

## **Critical Review: Are there communicative advantages or disadvantages to training symbolic gestures to typically-developing hearing infants?**

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This critical review evaluates the evidence on communicative outcomes with symbolic gesture use in typically-developing hearing infants. Five articles were reviewed, including one systematic review, one case study, one randomized clinical trial (RCT), one single subject 'n-of-1', and one single group (post)test. Overall, the research reveals the following communicative benefits: improved receptive and expressive communication and cognition, ability to communicate various functions and internal states, improved caregiver-infant interactions, and diminished adverse behaviours. Although the literature supports training symbolic gestures in infancy, the studies only offer equivocal evidence due to several methodological limitations.

### ***Introduction***

Symbolic gestures (also known as baby signing) are hand gestures produced by preverbal infants that represent words to allow them to communicate their thoughts, needs, and desires. Several infant symbolic gesture training programs have emerged in recent years and have been growing in popularity. (Pizer, Walters & Meier, 2007)

According to Pizer et al. (2007), there are a variety of reasons caregivers choose to teach symbolic gestures to their infants. The main motive is to improve caregiver-child communication. By using symbolic gestures, infants can more clearly communicate nonverbally, and in turn caregivers are better able to cater to their child, leading to less parental and infant frustration and fewer temper tantrums. In addition, some caregivers believe that improved communication through signing reflects optimal parenting. It follows the notion that by parents putting extra effort and energy into teaching their child to use symbolic gestures, their child will have a richer life through better communication.

Symbolic gestures are also believed to teach infants socially appropriate behaviours and interaction rituals associated to particular social groups. For example, shared storybook reading is valued in the mainstream middle class, however this may not be the case for families from low socio-economic backgrounds.

Another reason caregivers use symbolic gestures is to promote infant bilingualism in American Sign Language. Learning multiple languages in childhood is thought to have cognitive benefits. In addition, the use of symbolic gestures is believed to be beneficial in developing infants' linguistics, emotions, and intellect. Some believe that children can communicate earlier through gestures before

communicating verbally, setting the stage for early development in other areas. Use of symbolic gestures are claimed to result in larger lexicons, higher IQ, and accelerated development of spoken language.

There are many motives for why caregivers choose to use symbolic gestures with their infants, however it is unclear whether or not this practice is supported by research.

### ***Objectives***

The primary objective of this paper is to critically evaluate the current literature on the communicative benefits and detriments of teaching infants to use symbolic gestures. This is explored in terms of: receptive and expressive communication, cognition, communicative functions, caregiver-infant interactions, diminishing adverse behaviours, and conveying internal states. The secondary objective is to provide evidence-based practice recommendations regarding the use of symbolic gestures with infants.

### ***Methods***

#### **Search Strategy**

Articles were found on the following internet databases: PsychINFO, CINAHL, Scopus, and PubMed. The search strategy used was (baby sign language OR gestural sign OR symbolic gesture) AND (language development OR language acquisition) AND (infant). The search was limited to articles written in English.

#### **Selection Criteria**

Inclusion criteria included any symbolic gesture training to infants under the age of 12 months. This age was chosen because the review looked at preverbal infants, so it was necessary to look at children prior to expression of first words, which is around 12 months old (Kuhl, 2004). The review

focused on participants and trainers that were typically-developing with normal hearing, therefore excluding populations such as hearing-impaired, autism, and Down syndrome. Only papers published after May 2003 were included because one paper found was a systematic review of the topic (Johnston, Durieux-Smith & Bloom, 2005) and covered an abundance of relevant literature prior to this time.

#### Data Collection

Five articles were found that met the inclusion and exclusion criteria. The research designs of these studies included one systematic review, one case study, one randomized clinical trial (RCT), one single subject 'n-of-1', and one single group (post)test.

### **Results**

#### Receptive & Expressive Communication and Cognition

Johnston et al. (2005) conducted a systematic review evaluating the literature on the effectiveness of prelingual signing for typically-developing hearing infants on child development. It has a level II+ study design. For the purpose of this review, studies with participants with deaf parents were excluded because the focus was on the effects of symbolic gestures in hearing families.

Five longitudinal prospective cohort studies met the criteria. The reviewers indicated that all five studies were conducted by the same authors (Acredolo, Goodwyn, and colleagues) and used the same participants over a period of time. Therefore, majority of the relevant literature published before 2003 was conducted by these authors. This posed a problem because often the same methodological weaknesses and biases were found in studies by the same authors. This raised the question whether or not the studies could be replicated with other individuals.

