

Baby Talk!

A Canadian Language and Literacy Research Network Program Catalogue and Review of Evidence



Training hearing infants to use sign language

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Should parents be encouraged to teach their hearing infants to communicate using gestural signs? Does signing in infancy advance child behaviour and development as claimed? To answer these questions a **Program Catalogue** describing infant signing programs, products and their claims was created. Claims of benefits included advancements in language and cognitive development, increased parent-infant bonding, and decreased infant frustration. To assess the legitimacy of these claims, research studies that examined the effectiveness of prelingual signing for hearing infants were retrieved and evaluated. The **Review of Evidence** failed to adequately support claims due to insufficiencies in scientific methods, and equivocal results. Moreover, the programs and products available for purchase were not the same as those evaluated in the research studies.

Introduction

The first year of life sets the stage for the development of language. While most babies will not utter their first words or sentences until the second year of life, the foundation for language, including sound perception and production, communicative gestures, and non-linguistic cognition, is laid in the pre-speech “conversations” of young infants and their parents (Bates, O’Connell, & Shore, 1987). When parents speak and read to their infants they foster language development by providing models of the phonemic, morphological, syn-

tactic, and pragmatic structure of babbling. Parents help their infants develop communication skills (e.g., vocal turn-taking) that might otherwise be beyond their abilities by providing *scaffolding* and language supports (Bloom, 1990). Parents focus on the objects and topics that are of interest to their infants and provide appropriate feedback and verbal labels for the events that are attended to jointly by parent and child (Morales et al., 2000).

Sign language training in infancy has been hypothesized as a vehicle for parental support of pre-speech development over and above oral communication. Sign language uses a manual mode of communication but provides the same language foundation encompassed in oral communication (Petitto, 1994; Petitto, 2000). The manual mode of communication is thought to be easier than oral communication for young infants to master. Infants’ early gross motor skills are better than the fine motor skills they need to control in the phonetic and articulatory actions required for speech (e.g., Acredolo & Goodwyn, 1990). This argument has been used to support sign language training in nonhuman primates, as well as in children with and without developmental delays (Petitto, 2000; Abrahamson, Cavallo & McCluer, 1985). In addition, it is thought that the language fundamentals acquired early through the manual modality are transferred to the oral modality once phonetic development is complete.

Recommendations

To parents: Invest time and money in baby signing programs or products only for the enjoyment of the activity, and not for any proven benefit for infant or child development. The high accessibility of a wide range of baby signing products is not matched by good quality evidence that would reinforce manufacturers’ claims.

To industry: Temper marketing claims. Partner with researchers to evaluate implementation and outcome effectiveness, and offer protocols and incentives to families interested in taking part in evaluation research.

To researchers: Evaluate the impact of gestural sign training for hearing prelingual infants using appropriate comparison groups. Assess both immediate and long-term outcomes related to child language development and parent/child interaction. Monitor the quality and frequency of signing by parents and infants to evaluate the effectiveness of implementation in relation to outcome.

Sign language learning is meant to teach infants to express their thoughts. Like verbal language, sign language uses symbols to represent ideas. The connection between the sign and the object in mind might be easier for the young child to learn because, as symbols, signs resemble the object in mind more closely than would a word. The use of symbolic gestures is thought to provide parents with an opportunity to create more meaningful language learning interactions between themselves and their infants. For example, when a prelingual child points out a dog to her mother, the mother says and signs the word for dog, and then shows her child how to produce the sign by manipulating the child's hands. In this way, the mother and child jointly attend to the same object, the dog, and the mother provides scaffolding to help the child go beyond pointing to produce the symbol for "dog." The sustained joint attention held by the mother and infant, coupled with the training of symbolic gestures for communication, is thought to advance language development before speech (Wetherby, 1998). As well, the social by-product of early signing may advance language development, based on evidence that the frequency of caregiver-infant interaction predicts vocabulary and cognitive growth (Hart & Risley, 1995).

Historically, the interest in infant signing programs arose, in part, from the study of hearing children of deaf parents. Children who were exposed to both signed and spoken languages from birth were studied to determine whether language acquisition differed in speech and in sign. In many studies, the linguistic and cognitive development of hearing children of deaf parents was also evaluated (Bonvillian, Orlansky, Novak & Folven, 1983; Bonvillian, Orlansky & Novak, 1983; Capirci, Montanari

& Voltarra, 1998; Petitto et al., 2001). In this unique population, there emerged conflicting evidence regarding the timing of language acquisition milestones. Some researchers reported earlier language acquisition amongst this population (Bonvillian, Orlansky, Novak & Folven, 1983; Bonvillian, Orlansky & Novak, 1983), whereas other researchers reported milestones at ages similar to those of children acquiring only oral language (Capirci, Montanari & Voltarra, 1998; Petitto et al., 2001).

Notwithstanding the equivocal evidence based on hearing children of deaf parents, a small group of researchers studied hearing children of hearing parents exposed to symbolic gestures, not as a complete language system but as a symbolic and linguistic auxiliary to oral language (Acredolo & Goodwyn, 2000; Goodwyn & Acredolo, 1993; 1998; Goodwyn, Acredolo & Brown, 2000; Moore, Acredolo & Goodwyn, 2001). These researchers postulated that language development of all children could be advanced if a "baby sign language" was developed and promoted, and if parents used and taught sign language when communicating with their infants. Consequently, and capitalizing on parents' enthusiasm for supporting and advancing their infants' development, sign training programs and products were developed and marketed internationally. Sign training books, videos, and flashcards became available for sale, and some of these products claimed that signing was a "great way to enhance your child's early brain development."¹ Others claimed that sign language training, by providing a

feasible (manual) method of communication, reduced frustration possibly experienced by prelingual infants when trying to convey their thoughts and desires.

Well-publicized, commercially available programs (*Baby Signs Inc.*©, *Sign With Your Baby*[™], *Baby Talk Ltd.*©) were produced for parents of hearing infants by former sign language interpreters for the deaf and by child development experts. For example, Joseph Garcia, a former sign language interpreter, created *Sign With Your Baby*[™] by incorporating signs used by deaf parents in communicating with their hearing infants. In contrast, Linda Acredolo and Susan Goodwyn, university professors of developmental psychology, created *Baby Signs Inc.*© based on both naturally occurring symbolic gestures that hearing children produce in the transition from the prelingual stage of language development to early, meaningful vocalization, and based on signs used in American Sign Language (ASL). All programs claim that signing programs improve language development, encourage parent-child bonding, reduce the frustration of prelingual infants, and facilitate cognitive development. The programs offer a myriad of products including classes, videos, books, bumper stickers, and cue cards. While the products are available to parents worldwide for purchase on the Internet, the majority of programs emanate from the United States, Canada, the United Kingdom, New Zealand, and Australia.

