The impact of a bimodal bilingual input on deaf children's communication and language development

Elizabeth M. Levesque

Trained Infant Teacher's Certificate
Graduate Diploma in Special Education (Hearing Impairment)
Master of Sign Language (Linguistics)
Graduate Certificate in Deaf Studies

Submitted in total fulfilment of the requirements of the degree of
Doctor of Philosophy

September, 2014

Melbourne Graduate School of Education
and
School of Languages and Linguistics
The University of Melbourne
Parkville,
Victoria, 3010

Abstract

This study explores the impact of hearing parents' bilingual English and Auslan (Australian Sign Language) input on the communication and language development of their young deaf children. The participants in this study were eight severe-to-profoundly deaf children and their hearing parents living in Victoria. The families were enrolled in a state-wide Victorian Department of Education and Training bimodal bilingual early childhood intervention program for deaf children and their families.

Despite earlier diagnosis of infants' deafness, access to early intervention programs and enhanced amplification technology, communication and language outcomes for children born with permanent deafness have been generally below those of hearing children. The communication needs of deaf children therefore continue to present significant challenges to parents and educators. Given the diverse language and learning needs of deaf children and the numerous factors contributing to their language outcomes, no single mode of communication has been found that suits all children. Amongst the various communication approaches adopted by early childhood intervention programs for deaf children is a bimodal bilingual approach, in which the children are exposed to spoken language and sign language. However, although the literature reports numerous studies that focus on language input and communication development for young deaf children, there are very few studies devoted to bimodal bilingual communication and first language acquisition. This study therefore aimed to measure the language outcomes of children exposed to English and Auslan early in their development and to determine the extent to which the parents' interaction strategies promoted optimal language outcomes for their children.

Due to the heterogeneity of the participants in this study, it was difficult to control the wide range of variables known to impact on the language development of young deaf children. Therefore, a single case design was chosen as the methodology for this study which incorporated detailed descriptions about each case and allowed each of the eight

cases (i.e. parent or child) to act as their own control. Three research questions were explored in the study and were designed to elicit a deeper understanding of the factors contributing to the children's language outcomes. The research questions related to three main areas: parental language input, the parental sensitivity to their children's communication needs and the children's language outcomes. Using both quantitative and qualitative methods, data were collected from bi-monthly assessments over 20 months, allowing for ten progression points to be analysed. Particular attention was given to measuring the Auslan proficiency of the parents, type of language input, the children's emerging language skills and modality preferences and the factors influencing these preferences. Several assessment tools were devised specifically for this study and are described in detail in the Method Chapter of this thesis. The findings of the study reveal that the children's language outcomes were strongly predicted by parent sensitivity and that the children with the strongest language skills changed their modality preferences over the duration of the study. These findings contribute valuable insight into the nature of effective parent-child interactions using a bilingual approach and identify the communication strategies that promote positive language outcomes for young deaf children.

Declaration

This is to certify that:

(i) the thesis comprises only my original work towards the PhD except where indicated in the Preface,

(ii) due acknowledgement has been made in the text to all other material used,

(iii) the thesis is fewer than 100 000 words in length, exclusive of tables, maps, bibliographies and appendices

……

Elizabeth M. Levesque

Acknowledgements

This research study has provided an invaluable opportunity for me to share the experiences of eight inspiring families who are facing the challenges of raising a deaf child. They participated in this study in the hope that they would learn more about the communication and language needs of their children, but also wanted other parents with deaf children to benefit from the findings of the study. I wholeheartedly thank these families for reinforcing the value of family-centred early intervention and the importance of developing strong parent-professional partnerships to bring about optimal outcomes for deaf children. I could not have completed this research without their readiness to welcome me into their homes and their eagerness to participate in the many assessments and discussions conducted over the 20 months of data collection. There is no doubt that it is a privilege to be able to conduct research on young children's language development within the context of their own family and community environments. The pleasure of being well acquainted with the children's family pets, favourite toys and daily routines far outweighed the more formal aspect of assessment and data collection.

However, this study would not have been possible without the support and encouragement of my principal supervisor, Associate Professor P. Margaret Brown from the Melbourne Graduate School of Education, my co-supervisor, Professor Gillian Wigglesworth from the Department of Linguistics and Applied Linguistics and my Advisory Committee chairperson, Professor Field Rickards, Dean of the Melbourne Graduate School of Education. I have been most fortunate to have shared my PhD journey with such eminent academics who are so highly regarded in their specific fields of teaching and research. With the benefit of hindsight, I am now able to fully appreciate why Margaret and Jill needed to focus their critical, analytical editing skills on every word I wrote to ensure that my thesis reached the high standard they expected of me. I thank them both

for not wavering in their belief that I could reach these dizzy heights and I have no doubt that their dedication has resulted in attaining my goal of completing my PhD. With the vast amount of data collected for the eight in-depth case studies, it was no mean feat to get to the 'pointy end' of the study and produce a coherent, well-constructed thesis that will contribute to the field of deaf education for many years to come.

My thanks also are also extended to the Victorian Department of Education and Training for their support and encouragement and for providing me with the opportunity to pursue my dream of completing this study in a field of education I know so well. My gratitude also goes to friends and colleagues in the field of deaf education and allied fields who showed so much interest in my study and provided endless encouraging words and support over the years.

Last, but by no means least, I thank my long-suffering husband and four wonderful sons, three cats and lovable dog who have been waiting for the day that I finally unshackle myself from my computer and resume my former busy role in family life. Without the comfort of family support and encouragement, the solitary task of writing a PhD thesis would not have been possible.

Table of Contents

List of tables

List of Figures

List of Appendices

CHAPTER ONE

Rationale for the Study

1.0 Introduction

Research has consistently shown that the communicative, linguistic and educational outcomes for children born with a permanent hearing loss have been generally below those of hearing children (Blamey et al., 2001; Conrad, 1979; Gregory, 1996; Lang, 2003; Marschark, Lang, & Albertini, 2002; Pisoni, 2007; Schick, 2007; Traxler, 2000). This disparity in the level of communication and language competence attained by deaf children compared to their hearing peers is an issue that drives the early intervention and education fields internationally.

Between one and two infants in every thousand in Australia are born with permanent childhood hearing loss (Ching, Oong, & van Wanrooy, al., 2006; Russ et al., 2002; Wake, Hughes, Poulakis, Collins, & Rickards, 2004). Historically, one of the major factors contributing to the communication and language delays experienced by prelingually deaf children was the age of diagnosis of their deafness. Prior to neonatal hearing screening, the average age of diagnosis for congenital, permanent hearing loss in children was between 12 and 25 months (Mehl & Thomson, 1998). The relative lateness of diagnosis consequently resulted in delayed provision of listening devices and enrolment in early intervention programs, which in turn lead to compromised communication and language development (Ali & O'Connell, 2007; Nicholas & Geers, 2007; Yoshinaga-Itano, Sedey, Coulter, & Mehl, 1998). More recent advancements in technology have made it possible to detect a newborn infant's hearing loss within hours of birth, with subsequent confirmation of diagnosis made within the following weeks, followed by hearing aid fitting shortly thereafter.

It is well documented in the literature that deaf children's language outcomes are enhanced by early diagnosis, access to assistive listening devices, enrolment in early intervention and effective parent input (Apuzzo & Yoshinaga-Itano, 1995; Robinshaw, 1996; White & White, 1987; Yoshinaga-Itano, 2003). The provision of assistive listening devices such as digital hearing aids and cochlear implants in infancy has undoubtedly increased deaf children's access to spoken language (Blamey, Paatsch, Bow, Sarant, & Wales, 2002; Nicholas & Geers, 2006; Khan, Edwards, & Langdon, 2005; Robbins, Svirsky, & Miyamoto, 2000). However, there continues to be a wide variation in language outcomes and rates of development for deaf children that is not accounted for by the use of high quality listening devices (Ching et al., 2010; Dettman, 2006; Horn, Davis, & Pisoni, & Miyamoto, 2005; Leigh, 2007; Marschark, 2001; Pisoni, 2007). Although improvements in audiological technology have contributed to better language outcomes for many deaf children, neither digital hearing aids nor cochlear implants are able to successfully restore normal hearing or provide normal speech perception in a variety of listening conditions (Nicholas & Geers, 2006; Pisoni 2007). Furthermore, research suggests that some deaf children do not benefit from exclusively oral-aural approaches and do not acquire age-appropriate language oral language through audition alone (Leigh, 2007; Pisoni, 2007). Very often this is due to their inability to take full advantage of their auditory capacity to attain optimum auditory skills, irrespective of types of listening devices (Blamey et al., 2002; Boothroyd, 1991; Dettman, 2006; Pisoni, 2007). Differences in a range of underlying cognitive, sensory and perceptual skills may explain some of this variance, with numerous factors considered to have an impact on a child's ability to acquire language through audition. These factors include nonverbal cognitive abilities, the etiology of deafness, age at onset of deafness, age at diagnosis and amount of auditory experience (Harrison et al., 2001; Manrique, Cervera-Paz, Huarte, & Molina, 2004). It is therefore necessary to consider alternative communication options for the proportion of deaf children who are not able to access and process spoken language effectively.

Recent research studies have found that deaf children have the same potential for language and learning as hearing children, as long as they are able to access the language of their learning environment (Swanwick & Gregory, 2007). The issue of

language access and communication options has been debated in the field of deaf education for many years (Allen, 2002; Grosjean, 2001; Hyde & Punch, 2011; Marschark, 2001; Mayberry, 2002; Mayer & Leigh, 2010; Preisler, 2007; Singleton, Supalla, Litchfield, & Schley, 1998). This issue of speech versus sign language has presented many challenges for parents and professionals as they seek to determine the language modality that will best support the deaf child's communication, language and learning needs (Hyde & Punch, 2011). Most early intervention programs adopt a specific communication philosophy that either embraces an oral approach, incorporating listening and speaking, a bilingual approach that incorporates varying proportions of speech and sign language, or a combination of approaches that suits the needs of the child and the wishes of the parents. Research has shown that each communication approach has been demonstrated to work with some children, but the responsibility for making the choice of language modality has usually been taken by the parents and professionals on behalf of the child (Stredler-Brown, 2010). In this respect, there remains considerable variation in language outcomes, often because the chosen language modality may not suit the child's sensory and language processing needs.

In order to address the diverse language needs of young deaf children, a bimodal bilingual approach, incorporating a spoken language and a sign language, has been identified as a way of providing access to language whilst at the same time accommodating the children's preferences for the modality that best suits their communication needs (Swanwick & Gregory, 2007; Wheeler, Archbold, Hardie, & Watson, 2009). Although there has been very little research carried out in this area of deaf children's language development, there is evidence in the literature that deaf children are able to make use of both language modalities, spoken and signed, to an extent determined by the level of their sensory impairment, the quality and frequency of input and their motivation to communicate (Marschark, 2001). However, despite providing access to both modalities, the heterogeneity of children's language environments also contributes to a variance in language outcomes (Stredler-Brown, 2010). In addition to providing children access to a shared language, a critical factor influencing their language development is the quality of parent-child interactions and

the parents' level of sensitivity to their children's communication (Snow, 1986). There is much evidence in the literature that engaged parents encourage their children's language development by intuitively making various adjustments to their interactions (Belsky et al., 2007; Hart & Risley, 1995). Studies have also found that deaf children do not have the same opportunities as their hearing peers to engage in effective and rewarding interactions due to limitations in shared communication experiences (Harris & Mohay, 1997; Marschark, 2001; Spencer & Harris, 2006). It is therefore critical that parents develop a high level of sensitivity to their deaf children's specific communication needs, including an ability to adjust their language input to support effective interactions. In the context of bimodal bilingual communication, adjustment of language input involves the parent's awareness of the language modality that supports mutually satisfying interactions.

