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The effects of baby sign training on child development

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Although Baby Sign is gaining in popularity, there is a scarcity of research supporting its use. The research that has been conducted is conflicting. In the current study, nine families with children ranging in age from six months to two years and five months participated in a baby sign workshop. A pre–post-test design was used to assess the effects the baby sign training had on the communicative, cognitive, social, adaptive behaviour, and physical development. A Wilcoxon signed-rank test was used to analyse the data. The data suggest that the baby sign training had a significant, positive impact on the overall development of the children. The use of baby sign was supported. Key aspects of baby sign training will be discussed.

Keywords: baby sign; gesture; child development

Background and significance

Introduction

Baby signing is the use of sign language with normally developing hearing infants for the purpose of facilitating communication. Doherty-Sneddon (2008) defines baby signing as an 'augmentative communication approach that teaches babies keyword signing that they can use to communicate before they can talk' (p. 300). Although Doherty-Sneddon (2008) notes that baby signing is not entirely new, it has become increasingly popular among parents. Baby signing has also started to gain the attention of researchers who seek to better understand its impact on child development. Because the empirical testing of baby sign is still in its infancy, the current study was conducted to add to the research base addressing the impact of parental training of baby sign on the cognitive, communicative, social, adaptive behaviour, and physical development of their children.

Baby sign research

Interested parents can easily access information on the use of baby signs with infants through popular media such as television and the internet. Numerous websites and smartphone and tablet applications promote the use of baby signs by citing the claimed benefits of its use with infants and toddlers and by offering instructional videos, products for purchase, and encouraging anecdotal evidence from parents who

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have noted increased communication development in their children as well as other improvements such as decreased infant frustration (Nelson, White, & Grewe, 2012).

Pizer, Walters, and Meier (2007) note that baby sign matches parent ideologies that value early communication with infants to meet the parents' perceived needs. It is understandable why baby signing is appealing to parents as claimed benefits include earlier communication of wants, thoughts, and needs, advanced speech and language development, increased IQ and cognitive skills, reduced frustration and emotional outbursts, a strengthened parent–child bond, improved literacy, and increased self-esteem and feeling of satisfaction and accomplishment (Doherty-Sneddon, 2008; Nelson et al., 2012).

Empirical research on baby sign is scarce, yet may provide positive data supporting its use to enhance communication and cognitive ability. Holmes and Holmes (1980) found that the use of sign language in combination with speaking resulted in accelerated expressive language in both modalities (sign and oral) in an infant who was exposed to spoken English and American Sign Language (ASL) from birth. The infant produced her first sign at 6.2 months and continued to reach developmental milestones at an accelerated rate. In addition, she had a larger vocabulary when compared to typically developing infant normative data at 17 months. Research conducted by Daniels (1994) revealed that baby signing had a positive impact on the vocabulary development of typically developing pre-school children. Similarly, Goodwyn, Acredolo, and Brown (2000) found that 11-month-old hearing infants exposed to symbolic gestures (SGs) outperformed infants who were not exposed to SGs on standard language tests at 11, 15, 19, and 24 months. However, there was no longer a significant difference between the groups at 30 and 36 months. A follow-up study by Acredolo and Goodwyn (2000) found that children who were exposed to baby sign as infants scored significantly higher on IQ tests than a control group.

Regarding motor development, there is very little research available concerning the direct impact of baby sign. Bonvillian, Orlansky, and Novack (1983) found that children who had been exposed to baby sign met motoric developmental milestones at an accelerated rate. However, Johnston, Durieux-Smith, and Bloom (2003) found no advantage of exposure to baby sign on motor development in their systematic review.

As the popularity of baby sign increases with parents, there is much more research to be conducted to assess the effects of using baby sign with normally hearing infants (Doherty-Sneddon, 2008; Johnston, Durieux-Smith, & Bloom, 2005; Nelson et al., 2012). Nelson et al. (2012) revealed that over 90% of the evidence cited on 33 baby signing websites consisted of opinion articles and product descriptions. Only eight studies were 'empirical research studies relevant to the benefits of teaching sign language to young children with normal hearing' (Nelson et al., 2012, p. 490).