Aims and Objectives ———

Do baby signing programs work? Are these programs effective in improving expressive and receptive language, parent-child interaction, and infant cognition as claimed? Can and

¹Baby BumbleBee (2003). BeeSmart Baby Videos. Retrieved on August 4, 2003 from <http://www.babybumblebee.com/store/asl.cfm>.

should parents be encouraged to teach their hearing infants to communicate using gestural signs? To answer these questions a review was conducted that had two main objectives. The first objective was to create, in a systematic manner, a **Program Catalogue** of infant signing programs and products for parents of normally hearing infants. The Program Catalogue was designed to describe the programs and products including evidentiary claims, and to identify common elements or differences. The second objective was to retrieve and review all studies that examined the effectiveness of prelingual signing for increasing children's expressive and receptive language, cognitive function, and parent/child interaction. The **Review of Evidence** was designed to produce a summary of research evidence, to identify gaps in research, and to weigh the evidentiary support against characteristics and claims of the programs and products. The Canadian Language and Literacy Research Network (www.cllrnet.ca) provided guidelines and a protocol for conducting the Review of Evidence within a 4-month time frame. The procedures were adapted in part from Systematic Review protocols (e.g. The Campbell Collaboration, www.campbellcollaboration.org). The Program Catalogue and Review of Evidence were designed to serve as resources for parents and practitioners.

The Program Catalogue —

Methods

Inclusion/Exclusion Criteria:

Programs and training materials were included in the **Program Catalogue** if they involved the training and use of sign language with prelingual

infants. The definition of "sign language" included any derivative of ASL or other sign language used by the deaf community, as well as other forms of gestural signing designed specifically for hearing infants. Only programs for hearing prelingual infants were reviewed. Programs were reviewed only if instruction of signing began in the prelingual stage of language development, before the age of 12 months. The Program Catalogue was restricted to programs available in English or French, but the national origin of the program was not a restricting variable. To summarize, in cataloguing sign programs and intervention materials, the criteria for inclusion were four-fold; 1) use of elements of a standardized sign language or of any idiosyncratic gestural sign system created for infants; 2) application of the program or materials to prelingual hearing infants; 3) interventions beginning prior to the second year of life; 4) availability of the intervention in the English or French languages.

Search Strategy: Online search engines were used to examine documents on the Internet. The following keywords were used: sign language, gestures, and signing. These keywords were combined with the term: babies. Such searches retrieved approximately 191,000 relevant sites. Online parenting information websites (www.todaysparent.com, www.babycenter.com) and bookstores (www.amazon.com and www.chapters.indigo.ca) were also searched for information relevant to the **Program Catalogue**. Products identified for infants or the parents of infants were deemed relevant to the construction of the Program Catalogue.

Results

Activities and Materials: A variety of resources were found to be available for parents interested in teaching their prelingual hearing infants to use sign language (See **The Program Catalogue**). A program was defined as a formalized intervention procedure for training prelingual infants to use gestural signs to represent words or concepts, and included at least two of the following components: books, videos, courses, online support, information, internet chatrooms, and other products. Seven multi-component programs were identified. For example, the *Sign with your Baby™* program provides an online store for parents to purchase a "complete learning kit" and other products. This kit provides parents with a video and book demonstrating approximately 50 symbolic gestures and instructions on how to use them with their children from eight months of age and older. Information is also provided on the website for affiliated instructional classes that may be available in the parent's region. Support is also available to parents in online chatrooms. Parents can post questions to both the creators of the program and to other parents using symbolic gesturing with their infants. All identified programs provide multiple services or products to parents.

Eleven videos and DVDs were identified. These videos were produced to train parents to sign, or for infants to learn signs by themselves. J. Garcia offers a *Sign with your Baby™* training video for parents, while the Baby BumbleBee "Bee Smart Baby Videos" provide "stimulation" for infants to view by themselves. Twenty-three books were identified. Again, these included books that taught parents to use signs with their prelingual infants

(e.g., *Baby Signs* by L.Acredolo, S. Goodwyn, and D. Abrams) as well as board books and other children's books that were created for prelingual infants. The board books are available in a variety of themes including signs for eating, animal signs, and the concept of "opposites."

Fourteen courses, classes, and children's playgroups were identified across Canada. The search did not include strategies for identifying community-specific programs that were not discovered using Internet search engines. Such programs may not have registered websites and may have been missed during searches. Unlike the multi-component programs, courses included hands-on instruction in gestural sign training. Additionally, they did not typically involve any additional products. While some of the courses may have recommended particular books to parents, the course instructors did not provide self-authored or other books for sale to parents. The primary product was the instruction.

Accountability: Most of the programs, books, and videos claim that using gestural signs to communicate with prelingual infants promotes language acquisition, reduces frustration, increases cognitive functioning, and improves early communication. While the extent of these claims varied, all program creators made some claims of benefits.

Accessibility: Due to the availability of many of the products on-line, programs would be accessible to individuals who use Internet services. However, the price of the products (from 7\$US for a child's board book, to 50\$US for an instructional video and book, to 65\$CA for a workshop and instructional book) may make many of these products inaccessible to some Canadian families. The fourteen courses and classes were identi-

fied only in Ontario, Alberta, and British Columbia. The Internet search for these programs was quite challenging as many classes are held in small community centres or instructors' homes. It is uncertain whether the abundance of classes in these provinces is indicative of an increased interest in signing to infants, or if classes in other provinces were less likely to be listed on websites and were therefore missed by Internet searching. While both French and English intervention programs qualified for inclusion in the searches, no Francophone programs were identified.

The **Program Catalogue** provides a compendium of programs and products including contact information, price, and claims. Included in the Program Catalogue are videos that are designed for infants to watch on their own, without parental training or interaction. Finally, the Program Catalogue is meant to be updated and also enlarged to include programs, classes, and products not advertised on the Internet.

The Review of Evidence —

Methods

Inclusion/Exclusion Criteria: The selection of studies for review included no restrictions with regard to research methods. Randomized controlled trials, prospective and retrospective cohort studies with and without control groups, case studies, and case series were all deemed eligible for inclusion in the **Review of Evidence**. Expert opinion was not included in this Review of Evidence.