These studies consisted of one experimental group whose parents received symbolic gesture training for their 10 month old infant (n=32), and two comparison groups who received verbal language encouragement training (n=32) or no training (n=39). The reviewers identified that recruitment procedures and criteria for group assignment were not reported. In addition, no baseline measures were identified, therefore it was difficult to know if the effects were a result of gesture training or if another confounding variable existed based on grouping or sample selection.

Attrition rates were also high for one study, however Acredolo, Goodwyn, and colleagues retrospectively compared the original cohort with the follow-up participants on parental education, child development

measures, and number of gestures used. No differences were found, strengthening the argument that effects were a result of symbolic gesture training. According to this systematic review, these studies reported higher IQ and receptive and expressive language scores on standardized tests compared to the no training group.

The reviewers indicated that there were no significant differences in outcome measures between the two control groups, however the experimental group was only compared to the no training group. To strengthen the validity of the study, Acredolo, Goodwyn, and colleagues should have compared the experimental group to both control groups, to ensure effects were not a result of the act of training, regardless of the type.

The systematic review provided qualitative analysis of the literature and identified many limitations; however, it failed to report how the data was analyzed, making it difficult to confirm appropriate statistical analysis. The review would be strengthened by conducting a meta-analysis or having more than one reviewer evaluate the studies.

The reviewers concluded that the literature failed to support claims of communicative advantages due to insufficient methodologies and equivocal results. This systematic review offered compelling evidence that the literature did not support symbolic gesture training and cautioned interpretation of findings. The review was clinically relevant because it investigated an area vital for infant communication.

#### Communicative Functions

Pizer et al. (2007) conducted a case study to evaluate the communicative functions of symbolic gestures. This study has a level IV study design. The participants were two typically-developing infants whose families chose to use symbolic gestures with them. They were introduced to signing by their families at seven and nine months of age. The participants came from the same geographical location and had similar family structures, however the recruitment procedure was not reported. The methodology used to train the participants how to use symbolic gestures was also not reported, therefore lacking methodological consistency.

The participants were videotaped while interacting with family members during meal and playtime in their home. Parental reports were used to identify symbolic gesture use when participants were not videotaped. It was not clear if the parents were blind to the purpose of the study, and therefore may have

had biases in reporting data. The researchers did not report whether the parents indicated communicative function when identifying the gestures.

Functions of symbolic gestures were determined by context of production and parental reactions, however the researchers failed to outline the criteria for categorization. More than one rater should be used to identify the functions to ensure appropriate assignment. It was also unclear if these measures revealed the true functions intended by the participants. The study found that participants used symbolic gestures to communicate: labels, displays of knowledge, politeness, requests, and errors.

This study offered suggestive evidence that symbolic gestures provided a communicative advantage for infants to preverbally convey a range of functions, however the findings should be taken with caution due to sampling and methodological limitations. This study was clinically relevant because it investigated one of many communicative aspects that were essential for effective infant communication.

#### Caregiver-Infant Interaction

Góngora & Farkas (2009) investigated the effects of teaching symbolic gestures to infants on the mother-child interaction. The researchers indicated that the study design was quasi-experimental, however since the participants were randomly assigned to a group, the study fell under a RCT design. This increased the level of evidence from I to II, which was unusual that the researchers would report a study design that had a lower level of evidence.

Fourteen mother-infant dyads were recruited from a private health centre, limiting the sample to middle-upper socio-economic status. Participation was voluntary, therefore it may have only attracted mothers who were actively engaged with their infants. The participants were five to nine months of age at the start of the study.

Mother-child interactions were evaluated during free play at three different ages using the AIT Grid (Early Interaction Analysis, in Spanish). The mothers were aware of being videotaped; however it was unclear if they were blind to the purpose of the study. This could result in the mothers altering their behaviour and interaction-style with their children, and therefore may not represent natural dyadic interactions. The researchers attempted to control for effects of general parental training by providing the control group with workshops on language development that did not mention the use of symbolic gestures.

The mother-child interactions were coded and converted into a scaled score by three independent observers who were blind to group assignment, strengthening the validity of the study. Coding disagreements were resolved by an expert to reach 100% agreement. It was unclear if the expert was blind to the purpose of the study and group assignment. The researchers also failed to report how the expert revised scores and to what extent there were coding discrepancies among the original scores.