This study aims first to describe a bimodal bilingual intervention environment in which language modality choice is mediated by the child in the sense that the parents respond to their child's language preference, and second to identify the developmental outcomes of this intervention. With exposure to both modalities, it is hypothesized that linguistic input in either modality should be available to the child at all times and should therefore increase opportunities for optimal language acquisition. Also investigated will be the way in which young deaf children display a clear preference for a particular language when two languages are used in natural discourse. By exposing young deaf children to a bilingual model in which they are encouraged to learn both languages, we will better understand how the children determine the language most suited to their receptive and expressive language needs. In addition, by measuring the ways in which hearing parents communicate bilingually with their deaf children, the relationship between the quality of parental language input and the children's language competence will be identified. These measures will include the signing skills of the parents, the amount of their Auslan and English input and their level of sensitivity to their children's communication needs.

The following chapter will critically review the research literature related to the challenges experienced by deaf children in developing language and the role parents

play in supporting their deaf children's language development through quality interactions. Chapter Three will focus on the literature related to the place of bilingualism in the world of deaf children and will review current bilingual research for spoken languages and for bimodal bilingualism. Research findings on children's language use are also reviewed and give valuable insight into the conditions under which parents provide language input to their bilingual deaf children. The literature also contributes to a better understanding of the relationship between the two languages and sheds light on the factors that influence deaf children's choices about their modality preferences during bilingual interactions. In addition, a review of the relevant literature has made an important contribution to the formulation of the research questions that underpin this study. These research questions are articulated at the conclusion of Chapter Three and focus on three main areas: the nature of parental bimodal bilingual input while their sign language skills are still developing, the quality of the parental input and their sensitivity to their child's communication and the bilingual outcomes for the children including their modality preferences. Chapter Four provides information about the design and background of the study, details of the participants, the setting, data collection, instrumentation and data analysis. Chapter Five focuses on the results of the parents' and children's assessments and Chapter Six will discuss the implications of the results in light of the research questions, will identify limitations of the study and make recommendations for practice and future research.

CHAPTER TWO

Childhood deafness and parental input

2.0 Introduction

This chapter critically reviews the research literature related to the factors that contribute to the communication and language outcomes of young deaf children. The review encompasses a range of areas, including the latest findings from research studies on early diagnosis of deafness, device fitting, early intervention and children's acquisition of language skills in spoken and signed modalities. The review also investigates the literature on parental influences on their children's language development, with particular focus on the skills hearing parents need to develop in order to communicate effectively with their deaf children.

2.1 Terminology

In this thesis, various terms are used to refer to aspects of deafness, language development, bilingual acquisition and parent-child interactions. In order to ensure that there is no ambiguity with terminology, a brief description is provided below of terms frequently used throughout the thesis.

2.1.1 Bimodal Bilingualism

The term *bimodal bilingualism* (Bernstein, Maxwell, & Matthews, 1985; McLaughlin, 1984) is first announcedn the title of this study and refers to the use of two language modalities – vocal, in the form of speech, and visual-gestural, in the form of sign, gesture and body movements (Emmorey, Borinstein, & Thompson, 2005).

The concept of dual language use of spoken and sign language by deaf children and adults is referred to in various ways in the literature, with bimodal bilingual being just one of the terms used internationally. Other terms include sign bilingual, bilingual deaf education, bilingual-bicultural and co-enrolment (Knoors, Tang, & Marschark, 2014; Pickersgill & Gregory, 1998; Swanwick, 2010). When referring to the two languages in the bimodal bilingual partnership for this study, the term *sign language* is used to denote native visual-gestural languages such as Auslan and *spoken language* refers to all languages expressed vocally. The term *balanced* is used when skills have been acquired in both languages that support effective communication, although it is not necessary to have acquired equal competence in both languages (Grosjean, 2008).

With regard to bilingual acquisition, several terms are used in this thesis to describe the ways in which the two languages are used, the relationship between the languages and how young children demonstrate their language choice. It is important to note that when the term *modality preference* is used, it is referring to the language that is most accessible to the child when the input includes both language modalities. Factors contributing to accessibility would include functional auditory skills, quality of parental input and language processing abilities. In this respect, modality preference may refer to a child's output in a specific language or attention paid to the parental input one of the languages, also referred to in the bimodal bilingual literature as *language choice* (van den Bogaerde, 2000) or *language dominance* (Klatter-Folmer, van Hout, Kolen, & Verhoeven, 2006). Although the term *preference* may at first appear to denote a more monolingual or polarized view of bilingualism, in this study it sits on the spectrum of bilingual practice that acknowledges language mixing and blending as features of bimodal bilingualism. In the case of determining the children's bilingual competence, the concept of *translanguaging* helps to explain how communication is maximized by making use of various linguistic features of each language to enhance their interactions (García, 2009). Chapter Three will expand further on this concept.

2.1.2 Deafness

In this study, the term *deaf* is used to refer to all people with a hearing loss, regardless of degree of severity or mode of communication. The term *Deaf* with a capital 'D' is used to refer to culturally Deaf people who communicate in sign language and identify with the Deaf community. On an international level, these terms are articulated in the co-operation agreement between the World Federation of the Deaf and the International Federation of Hard of Hearing People (World Federation of the Deaf, 2013). In Australia, the terms have been endorsed by Deaf Australia Inc., (2010) the national peak advocacy and information organization for Deaf people who communicate in English and Auslan. Both organizations endorse the use of the term *hard of hearing* to refer to people whose primary communication mode is speech and the term *deaf* to encompass all groups of Deaf and hard of hearing people. There is a shared agreement that deaf and hard of hearing individuals should not be identified by the term *hearing impaired*.

2.1.3 Language

When referring to topics related to language acquisition, bilingual use and parent-child communication, it is important to understand the way in which specific terms will be used in this study. With respect to aspects of language use, mention is made of *quality* of input and levels of *competence* attained by parents and children. In the context of this study, quality refers to the level of communicative and linguistic features incorporated into the interactions between parents and children. A higher level of quality would be expected to include more richness and complexity in the use of communicative strategies and usually a higher level of language fluency and use of linguistic rules. Competence refers to an ability to communicate effectively and, in the case of bilingual practice, to make appropriate language choices with a range of interlocutors (Genesee & Nicoladis, 2006). In this study, language choices will involve spoken language (English) and sign language (Auslan). When related to parents, competence is not only about fluency or grammatical use in either language, but

encompasses their ability to use a range of strategies that facilitate effective communicative interactions with their deaf children. The nature of the ways in which these linguistic features are utilized by parents in this study will be described in Chapter Three.

2.2 Communication and language challenges faced by deaf children

Many children who are born with permanent sensorineural deafness experience challenges in learning to communicate and acquire language. These challenges persist in current times, despite significant advances in technology that have improved the diagnostic process and the quality of assistive listening devices, such as hearing aids and cochlear implants (Ching et al., 2013). The consequences of permanent prelingual childhood deafness are well reported in the literature and include significant delays in language, cognitive and social-emotional development (Kushalnagar et al., 2010; Marschark, 2007; Steinberg, Brainsky, Bain, & Montoya, 1999; Wake et al., 2004; Yoshinaga-Itano, 2003). For many years, the language delays of deaf children with hearing parents have been attributed to reduced access to language experiences in their family environments compared to hearing children (Marschark & Wauters, 2011; Spencer, 1993). Furthermore, reduced input in early language environments is considered to be linked to the lag in academic performance of deaf children compared to their hearing peers (Marschark, Convertino, & LaRock, 2006; Traxler, 2000). Studies also show that language plays an important part in children's ability to self-regulate, which in turn is facilitated by mothers who provide effective scaffolding and are sensitive and responsive to their children's needs (Bernier, Carlson, & Whipple, 2010). It is generally accepted that these same factors would also influence children with hearing loss (Ching et al., 2010).

Children's exposure to language during their early developmental years is critical for their future linguistic skills and for the most part is provided by parents and primary caregivers (Belsky et al., 2007). The communicative competencies and strategies young children learn with their parents and primary caregivers have wide implications for

future language development and help to set the stage for learning about their world (Marschark, 2001). However, the home language of the primary caregivers is not always accessible to deaf children, depending on their degree of deafness and language processing abilities. In order to redress the communication challenges experienced by young deaf children, a variety of approaches has been implemented, but there has been no empirical evidence that identifies a single communication approach to suit every deaf child (Stredler-Brown, 2010). In Australia, the range of approaches includes Auditory-verbal/oral, Total Communication, Sign Bilingual/Bimodal Bilingual (Auslan -Australian Sign Language and English) and Augmentative and Alternative Communication systems (Australian Hearing, 2005). In many early intervention programs, it is deemed the responsibility of the professionals, in collaboration with the parents, to determine a communication approach that supports age-appropriate communication and language development for the child (Stredler-Brown, 2005, 2010). However, adopting this model may be problematic if the determined language modality does not suit the child's sensory and language processing abilities. It is therefore important to identify an intervention approach that provides deaf children with access to a shared language so they have opportunities to reach their potential for language and learning in the same way as hearing children (Swanwick & Gregory, 2007).

Although the term *approach* suggests a somewhat contrived and structured system of parent-child communication, there are circumstances when parents enrolled in early intervention programs for deaf children make a conscious decision to utilize specific communication strategies that are known to facilitate the development of deaf children's language skills (Harris & Mohay, 1997; Janjua, Woll & Kyle, 2002; Spencer & Harris, 2006; Traci & Koester, 2003). There is much evidence in the literature that young children benefit from natural, spontaneous parental interactions (Snow, 1989; Tomasello, 2003) and that the majority of parents intuitively make communication choices based on their understanding of their children's skills. However, in the case of hearing parents of deaf children, many early intervention programs encourage parents to incorporate a range of communicative strategies with their children in spontaneous, natural interactions during their daily routines. Many of these strategies

are not necessarily intuitive and often require a high degree of dedication by the parents to learn how to implement them effectively. Strategies include the use of sign language, fingerspelling and auditory-verbal techniques as well as implementing ways of gaining and maintaining their children's attention to communication and recognizing their children's modality preferences or language choices.

To fully understand the challenges experienced by young deaf children in developing communication and language skills, it is necessary to take into account four major factors contributing to deaf children's language outcomes: age of diagnosis of deafness, access to assistive listening devices, early intervention and parental input. This review of the literature will also examine the research evidence related to first language acquisition of spoken languages and sign languages and the principles that underpin their development, particularly with regard to parental influences. Included in this focus is the nature of interactions between hearing parents and their deaf children and the adjustments they make to facilitate their children's communication. Of particular interest will be a review of the findings of studies related to parent-child interactions involving spoken language and sign language and how these exchanges are mediated by factors such as the parents' language fluency and their sensitivity to their children's communication needs.

2.3 Early diagnosis of deafness

Delayed detection of an infant's deafness is regarded as a major public health concern in many countries, with negative effects often lasting well into adulthood and resulting in lower educational and employment opportunities (Holte et al., 2012; Vohr et al., 2008). The consequences of permanent childhood deafness are well reported in the literature and include significant delays in language, cognitive and social-emotional development (Wake et al., 2004; Yoshinaga-Itano, 2003). Prior to the introduction of infant hearing screening in birthing hospitals, most childhood deafness was not diagnosed before two years of age, with consequent delays in communication and language development (Halpin, Smith, Widen, & Chertoff, 2010; Sininger et al., 2009;

Yoshinaga- Itano et al., 1998). More recently, routine neonatal hearing screening has resulted in the age of hearing loss detection decreasing to between three and six months of age (White et al., 2010).