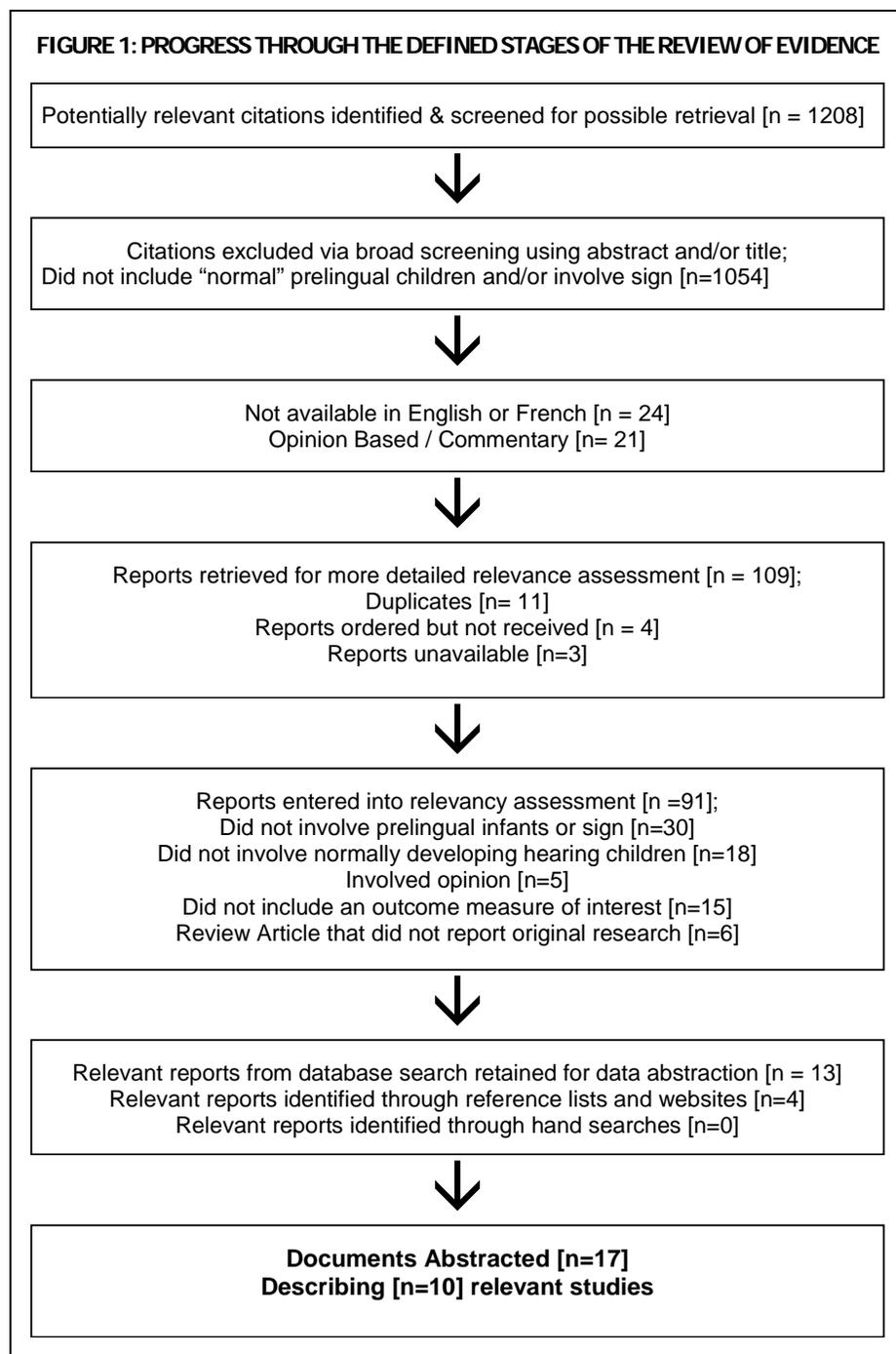
Infants and children from whom outcome data were collected had to have received gestural sign intervention as prelingual infants. The mode of instruction was not a restricting variable. Instruction could have been

provided by parents in an informal setting at home, or through a program instructor in a more structured classroom environment. Only studies of normally developing, hearing children were included in this **Review of Evidence**.

Outcome measures were defined as those related to expressive and receptive language, social and cognitive development, literacy, and parent-child interaction. Research must have included at least one of these measures of interest for inclusion in the review. The report must have been available in English or French.

Search Strategy: Databases, websites, reference lists, and review articles were examined for relevant articles and programs. Medline, Pre-medline, LLBA, ERIC, CINAHL, EBM, EMBASE, and PsychInfo databases were searched for documents between the years 1980 and May 2003. These years were chosen due to the abundance of relevant literature produced during this period and the lack of such documents prior to 1980. Keywords used included: sign language, gestural sign, and manual communication. Other keywords were used to eliminate documents that were irrelevant to the review by combining the keywords with the term "not." These exclusionary keywords included: developmental delay, autism, down syndrome, deafness, hearing disorder, and hearing loss. The search strategy was designed with the help of a librarian at the Health Sciences Library at the University of Ottawa.

Journals that were manually searched for literature included: *Child Development*, *The Journal of Nonverbal Behaviour*, *Sign Language Studies*, *Journal of Child Language*, *New Directions for Child Development*, *Language Learning*, *Language*



and Speech. These journals were searched for relevant articles published between 1980 and May 2003.

Reference lists of articles that met the inclusion criteria were searched for other relevant articles. The research websites of authors were searched for additional references and new studies (Petitto, 2003;

Acredolo & Goodwyn c/o Baby Signs Inc.©, 2003). Experts were contacted and requests were made for clarification of previously published studies as well as for new, unpublished studies. (L. Acredolo and S. Goodwyn, personal communication, June 23, 2003.)

The results of database searches were downloaded into Reference Manager® 10 (ISI ResearchSoft, 2001) software where inclusion/exclusion criteria were applied. Inclusion decisions were made by reading titles, abstracts, and when necessary, complete documents. Figure 1 depicts progression through the search and the resultant studies that were included in the [Review of Evidence](#).

Reliability: A randomly selected sample of ten percent of the articles identified through the various search strategies were examined for inclusion decision-making reliability by having two independent researchers (CJ and ADS) apply the inclusion criteria. An inter-rater reliability of 95% was found in assessing reliability of the inclusion criteria for this sample. While there was disagreement on only 6 of the 121 documents co-examined, when a Kappa statistic was applied, which took into account the occurrence of concordance that would be present due to chance, the resultant value was 0.68 ($p=.002$). The articles that were in disagreement were discussed until consensus regarding inclusion was reached.

Data Abstraction: Programs and studies that met the inclusion criteria were abstracted for information relevant to the [Review of Evidence](#). A summary of the 17 eligible research documents is presented in The Review of Evidence.

Results

What evidence of effectiveness supports the development and marketing of the programs and products listed in the [Program Catalogue](#)? Does signing to babies *work*? The review of evidentiary research reports found that only 17 out of 1208 identified articles met the inclusion criteria. The [Review of Evidence](#)

provides an overview of these studies, their methods, outcome measures, and results. Of the 17 reports, 8 were original research studies, 7 reported additional or secondary analyses of data collected from children who participated in the 8 original studies, and it was unclear in 2 of the reports whether the sample was original or secondary. Of the eight studies that reported original data and of the two for which the origin of the data was unclear, five studies were case studies, four were longitudinal prospective cohort studies, and one was a single-measure cross-sectional study.