Nelson et al. (2012) concluded that there is not enough high-quality evidence to draw research-based conclusions about whether baby sign actually facilitates child development (Nelson et al., 2012). Johnston et al. (2005) reached similar conclusions. In a review of 17 studies looking at the impact of baby signing on the development of typically developing hearing children, the authors highlighted several methodological weaknesses. None of the studies were randomised control trials and most did not have proper control groups. In addition, most studies were characterised by small sample sizes and poor follow-up.

A recent study has been conducted in an attempt to address the weaknesses of previous ones. The study by Kirk, Howlett, Pine, and Fletcher (2013) is the first longitudinal randomised controlled trial to assess the impact of baby signing on child language

development and mother–infant interactions. In this study, parents and their infants were assigned to one of four groups, an SG training group, a British Sign Language (BSL) group, a verbal training (VT) group, and a no intervention control group. The researchers asserted that the SG group was included because symbolic gesturing is the kind of signing many baby sign programmes promote.

Mothers in the SG, BSL, and VT groups were instructed to gesture, sign, or label a specific set of target words, respectively. During an initial home visit when the infants were eight months old, the researchers introduced 10 target gestures/signs/labels to parents and provided them with a training packet. The training packet included still pictures of the signs/gestures and suggestions on how to implement them with their children. Another home visit occurred when the infants were 12 months old and 10 additional gestures/signs/labels were introduced.

The children's receptive and expressive language was assessed prior to the introduction of gestures/signs (8 months) and after the introduction of gestures/signs (12, 16, and 20 months). The researchers found no significant differences in assessment scores between the gesture and control groups at any point during the study. Therefore, the researchers concluded that no support was found for previous claims that baby signing facilitates language development.

Kirk et al. (2013) also conducted the general linear models to assess the interaction of condition, ability (high vs. low) and gender. They found a significant difference in the expressive communication scores between low- and high-ability infants in their BSL condition. In other words, baby sign training significantly increased the expressive communication of boys with low language ability. The researchers concluded that these findings suggest baby signing may benefit children with weaker language abilities and that baby signing may enrich an impoverished linguistic environment by enhancing maternal responsiveness to non-verbal cues. Furthermore, they conclude that baby signing may therefore have clinical potential for children who are at risk of language delay or disorder.

Kirk et al. (2013) also examined the effects of baby signing on mother–infant interactions in their study through analysis of video recordings at 10, 12, 16, and 20 months of age. Subtle, yet significant changes in mother–infant interactions were observed. Mothers in the SG and BSL groups were more responsive to their infants' non-verbal cues and encouraged more independent action by their infants.

While this study yields valuable information, it was not without limitations which will be discussed. Regarding the training, few signs were taught and the sign training provided to the mothers was minimal. There is an issue of treatment integrity and there are questions regarding the study design and methodology. Furthermore, the researchers commented that the language abilities of the infants may have been beyond the threshold for improvement.

The training provided to the parents was minimal. First, only 20 signs were provided to the mothers throughout the course of the study. Mothers had no input regarding the signs that would be most useful for their families. Had more signs been taught, mothers potentially could have chosen signs that were most relevant and would be used often. To teach the mothers the signs, a researcher demonstrated the signs and ensured the mothers could produce them. A handout was left with the mothers that included a still image of the signs and suggestion for implementation. However, implementation was never discussed or practised with the mothers and their children. Even if the mothers knew the signs, implementing them with their children is a skill that may need to be taught and practised.

Regarding treatment integrity, the mothers only reported using gestures/signs with their children a few times a week. Using a sign a few times a week would not seem to make the treatment salient enough for the children to have any effect. The problem may have been one of recruitment. Kirk et al. (2013) purposefully withheld the scope of the study during recruitment. Families who participated were not interested in using baby sign with their children. Had mothers who were interested in using sign with their children been included in the study they may have used the signs more often than a few times a week. Also, no further information was reported regarding how mothers implemented signs with their children.