A non-parametric Mann-Whitney Test revealed significantly greater duration and frequency of visual and tactile interactions when infants were 18 to 20 months of age compared to the control group. This was an appropriate statistical analysis to use because since there were limitations in recruitment, the small sample was not assumed to follow the normal distribution of the general infant population.

This study provided suggestive evidence for training infants to use symbolic gestures by demonstrating its communicative benefit of improving dyadic interactions. Since there were limitations in sample selection and methodology, the findings should be interpreted with caution. This study was clinically relevant because it explored a critical aspect of infant communication.

#### Adverse Behaviours

Thompson, Cotnoir-Bichelman, McKerchar, Tate & Dancho (2007) conducted a single subject 'n-of-1' study to determine if adverse infant behaviours (i.e. crying and whining) could be replaced by symbolic gestures. This study has a level I study design. The participants were two typically-developing nine and ten month old males, who were selected due to reports of adverse behaviours during particular situations, presenting a selection bias. This limited generalization of findings because the behaviours targeted were not present in all infants or may have been present for different reasons, however this reflected the individualistic nature of infant behaviours. The researchers had to train participants to use a symbolic gesture related to the cause of their distress, reducing procedural consistency.

Gesture training was provided in conjunction with extinction. The researchers acknowledged that the effects of each variable could not be differentiated, and therefore it was difficult to conclude that the findings were a result of gesture training alone. The participants received frequent intensive training in an unnatural therapy setting, which restricted clinical applicability and generalization.

An observer measured the duration of crying and whining, and the frequency of gestures per minute, following an ABAB design (A=baseline, B=gesture training condition). It was not reported if the observer was blind to the study purpose. Accuracy of data collection was verified by a second observer for a portion of the sessions. Agreement percentages were high, although the use of Cohen K to determine inter-observer reliability would have provided greater validity to the study because it would account for the likelihood of agreement occurring by chance.

The researchers found an increase in independent gestures and a decrease in adverse behaviours during gesture training and vice versa during baseline, which supported the notion that symbolic gestures could replace adverse behaviours. Since gesture training could not be discriminated from extinction, this study only offered equivocal evidence of symbolic gestures having a communicative advantage. This study was clinically relevant because it offered a practical strategy to manage undesirable infant behaviours.

#### Internal States

Vallotton (2008) used a single group (post)test design to determine if infants and toddlers could convey internal emotional states through symbolic gestures, which were trained by caregiver modeling. This has a level III study design. The small sample consisted of 10 infants and 12 toddlers, aged 4.5 to 24.8 months at the start of the study. They were recruited from a university daycare, limiting the sample to high parental education.

Infant interactions were videotaped with only caregivers and were limited to the daycare setting. Frequency of the caregiver's gesture use was unclear, leading to variability in participants' exposure to gestures. The caregivers and children were aware of the videotaping and may have altered their typical behaviours causing skewed results.

The videotaped episodes were coded in terms of gesture content, conversational context, and social-emotional context to establish meaning of gestures. The coders did not interact with the participants, however they assisted in videotaping, so they had some exposure to them. The researchers did not report on the number of coders, however Cohen's K analysis revealed they had substantial agreement, and therefore good inter-coder reliability.

The researchers found that most of the participants used emotional, feeling and/or time-related gestures, however it was difficult to verify if these symbolic gestures were true reflections of the infant's internal

states. Binomial distribution analysis was conducted to determine the likelihood that a gesture was meaningful rather than random, and found that there was less than a 1% probability that the gestures occurred by chance. Therefore, the researchers concluded that participants were able to convey their own internal states.

For the purpose of this review, only infant data was of interest. Infant and toddler data was analyzed in combination and therefore infant gesture use alone could not be determined. From evaluating the infant raw data, most of the gestures could not be interpreted due to insufficient information, therefore the gestures would likely not be meaningful. Due to limitations in sampling, methodology, and data analysis, this study provided equivocal evidence for gaining communicative advantages in infancy from symbolic gesture use. This study was clinically relevant because it evaluated a communicative component that was important for infant expression.

#### *Discussion*

In general, the literature on the effects of symbolic gesture training on infant communication development has been positive, however the evidence in these studies were weakened due to narrow sampling, restrictive settings, methodological inconsistencies, and biases.