There are significant problems in attempting to draw conclusions about the effectiveness of signing to infants from the case studies (Capirci, Montanari, & Volterra, 1998; Gregory, 1991; Holmes & Holmes, 1980; Holowka, Brosseau-Lapre, & Petitto, 2002; Petitto et al., 2001). For example, differences existed in the reporting and recording of children's language development. Pettito et al. (2001) measured language only as that expressed during experimental sessions, while Holmes and Holmes (1980) used parental reports of expressed language as their measure of effectiveness. Studies differed in their conclusions about the impact of gestural sign on language acquisition. In terms of results, one study suggests that language milestones occur earlier for children exposed to sign language (Holmes and Holmes, 1980), while other studies report language milestones similar to published norms for children receiving either monolingual or bilingual oral language input alone (Capirci et al., 1998; Holowka et al., 2002; Petitto et al., 2001). While case studies are valuable in the early development stages of intervention programs, their value is limited in

evaluating evidentiary claims of program effectiveness due to their lack of comparison control groups against which one can evaluate treatment outcomes.

A cross-sectional study (Daniels, 1993) reported Peabody Picture Vocabulary scores of a small sample of children ($N=14$) between the ages of 2 and 13 years. As a group the children were reported to have exceeded their expected vocabulary level (standard scores). However, averaging across such a broad age range, and with no way of showing that the children would have performed more poorly without exposure to sign language in infancy, renders these results problematic.

The 4 prospective cohort studies, and 11 documents that emanated from them, were each completed by one of two pairs of researchers, Acredolo and Goodwyn, or Bonvillian and Orlansky (Acredolo & Goodwyn, 2000; Bonvillian, Orlansky, & Novack, 1983; Bonvillian, Orlansky, Novack, & Folven, 1983; Folven, 1989; Folven, Bonvillian, & Orlansky, 1984; Goodwyn & Acredolo, 1993; Goodwyn & Acredolo, 1998; Goodwyn, Acredolo, & Brown, 2000; Moore, Acredolo, & Goodwyn, 2001; Orlansky & Bonvillian, 1984; Orlansky & Bonvillian, 1988). The studies of Bonvillian, Orlansky, and their colleagues (1983, 1984, 1988) were the forerunners and included samples of either 9, 11, or 13 infants of parents who signed to them. It is unclear, however, whether reports on the smaller groups of children are subsets of the larger group of 13 or if the reports are each based on different samples of children. If the former is the case, then any selection biases that may have gone undetected in the first study would be perpetuated in later reports. New samples, with comparable results

would, on the other hand, speak to the reliability of the evidence.

Outcome measures were derived from both parental reports and periodic videotaped samples of child behaviour. Results of these studies indicate an advantage in early vocal word production for children who had received sign language training in infancy over published norms. The early language milestones that were reported to be accelerated included age at first word, age at 10-word milestone, and age of first two-word combination. These milestones were found to occur, on average, two to three months earlier for children who had been given sign language training. The average age at first use of sign was reported by parents to occur at 8.6 months amongst children exposed to sign language as compared to 10-14 months of age, as generally reported for children exposed to oral language alone. In contrast, development of motor skills was not accelerated by early sign language training. The linguistic content of the children's first signs was comparable to that expected of children's first oral words. For example, comparisons of nominal, action, modifier and functional words in children's 50-word vocabularies showed no significant difference between children learning to speak and children learning to sign. Although the Bonvillian and Orlansky studies have the benefit of prospective, as compared to retrospective, data collection, they represent "convenience" samples and are limited by their lack of comparison with matched or random control groups. Therefore, one cannot easily conclude that advantages in language acquisition were due to the sign language exposure alone. Orlansky and Bonvillian (1984) report the children's data individually for many

language milestones. Thus it was observed that two children were precocious in the number of signs that they used at 18 months, and represent what could be thought of as outliers. The other 11 children's outcome measures fell within the norms of typical development of oral language. The outlier scores increased the reported mean of the group. The mean number of signs at 18 months with all 13 children was 48.2 compared to 35.5 without the two extreme scores. Due to the small sample size it is difficult to determine if the high means are representative of the normative values of language development in children exposed to sign language or if they are skewed for other reasons. In other words, the two children noted above may have been precocious generally and from the start as suggested by their abilities to learn and use signs in infancy. Moreover, milestones reported by Bonvillian and Orlansky and those reported by other investigators cannot be compared with confidence due to differences in research methods and definitions for the onset of first words. For example, Bonvillian and Orlansky used parental report of language development as their primary outcome measures, while Pettito et al. (2001; 2002) used the occurrence of language observed during their videotaped sessions. These different methodologies could result in substantially different outcomes. Finally, even if the language development advantage reported by Bonvillian and Orlansky exists, generalization to other populations should be questioned. That is, the children in the Bonvillian and Orlansky studies had deaf parents who were fluent, consistent signers. Children of hearing parents, who have no prior exposure to sign language may be less successful in

implementing the signing program, and their infants may show modest or no language benefits if there are in fact any.

In contrast, Acredolo and Goodwyn and their colleagues studied the effects of signing by hearing parents. They set out to compare the development of infants in one experimental group with that of infants in two control groups. The experimental group (parents of 32 infants) received gestural sign training when their infants were 10 months old. The first control group (parents of 32 infants) received training to encourage verbal language with their infants, and the second control group (parents of 39 infants) received no intervention training. Procedures for recruitment and assignment to groups was not reported. Data from the three groups were reported across a number of years in several documents (Acredolo & Goodwyn, 2000; Goodwyn & Acredolo, 1993; Goodwyn & Acredolo, 1998; Goodwyn, Acredolo, & Brown, 2000; Moore, Acredolo, & Goodwyn, 2001).

It was reported that children in the gesturally trained group acquired an average of 20.4 signs. This was compared to earlier descriptive research by Acredolo and Goodwyn (1988) in which children not exposed to sign acquired an average of five signs. The greater number of signs used by children in the sign group was claimed as evidence that their parents were effective teachers. Sign use amongst control groups in the study was not reported. The use of signs by the verbally trained and non-intervention control groups should have been compared to the earlier data, and more importantly to the experimental group in the study.

Comparisons in outcome measures between the control groups (verbally trained and non-

intervention) showed no significant differences. No other comparisons (e.g., between the verbally trained and the sign trained group) were described. All effects of sign training were evaluated against the non-intervention control group only, and not the verbal training control group. The children of parents who received sign training intervention showed higher receptive language scores on standardized measures of language development relative to the non-intervention group at 19, and 24 months. Differences were not significant at 15, 30, and 36 months. Children in the sign-trained group had expressive language scores that were significantly higher than the non-intervention group at 15 and 24 months but not at 19, 30, or 36 months. These results indicate a linguistic advantage only in certain and variable months of the second year, but not beyond the second year of life.

When the children were 8 years of age, cognitive development was assessed for the children whose parents received sign training and those whose parents received no intervention (Acredolo et al., 2000). The verbal learning control group was again excluded from comparison for unreported reasons. With a subset of children (experimental group: 19 of original 32, non-intervention control group: 24 of original 39), the researchers reported that cognitive development, as measured by the WISC-III Intelligence Test, was significantly more advanced in the children of sign-trained parents compared to the children of parents who had received no training. The children of parents in the signing intervention group had scores in the 70th to 75th percentile, while the children of parents in the non-intervention control group had intelligence scores in 52nd to 55th

percentile. This finding indicates that the children of the sign-trained group performed better than both those in the non-intervention control group and those in the general population. There is no way of determining whether the sign group children were cognitively advantaged from the start, or whether any form of parent training (sign or verbal) accounted for the difference in intelligence scores at 8 years of age. Moreover, because the effects on early language outcomes were variable and short-term, the developmental route from sign training and use of signs in infancy to increased intelligence at 8 years of age remains uncharted.