The Joint Committee on Infant Hearing (Busa et al., 2007) defined a hearing loss eligible for early intervention support as being congenital sensorineural, permanent conductive, Auditory Neuropathy Spectrum Disorder (ANSD) or a neural conduction disorder. In terms of newborn and infant hearing loss, early intervention was highly recommended if the loss averages 30 to 40 dBHL or more in the frequency region important for speech recognition, i.e., between approximately 500 and 4000 Hz (Wake, 2002). Research studies have found that one of the primary reasons for diagnosing infants shortly after birth is to allow for early childhood intervention strategies to be introduced at a time when they are most effective (Mehl & Thomson, 1998; Yoshinaga-Itano, 2000, 2003; Yoshinaga-Itano et al., 1998). These findings have prompted numerous initiatives that have resulted in recommendations that hearing screening should be completed before the infant is one month of age, diagnosis of the hearing loss completed before three months of age, and enrolment in an early intervention program to occur before six months of age (Busa et al., 2007). In a systematic review of newborn infant hearing screening, it was found that that most of the evidence for favourable language outcomes came from observational studies and two quasi-randomized controlled trials. These trials looked at children's language ability after early detection of deafness (Kennedy et al., 2006) and developmental outcomes following newborn hearing screening compared to later hearing screening.

Although there is much evidence reported in the literature for the benefits of infant hearing screening (see Ching et al., 2013; Colgan et al., 2012), there are also findings questioning the cost-effectiveness of the program (Keren, Helfand, Homer, McPhillips, & Lieu, 2002) and the negative experiences faced by some families in accessing support services following their children's diagnosis (Holte et al., 2012). Shulman et al. (2010) found that standardized protocols were lacking in many screening programs and that some professionals did not have adequate knowledge of local early intervention supports and the benefits they provided. Furthermore, in many countries,

payment for specialist services such as audiology and early intervention created further barriers for families (Limb, McManus, Fox, White, & Forsman, 2010). In addition, other families did not take heed of the available research evidence and either declined the opportunity to have their infant's hearing screened or did not follow up the diagnosis with enrolment in early intervention program (Fitzpatrick, Graham, Durieux-Smith, Angus, & Coyle, 2007). The importance of following early diagnosis with enrolment in an early childhood intervention program is highlighted by Moeller (2000), who found that when deaf children's hearing parents were well engaged with early intervention programs, their children demonstrated language scores comparable to hearing peers, regardless of whether they used signed or spoken communication. The results of Moeller's study also suggested that high levels of family involvement in their child's early intervention program may ameliorate the effects of late diagnosis to some extent.

In Australia, the process following newborn hearing screening is more standardized than that of other countries. For instance, Ching et al. (2013) report that audiological services and technology are consistent across all Australian Hearing audiology service centres and that most children receive amplification from one of these national Australian Hearing service centres within three months of the diagnosis of their hearing loss. National paediatric protocols are strictly followed (King, 2010) and high quality multi-channel non-linear hearing aids are adjusted to the NAL-NL1 or the DSL v.4.1 prescriptions to ensure that children receive an audible signal across speech frequencies at a comfortable loudness level (Scollie, Ching, Seewald, & Dillon, 2010). One of the goals of the Joint Committee on Infant Hearing (Busa et al., 2007) was that early diagnosis of an infant's deafness should result in the attainment of language skills commensurate with their hearing peers.

In spite of the commitment by professionals in the deaf education field to improve children's language levels, the outcomes of many deaf infants have been well below population norms. For a variety of reasons, some children are not able to effectively comprehend and express spoken language because they are unable to take full advantage of their auditory capacity to process and comprehend spoken language

(Boothroyd, 1991; Dettman, 2006; Horn et al., 2005; Leigh, 2007; Marschark, 2001; Pisoni, 2007). In an Australian prospective population-based study on the outcomes of 451 early and late identified children at three years of age, Ching et al. (2013) found that, on average, language skills were well below norms for the general population. Results from standardized tests revealed that the global score of deaf children was more than one standard deviation below the mean of normal-hearing children at three years of age. The authors also found that 56 percent of the children in the study were fitted with hearing aids prior to six months of age and by the time they were three years of age, 134 children used cochlear implants and the remaining children used hearing aids. Significant predictors of child outcomes included severity of hearing loss, mothers' level of education, age of switch-on for children with cochlear implants, and additional disabilities. It is interesting to note that over 40 percent of deaf children are currently diagnosed with additional developmental needs (Fortnum, Davis, Butler, & Stevens, 1996; Holden-Pitt & Diaz, 1988; McCracken & Pettitt, 2011; Stredler-Brown & Yoshinaga-Itano, 1994), with many conditions presenting significant challenges to audiological assessment and management, intelligible communication and educational options.

Although the literature provides evidence that early diagnosis of deafness may not lead to age-appropriate language skills for all deaf children, nevertheless there is sufficient evidence that early identification of hearing loss and the initiation of early intervention within the first few months of life is a primary predictor of improved communication and language outcomes for young deaf children (Young & Tattersall, 2007). The sooner parents are able to communicate effectively with their deaf children and understand the ramifications of deafness on their child's development, the better the outcomes for their children. Improved outcomes include better relationships with their parents, better communication skills, better receptive and expressive language skills and better role models, all predictors of success (Calderon & Greenberg, 1997).

2.4 Early intervention and family support

Studies have found that one of the variables that plays a critical part in preventing the communication, language, and literacy delays frequently observed in deaf children is the availability of high quality early intervention programs (Moeller, 2000). Moreover, without following the diagnosis of deafness with the provision of intervention services for children and their families, the advantages of early detection of deafness may not be fully realised (Young & Tattersall, 2007).

In a consensus on the principles that guide family-centred early intervention (FCEI), Moeller, Carr, Seaver, Stredler-Brown, and Holzinger (2013) described the fundamental tenets of best practice in intervention for deaf children. The international consensus identified ten foundation principles that underpin best practices in early intervention for deaf children: (1) early, timely, and equitable access to services, (2) family/provider partnerships, (3) informed choice and decision making, (4) family social and emotional support, (5) family infant interaction, (6) use of assistive technologies and supporting means of communication, (7) qualified providers, (8) collaborative teamwork, (9) progress monitoring, and (10) program monitoring. Together with the international participants in the consensus, Moeller and colleagues agreed that family-centred practices made valuable contributions to positive communication outcomes for deaf children and their families. Within the FCEI framework, deaf children's communication development broadly refers to their auditory skills, visual skills, spoken and/or sign language skills and pragmatic language skills. Whilst interventions with deaf children embrace family differences and choices, they should also be guided by evidence-based research (Dumas, Lynch, Laughlin, Phillips-Smith, & Prinz, 2001; Russ, Dougherty, & Jagadish, 2010) and clearly stated principles (Moeller et al., 2013). A feature of the family-centred approach is that families form partnerships with professionals that facilitate the best outcomes for their deaf children, while at the same time interacting and supporting their children in the ways families know best. Research studies have also found that, when families and communities collaborative in positive ways, a child's capacity to achieve optimal learning potential is significantly enhanced (Clabaugh, 2005; Hodges & Clifton, 2006).

Family-centred early intervention is therefore seen as a holistic approach that supports children's development by building on families' strengths and skills and encouraging positive interactions, active participation and advocacy for their children. By forming strong, respectful and collaborative family–professional partnerships, family values and goals are supported in culturally sensitive ways to maximize developmental outcomes for their deaf children (Busa et al., 2007).

Numerous research studies have shown that successful outcomes are more likely to be achieved when early identification is paired with intervention programs in which families are actively engaged (Calderon, 2000; Moeller, 2000; Moeller et al., 2013; Yoshinaga-Itano, 2003; Yoshinaga-Itano & Sedey, 2000). Furthermore, the language advantages gained from quality interventions have been found to continue beyond the early childhood phase (Toscano, McKee, & Lepoutre Toscano, 2002). Toscano and colleagues reported on the reflections of deaf tertiary students and found that academically competent deaf tertiary students were more likely to have parents who were very involved in their early education, communicated effectively within the family (irrespective of mode), provided enriched early literacy experiences and had high expectations of their children. Similarly, in her study of parental involvement in their deaf children's education, Calderon (2000) found that there was strong evidence that direct parent participation influenced positive child outcomes, apart from factors frequently attributed to a child's academic success such as the mothers' education level and socio-economic status. Calderon's study also found that parental involvement shared considerable predictive power with mothers' communication skills.

Moeller (2000) examined the relationship between age of enrolment in early intervention and language outcomes of 112 deaf children at five years of age. Results of this study found that, when hearing parents were highly involved in early intervention activities, their children were more likely to demonstrate language scores comparable to hearing peers, irrespective of whether they use signed or spoken communication. In order to understand the variables contributing to the children's outcomes, Moeller devised a rating scale that measured the quality of family

participation in their children's early intervention programs and the quality of communicative interactions with their child. The five-level scale measured from 'limited participation', in which the family has developed only a limited understanding of the impact of deafness on their child to 'ideal participation' in which the family appears to have adjusted well to the child's deafness and can put the child's deafness in perspective within the family. An interesting finding of this study was that the degree of the child's hearing loss was not a significant predictor of language outcomes. This finding has also been reported by others, including Yoshinaga-Itano, (2000) and Davis, Elfenbein, Schum, and Bentler (1986), but remains a much debated issue in the field of early intervention. Moeller also suggested that, with effective interventions in place, the child's degree of hearing loss becomes a less significant predictor for measures of language performance compared with the mother's communication skills. As mentioned earlier, Moeller's study also found that high levels of family involvement in their child's early intervention program could help to counteract the negative effects of a late diagnosis of deafness.

When considering the provision of intervention support services for deaf children and their families following diagnosis, it is important to take into account other contributing factors such as the diverse nature of families, their modality use and language interventions (Young & Tattersall, 2007). Young and Tattersall suggested that the designs of some previous studies (see Kennedy et al., 2006; Wake, Poulakis, Hughes, Carey-Sargeant, & Rickards, 2005) may not have taken into account these important factors. In her response to Wake et al.'s population study of deaf children's age at diagnosis, severity of deafness and language outcomes at seven to eight years of age, Janjua (2005) also questioned aspects of this study's methodology. She suggested that, although the authors attempted to control many of the variables known to contribute to deaf children's language outcomes, the inclusion of hearing losses from mild to profound may have skewed the results. Janjua states that, in general, children with mild to moderate deafness who wear hearing aids would be expected to have more access to spoken language than children with severe-profound deafness. She believed that the severity of deafness is such a strong predictor of language outcomes that it compensates for many other variables, including the children's age at diagnosis.

Furthermore, Janua added that there may have been other factors that influenced the children's language outcomes, such as the type of early intervention program and the children's use of language modality.

Although a family-centred early intervention approach is characterized as a flexible, holistic process that recognizes families' strengths and skills, some families may require additional support to achieve the positive outcomes promoted by the FCEI model. The international consensus statement on best practices in family-centred early intervention (Moeller et al., 2013) articulated that effective interventions for deaf children should support enjoyable and competent parent-child interactions, family well-being and engagement, informed choice, advocacy for the child and support of the child's development. However, when families are challenged in attaining these positive outcomes, they may require an increased level of guidance and support in order to engage in satisfying interactions with their deaf child. There is evidence in the literature that the use of interactive coaching strategies is effective in identifying a family's existing skills, supporting the development of new skills and using productive feedback to consolidate these skills (Brown & Nott, 2006; Dinnebeil, McInerney, Roth, & Ramaswamy, 2001; Rush & Shelden, 2011). By establishing collaborative, strength-based partnerships within the early intervention phase, parents are given opportunities to gain a deeper insight into the ways in which to strengthen their parent-child interactions and communication (Clabaugh, 2005).