With the exception of the systematic review that did not provide recruitment information, all of the other studies utilized small non-representative samples from the same geographical location. This limited generalization of the results to the general infant population. Due to the complexity of communication, a small sample size was necessary to fully evaluate the communicative outcomes. Therefore, these studies contributed valuable information to the literature, however study replication with diverse samples would increase the strength of evidence.

In addition, all of the studies except for Thompson et al. (2007) were conducted in a naturalistic environment, however these studies only evaluated infant gesturing in one setting during specific routines. This limited generalization to other settings or activities.

Excluding the study by Thompson et al. (2007), gesture training by caregivers was consistent across studies, however training procedure and duration varied, or was not reported. There were also these inconsistencies within several studies (Vallotton, 2008; Thompson et al., 2007; Pizer et al., 2007). Therefore, the different outcomes could be

attributable to differences in symbolic gesture training.

Many of the studies failed to report if the participants were blind to the purpose of the study, possibly resulting in participant bias. Góngora et al. (2009), Pizer et al. (2007) and Vallotton (2008) used videotaping to record gesture use, however awareness of the video camera could have caused the participants (including family members) to alter their behaviour and gesture use. Therefore it was difficult to know if the symbolic gestures recorded represent naturalistic use. The researchers could overcome this by videotaping through a one-way mirror or using hidden cameras so that the participants would not be aware of when they were being recorded.

Góngora et al. (2009), Thompson et al. (2007), and Vallotton (2008) strengthened the validity of their studies by using multiple raters to analyse the data. Although it was not reported if the raters were blind to the purpose of the study, possibly resulting in coding biases.

Each study evaluated a different communicative outcome, making it difficult to compare the results and analysis between studies, however this reflected diversity of communication. This was overcome by evaluating each study for its unique contribution and then determining overall clinical relevance.

Symbolic gesture use impacted many communicative aspects that were essential to productive infant communication. Although the studies investigated different communicative areas, all of the studies enhanced infants' ability to express themselves. As a result, it was hypothesized to improve parental and infant frustration levels and encourage social interactions (Pizer et al., 2007).

Pizer et al. (2007) and Vallotton (2008) looked at communicative components that were difficult to objectively evaluate (i.e. communicative function and internal states) and therefore were unable to confirm whether or not they were true measures of the variable. These researchers dealt with this by using the context in which the gestures were made to infer the meaning. This was a valid solution because clinicians use context and other non-verbal cues when determining communicative intent of non-verbal clients.

Overall, the literature provided equivocal evidence for gaining communicative advantages from training infants to use symbolic gestures due to limitations identified in the studies. Although the findings should

be interpreted with caution, the studies offered clinically relevant information on gesture use.

### ***Recommendations***

Further research needs to be done to strengthen the evidence of the literature. Conducting more studies with design levels I or II would offer stronger support, however due to the various aspects and complexity of communication, studies with lower design levels also provide significant information. Therefore future research should improve on its methodology and the following suggestions should be considered:

1. Repeat studies with larger sample size, and more diverse and demographic populations in a variety of naturalistic settings and routines to allow for generalization of findings.
2. Research with methodological consistencies between and within studies to prevent confounding variables interfering with the results.
3. Implement blinding procedures with participants and raters to the purpose of the study and group assignment to avoid biases.
4. Use additional non-verbal cues to infer meaning of symbolic gestures (e.g. facial expressions and reactions to response).
5. Research other communicative aspects that may be impacted by symbolic gesture use, such as level of participation in social activities (e.g. shared storybook reading) and the ability to communicate choice-making.

### ***Clinical Implications***

Literature on symbolic gesture use in typically-developing infants is important because it provides the groundwork for potential communicative outcomes. In turn, this information can be clinically applied to individuals with disabilities that have difficulties in specific aspects of communication and can be used to promote development in those areas. Without the foundation of the effects in typically-developing individuals, it would be unclear how the use of symbolic gestures could be beneficial. The current literature suggests potential benefits in typically-developing infants and therefore may offer communicative advantages when clinically applied to other populations. It is only suggested to use these findings on an exploratory basis until further research is available. Clinicians should recommend the use of symbolic gestures to interested parents considering only advantages were identified, however they should be cautioned not get their hopes up due to limitations in the studies that therefore weaken the evidence.

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