Although the study design is commendable, there is a question regarding the treatment groups created. The researchers included a BSL group and a SG group. Again, the purpose was to include a group (SG) that represented the kind of signing that many baby sign programmes promote. First, the authors gave no information regarding the source of that idea. Second, it can be argued that any SG that is taught to a child is essentially a sign. The difference between formal sign languages and SGs that is often argued relates to iconicity, where gestures are more iconic and signs are less so. However, it is still the responsibility of the infant to match the gesture/sign to its referent as they do with completely arbitrary spoken words. It may be that to the child, there is no difference in learning what we label a sign or an SG.

Finally, the authors stated that they may not have found significant results because the language abilities of the children in their study were beyond the threshold for improvement. As the children in the Kirk et al. (2013) study were from middle- or upper-class backgrounds who tend to have better language abilities than those from low socio-economic status (SES), there may have not been much opportunity for improvement especially given the weak treatment provided. However, it is important to reiterate that when the researchers ran additional analysis, the boys with the lowest scores did improve significantly in their expressive language abilities.

Purpose of study

The purpose of our study was to examine the impact that baby sign training for parents had on overall child development while improving on the limitations of the Kirk et al. (2013) study. The research question asked is: What are the effects of parental baby sign training on the overall development of typically developing hearing infants? The parameters investigated were the communicative, cognitive, social, and physical development of the children.

In providing a rationale for the use of baby sign with infants Doherty-Sneddon (2008) commented, 'communication is at the heart of child development, be it cognitive, social, emotional, or behavioral' (p. 300). She suggests that the next step is to gain a better scientific understanding of the effects of baby sign on both parents and infants, particularly the effect that baby signing has on communication skills, interactional style, and social/emotional environment.

The current study was carried out in a predominantly Latino community where Spanish and English are spoken regularly. In addition, the community is predominantly made up of families of low SES. This is important to note because differences in social class have been found to impact cognitive and language development (Bradley & Corwyn, 2002). Hoff (2003) suggests that infants from low SES families are spoken to less and are therefore less likely to be exposed to richer and more abundant vocabulary and longer, more diverse, and complex grammatical structures. Furthermore, these

Table 1. Gender and age of child participants.

Participant	Gender	Age (years:months) at pre- and post-assessment
C1	Female	0:6–0:9
C2	Male	0:7–0:11
C3	Male	0:10–1:14
C4	Female	0:10–1:0
C5	Male	1:3–1:5
C6	Male	1:3–1:6
C7	Female	1:6–1:9
C8	Female	1:7–1:10
C9	Female	2:0–2:3
C10	Female	2:0–2:3
C11	Male	2:5–2:7

children may be at risk for developmental and educational problems (Bradley & Corwyn, 2002; Topping, Dekhinet, & Zeedyk, 2011).

Methods

Participants

The participants were 11 infants (6 females and 5 males) whose age range was 6–29 months (Table 1). Participants were recruited using university mass mailings and flyers. In total, nine families enrolled in the study (some families attended with more than one child). The language environment of the participants was not homogeneous. The families were either monolingual English speakers or bilingual Spanish/English speakers. The level of language dominance for the bilinguals was varied.

Nearly all children were typically developing as reported by their parents and verified through pre-testing assessment, and had not been exposed to any form of sign language. The exceptions were children 9 and 10. These participants were twins who were previously diagnosed with an expressive language delay. They had received speech–language therapy which included the introduction of approximately five signs. At pre-test, however, these children scored within average limits for their age.

Experimental design

A one-group, pre-test–post-test case study design was conducted in order to evaluate the effects of baby sign on the development of the infants. Each child was twice administered the Developmental Assessment of Young Children (DAYC) language battery (Voress & Maddox, 1998). Pre-testing was administered one week prior to the Baby Sign workshop. Post-testing occurred approximately six weeks after the end of Baby Sign workshop.

