specifically.

Future Instructional Practice

In terms of the information currently available regarding the developmental benefits of Baby Sign, the social-emotional benefits are the most compelling in terms of implementation. The easiest means of introducing Baby Sign to infant classrooms would be its inclusion in the daily routines (i.e. diapering, feeding, and naptime). Both the teachers and the infants are already familiar with the basics of how these routines function, so the addition of the signs would be simple and easy to understand. Using Baby Sign labels for favorite songs within the classroom will also provide preverbal infants the ability to make song requests. As Karsten et al. (2017) showed, song requests during stressful times can be a useful emotional regulation tool that infants can utilize with signs before being able to speak.

Baby Sign can be promoted by teacher supporters to parents with the information regarding responsiveness and the benefits of responsive caregiving. Parents interested in

potentially strengthening infant attachment would most likely desire to hear more information about Baby Sign and its effects on parent-child interactions. So long as teachers are honest regarding Baby Sign's limitations in terms of longevity, teachers can also discuss with interested parents the effects symbolic gesturing such as Baby Sign can have on expressive and receptive language skill in younger infants and toddlers. With full honesty regarding Baby Sign's limitations and the proper implementation of Baby Signs in daily life, teachers can suggest Baby Sign to parents that the teachers believe would appreciate the information.

Conclusion

Baby Sign has been shown to have developmental benefits in the areas of language, cognitive, and socioemotional development. The differences between signing infants and non-signing infants tend to get smaller and ultimately disappear in the majority of cases. This can leave parents and teachers to wonder if its implementation can be worthwhile if the results do not stay in the long-term. Goodwyn et al. (2000) summed up the feelings of many when they said "The period after infants become mobile and before they can talk is a very difficult one for both parents and children" (p. 101). If Baby Sign can provide any level of assistance in the communication between adults and infants, while also providing benefits to the closeness of the relationships that the infant is forming with important people, it is worthwhile for teachers to suggest Baby Sign to infant parents and provide additional information on it when requested.

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