There is no doubt that current research provides much evidence in favour of the benefits of enrolment in an early intervention program following diagnosis of a child's deafness (Moeller et al., 2013; Yoshinaga-Itano, 2003; Yoshinaga-Itano et al., 1998). However, in many cases determining the most appropriate early intervention program involves a choice of communication options with which most parents have had no prior experience. The foundation principles proposed by the family-centred early intervention international consensus (Moeller et al., 2013) state that intervention professionals must be skilled in optimally supporting the child's language and communication development. Furthermore, the panel of intervention experts recommended that early intervention systems must endorse a range of

communication options and ensure that each child has access to communication within their family. Included in these principles is the expectation that programs will source professionals who are fluent users of spoken and/or sign languages that support the family's choice of communication mode. Whilst it is acknowledged that informed choice is an evolving process, there remains the issue of who makes the choice of communication mode – the parent, professional or, indeed, the child. As was mentioned in the introduction to this chapter, in most intervention programs it is deemed the responsibility of the professionals, in partnership with the parents, to decide which communication approach is best for the child's communication needs (Stredler-Brown, 2010). However, this approach is problematic if the determined language modality does not suit the child's sensory and language processing abilities.

The issue of communication options for deaf children has been debated in the field of deaf education for many years (Hyde & Punch, 2011; Mayer & Leigh, 2010; Preisler, 2007; Vonen, 2007). The choice of language modality is an important decision, often made by parents and professionals on behalf of young deaf children at a time when they have insufficient information about their children's language processing abilities in auditory and visual modes. More than 90 percent of deaf babies are born to hearing parents, most of whom have had minimal experience with the implications of deafness on a child's language development (Blamey et al., 2001; Leigh, 2007; Marschark, 2001; Pisoni, 2007). In many cases, it is a challenging task for parents to understand the communicative potential of their deaf child and to acquire competence in accommodating their communication needs (Hintermair, 2006). Lately, technological advances have had a considerable impact on the choices parents make with regard to the mode of communication they use with their deaf children. There is now greater focus on oral language development due to the widespread availability of newborn hearing screening programs in birthing hospitals, availability of listening devices and access to early intervention programs. However, despite the general assumption that the availability and prevalence of cochlear implantation simplifies the choice of language modality for young deaf children, there is evidence in the literature that bilingual approaches are also viable options for deaf children (Hyde & Punch, 2011) and are being chosen by some parents as their preferred approach.

Having discussed the impact of early diagnosis and early intervention on the communication and language outcomes of young deaf children, the way in which young children acquire language and the role of the parent or primary caregiver in this process will now be reviewed.

2.5 Acquiring a first language

Language plays a central role in children's lives and is a means by which they can participate in social interactions, develop thinking skills and share attitudes and ideas with others (Marschark & Wauters, 2011). Most children become fluent users of complex grammatical sentences by the age of three, without benefit of formal instruction and appear to acquire their native language effortlessly, despite the complexities of their structure (Brown, 1973; Bruner, 1983; Marschark 2001; Petitto, 2000; Pinker & Bloom, 1990). During their early developmental years, children must learn the communicative conventions used by those around them and acquire the many thousands of linguistic symbols and grammatical constructions of their cultural group. Using symbols, such as words, in a social manner with other individuals, children share attention and refer to a range of objects, events, people and situations in the world (Tomasello, 2006). Their communication becomes grammatical, with linguistic symbols being used together in patterned ways and a young child's linguistic system showing the use of rules connecting form and function in their speech (Bruner, 1975; Clark & Clark 1977; Halliday, 1975; Ninio & Snow, 1999; Snow, 1979).

In an attempt to identify how children eventually attained adult-like linguistic structures, Brown (1973) reviewed and evaluated numerous linguistic theories and concluded that, while children's linguistic productions could fit into any one of the models, none of the models satisfactory accounted for all the data of child language acquisition. The literature also supported the fact that no single formal grammar could account for the acquisition process in all of the world's many thousands of languages (Slobin, 1973). Vygotsky (1978, 1986) and Bruner (1975, 1983) believed that language was a product of cognitive growth and was significantly mediated by social and

interactional influences. The linguistic theory proposed by Bruner in the 1970s reiterated the role of the social context for the development of many areas of language and proposed that a child experienced language in the context of familiar routines. These routines are in the form of predictable, shared activities repeated numerous times which provide opportunities for the child to map linguistic input and subsequently process language. Vygotsky's theory of language development featured the concept of a Zone of Proximal Development (ZPD) that recognized play as being the source of development (Vygotsky, 1978, 1986). In this theory, he highlighted the relationship between language and thought, also bringing attention to the role of the adult in a child's development. In a similar approach, social-interactionists such as Snow (1989), Bates (1976) and Tomasello (2003) also proposed that children are presented with the evidence they need to decode language through parent-child interaction. They hypothesized that language acquisition is a function of general cognitive abilities and the interactions between learners and their surrounding communities.

There is strong evidence in the current literature that rich, reciprocal language environments are essential to children during their early years of development (Shonkoff & Phillips, 2000; Siegel, 1999; Siegel & Hartzell, 2003; Stien & Kendall, 2004). However, as has been reported earlier in this chapter, many children who are born with a permanent sensorineural hearing loss face challenges in participating in reciprocal interactions with their parents and primary caregivers. It is therefore important to ascertain how young deaf children are provided with access to early communicative experiences within a normal maturational timeframe and the conditions under which they achieve optimal language outcomes. In their study of cognitive functioning in deaf adults and children Marschark and Wauters (2011) suggested that many deaf children from hearing families are at risk of delayed thinking and social skills as a result of reduced access to fluent language in their family environments. Research findings also indicate that young children are able to self-regulate more effectively when they have attained higher levels of language abilities (Hughes, 1998) and when their mothers provide more effective scaffolding and are more sensitive and responsive (Bernier et al., 2010).

2.5.1 Spoken and sign language acquisition: similarities and differences

In addition to the role of social and interactional influences supporting an infant's acquisition of language, there is a belief amongst many linguists that the newborn human makes use of the brain's biological foundations to acquire language (Liberman & Mattingly, 1985, 1989; Lieberman, 1984; McNeill, 1970). These studies have found that infants possess a readiness to learn language that is governed by highly subtle and abstract principles and they achieve language milestones without explicit instruction within discrete periods of development (Petitto, 2000). There has been debate for decades about whether an infant's brain is specialized to detect the underlying contrasting patterns in spoken language or whether it simply processes general auditory perceptual features of sound that, over time, become utilized for language learning (Baker, Golinkoff, & Petitto, 2006). Studies on infant speech perception and language acquisition have found that newborn infants possess an impressive level of competence to discriminate and classify phonetic contrasts (Eimas, Miller, & Jusczyk, 1987; Miller & Eimas, 1996). Moreover these studies have found that infants are born with a well-developed sensitivity for rhythmic and other prosodic properties of natural languages.

All natural languages, including sign languages, are typically described on several distinct levels: phonology, morphology, syntax, semantics (Bavelier, Newport, & Supalla, 2003; Goldin-Meadow, 2003; Klima, & Bellugi, 1979; Malle, 2001). In English, 44 phonemes are combined to form the thousands of words used by fluent speakers of the language (Fromkin et al., 2012), whilst the handshapes of sign languages are used in various combinations to form thousands of signs. In Auslan, linguists have identified 62 handshapes, comprised of 37 distinct configurations and 25 variants that are used in various combinations to form thousands of signs used by fluent communicators (Johnston & Schembri, 2007). Sign language linguists have identified that the gestural elements of sign languages could be broken down into smaller discrete units (Johnston & Schembri, 2007; Schembri, 1996; Stokoe, 1960; Stokoe, Casterline, & Croneberg, 1965). Most contemporary researchers now acknowledge the four formational aspects of location, handshape, movement and orientation as the

basic units of phonological contrast in signs (Bonvillian & Siedlecki, 2000; Coulter & Anderson, 1993; Wilbur, 1987, 1993; Woll, 1990).

Although it is important to fully understand the linguistic properties of sign languages and their relationship to spoken languages, this chapter will not investigate the linguistic features in detail. For the purposes of this study, it will suffice to give an overview of current research related to natural sign languages and the way they are acquired as first languages. For a more detailed description of sign language linguistics and acquisition, see Anderson and Reilly (1997, 1998), Baker and Woll (2008), Johnston and Schembri, (2007) and Mayberry and Squires (2006). It is also important to clarify the distinction between natural sign languages and artificial sign systems such as Sign Supported English (SSE), Manually-Coded English (MCE), Signed English (SE), Pidgin Signed English (PSE), Signing Exact English (SEE II) and Cued Speech. These systems will not be discussed in depth here (for more information see Fleetwood and Metzger, 1991, 1998; Hage and Leybaert, 2006; Johnston and Schembri, 2007; LaSasso and Metzger, 1998; Luetke-Stahlman, 1991; Schick and Moeller, 1992).

Sign language acquisition has been studied around the world (Johnston & Schembri, 2007; Mayberry & Squires, 2006). Although research has found a similar developmental path across sign languages, it is worth noting that a number of linguistic details are specific to each language. Sign languages are natural visual-gestural languages, possessing the full abstract and expressive capacity and strict grammatical regularities of all spoken languages (Hickok, Bellugi, & Klima, 2001; Johnston & Schembri, 2007; Klima & Bellugi, 1979; Petitto, 2000). Like spoken languages, sign languages are passed down from one generation of language users to another within distinct social and cultural groups. Moreover, natural or native sign languages are no more likely to be universally understood than spoken languages, although there is an underlying commonality of structure and morphology (Hickok et al., 2001; Johnston & Schembri, 2007). While spoken languages are encoded in acoustic-temporal change-variations in sound over time, sign languages rely on visual-spatial changes to signal linguistic contrasts. Despite obvious differences in modality, sign languages display many of the grammatical devices found in spoken languages.

However, Johnston and Schembri stress that sign languages are not spoken languages in signed form, but have their own grammatical structures that are very different from the spoken languages of their countries or cultures.

2.5.2 Developmental milestones in spoken and sign languages

Over the years, research studies have attempted to identify the impact of modality on the structure of language (Meier, Cormier, & Quinto-Pozos, 2002) and have sought to determine the ways in which spoken and sign languages fundamentally differ (Johnston & Schembri, 2007). It is important to acknowledge these differences, particularly in terms of first language acquisition by young children. It should also be noted that, to date, studies of sign language development are based on research with children of deaf parents who are exposed to fluent sign language from infancy (Baker, van den Bogaerde, & Woll, 2008). Children of parents not fluent in sign language may therefore not follow the same pattern of acquisition, although there is evidence in the literature that children from hearing families can become fluent signers if the parents are supported in their sign language learning (Mayberry & Eichen, 1991). In their study of the long-lasting advantage of learning sign language in childhood, Mayberry and Eichen examined the effects of age of acquisition of 49 deaf signers who had acquired their language between the ages of birth an 13 years. They found that the age at which the sign language was acquired significantly influenced all levels of linguistic structure, particularly at the sentence level. In other words, when reviewing the literature related to children's sign language development, it is important to identify whether they were exposed to the language from infancy.