Dependent measures

The dependent variable is the raw scores collected from each participant during the pre- and post-testing administration of the DAYC. The DAYC is a standardised test which evaluates children from 0 to 48 months in five domains of child development. The five domains that measure different but interrelated developmental abilities are in the areas

of communication, cognition, social, adaptive behaviour, and physical development. Measurements were taken in all areas of child development and were recorded.

The DAYC protocol administered to assess the child's area of development has a high degree of reliability. The three types of test errors observed were content, time, and scorer. The data retrieved from these observations suggest that the DAYC possesses little test error and that users can have confidence in its results. The DAYC was normed on a sample of 1269 children residing in 27 states.

Independent variable

The independent variable for the current study was the training provided to the caregivers in a five-week-long Baby Sign workshop. Parents learned nearly 200 signs throughout the workshop and, more importantly, learned ways to implement baby signs at home with their children. Several materials were used during the training of the course in order to facilitate with the instruction of Baby Signs.

(1) Signs for each week were displayed in a PowerPoint presentation which contained a still image and label for each sign.
(2) At the beginning of the workshop, the parents were given binders and each week they were given handouts with a still image of each sign, the label, a brief description of how the sign is produced, and ways the sign could be implemented at home.
(3) Upon the conclusion of the workshop, parents were given a DVD containing videos of a certified sign language interpreter demonstrating the production of all the signs presented in the workshop.
(4) Food, toys, and books were used during the workshop to demonstrate ways the parents could implement baby sign at home with their children during various daily routines.

Setting

The Baby Sign workshop took place at a university speech–language pathology clinic. In the first meeting, the seating arrangement for the parents was initially in rows directed towards the researchers as in a typical classroom setting. In subsequent meetings, the room was modified to a circular arrangement of chairs with a rug in the centre to allow for more parent interaction and parent/child interaction. Additionally, the researchers found it easier to assist the parents in proper sign production by manipulating their hands in this arrangement. Administration of the DAYC at pre- and post-test occurred at either the child's home or in the university speech–language pathology clinic.

Procedure

One week prior to the beginning of the Baby Sign workshop, the infants were administered the DAYC. Scoring was based on observation, requested actions directed to the child, and by caregiver report.

The Baby Sign workshop was five weeks in length. Families met once a week for two hours. The workshop was divided into two parts: the study portion and the

implementation portion. Upon arrival to the university clinic, the parents dropped off their children to be cared for by research assistants while they met with the primary researchers in a separate room to study the signs of the week for the first 30–45 minutes of each meeting. Each class was taught mainly by a researcher who was a certified ASL interpreter who introduced and demonstrated each sign. Other researchers provided assistance to the parents regarding proper sign production and implementation.

During the study portion of the workshop, the parents were taught the signs with the help of the PowerPoint presentation. The researchers demonstrated each sign for the parents and checked for proper production. Parents' receptive and expressive knowledge of the signs was assessed to ensure that they knew that sign. Children then joined the parents for the implementation portion of the class while the researchers assisted the parents in remembering the signs, and gave them feedback regarding the implementation of the signs.

On the first day of the workshop, the parents were given information regarding the definition of baby sign and claimed benefits. Parents were then given an overview of the workshop. The researchers also commented on their own personal experiences with sign language and its use with infants. Lastly, parents were asked to share any comments or questions.

Throughout the course, parents were asked to share comments and concerns which were addressed at length by the researchers. Additionally, parents were encouraged to integrate the signs into their daily routines and to select signs that they felt would be useful and meaningful to their families to promote natural use within daily parent–child interaction. Each week the signs of the previous class were reviewed and assessed by the researchers.

Every week of the workshop had a distinct theme. The themes were as follows: week 1 – family members and greetings, week 2 – food items and related verbs, week 3 – toys and animals, week 4 – emotions and routines, and week 5 – miscellaneous. In total, nearly 200 ASL signs were taught to the families. Signs were chosen based on typical first words/signs used in both verbal language and ASL (Anderson & Reilly, 2002). A miscellaneous list of 74 signs was also compiled during the first four weeks of the baby sign instruction which included all the signs that parents requested to know or were interested in learning. This miscellaneous list was the lesson for the fifth week of the signing course.