Due to the high attrition rates (over 40% for the gesturally trained group and 35% for the non-intervention control group), the researchers retrospectively compared the follow-up samples to the original cohort on measures of parental education, early child development measures, and the number of gestures used. They found no difference in these measures between the participants who returned to the study and those who did not return. The researchers did not explain why cognitive assessments were not reported for children of parents in the verbal-training control group. Therefore, there is no way to determine whether the cognitive advances reported were due to parents being trained in signing or were due to parental training in general.

One cannot rule out the possibility that the children in the sign-training group differed from the children in the control groups from the start on unaccounted-for factors relevant to language and cognitive development. The researchers reported no description of subject recruitment, and no attempts at random assignment. Attempts were

made to contact the researchers to determine their selection criteria and group assignment procedures, but no responses were received. Differences in parent or child factors that may have been present at group selection and assignment may have influenced the multiple longitudinal analyses and reports of the study.

Conclusions

A substantial number of programs and products are available to train Anglophone parents to communicate with their prelingual infants using gestural signing. Claims of benefits range from advancements in language development and literacy to increased intimacy between parent and infant and decreased infant frustration. The research evidence reviewed herein fails to support these claims due to insufficiency of scientific methods. There exist no randomized-controlled studies of the effectiveness of sign training. The two prospective quasi-experimental research programs lacked adequate comparison groups, and used procedures and outcome measures that varied so significantly that the studies could not be reasonably compared or summarized statistically. Although parents in the studies were trained to sign to their infants, evidence of whether, how often, and how effectively parents communicated with their infants using signs was not reported. Whether infants used signs in return was also insufficiently monitored and reported, and the magnitude of signing was not correlated with the supposed effects in a "dose-effect" manner. Collateral and confounding effects such as increased incidence and duration of oral communication, eye-to-eye contact, singing, laughing, caressing, and so forth, that could account for many of the claims,

independently of signing, were not ruled out.

The programs and products available for purchase do not encompass those used in research studies. For example, the effects of videotapes, in which the infant is meant to view alone the procedures for gestural signing, have not been studied whatsoever. Although one cannot be confident, based on available research evidence, that there are any language, cognitive, or social benefits from the implementation of gestural signing in early infancy, one cannot easily imagine that there are any significant harmful effects.

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The Program Catalogue

Program Title	Search Source	Location/ Language	Contact	Background of Contact	Program Focus	Intervention Methods	Price	Claims	Program Duration and Intensity	Age of children at program onset
International Programs										
Baby Signs Inc.	Internet	www.babysigns.com English	Linda Acredolo Susan Goodwyn	Developmental Psychology Sign language	Infants Toddlers Children	Books Classes Cue cards Stickers Videos	Board books: 7\$US Book for parents: 15\$US Video: \$20US	Higher IQ Improved language Increased bonding Reduced frustration	Parent Directed	No Restrictions
Baby Signing in the UK	Internet	www.nuwesgroup.com/links _home.asp English	NR	NR	Infants Toddlers Children	Chat Room Highlighted stories Information Media Sources	Free access	Higher IQ Increased vocabularies Reduced frustration	Parent Directed	No Restrictions
Hand Speak	Internet	www.handspeak.com/ English	Jolanta Lapiak	Profoundly deaf adult Sign language	Hearing/deaf infants, toddlers, and children	Online dictionary (various "Baby friendly" signs)	Online monthly subscription: 5\$US	Improved language Reduced frustration	Parent Directed	No Restrictions
Kindersigns	Internet	www.kindersigns.com/ English	Diane Ryan	Speech Language Pathology	Infants Toddlers Children	Guest speakers Online classes Online dictionary Newsletters	Online course & sign dictionary access: 20\$US	Higher IQ Increased vocabularies Reduced frustration	Parent Directed	No Restrictions
Sign With Me	Internet	www.baby-talk.co.nz English (based in NZ)	Karyn and Giles Warburton	Parents	Infants Toddlers Children	Books Classes Cue Cards Online Resources Puppets Stickers Videos	Board Books: 10\$US Online Access 17\$US Parent Book: 20\$US Video: 15\$US	Higher IQ Improved language Increased bonding Reduced frustration	Parent Directed	No Restrictions
Sign with your baby Training Video, Book, and quick reference guide (1999)	Internet	www.sign2me.com/ Canada US UK English	Joseph Garcia	Adult Education Sign language	Infants Toddlers Children	Books Classes Cue Cards Stickers Videos	Book: 15\$US Learning Kit (video, Book): 50\$US	Improved language Reduced frustration	Parent Directed	No Restrictions
Signing Baby	Internet	www.signingbaby.com/ English	NR	NR	Infants Toddlers Children	Books Information Resources	Free access	Higher IQ Increased vocabularies Reduced frustration	Parent Directed	No Restrictions

The Program Catalogue

Program Title	Search Source	Location/ Language	Contact	Background of Contact	Program Focus	Intervention Methods	Price	Claims	Program Duration and Intensity	Age of children at program onset
Canadian Programs										
Babble 'n beyond	Internet	www.geocities.com/babblen beyond/ London, ON English	Shannon Lafferty	Sign language	Infants	Classes Workshops	Unspecified	Improved language Increased bonding Reduced frustration	Classes (1hr for 6 wks) Workshop (2hr)	Infant
Baby Hand Talk	Internet	www.infantsignlanguage.co m/classes/pbainard	Petrina Bainard	Communications	Infants	Classes Workshops	Class: 95\$CAD Workshop: 65\$CAD	Improved language Increased bonding Reduced frustration	Classes (1hr for 6 wks) Workshop (3hr)	Infant
Baby Sign Instructor	Internet	wsmith@sprint.ca Toronto, ON English	Lisa M.Smith	NR	Infants	Classes Workshops	Unspecified	NR	NR	Infant
Dancing Hands	Internet	www.dancinghands.ca Lower Mainland, BC English	Paula Fisher	Communications Sign language	Infants	Classes Workshops	Class: 95\$CAD Workshop: 65\$CAD	Improved language Increased bonding Reduced frustration	Classes (1hr for 6 wks) Workshop (3hr)	Infant
Itty Bitty Baby Signs	Internet	ittybittybabysigns@canada.c om Fairview, AB Peace Country AB & BC English	Carren Bough	Parent	Infants	Workshops	Class: 20\$CAD (1.5hr)	Improved language Increased bonding Reduced frustration	Workshop (1.5hr)	Infant
Little Hands Sign	Internet	www.infantsignlanguage.co m/classes/lhoran	Lorianne Horan	Sign language	Infants Toddlers	Group classes Private classes Workshops	Unspecified	Improved language Increased bonding Reduced frustration	Classes (1.5hr for 6 wks) Workshop (2.5hr)	Infant Toddler
See Me Say	Internet	seemesay@shaw.ca Vancouver, BC English	Karen Hansen	Parent	Infants	Classes Workshops	Class: 95\$ CAD Workshop: 65\$CAD	Improved language Increased bonding Reduced frustration	Classes (1hr for 6 wks) Workshop (3hr)	Infant Child