In the first year of life, babies learn to detect the specific phonological properties of their native language, yet lose their sensitivity to phonological information that is not pertinent. For instance, by six months, infants acquiring spoken language will have acquired the vowels of their language and will start to babble with these phonemes, (Brown, 1973) but they do not show recognition of the phonemes of another language (Iverson & Kuhl, 1995). It appears that, by nine months of age, infants acquiring

English are more sensitive to the prosodic properties of their language in comparison to that of any other language and prefer to listen to the phonetic patterns frequently occurring in English (Jusczyk, Luce, & Charles-Luce, 1994). With these competencies in place, a baby is able to segment speech and consequently learn words during the first year of life. It is also apparent that three-day-old infants can discriminate word boundaries and that eight-month-old infants can segment speech on the basis of statistical cues only (Christophe, Dupoux, Bertoncini, & Mehler, 1994). However, according to Petitto (2000), this initial sensitivity should be seen as dedicated to language in general, including sign language. Petitto suggests that, rather than being exclusively sensitive to sound or speech, infants learn to detect aspects of patterning of language. This developmental sensitivity is therefore focused on the temporal qualities of syllabic and prosodic levels of natural language organization. If the environmental input contains the requisite patterns unique to natural language, human infants will attempt to produce and to acquire those patterns, irrespective of whether the input is on the hands or the tongue.

During the babble phase, babies repeat sounds to produce the first consonant-vowel combinations that can be interpreted as words, such as ‘mama’, which in turn leads to the start of parent-child conversations. This stage of language development is considered to be essential as children use the phonemes that will form the foundation of their words and sentences (Marschark, 2001). Just as hearing babies babble vocally, infants who are exposed to sign language produce ‘manual babble’ on their hands at around the same time (Petitto et al., 2001; Petitto & Marentette, 1991). Manual babble consists of a reduced set of the phonological parameters found in the sign language (handshape, orientation, location, movement) and follows the syllabic organization of sign languages, especially with respect to rhythmic timing. Manual babble and early sign production in most sign languages are comprised of hand configurations known as ‘unmarked handshapes’ (Baker & Cokely, 1980; Brentari, 1998; Calabrese, 1995), which appear to be the first handshapes acquired by infants (Marentette & Mayberry, 2000; McIntire, 1977). In linguistic terms, ‘marked’ refers to the least commonly occurring forms in the language, whilst ‘unmarked’ forms are phonetically and phonologically more simple (Morgan, Barrett-Jones, & Stoneham,

2007). In spoken language, marked sounds include less common nasal vowels that are acoustically-articulatorily more difficult than others such as oral vowels. Unmarked handshapes contain phonological contrastive features that are basic, simple and the most frequently occurring in the language. There are seven unmarked handshapes described in sign language literature (Johnston & Schembri, 2007), however signing infants have been observed to use four of these in their early babble, involving relaxed hand, fist, O shape and index point. These handshapes appear to be the most physically and perceptually distinct from one another and are used with more repetitious movements than in the adult model. Unmarked handshapes account for more than 60 percent of Auslan signs and occur in the greatest range of combinations with other elements of signs (Johnston & Schembri, 2007). However, in addition to Petitto and Marentette's findings, Meier and Willerman (1995) and Cormier, Mauk, and Repp (1998) found frequent manual babbling in hearing children with no sign exposure. Moreover, they observed a broad spectrum of similarities between prelinguistic gestures in deaf and hearing infants, consistent with the claim that the development of manual babble may be linked to the availability of visual feedback and to the emergence of motor control of the hands (Sperling, 1978).

Most children acquire the surrounding language with relative ease if exposed to a variety of early childhood language experiences with fluent communication partners (Petitto, 2000; Shonkoff & Phillips, 2000; Siegel, 1999). While the majority of findings related to language development come from studies of spoken language, there have been numerous studies that have identified the way in which sign languages are acquired as a first language during the early developmental years (Emmorey & Corina, 1993; Hickok et al., 2001; Klima & Bellugi, 1979; Petitto, 1994, 2000; Ronnberg, Soderfeldt, & Risberg, 2000). Some of these studies, such as those carried out by Hickok et al. (2001), investigated the way the brain processed two languages that shared the same abstract properties of language but differed markedly in the way they were expressed. Through these important studies, natural languages were found to be unconstrained by sensory modality, with speech encoded in acoustic-temporal changes and sign languages using visual-spatial changes to indicate linguistic contrasts (Bellugi & Klima 2001; Hickok et al., 2001).

It is important to note at this point that, although some researchers have claimed that children's first signs are acquired earlier than first words (Acredolo & Goodwyn, 2000), more recent research suggests that there is no significant difference in the timing of the signs and words and that developmental milestones are met within similar timeframes (Johnston & Schembri, 2007). When Meier and Newport (1990) reviewed the relevant literature, they concluded that the available evidence supported a slight sign language advantage at the one-word stage of language development. However, they also concluded that the visibility of sign features is more contrastive than for speech, particularly in the case of young children acquiring language. Meier and Newport further reported that this sign advantage disappears by the two-word stage, when more syntactic and morphological features emerge in the grammar of sign language.

In their study of the developmental milestones of sign language acquisition and motor development of 11 children of deaf parents, Bonvillian, Orlansky, and Novack (1983) reported that the children showed accelerated early language development in sign compared to speech. However, these results need to be interpreted with caution, considering that the deaf parents' dominant input to their children was sign language and their quality and intelligibility of speech was variable. In other studies, signing children are reported to produce their first lexical sign and develop a 10-word vocabulary up to two months earlier than children developing oral language (Folven & Bonvillian, 1991; Orlansky & Bonvillian, 1984). However, *w*hen Johnston, Durieux-Smith and Bloom (2005) reviewed the evidence that infants reach sign language milestones before those for spoken language, they found that most of the studies were methodologically weak. They determined that the studies varied significantly with regard to many factors, such as the parents' sign language competence, measurement of language milestones and the nature of the children's exposure to sign language. In addition, Johnston and colleagues noted that important theoretical issues related to language modality development and preference were not adequately addressed in any of the studies they reviewed.

2.5.3 First words and signs

In the past, vocal babbling and first words were viewed as discrete stages in the child's acquisition of language, perhaps being separated by a silent interval (Jakobson, 1968). However, more recently, a significant body of evidence has accumulated to show that, rather than separate stages, there is a smooth transition between babbling and first words (Oller, Eilers, Urbano, & Cobo-Lewis, 1997, Vihman, 1985) and that many of the articulatory tendencies during babbling carry over into production of true words. Locke (1990) for example, identified a repertoire of babbling consonants that have also proven to be the most frequent consonants in early word productions. Following the babble stage, young children acquiring spoken and sign languages incorporate gestures as a precursor to their eventual use of spoken words or signs (Volterra & Erting, 1990). Just as vocal babble declines before the emergence of the first word, reported from as early as eight months to as late as 16 months, manual babble and communicative pointing decline just before the appearance of the first sign (Petitto, 1987b). Generally, the first 10 words or signs are produced at around 12 months of age, and the first 50 words or signs from between 19 and 24 months (Anderson & Reilly, 2002; Charron & Petitto, 1991). During this stage, research studies have found that children inevitably make verbal and signed errors, depending on the complexity of the lexical item. When Munson, Edwards and Beckman (2005) reviewed typical and atypical phonological development, they reported that a child's first words contained substitutions, deletions, additions, and distortions compared to the target adult form, but these phonological mismatches decreased over time. Marentette and Mayberry (2000) studied the emerging phonological system of American Sign Language (ASL) and found that the most frequently misarticulated sign parameter was handshape, followed by movement, with location being the most accurate. Development of motor control is evident in early signs, with movements made by proximal joints such as the shoulders and elbows, substituted for movements made by distal joints, such as wrists and fingers (Meier, Mauk, Mirus, & Conlin, 1998).

Young children's use of early gestures is generally accepted to be an important stage preceding the imminent use of spoken words or signs (Volterra & Erting, 1994).

Gestures are an essential component of communication in both language modalities during the first year of life and throughout adulthood (Stokoe & Marschark, 1999). In transitioning from single words to the two-word stage at about 12 months of age, gestures and signs both refer to the same meaning and are known as the semantic one-sign stage. At this stage, gestures are combined with a point and a single word or sign, with the point and the word/sign referring to two distinct meanings (Anderson & Reilly, 2002). In a study of the sign language development of two profoundly, congenitally deaf girls with deaf parents, Petitto (1987a) found that the children used pointing to show or request at about nine months of age, a comparable age to children acquiring spoken language. Although the findings of this study were based on only two children, other studies have replicated these findings and support the linguistic status of prelinguistic gestures, irrespective of modality (see Bonvillian et al., 1983; Namy, Acredolo, & Goodwyn, 2000; Volterra & Iverson, 1995). These studies found that, at approximately 12 months of age, signing children stopped using pointing to refer to people, although it still was used to refer to things and places. Six to 12 months later, person-pointing came back into use, but this time it was used as a sign to represent personal pronouns. Such shifts indicate that gestures and signs are distinct, even if they look the same, and indicate the need to examine more closely relations among early gestures, early signs, and early words.

2.5.4 Acquiring grammar

Regardless of the modality of the language, the development of grammatical complexity and language fluency by young children is facilitated by access to a variety of rich interactions (Marschark, 2001). Research into sign language acquisition has shown that children's first signs are semantically similar to those of children learning spoken languages (Anderson & Reilly, 2002; Baker et al., 2008). Signs closely related to the child's experience appearing first, such as words and signs for people, animals, and food. Questions, verbs and negations all appear after the first 100 words or signs have been learned at around 18 to 24 months of age, however non-manual markers are not used consistently or appropriately in sign language until the age of three and a half

years (Anderson & Reilly, 2002). There is much evidence in the literature that children's two-word combinations in spoken and signed modalities are highly similar across cultures (Braine, 1976; Brown, 1973; Clark, 1993, 2009; Marentette & Mayberry, 2000; Petitto, 2000; Pinker, 1984, 1995). Children use their words and signs for a variety of pragmatic functions, such as naming, requesting, negating, questioning and commenting and in most cases they understand how to put these words or signs together so that communicate effectively. Irrespective of the specific theory of language acquisition followed, linguists generally agree that, once children begin to combine words or signs their language rapidly expands into more complex grammatical structures (Baker et al., 2008; Brown, 1973; Marentette & Mayberry, 2000; Pinker, 1984). From this point, they gradually acquire grammatical morphemes such as inflections, prepositions, articles, and case markers in their spoken language and visual-spatial features in their sign language.

By the time children acquiring spoken language reach the two-word stage at around 16 months, there is an emergence of primitive syntax and a dramatic growth in vocabulary. Some linguists suggest that children at this stage of development learn a new word every two waking hours of each day until adolescence (Clark, 1993; Pinker, 1984). At the same developmental stage, signing children in the semantic two-sign stage are expanding their vocabulary, using nominals to refer to people and generally beginning to use pronouns by two years of age (Baker et al., 2008; Hoffmeister & Wilbur, 1980; Petitto, 1987a). Before three years of age, children will start to use 'indicating verbs', which are signs that are moved in the direction of the person or object being referred to, for example, 'I give it to you'. By three years, 'depicting signs' which describe attributes of the referent will emerge in the young child's expressive language (Johnston & Schembri, 2007; Mayberry & Squires, 2006). It is at this point that the linguists agree that the morphologies of spoken and sign languages begin to deviate, with noticeable differences in the ways their grammatical features are expressed (Johnston & Schembri, 2007). Since sign languages have been studied in depth from the 1980s (Stokoe 1960; Stokoe et al., 1965), linguists have agreed that, essentially, the grammar of spoken languages is linear and sequential in nature, whilst sign language grammar is characterized by the use of space, depicting signs and

simultaneous grammar (Johnston & Schembri, 2007). For example, spoken languages use morphemes such as suffixes, case agreements, plurality and inflections to modify meaning (Brown, 1973), whilst sign languages move signs in space, add nonmanual features and inflect verbs through reduplication, movement and stress (Baker et al., 2008; Mayberry & Squires, 2006).