Post-testing was administered approximately six weeks after the conclusion of the Baby Sign workshop either in the university clinic or at the infant's homes. Data collected were analysed and compared (pre- and post-workshop).

Statistical analysis

A non-parametric analysis was chosen, the Wilcoxon signed-rank test, to analyse the difference in pre-test and post-test raw scores on each of the DAYC subtests. This test was chosen due to the small sample size and the violation of the assumption of normality in the data.

Inter-rater reliability

The administration of the DAYC was video recorded and 30% of the assessments were re-scored from the videos. The second rater was a master's student in Speech-Language

Pathology who was trained to administer the DAYC. The inter-rater reliability was 95%. Analysis of the video recorded data presented some difficulties. Issues such as camera placement and reduced infant visibility account for the percentage derived.

Results

Descriptive statistics for the infants' pre-test and post-test raw scores on the five DAYC subtests are presented in Table 2. It should be noted that a sixth subtest was included to examine the effects of baby signing on fine motor development. This subtest was created by selecting questions on the physical development subtest that specifically pertained to fine motor skills as signing requires only fine motor movement.

The averages for the pre-test raw scores across the six subtests are as follows: physical development ($M = 19.82$, SD = 7.99), fine motor development ($M = 14.36$, SD = 3.44), social–emotional development ($M = 24.27$, SD = 8.82), communication development ($M = 28.82$, SD = 11.72), cognitive development ($M = 21.64$, SD = 8.46), and adaptive behaviour development ($M = 19.82$, SD = 7.99).

The averages for the post-test raw scores across the six subtests are as follows: physical development ($M = 24.27$, SD = 8.56), fine motor development ($M = 16.55$, SD = 3.67), social–emotional development ($M = 30.00$, SD = 8.71), communication development ($M = 34.91$, SD = 12.36), cognitive development ($M = 27.27$, SD = 7.84), and adaptive behaviour development ($M = 24.27$, SD = 8.56). The averages and the 25th, 50th, and 75th percentiles are reported in Table 2.

Figures 1–6 illustrate the individual pre-test and post-test performance of each child on the communicative, cognitive, social, and physical development, fine motor development, communication development, and adaptive behaviour development subtests, respectively. The *x*-axis represents the participants and the *y*-axis represents the raw scores on the DAYC. Figures 1–6 show consistently higher scores at post-test compared to pre-test for each child on each subtest.

Table 2. Descriptive statistics and percentiles for typically developing hearing infants on pre-test and post-test DAYC subtests.

						Percentiles		
DAYC subtest	*N*	Mean	Standard deviation	Min.	Max.	25th	50th (Median)	75th
Pre-test: physical	11	19.81	7.99	5	31	15	18	27
Pre-test: fine motor	11	14.36	3.44	8	19	13	14	17
Pre-test: social	11	24.27	8.82	10	36	18	28	30
Pre-test: communication	11	28.82	11.72	12	48	17	32	37
Pre-test: cognitive	11	21.64	8.46	10	36	10	23	26
Pre-test: adaptive	11	19.82	7.99	5	31	15	18	27
Post-test: physical	11	24.27	8.56	9	37	18	25	29
Post-test: fine motor	11	16.55	3.67	10	21	13	16	20
Post-test: social	11	30.00	8.71	15	38	21	33	37
Post-test: communication	11	34.91	12.36	14	51	26	36	45
Post-test: cognitive	11	27.27	7.83	13	38	24	28	33
Post-test: adaptive	11	24.27	8.56	9	37	18	25	29

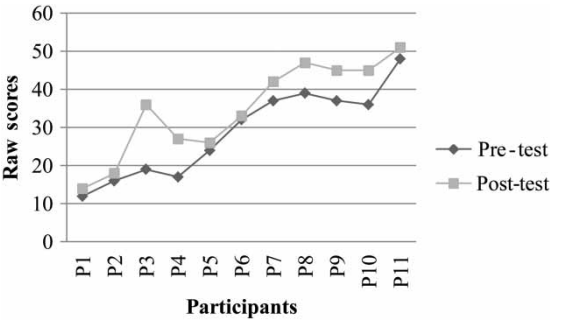

Figure 1. Comparison of pre-test and post-test scores on the communication development subtest of the DAYC.