The Program Catalogue

Program Title	Search Source	Location/ Language	Contact	Background of Contact	Program Focus	Intervention Methods	Price	Claims	Program Duration and Intensity	Age of children at program onset
Sign 4 Baby	Internet	wendi@sign4baby.com Niagara, ON English	Wendi Moore	Systems analysis	Infants Toddlers	Classes Workshops	Class: 95\$-150\$CAD Workshop: 65\$CAD	Improved language Increased bonding Reduced frustration	Classes (1hr for 2 or 6 wks) Workshop (3hr)	Infant Toddler
Sign with me	Internet	www.signwithme.ca, signwithme@sympatico.ca Toronto, ON English	Elyza Polsky	Hearing/Deaf Education	Infants Toddlers	Classes Workshops	Unspecified	Improved language Increased bonding Reduced frustration	Classes (1.5hr for 6 wks) Workshop (2.5hr)	Infant Toddler
Signing With Baby	Internet	Ottawa Deaf Centre, www.ottawadeafcentre.org/# Baby Ottawa, ON English	Louise Ford	NR	Infants	Baby sign classes	Unspecified	Improved early communication	NR	Infant
Signs 4 Tots	Internet	www.infantsignlanguage.co m/classes/vgushulak	Val Gushulak	Education Rehabilitation	Infants	Classes Workshops	Unspecified	Improved language Increased bonding Reduced frustration	NR	Infant
Sweet Signs	Internet	www.infantsignlanguage.co m/classes/bbrass	Brandi Brass	Sign language	Infants	Classes Workshops	Unspecified	Improved language Increased bonding Reduced frustration	Classes (1hr for 6 wks) Workshop (3hr)	Infant
Tiny Hands Speak	Internet	www.infantsignlanguage.co m/classes/nbarnes	Nicole Barnes	Parent	Infants	Classes Workshops	Class: 95\$CAD Workshop: 35\$CAD Workshop: 65\$CAD	Improved language Increased bonding Reduced frustration	Classes (1hr for 6 wks) Mini-workshops (1.5hr) Workshop (3hr)	Infant
Wee Hands	Internet	weehand@canada.com Toronto, ON English	Sara Bingham	Communication Disorders	Infants	Group classes Private classes Workshops	Class: 95\$CAD Private class: 235\$CAD Workshop: 65\$CAD	Improved language Increased bonding Reduced frustration	Classes (1hr for 6 wks) Private classes (6 classes) Workshop (3hr)	Infant

The Program Catalogue

Program Title	Search Source	Location/ Language	Contact	Background of Contact	Program Focus	Intervention Methods	Price	Claims	Program Duration and Intensity	Age of children at program onset
Wee Sign	Internet	www.members.shaw.ca/wee sign/ Red Deer, Ponoka, Lacombe, Stettler, Sylvan Lake, Edmonton, and Calgary, AB English	Terese Westergreen	Education Sign language	Infants Toddlers Young Children	Baby sign classes Courses Play groups Toddler sign classes Workshops	Course, book: 95\$CAD	Improved early communication Increased bonding Reduced frustration	6-wk course for: Parents Infants Toddlers Workshops (1hr) Playgroup (1/wk)	Infant - 4 yrs

The Program Catalogue

Program Title	Search Source	Location/ Language	Contact	Background of Contact	Program Focus	Intervention Methods	Price	Claims	Program Duration and Intensity	Age of children at program onset
Products: Videos and DVDs										
Baby BumbleBee, Bee Smart Baby Videos	Internet	www.bumblebee.com/s tore/asl.cfm English French Spanish German Japanese	NR	NR	Developmentally delayed: Infants Toddlers Children	DVD Flashcards Music Video	DVD: 25\$US (1 vol.) 69 \$US (3 Vol. Set) Video: 15\$US	Improved early communication Improved IQ Improved language Improved reading	195 min	Infants, toddlers and children with developmental delays
Baby See 'N Sign (2001)	Internet	www.amazon.com US Canada English	Kathryn Kronz Faber	Sign language	Infants Toddlers	Video	15\$US	Improved language Increased bonding Reduced frustration	NR	Infant Toddler
Say Sing and Sign Nursery Rhymes (1998)	Internet	www.amazon.com US Canada English	NR	NR	Infants Toddlers	Video	15\$US	NR	NR	Infant Toddler Child
Sign With Me (2000)	Internet	www.amazon.com US Canada English	NR	NR	Infants Toddlers	Video	13\$US	Improved language Increased bonding Reduced frustration	NR	Infant Toddler
Sign with your baby Training Video, Book, and quick reference guide (1999)	Internet	www.amazon.com US Canada English	Joseph Garcia	Adult Education Sign language	Infants Toddlers	Video	40\$US	Higher IQ Improved language Increased bonding Reduced frustration	60min	Infant Toddler
Signing Smart	Internet	www.rmlanguage.com/babys gnlanguage English	M. Anthony R. Lindert	Developmental Psychology	Infants Toddlers Children	Video	Handbook: 25\$US Video: 15\$US	Improved early communication Increased bonding Increased learning	NR	Infant Toddler Child
Signing Time (2002)	Internet	www.amazon.com US Canada English	Emilie de Azevedo Brown Jon Pierre Francia	NR	Infants Toddlers	Video	17\$US	Higher IQ Improved language Increased bonding Reduced frustration	NR	Infant Toddler Child

The Program Catalogue

Program Title	Search Source	Location/ Language	Contact	Background of Contact	Program Focus	Intervention Methods	Price	Claims	Program Duration and Intensity	Age of children at program onset
Signing Time: Vol Two (2002)	Internet	www.amazon.com US Canada English	Emilie de Azevedo Brown Jon Pierre Francia	NR	Infants Toddlers	Video	17\$US	Higher IQ Improved language Increased bonding Reduced frustration	NR	Infant Toddler Child
Signing Time: Vol Three (2002)	Internet	www.amazon.com US Canada English	Emilie de Azevedo Brown Jon Pierre Francia	NR	Infants Toddlers	Video	17\$US	Higher IQ Improved language Increased bonding Reduced frustration	NR	Infant Toddler Child
Talking Hands, A Sign Language Video for Children (2000)	Internet	www.amazon.com US Canada English	NR	NR	Infants Toddlers	Video	17\$US	Improved language Increased bonding Reduced frustration	40 min	Infant Toddler
We Sign Babies and Toddlers (2002)	Internet	www.amazon.com US Canada English	NR	NR	Infants Toddlers	Video	30\$US	NR	NR	Infant Toddler