Between the ages of two and three years, children's language incorporates even more morphological features, with increased combinations of syntactic structures and a rapidly growing vocabulary (Brown, 1973; Pinker, 1995). In spoken languages, these linguistic skills account for the range of grammatical features necessary for future adult grammar and include the use of a full range of sentence types, relative clauses, comparatives, negations, complements, conjunctions, and passives. These constructions appear to display the most, perhaps even all, of the grammatical machinery needed to account for adult grammar (Pinker, 1995). In sign language acquisition, children start to include more use of space, non-manual markers and topicalization (Anderson & Reilly, 1997, 1998; Johnston & Schembri, 2007, Pichler, 2002; Sutton-Spence & Woll, 1999). There is also evidence that, from about two years of age, children start to use fingerspelling to encode words (Padden, 1991) and by the end of their third year, they realize that fingerspelling is a special form of language used to name a thing or a person.

From three to four years of age and beyond, studies of child language development have found that children show more control over the phonological, morphological, syntactic and semantic features of their language (Baker et al., 2008; Brown, 1973). In English, for example, children include infinitives, possessives, past tense and reflexive pronouns in their utterances (Brown, 1973), whilst children acquiring sign language gradually use compounds, include movement and manner in spatial agreement verbs and start to make use of simultaneous grammar (Morgan & Woll, 2002). They are also able to recognize fingerspelled sequences (Padden, 1991) and comprehend conditional sentences, although they do not master nonmanual markers to signal this use until they are at least eight years of age (Reilly, McIntire, & Bellugi, 1991). By this age, they begin to comprehend the use of locations in space for verb agreement and

can inflect verbs using people, places and objects that are present. However it is not until six years of age that children display correct production of basic verb agreement (Meier, 2002; Morgan & Woll, 2002).

In general, the language skills of children between four and six years are characterized by consolidation of the phonology, morphology, syntax and semantics acquired from the time of their first words and signs. Children's oral language contains more complex linguistic features such as comparatives, adjectives and irregular verbs (Brown, 1973), whilst signing children use sophisticated structures such as innovative compounds, role shift, semantic classifier handshapes, spatial verbs and noun-verb pairs (Baker et al., 2008; Slobin et al., 2003). In other words, at the relatively young age of six years, most children have mastered the morphology of their language, regardless of modality, and are well on their way to becoming competent communicators.

Throughout these language stages, children's pragmatic language skills become more sophisticated as they facilitate effective discourse, meaningful conversations and satisfying social interactions (Jeanes, Nienhuys, & Rickards, 2000). Pragmatic behaviours relate to the way in which language is used to convey meanings and engage in effective interactions and include skills such as taking conversational turns, topic maintenance, repairing utterances, adding information and asking questions (Adams, 2002; Ninio & Snow, 1999). Prior to the emergence of language, children communicate by non-verbal means (Bates, Camaioni, & Volterra, 1975), however Dore (1978) also suggests that these prelinguistic communication skills are not necessarily sufficient for the acquisition of language-based communication. Dore proposes that a child's development of pragmatic skills is separate from their language development and that many young children display skills such as non-verbal requesting, protesting and negation prior to attaining language skills. With regard to the development of pragmatic language skills by children acquiring sign language, numerous studies have found that children in deaf families follow the same maturational trajectory as children acquiring any other language (Mayberry & Squires, 2006; Morgan & Woll, 2002; Newport & Meier, 1985; Schick, 2006). Although specific attention-gaining and communication strategies may differ between spoken and sign languages, the

development of pragmatic skills is not constrained by modality (Harris, 2001; Spencer, 2001). There is much evidence to be found in the literature that deaf children with hearing parents experience delays and challenges in their interactions due to reduced exposure to frequent, natural discourse (Gallaway & Woll, 1994; Jeanes et al., 2000). However, although there are fewer studies that have examined the development of pragmatic skills by deaf children with hearing parents, it is likely that poorer speech perception and lower speech intelligibility may affect deaf children's pragmatic communication skills (Lederberg & Everhart, 2000; Most, Shina-August, & Meilijson, 2010; Tye-Murray, 2003).

2.6 Parental influences on children's language development

In order to determine the role parents play in supporting their deaf children's language development, it is first necessary to understand the ways in which they support typically developing hearing children's language within their social environments. Numerous studies have found that language use in early childhood is highly interactive, with an important role played by parental, particularly maternal, input and scaffolding (Bruner, 1983; Ninio & Snow, 1999; Snow, 1977, 1979; Tomasello & Todd, 1983). Parents who are sensitive to their children's communicative signals are more likely to have children who are securely attached (Siegel, 1999) and who seek interactions with their caregivers. Such parents and caregivers are emotionally available to their children, engage in communicative exchanges and are responsive to their needs and mental states. In a prospective longitudinal study involving 40 mother-child dyads, Tamis-LeMonda, Bornstein, and Baumwell, (2001) found that variations in the children's language outcomes in their first two years of life were significantly influenced by differences in the mothers' responsiveness and their children's access to language. Five critical child language abilities were found to be predicted by the mothers' responsiveness when the children were aged nine and 13 months: first imitations, first words, first 50 words, first use of combined words, and first use of language to talk about the past. Their study also found that optimal language learning

occurred when joint attention was paired with input from a mature, fluent language user.

Effective parent-child interactions mostly occur in routine, familiar contexts, but it is also important to note that parents and their children need to share a communication code which enables and promotes reciprocal interactions. Even though non-verbal communication during the first two years is sufficient for interactions to occur (Greenfield & Smith, 1976), it is essential that children are exposed to language-rich environments and that parents and caregivers adapt to the communication needs of young children within the first year of life (Traci & Koester, 2003). Numerous research studies have found that a strong relationship exists between diminished parental language input and delayed development of vocabulary and syntax in children (Hoff & Naigles, 2002; Huttenlocher, Vasilyeva, Waterfall, Vevea, & Hedges, 2007; Lacroix, Pomerleau, & Malcuit, 2002; Weizman & Snow, 2001). Bilingual studies have also found that fluency of parental language input to young children is a factor contributing to dominance of one language over another (De Houwer, 1995; Lanza, 2001; Taeschner, 1983). However, in terms of deaf children whose hearing parents have opted to communicate in sign language, the quality of sign language input may be severely compromised due to low levels of proficiency and fluency (Hyde & Punch, 2011; Napier, Leigh, & Nann, 2007). Furthermore, access to fluent spoken language may also be compromised due to the distortion effects of sensorineural deafness on a child's ability to perceive speech in their natural environments (VanDam, Ambrose, & Moeller, 2012).

One of the most important factors in a child's development is the availability and accessibility of communication with a parent or primary caregiver (Marschark, 2001). In order to facilitate their children's participation in social interactions from infancy, parents use a range of communication strategies to ensure that reciprocal, satisfying exchanges ultimately lead to optimal language skills (Bates et al., 1975; Carpenter, Nagell, & Tomasello, 1998*;* Dore, 1978; Halliday, 1975; Ninio & Snow, 1999; Tomasello, 2006). Communicative competence is attained through collaborative communication which is a function of attachment, one of the earliest of infant

behaviours (Siegel & Hartzell, 2003). As the child grows and attention becomes more focused on objects and their meaning, the communication process becomes more challenging and requires the communication partner to be responsive to the child's topic of interest, reinforcing and commenting on events in the surrounding environment (Harris & Mohay, 1997; Snow, 1986). During the process of language acquisition, parents and primary caregivers serve as models for their child's communication and provide access to language. Engaged parents intuitively make various adjustments in communicating with infants and toddlers in order to encourage their development (Belsky et al., 2007; Hart & Risley, 1995; Snow, 1995). They facilitate their interactions by way of a high degree of contingency (Janjua et al., 2002) and are highly responsive to the child's interests in play or conversation.

As children reach their preschool years, they initiate and engage in conversations with a range of communication partners and refine their pragmatic language skills (Lederberg & Everhart, 2000). There is much evidence to be found in the literature that parents vary in terms of the quantity and frequency of their communication and how much they actually direct their communication to their children (Gilkerson & Richards, 2009; Hart & Risley, 1995). Studies have found that talkative parents encourage stronger language skills in their children by providing them with more opportunities to connect the phonological form of the word with its meaning, which in turn leads to future lexical proficiency (Hoff & Naigles, 2002; Hurtado, Marchman, & Fernald, 2008; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991). VanDam and colleagues (2012) further suggest that, although children's language skills do not necessarily influence the quantity of parental language input, there is a positive relationship between language abilities and the number of parent-child conversations.

2.6.1 Parental responsiveness to children's communication

Parental and caregiver responsiveness has been shown to play an important role in a young child's communication experiences and future language outcomes (Olson & Masur, 2013; Paavola, Kemppinen, Kumpulainen, Moilanen, & Ebeling, 2006; Tamis-

LeMonda et al., 2001). Responsive parents encourage mutual exploration of objects and interpret their children's referential signals, gradually adapting their interactive behaviours to facilitate language acquisition (Abu Bakar, Brown, & Remine, 2010; Smith, Adamson, & Bakeman, 1988). The importance of establishing connections between words and their meaning has been well reported in the literature (Baldwin & Markman, 1989; Barnes, Gutfreund, Satterly, & Wells, 1983; Harris, 1992; Harris, Jones, Brookes, & Grant, 1986; Tomasello & Todd, 1983). This apparent intuitive parental response to their children's communication is found across most cultures, although studies show that cultural differences may play a part in the way parents scaffold their children's attention and respond to their communication (Vigil & Hwa-Froelich, 2004). For example, Hsu and Lavelli (2005) found that mother–infant dyads in America spent less time in social exchanges, such as a mother smiling in response to her baby's eye gaze, than Italian dyads. Other studies have found that American mothers were more likely to direct their infant's attention to objects, whilst Japanese mothers tended to direct their infant's attention towards social exchanges (Bornstein et al., 1992).

Numerous studies have found that mothers who respond promptly and contingently to their children's utterances encourage a sense of communicative confidence and security of attachment (Ainsworth, 1970; Bornstein et al., 1992; 1978; Skinner, 1986; Tamis-LeMonda et al., 2001; Watson, 1985). Generally, mothers who show a high level of sensitivity to their children's communication modify their utterances to support their children's level of understanding (Clarke-Stewart, VanderStoep, & Killian, 1979; Cross, 1978). Furthermore, when a mother's input is semantically matched to her child's language, her level of responsiveness has been found to be a strong predictor of the child's language outcomes (Barnes et al., 1983). By being responsive and sensitive to early communication bids, a mother provides her child with a foundation for understanding adult communication and for engaging in parent–child conversations (Snow, 1986). These early communication bids are not exclusively vocal, but also include gestural behaviours. For instance, in a study of 30 mother-infant dyads, Olson and Masur (2013) found that the mothers verbally responded more frequently when their infants' communication bids included gestures.