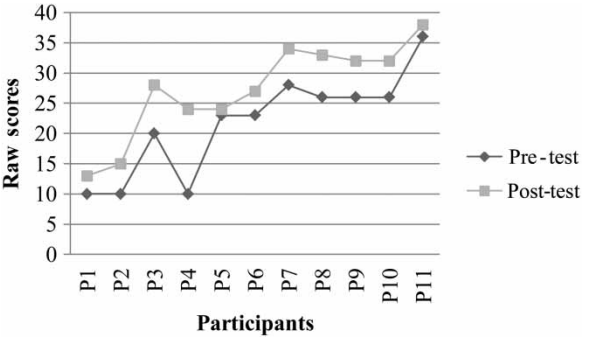

Figure 2. Comparison of pre-test and post-test scores on the cognitive development subtest of the DAYC.

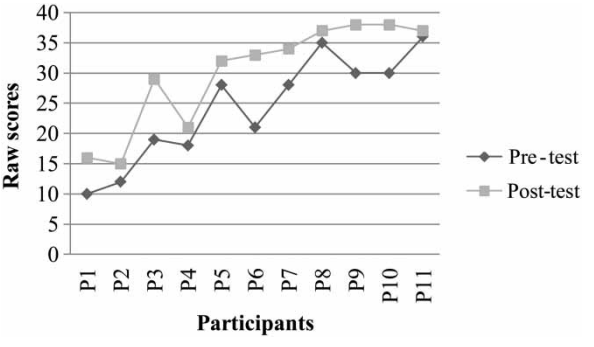

Figure 3. Comparison of pre-test and post-test scores on the social development subtest of the DAYC.

A Wilcoxon signed-rank test was performed on pre- and post-test raw scores on each of the DAYC subtests and the derived fine motor scores. The test showed that there was a significant difference between pre- and post-test scores across all areas of child development (Table 3). The infants demonstrated a significant improvement

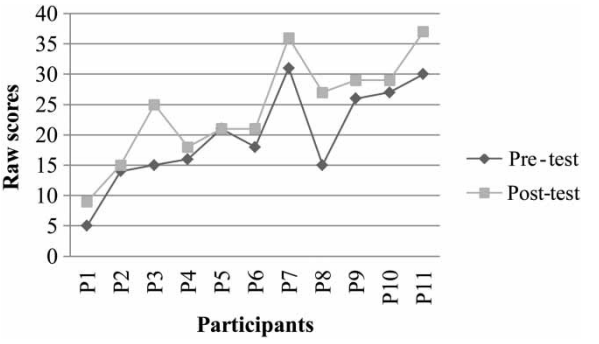

Figure 4. Comparison of pre-test and post-test scores on the adaptive behaviour development subtest of the DAYC.

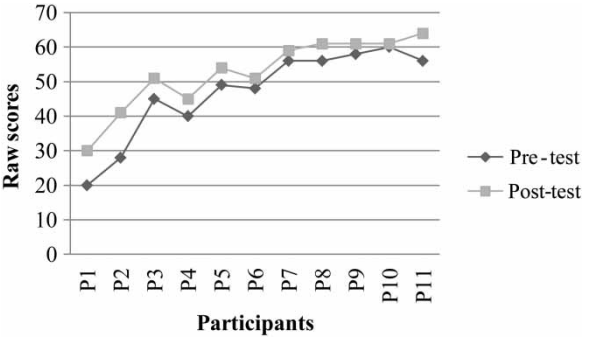

Figure 5. Comparison of pre-test and post-test scores on the physical development subtest of the DAYC.