The Program Catalogue

Program Title	Search Source	Location/ Language	Contact	Background of Contact	Program Focus	Intervention Methods	Price	Claims	Program Duration and Intensity	Age of children at program onset
Products: Books										
An Alphabet of Animal Signs (Early Sign Language)	Internet	www.amazon.com English ISBN#: 0931993652	S. Collins	NR	Infants Toddlers Children Parents	Board book	7\$US	NR	28pgs	Infant Toddler Child
Animal Signs: A first book of sign language	Internet	www.amazon.com English ISBN#: 1563680491	D. Slier	NR	Infants Toddlers Children	Hard cover book	7\$US	NR	16pgs	Infant Toddler Child
Baby Signs for Animals	Internet	www.amazon.com English ISBN#: 0060090758	L. Acredolo	Developmental Psychology Sign language	Infants Toddlers	Board book	7\$US	Higher IQ Improved language Increased bonding Reduced frustration	NR	Infant Toddler
Baby Signs for Bedtime	Internet	www.amazon.com English ISBN#: 0060090766	L. Acredolo	Developmental Psychology Sign language	Infants Toddlers	Board book	7\$US	Higher IQ Improved language Increased bonding Reduced frustration	NR	Infant Toddler
Baby Signs for Mealtime	Internet	www.amazon.com English ISBN#: 0060090731	L. Acredolo	Developmental Psychology Sign language	Infants Toddlers	Board book	7\$US	Higher IQ Improved language Increased bonding Reduced frustration	NR	Infant Toddler
Baby Signs Revised Edition: How to Talk with your Baby Before your baby can Talk	Internet	www.amazon.com English ISBN#: 0071387765	L. Acredolo S. Goodwyn D. Abrams R. Hansen	Developmental Psychology Sign language	Parents	Paperback Book	10.5\$US	Higher IQ Improved language Increased bonding Reduced frustration	NR	Infant Toddler
Baby's First Signs	Internet	www.amazon.com English ISBN#: 1563681145	K. Votry C. Waller	NR	Infants Toddlers Children Parents	Board book	7\$US	Improved early communication	NR	Infant Toddler Child

The Program Catalogue

Program Title	Search Source	Location/ Language	Contact	Background of Contact	Program Focus	Intervention Methods	Price	Claims	Program Duration and Intensity	Age of children at program onset
Baby's First Words, A Sign and Say Book	Internet	www.amazon.com English ASIN#: 0967082102	M. Layton B. Anderson D. Nester S. Goodwyn	NR	Infants Toddlers Children	Hard cover book	48\$US	Improved early communication	32pgs	Infant Toddler Child
First Signs (Early Sign Language)	Internet	www.amazon.com English ISBN#: 1930820119	S. Collins	NR	Infants Toddlers Children Parents	Board book	7\$US	NR	28pgs	Infant Toddler Child
Food Signs (Early Sign Language)	Internet	www.amazon.com English ISBN#: 1930820097	S. Collins	NR	Infants Toddlers Children Parents	Board book	7\$US	NR	28pgs	Infant Toddler Child
Happy Birthday: A Beginner's Book of Signs	Internet	www.amazon.com English ISBN#: 1887734058	A. Bednarczyk	NR	Infants Toddlers Children	Hard cover book	5\$US	NR	16pgs	Infant Toddler Child
"I want to be a farmer" in Signed English (The Signed English Series)	Internet	www.amazon.com English ISBN#: 0913580147	H. Bornstein R.R. Miller L.B. Hamilton	NR	Infants Toddlers Children	Paperback Book	12\$US	NR	48pgs	Infant Toddler Child
My Animal Book/Signed English (The Signed English Series)	Internet	www.amazon.com English ISBN#: 0930323386	J.L.Fennell K.L. Saulnier H. Bornstein L.B. Hamilton	NR	Infants Toddlers Children	Paperback Book	7\$US	NR	13pgs	Infant Toddler Child
More Baby's First Signs	Internet	www.amazon.com English ISBN#: 1563681153	K. Votry C. Waller	NR	Infants Toddlers Children Parents	Board book	7\$US	Improved early communication	NR	Infant Toddler Child

The Program Catalogue

Program Title	Search Source	Location/ Language	Contact	Background of Contact	Program Focus	Intervention Methods	Price	Claims	Program Duration and Intensity	Age of children at program onset
My First Baby Signs	Internet	www.amazon.com English ISBN#: 006009074X	L. Acredolo	Developmental Psychology Sign language	Infants Toddlers	Board book	7\$US	Higher IQ Improved language Increased bonding Reduced frustration	NR	Infant Toddler
My First Book of Sign Language	Internet	www.amazon.com English ISBN#: 0439635829	P.J. Baker P.B. Gillen	NR	Infants Toddlers Children	Hard cover book	14\$US	NR	80pgs	Infant Toddler Child
My First Book of Sign Language	Internet	www.amazon.com English ISBN#: 081674033X	J. Holub	NR	Infants Toddlers Children Parents	Paperback Book	3.5\$US	NR	NR	Infant Toddler Child
Opposites: A Beginner's Book of Signs	Internet	www.amazon.com English ISBN#: 1887734066	A. Bednarczyk	NR	Infants Toddlers Children	Hard cover book	5\$US	NR	16pgs	Infant Toddler Child
Parenting Magazine's: Sign Language For Babies	Internet	www.amazon.com English ISBN#: 1401900410	Parenting Magazine	NR	Infants Toddlers Children	Hard cover book	10\$US	Improved early communication	NR	Parent
Signing Smart; Beginner, Intermediate, and curriculum Booklets	Internet	www.rmllearning.com/babysignlanguage	M. Anthony R. Lindert	Developmental Psychology	Infants Toddlers	Soft cover book	15\$US	Improved early communication Increased bonding Increased learning	NR	Infant Toddler Child
Signs For Me: Basic Sign Vocabulary for Children Parents and Teachers	Internet	www.amazon.com English ISBN#: 0915035278	B. Bahan J. Dannis	NR	Children Parents	Soft cover book	10.5\$US	NR	112pgs	Infant Toddler Child

The Program Catalogue

Program Title	Search Source	Location/ Language	Contact	Background of Contact	Program Focus	Intervention Methods	Price	Claims	Program Duration and Intensity	Age of children at program onset
Signs for Pets and Animals (Early Sign Language)	Internet	www.amazon.com English ISBN#: 1930820100	S. Collins	NR	Infants Toddlers Children Parents	Board book	7\$US	NR	28pgs	Infant Toddler Child
Word Signs: A first book of sign Language	Internet	www.amazon.com English ISBN#: 1563680483	D. Slier	NR	Infants Toddlers Children	Hard cover book	7\$US	NR	16pgs	Infant Toddler Child