In addition to facilitating communicative confidence and strong attachment, there is much evidence in the literature that maternal responsiveness plays an important role in early language acquisition (Paavola et al., 2006; Paavola, Kunnari, & Moilanen, 2005; Snow, 1979; Tomasello & Farrar, 1986). Children are seen as active participants in interactions and demonstrate increasing competence in conveying messages to interactive partners. In a Finnish study of 27 mothers with first-born children, Paavola and colleagues (2005) found that both maternal responsiveness and infant intentional communication predicted early language skills. Results of the study showed that maternal responsiveness during the pre-linguistic stage was not necessarily dependent on the child's communicative competence, but both maternal responsiveness and infant intentional communication made a distinctive contribution as predictors of early communicative and linguistic skills. Similarly, Paavola et al. (2006) found that maternal responsiveness played an important part in eliciting interaction and conversational interchanges at the onset of infant intentionality. It was acknowledged, however, that parent-child interaction is a transactional process, with unique contributions by mother and child.

Whilst it is necessary to understand the nature of parents' interactive behaviours and responsiveness to their children, it is also important to acknowledge the children's developing attentional abilities and their impact on language development (Harris & Mohay, 1997). If parents are to be effective in attaching linguistic meaning to objects and events, they need to be responsive to the focus of their children's attention and be ready to provide their children with the language that relates to what they are looking at. In fact, studies have found that the wide variation in language outcomes between children can be explained by the differences in the effectiveness of parents' ability to provide meaningful language to match their children's attention (Tamis-LeMonda et al., 2001). In addition, there is evidence in the literature that children will acquire new language skills more effectively when engaged in coordinated joint attention with a mature language model (Moore & Dunham, 1995). Attention regulation also plays an important part in typically developing hearing children's language development (Reynell, 1977). In their study of joint attention and maternal attention strategies, Spencer and Waxman (1995) found that the developmental

pathways of attention regulation in deaf and hearing children are relatively similar up to the age of 18 months. In another study, Lederberg and Everhart (2000) examined the communication between hearing mothers and their deaf children when the children were aged between 22 and 36 months. They found that mothers of deaf children were as responsive to their children's attentional focus as mothers of hearing children and that they used directive behaviours as an appropriate adaptation to their children's linguistic development.

Specific attention-gaining strategies involving gestures, facial expressions, vibration and touch are also used by many hearing parents in their quest to engage their children during communication exchanges (Harris & Mohay, 1997; Loots & Devisé, 2003; Spencer, 1993; Spencer & Harris, 2006). On the other hand, other studies have found that there is some evidence for impaired attention in deaf children compared with their hearing peers (Figueras, Edwards, & Langdon, 2008; Khan et al., 2005), although Tharpe, Ashmead and Rothpletz (2002) found no differences in visual attention skills. However, in a study of 24 hearing child/hearing mother dyads and 24 deaf child/hearing mother dyads, Prezbindowski, Adamson, and Lederberg (1998) found that deaf children spent significantly less time in symbol-infused joint attention with their hearing mothers than did their hearing peers with their hearing mothers. Symbol infused joint attention occurs when the child attends to the communication partner's symbolic words or gestures during interactions. Moreover, the deaf children and their mothers did not use language to mediate their interactions, nor did the deaf children use symbolic gestures, symbolic play or language to initiate and maintain episodes of symbol-infused joint attention with their mothers.

It appears that it is not until after the vocabulary spurt at approximately 18 months of age that language facilitates joint attention between children and their primary caregivers (Spencer & Waxman, 1995). Prezbindowski et al. (1998) suggest that, overall, the developmental pathways of joint attention of deaf and hearing children diverge near the end of the second year when symbol-infused joint attention becomes one of the primary states of parent-child interaction for hearing children and their hearing parents, but not for deaf children and their hearing parents. To redress this

disparity, the authors suggest that hearing mothers of deaf children would benefit from an early intervention program that focuses upon the infusion of symbols into already present episodes of coordinated joint attention.

2.6.2 Parental interactions with deaf children

The majority of studies devoted to parent-child interactions and their influence on children's language development have focused on typically developing hearing children (Paavola et al., 2006; Snow, 1979; Tomasello, 1998). However, as has been mentioned earlier, children diagnosed with prelingual deafness are frequently faced with significant delays in their communication and language development and disruptions to effective interactions with parents and primary caregivers (Kushalnagar et al., 2010; Marschark, 2007; Spencer & Harris, 2006; Yoshinaga-Itano, 2003). This may be partly due to the fact that most deaf children are born to hearing parents who have usually had minimal experience with the specific communication strategies known to effectively engage deaf children (Leigh, 2007; Marschark, 2001). Paul and Elwood (1991) suggest that variability in children's language development is due to a number of factors, including a less than optimal language input and a mismatch between the child's language needs and parental input. Paul and Elwood also propose that children with language delays may present a different set of linguistic stimuli to their parents, which in turn affects the reciprocal input. Several studies have found that, not only do interactions between hearing parents and their deaf children often lack reciprocity, they are usually not as sustained as those with hearing children and they show significant differences in type and frequency of utterances (Carey-Sargeant & Brown, 2005; Gale & Schick, 2009; Lederberg, 1993).

In order to understand the factors that influence deaf children's language development, it is important to consider the ways in which parents adapt their interactions and modify their language input to achieve the best language outcomes. There is evidence in the literature that the language development of young deaf children is significantly influenced by different styles of parental interaction (Cross,

Nienhuys, & Kirkman, 1985; Janjua et al., 2002; Lederberg & Mobley, 1990; Spencer & Harris, 2006; Traci & Koester 2003; Wedell-Monnig & Lumley, 1980). Lederberg and Everhart (2000) found that hearing mothers tended to be more controlling and intrusive, constantly correcting their children and control their activities. These parents were more likely to have less enjoyable conversations with their children and the children were therefore likely to be less communicative and interactive.

Research findings reported in the literature also suggest that specific aspects of a child's behaviour may affect the way in which a parent responds to their communication bids (Bornstein et al., 1992; Snow, 1986; Yoder & Kaiser, 1989). In studies that investigated the communication skills of deaf preschoolers, many children were found to demonstrate behaviours that differed significantly from their hearing peers (Cross et al., 1985; Meadow, Greenberg, Erting, & Carmichael, 1981), particularly in their use of pragmatic language skills and the size of their vocabulary. These behaviours included the frequency and number of spontaneous communications, the degree of responsiveness to maternal directives and the ability to maintain conversation about a topic (Lederberg & Everhart, 2000). The deaf children's pragmatic language skills were also different from typically developing hearing peers in that they used more directives, asked fewer questions, referred more to objects than feelings and imitated their mothers more (Meadow et al., 1981; Nicholas & Geers, 1997; Power, Wood, Wood, & MacDougall, 1990).

Past studies have shown that there appears to be a difference in quality of interactions when a child is deaf and that communicative interactions between hearing mothers and their deaf children were reduced compared to those for hearing dyads (Carey-Sargeant & Brown, 2005; Lederberg & Mobley, 1990; Meadow et al., 1981). In a study of the effects of parental interaction style on the language development in young deaf children, Janjua, Woll and Kyle (2002) observed that there were striking differences in parents' attitudes when interacting with their deaf children. They also noted that children with the same degree of deafness, similar cognitive development and the same type of intervention appeared to be acquiring language at very different rates. When looking at the effect of parental style of

interaction on the language development of very young deaf children, Janjua and colleagues comment: “Of all conditions that may affect interaction, deafness, due to its pervasive effect on communication, is possibly one of the most disruptive for parent–child interaction” (p. 203). In their study, they found that the general attitude and behaviour of parents when interacting with their children affected not only language, but also their children’s social and emotional behaviour. Regardless of the language modality parents use with their deaf child, they face the challenge of modifying previously learned interactive styles and replacing them with more effective communication strategies (Jamieson, 1994; Quittner et al., 2010). This adjustment to fundamental interactive practices often creates considerable stress within the family and may have a negative impact on parents’ roles and responsibilities (Quittner, Glueckauf, & Jackson, 1990; Tamis-LeMonda, Uzgiris, & Bornstein, 2002).

Amongst the factors that are known to contribute to the inhibition or disruption of parents’ responses is the level of intelligibility of the child’s communication (Camarata, 1996; Warren & Brady, 2007). In addition, speech intelligibility has been found to be significantly influenced by the child’s level of expressive language ability, regardless of their language modality (Yoshinaga-Itano & Sedey, 2000). If parents are to be able to scaffold their children’s language development effectively and respond contingently, they need to understand their utterances. In addition, the reverse is also true, in that children need to be able to understand their parents’ utterances and therefore must be exposed to fluent adult language models. This is a somewhat unusual situation in terms of typical child language acquisition, as most parents are fluent in the language they use with their children and serve as models for communication (Hoiting & Slobin, 2002). In the case of young deaf children who are exposed to sign language that their parents are in the process of learning, there is undoubtedly a risk that fluency of parental input may be compromised (Moeller & Schick, 2006; Spencer & Marschark, 2010). Indeed, some theorists have suggested that parents' attempts to learn and use a new language while their children are still acquiring their first language may reduce communication with the child and the family (Stewart, 1992). However, contrary to the findings of the studies that highlighted the relationship between parents’ lack of language fluency and reduced language outcomes for children, Young (1997) took a

different approach. In her study of parents' sign language use in bilingual early intervention, Young acknowledged that many theorists believed that sign language was too hard for hearing families to learn well enough in a short time to meet a deaf child's communication needs (also see Lynas, 1994). Nevertheless, Young suggested that parents should not take sole responsibility for their child's acquisition of sign language and should not be concerned about being fluent language models. Rather, it is more important that parents engage in typical social interactions with their children, regardless of the approach they use, and allow native signers to expose the child to fluent sign language models (Svartholm, 1993; Young, 1997).

Deaf children who are exposed only to spoken language may also be at risk for not accessing fluent language input, not due to the parents' lack of oral fluency, but due to the impact of deafness on their ability to discern undistorted speech (VanDam et al., 2012). With regard to quantitative aspects of parental communication with deaf children, there is a wide variation of research findings reported in the literature (VanDam et al., 2012). Some studies have found decreased communicative interactions between hearing mothers and their deaf children (Lederberg & Mobley, 1990; Meadow et al., 1981; Wedell-Monnig & Lumley, 1980), whilst other studies have found no difference in the amount of communicative input by mothers of deaf children (Lederberg & Everhart, 1998, 2000; Spencer, 1993). It is also worth noting that, in the case of deaf children, the level of exposure to their parents' spoken language does not necessarily imply that they have the same level of access (VanDam et al., 2012), particularly during periods of reduced amplification due to illness, middle ear infections, compromised listening environments and behavioural factors.

2.7 Child-directed speech and child-directed sign

There is a large body of research on child-directed speech across a number of languages, showing that parents naturally make various adjustments in communicating with infants and toddlers to encourage their development (Snow, 1995). Child-directed speech displays specific intonation contours, simplified

vocabulary and syntax, and much repetition as a means to attract and maintain a young child's attention to language. Research on vocabulary development in young hearing children has shown a close relationship between maternal speech and the objects and events on which children focus their attention. For example, Harris, Jones and colleagues (1986) showed that almost 80 percent of a hearing mother's utterances to her hearing child had a salient context, that is, referring to objects and events at which their children are currently looking. The importance of this salient context for early vocabulary development is critical for any language, both spoken and signed and is a finding well supported by other researchers such as Baldwin and Markman (1989), Harris (1992) and Tomasello and Todd (1983).