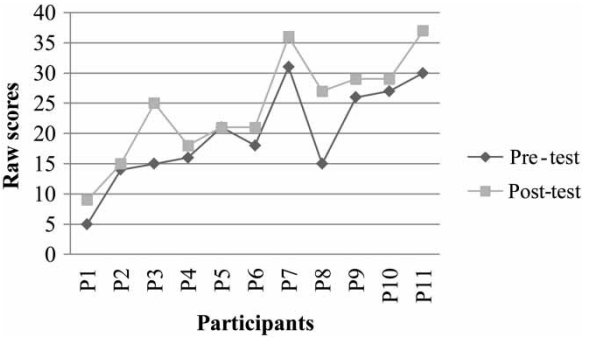

Figure 6. Comparison of pre-test and post-test scores on the fine motor development derived score from the physical development subtest of the DAYC.

in physical development ($Z = -2.81$, $p = .005$, $r = .85$), fine motor development ($Z = -2.83$, $p = .005$, $r = .85$), social development ($Z = -2.94$, $p = .003$, $r = .89$), communication development ($Z = -2.94$, $p = .003$, $r = .89$), cognitive development ($Z = -2.94$,

Table 3. Wilcoxon signed-rank test – test statistics[a].

	Communication	Cognition	Social	Adaptive behaviour	Physical	Fine motor
Z	−2.941[b]	−2.940[b]	−2.938[b]	−2.807[b]	−2.807[b]	−2.825[b]
Asymp. sig. (two-tailed)	.003	.003	.003	.005	.005	.005

[a]Wilcoxon signed-rank test.
[b]Based on negative ranks.

$p = .003$, $r = .89$), and adaptive behaviour development ($Z = -2.81$, $p = .005$, $r = .85$). These results suggest that the Baby Signing workshop had a positive impact on all areas of the infants' development.

Discussion

The key intent of this study was to explore and assess the impact that our Baby Sign workshop had on the overall development of our participants. Specifically, the research question asked was: What are the effects of parental baby sign training on the overall development of typically developing hearing infants? The data collected in this study indicate that the training the parents received enhanced their child's development across several areas (communication, cognitive, social, adaptive behaviour, physical, and fine motor skills).

These results seem to contradict those found by Kirk et al. (2013). Despite encouraging the use of symbolic gesturing and sign with infants and providing a workbook, Kirk et al. found no support towards the claimed benefits of baby sign on language development. Several reasons for the difference will be discussed.

First, there were many differences between the training provided by our Baby Sign workshop and that of Kirk et al. Many more signs were taught in the present study than in the Kirk et al. (200 signs compared to 20). More signs may have made it easier for parents to pick and choose signs they felt would be useful for their children and be well suited to their everyday language needs. The time devoted to sign training and to sign implementation training was much greater in the present study. Mothers' in the Kirk et al. study were shown the signs and received a handout with pictures of the 20 signs and suggestions for implementation. Our five-week-long workshop (two hours each meeting) allowed the researchers and the parents much practice with using the signs and with learning to sign with their children. Parents occasionally made mistakes in implementing sign such as withholding an object from their child until the child produced the sign. These mistakes were quickly caught by the researchers and proper implementation could be modelled which includes natural use of the sign in context.

Also during our Baby Sign workshop, parent fears and concerns regarding baby sign use were addressed and alleviated. The workshop was conducted within a supportive group of researchers that provided a surplus of strategies to use sign without stress and within a natural context. These include, but were not limited to, providing parents with various resources, encouraging personalised use of baby signs, and natural incorporation of baby signs into daily activities. Overall, parents reported enhanced communication with their children, a strengthened bond, and reduced frustration as a result of the workshop. Parents also reported enjoying the interaction with other parents as they felt

able to learn from each other (see Mueller and Sepulveda, 2013, for a detailed description of thoughts and perceptions presented by parents throughout the workshop).