Review of Evidence

Authors	Source	Study Design	Age at Onset	Description of Intervention	Age at Completion	SES	Outcome Measures	Statistical Analysis	Reported Results
Holmes, Holmes (1980)	Journal	Case Study Group Assignment: Purposeful Sample Size: N=1	0;5	Parents who are deaf educators use signed English at home with their hearing infant	1;5	NR	Parental language reports Number of words and signs Age at 2-word combinations Morphological vocabulary analysis	Descriptive	Accelerated language acquisition compared to norms
Bonvillian, Orlansky, Novack (1983)	Journal	Prospective Cohort (2 children retrospectively from parental diaries) Group Assignment: Convenience Sample Size: N=11	0;4 - 3;0	Deaf parents of 10 hearing children and 1 deaf child use ASL as their primary language	1;8 - 4;4	NR	Parental language reports Age at 1st word Age at 50 sign vocabulary Number of signs and words Motor milestones	Descriptive t-tests	Normal motor development Sign language development exceeds oral (M=1st sign=8.5mos) (M=50signs=18 mos)
Bonvillian, Orlansky, Novack, Folven (1983)	Book Chapter	Prospective Cohort Group Assignment: Convenience Sample Size: N=13	NR	Deaf parents or an ASL interpreter use ASL at home as the primary language with hearing infant	1;6	NR	Parental language reports Age at 1st word Age at 10- word vocabulary Uzgiris-Hunt	Descriptive	Mental representations are not correlated with 2 sign combinations
Orlansky, Bonvillian (1984)	Journal	Prospective Cohort Group Assignment: Convenience Sample Size: N=13	0;4-1;1	Deaf parents or an ASL interpreter use ASL at home as their primary language with hearing infant	1;6	NR	Parental language reports Age at 1st word Age at 10-word vocabulary Sign categories (Iconic, Arbitrary, Metonymic)	Descriptive	Increased language development compared with norms Metonymic and arbitrary signs were equally distributed
Folven, Bonvillian, Orlansky (1984/85)	Journal	Prospective Cohort Group Assignment: Convenience Sample Size: N=13	0;9	Deaf parent signs with hearing infant	2;6	NR	Parental language reports Number of signs and words	Descriptive Correlations	Early gesture use is correlated with language and sign development
Folven (1988)	Thesis	Prospective Cohort Group Assignment: Convenience Sample Size: N=9	0;7	Deaf parent signs with hearing infant	1;2	Middle Class Caucasian	Parental reports of children's first signs Vocabulary rate	Descriptive	Increased language acquisition compared to norms

Review of Evidence

Authors	Source	Study Design	Age at Onset	Description of Intervention	Age at Completion	SES	Outcome Measures	Statistical Analysis	Reported Results
Orlansky, Bonvillian (1988)	Book Chapter	Prospective Cohort Group Assignment: Convenience Sample Size: N=13 No comparison group	0;4- 1;1	Deaf parents or an ASL interpreter use ASL at home as the primary language with hearing infant	1;6	NR	Age at 1st sign Nature of 1st signs Age at 2-word combinations Age at 50 word vocabulary Uzgiris-Hunt Nicolich symbolic maturity scale	Descriptive	Accelerated language acquisition
Daniels (1993)	Journal	Cross-Sectional Group Assignment: Random Sample Size: N=14	2;10 - 13;6	Deaf parents or an ASL interpreter use ASL at home as the primary language with hearing infant	Age at onset	Income below national average	Peabody Picture Vocabulary Test	Descriptive t-test	Standard scores higher than norm
Goodwyn, Acredolo (1993)	Journal	Prospective Cohort Group Assignment: NR Sample Size: N=22 No comparison group	0;8-0;11	Parents taught by experimenters to use target signs and toys to encourage infant signing	Age of first word	Middle Class 90% Caucasian	Mean age of 1st and 5th sign and word	Descriptive Nonparametric	Acquired signs earlier than words
Gregory (1994)	Conference	Case Study Group Assignment: Purposeful Sample Size: N=1	0;11	Deaf parent and hearing parent signs with hearing infant	1;6	NR	Age at 1st words Age at 2-word combinations MLU Morphological vocabulary analysis	Descriptive	Rapid learning at 50-100 word/sign stage
Caprici, Montanari, Volterra (1998)	Journal	Case Study Group Assignment: Convenience Sample Sizes: N=1	0;10	Deaf parent signs with hearing infant	2;6	NR	Age at 1st word Age at 2-word combinations 50-word vocabulary (signs/words)	Descriptive	No difference compared to norms
Goodwyn, Acredolo (1998)	Journal	Prospective Cohort Group Assignment: NR Experimental: N=32 Non-Intervention: N=39 Treatment Control: N=32	0;11	Parents taught by experimenters to use target signs and toys to encourage infant signing	3;0	Middle Class 90% Caucasian	Age at 1st word Age at target signs/words	Descriptive ANOVA	Sign group reported: An increase in acquisition of signs An increase in vocabulary

Review of Evidence

Authors	Source	Study Design	Age at Onset	Description of Intervention	Age at Completion	SES	Outcome Measures	Statistical Analysis	Reported Results
Acredolo, Goodwyn (2000)	Conference	Prospective Cohort, Prospective Control Group Assignment: NR Sample Sizes: Experimental: N=19 Non-Intervention: N=24	0;10	Parents taught by experimenters to use sign at home with hearing infant	6;10	NR	WISC-III Bayley MDI	ANOVA	Sign group IQ higher than norm
Goodwyn, Acredolo, Brown (2000)	Journal	Prospective Cohort Group Assignment: NR Experimental: N=32 Non-Intervention: N=39 Treatment Control: N=32	0;11	Parent taught by experimenters to use target signs and toys to encourage infant signing	3;0	Middle Class 90% Caucasian	Vocal rates MacArthur CDI SICD Gardiner Vocabulary Test MLU Phonemic discrimination	Descriptive ANOVA MANOVA	Some improvements in language measures for experimental groups
Moore, Acredolo, Goodwyn (2001)	Conference	Prospective Cohort Group Assignment: NR Experimental: N=32 Non-Intervention: N=39 Training Control: N=32	0;11	Parents taught by the experimenters to use target signs and toys to encourage infant signing	2;0	NR	Joint attention Gardiner expressive vocabulary test	Regression	Signing and joint attention both predict expressive language
Pettito et al (2001)	Journal	Case Study Group Assignment: Convenience Sample Sizes: French/English group: N=3 Sign/French group: N=3	0;10 - 4;6	Deaf parent signs with hearing child	1;10 - 5;6	NR	Age at 1st word Age at 2-word combinations Age at 50-word vocabulary MacArthur CDI	Descriptive	Timing of milestones similar between the paired children Normal vocabulary growth No sign of delay between groups
Holowka, Brosseau-Lapre, Pettito (2002)	Journal	Case Studies Group Assignment: Convenience Sample Sizes: French/English group: N=3 Sign/French group: N=3	0;7-2;2	Deaf parent signs with hearing child	1;7-3;2	NR	Age at 1st word Age at 2-word combinations Age at 50-word vocabulary MacArthur CDI Morphological vocabulary analysis	Descriptive	No difference between the norms for bilingual children (signed or spoken) and monolingual children for age of 1st, 10th or 50th word No difference in semantic meaning