Additionally, the families recruited in the Kirk et al. and in the present study were inherently different. The parents in the present study were interested in learning baby sign at the outset and responded to an invitation to a baby sign workshop. As the parents in the Kirk et al. study did not have any interest in baby sign, it may have affected their implementation of it. This may be why the parents reported only using the signs a few times a week. It is not surprising that little differences were found given the limited exposure to sign the children received. Conversely, in the present study, although usage was not tracked in our participants, anecdotally, parents reported using the signs several times a day with their children.

An important outcome of the Kirk et al. study that supports the findings of the present study was the significant increase in language assessment scores for those children who began the study with the weakest language abilities. The families in our study came from a low SES community and many were bilingual Spanish/English speakers, whereas the Kirk et al. study only included monolingual English-speaking participants with high educational attainments. Our data support the idea proposed by Kirk et al. that perhaps baby sign is most beneficial for children with low language abilities, as SES has been shown to be correlated with language development (Hart & Risley, 1995).

Much of the research on baby sign has focused on supporting or disclaiming the alleged benefits of its use. The impact of parental training of baby sign use and subsequent developmental progress in children, on the other hand, has received little attention. Perhaps the key difference is the approach researchers take to baby sign parental training. Our workshop was developed deliberately to encourage baby sign use and reduce parental stress regarding baby sign. The researchers were available to answer questions, address concerns, listen to comments, provide feedback, guide parents on when to use signs, and help parents in forming signs with hand-over-hand assistance. Lastly, parents were also provided with several resources on both sign production and implementation (verbal feedback during class meetings, take home workbook and DVD, etc.). These supplies were given deliberately to make habitual use of signs likely.

Limitations

Despite its findings, this study is not without its limitations. First, the study had a small sample size; it included only 9 participant families and 11 children. Thus, the results have reduced applicability to the general public. Moreover, the design of the study lacks a control group, which makes it impossible to account for confounding variables and attribute the improvements in child development solely to the baby sign training. Maturation could have surely accounted for the changes seen in the child development. Approximately six weeks lapsed after the end of the training and the post-testing. As children at this young age change quickly, it is possible that the time was enough for the children to learn new skills. The wide age range of the child participants may also make interpretation of the results more difficult. Thus, a clear pattern of the relationship between parental baby sign training and developmental progression is difficult to present.

Future considerations

This was a preliminary study to investigate changes of child development after parental baby sign training. More research is surely necessary to bridge the gaps to understand

the effects of baby sign on child development. Naturally, future research should consider inclusion of larger, more homogeneous samples. More randomised control trials are necessary which include parental training that is supportive and extensive. Future studies should also make distinctions in children with lower and higher language abilities before baby sign training is implemented as this seems to be a fruitful and necessary area of investigation. The implications to children at risk for language delay or with existing language disorders are far reaching.

It will be necessary to assess the impact of baby sign both on parental perceptions and practice and on the developmental outcomes of children in the long term. We are currently in the process of collecting such data. Parents from this present study are providing feedback regarding their use of baby sign and any perceived benefits one year after the conclusion of the Baby Sign workshop. We eagerly anticipate sharing these results.

Future researchers will also want to asses other subtle differences in parent–child interactions as a result of baby sign training. Kirk et al. (2013) found that mothers in their study were more responsive to their infants' non-verbal cues and encouraged more autonomy. The effects of these subtle differences on the child's language, social–emotional, and cognitive development is an interesting line of research.

As the baby sign training provided to the parents in the current study differed vastly from that provided by Kirk et al., more research should be conducted regarding how to best provide parental training on baby sign. Importantly, it may be that in the current study, the emphasis placed on communication and the increased awareness of the communicative attempts of their children, and not necessarily baby sign, produced the effects seen. The comparisons between a good parenting class and a baby sign class need to be assessed. Lastly, more evidence is needed to understand the impact of parental training on stress, parent–child interaction, baby sign use, and child development.

Conclusion

The results of this case study support a baby sign training for parents. Much further research is necessary as baby sign continues to gain popularity among parents. Those who work with children are currently only able to offer opinion when asked about baby sign, its use, and any advantages or disadvantages. It is the responsibility of researchers to investigate the effects of baby sign use and ways to best maximise any potential benefits.

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