The amount of verbal language parents direct to their children varies widely (Gilkerson & Richards, 2009; Hoff, 2003; Hart & Risley, 1995), which in turn may affect their children's linguistic proficiency (Hoff & Naigles, 2002; Hurtado et al., 2008). Cultures differ in their attitudes toward child rearing and child-directed speech (Goldin-Meadow & Saltzman, 2000) and there is also considerable evidence in the literature linking family social background and maternal educational to the quality of language provided to a child (Ching et al., 2010; Huttenlocher et al., 2007; Rowe, 2008). In fact, Hart and Risley (1995) suggested that children from language-rich, educated families were exposed to up to 11, 000 verbal utterances in a day, compared to 700 utterances for the children from families in which the mother was less well educated. These differences in quality and quantity of child-directed speech also included social-pragmatic aspects of language, with parents of higher social and educational background demonstrating more encouragement and affirmation of their children's communication bids (Hart & Risley, 1995). Moreover, the type of child-directed language has been found to be related to the social and educational background of the parents, with better educated mothers more likely to use speech to engage in conversation from their children, whereas the lower educated mothers tended to use speech to control their children's behaviour (Farran & Haskins, 1980). In her study of the parental communication styles of 47 parent-child dyads from different social backgrounds, Rowe (2008) found that the children's vocabulary sizes were greater when they were provided with more language input which was complex and diverse in

nature and contained minimal directive utterances. Rowe's study also found that the parents facilitated their children's language learning more when they understood the tenets of research-based child development. These parents also tended to communicate more, use a wider range of vocabulary and produce longer utterances during everyday interactions with their children.

With respect to the use of child-directed language with deaf children, parents make similar adjustments in their interactive behaviours in order to maximize the availability of their language input. In a study of 16 Chinese and American mother-child dyads (eight with deaf children, eight with hearing children), Goldin-Meadow and Saltzman (2000) found that American and Chinese mothers adjusted their initiations and oral communications with their deaf children in culturally sensitive ways. In fact, even though American mothers increased their use of gesture with their deaf children to aid communication, they gestured far less than the Chinese mothers with deaf children. In terms of child-directed speech with deaf children, VanDam et al. (2012) suggest that it is likely that parents talk more to their deaf children if they know have adequate auditory skills to comprehend speech. Furthermore, children with better access to speech sounds are more likely to develop stronger language skills and therefore engage more readily in spoken conversations.

In typical language acquisition, as the child develops the ability to join in interactions and attain joint attention, parents gradually increase the level of complexity of their communication, encouraging the child's competence as a communicative partner. This interactional relationship happens regardless of whether the modality of input is speech or sign language (Hoiting & Slobin, 2002; Snow, 1995). Studies have found that parents communicating in speech exaggerate the prosodic features of their oral utterances (Snow, 1977) and when using child-directed signing they are careful to make the sign more visible (Spencer & Harris, 2006). They achieve this by signing within the child's field of vision, using signs that are larger, slower or closer than usual, often displacing the signs on to the child's body (Hoiting & Slobin, 2002; Holzrichter, 2000; Mohay, Milton, Hindmarsh, & Ganley, 1998; Spencer & Harris, 2006). Competent signing parents also maximize their language input by waiting till their

child looks at them before signing to them (Ackerman, Kyle, Woll, & Ezra, 1990; Spencer, Bodner-Johnson, & Gutfreund, 1992). In their description of sign language acquisition, Mayberry and Squires (2006) suggest that child-directed sign language attracts and holds children's attention more than adult-directed sign, even when children have never seen it before. Masataka (1996) also found that child-directed sign has larger movement trajectories and tends to have more repetitions than adult-directed sign. Similar patterns of maternal signing were reported by Erting, Prezioso and O'Grady Hynes (1990), who noted that the mothers orientated their hands to allow complete visibility of the full '5' handshape, one of the most prevalent unmarked handshapes. Another modification in child-directed sign involves two types of facial expression, which are differentiated to match the maturity of the child. Adult signers use only affective facial expression until the child is approximately two years of age, after which time linguistic facial expressions are added to signed utterances (Reilly et al., 1991; Snitzer Reilly & Bellugi, 1996).

Once parents have gained their child's attention, they need to ensure that language is available and accessible (Gale & Schick, 2009). For bimodal bilingual children, this means that they need frequent and consistent opportunities to listen to spoken dialogue in optimal acoustic conditions and to observe signs in relevant contexts if they are to be able to attach meaning to what they hear and see. In their study of deaf mothers and their babies, Harris, Clibbens and colleagues (1989) found that almost three quarters of deaf mothers' signed utterances were visible and had a salient context. However, hearing mothers of deaf children may at first be challenged by the need to coordinate the language and nonverbal aspects of a visual-gestural language (Harris, 2001). While hearing children can look at objects and events while simultaneously listening to their mother, bilingual deaf children often need information to be presented sequentially so that their attention to both languages is not compromised. This requires a certain degree of modification by hearing caregivers in the way communication is shared, with more focus on timing, sequence and nonverbal cues (Harris, 2000; Harris et al., 1989).

Having reviewed the current literature on parent-child interactions in spoken and sign languages, it must be stressed that hearing parents who are novice signers will constitute the vast proportion of parents using sign language with their deaf children. Therefore, in order to fully understand the challenges many parents face in communicating bilingually with their deaf children, it would now be helpful to review the current literature on adults' learning of sign language as a second language.

2.8 Adults' learning of sign language as a second language

There are many studies reported in the literature related to second language acquisition by adults, (Ellis & Sagarra, 2010; Felser & Clahsen, 2009; Hakuta, 2001; Mayberry, 2006; Wills, 2005), but not a great deal related to the late acquisition of sign languages by hearing adults (Quinto-Pozos, 2011). Second language learning of sign languages is essentially no different from the learning of spoken languages and the level of proficiency attained is constrained by similar factors, such as the extent and maintenance of language exposure and the age of acquisition of the first language (Kovelman, Shalinsky, Berens, & Petitto, 2008). In the past, research on the teaching and learning of sign languages as second languages by hearing adults has generally focused on methodologies used for oral languages (Cogen & Philip, 1981; Cokely & Baker, 1980). Studies have found that many sign language programs have typically based their approach on vocabulary acquisition (Fuller & Wilbur, 1987), while others have considered the ways in which hearing learners acquire the nonmanual morphology of sign language (McIntire & Reilly, 1988). The findings of these studies indicated that, although adult second language learners of sign language are able to discriminate nonmanual features when used by others, they often have difficulties in producing them correctly.

One of the factors constraining the learning of sign language by parents of deaf children is the amount of time required to master a level of proficiency that would support routine social interactions and typical child-directed language. To put this challenge in perspective, Jacobs (1996) calculated that, on average, 1320 hours of

instruction would be necessary to attain this level of proficiency – a daunting task for busy parents. Moreover, the learning needs of these parents are somewhat more urgent than other language learners due to the fact that they need to learn sign language to communicate with their young deaf children (Napier et al., 2007).

In general, a feature of the first stage of adult second language learning of sign languages is a heavy reliance on the iconic features of signs. Iconicity is used as a way to attach meaning to new handshapes and to remember new signed vocabulary items in both receptive and expressive modes (Campbell, Martin, & White, 1992). Adult learners of sign language often want to know about the derivation of a particular handshape and the reason why a sign bears a particular form. However, Mayberry (2006) reports that, although sign languages appear to be mere forms of manual gesture, they are not iconic by nature. An important difference between adult second language learning of sign and infant acquisition of sign languages is that iconicity plays no role in infants' vocabulary development at all. Petitto (1994) further explains that natural sign languages are not made up of 'concrete pictures', mime or gestures in the air, but have the full abstract and expressive capacity, as well as the strict grammatical regularities, of all spoken languages. In addition to learning a signed vocabulary, adult students of sign languages such as ASL (American Sign Language), BSL (British Sign Language) and Auslan are also faced with morphology and syntax that differs greatly from that of their spoken language, particularly with languages such as English. For this reason, some studies report that the use of English word order in the preliminary phase of sign language teaching may be beneficial for pedagogical purposes (Buisson, 2007). However, it should be noted at this point that signing in English word order, such as when using sign supported speech and 'contact sign', is also a feature of natural and spontaneous language contact between Deaf and hearing communication partners (Emmorey et al., 2005; Sutton-Spence & Woll, 1998).

Another factor known to contribute to better outcomes for adult sign language learners is the opportunity to be immersed in the culture and language of the Deaf community (Napier et al., 2007). However, an interesting outcome of McKee and McKee's 1992 study of adults learning sign language was that, although many adults

acknowledged that immersion in Deaf culture would promote better signing skills, they felt intimidated by their limited competence amongst native signers. Several studies identified the need to develop programs that provide a range of opportunities for the learning of sign language, including well designed curricula based on solid pedagogy and methodology (Thoryk, 2010; Quinto-Pozos, 2011). Other researchers have suggested that many adult learners develop limited proficiency in a second language, regardless of the skill of the language teacher (Kemp, 1998). Furthermore, Kemp reports that there will always be a proportion of students who are not able to master the features of a visual-gestural language. In their study of 12 teachers and 72 students learning ASL as a second language, McKee and McKee (1992) found that many adults experienced challenges in communicating with Deaf people and overcoming their inhibitions in expressing themselves in a highly visible way. They also reported that many hearing adults found attending visually to linguistic information in a visual-gestural language to be challenging because they had no perceptual schema for this type of input. In addition, Fuller and Wilbur (1987) found that novice hearing sign language learners experienced difficulty in discriminating and recalling the phonological parameters of signs. Although these linguistic skills are not problematic for native Deaf signers (Hamilton, 1986), hearing sign language students often need to learn these features by direct instruction, particularly in the early stages of tuition (Cokely & Baker, 1980).

The challenges of second-language learning of sign language are particularly concerning when they relate to parents of deaf children, as they are likely to impinge on the children's acquisition of a first language. Several studies have found that children's language outcomes were often hindered because of the slow development of the parents' sign proficiency, their grammatical inaccuracies and their difficulties in adapting to their children's visual attention needs (Johnson, Liddell, & Erting, 1989; Spencer et al., 1992; Swisher & Thompson, 1985). In order to redress this issue, Napier et al. (2007) have recommended that an effective sign language program should be made available to parents and caregivers of young deaf children and that these programs should incorporate classroom-based teaching in addition to immersion in a range of language experiences with native signers.

2.9 Summary

This chapter outlined the impact of deafness on young children's communication and language development and highlighted the importance of early diagnosis, amplification and early intervention. Although families in Australia have ready access to diagnostic, audiological and early intervention services, the literature reports numerous variables that may impact hearing parents' ability to maximize their deaf children's early language development. One of the variables pertinent to this study was the level of the parents' engagement with their early intervention program, which in this case followed an English-Auslan bimodal bilingual philosophy. An important aspect of this study was to determine whether the level of parental participation and involvement in the early intervention program contributed to better language outcomes for their children. The study aimed to measure the children's language outcomes when their hearing parents engaged with them in bimodal bilingual conversations during natural, spontaneous interactions in the home. The parents in this study had only recently been introduced to bimodal bilingualism and consequently were novice users of sign language.

The research evidence raises awareness of the challenges faced by many hearing parents learning sign language at the same time as supporting their young children's acquisition of the same language. Parent sign proficiency was an important focus of this research, as studies have highlighted the risk of reduced communication with the child when the parents' language fluency is compromised. In light of the parents' lack of signing experience, it would be expected that their level of Auslan proficiency would be variable and woould be influenced by their ability to acquire conversational fluency in a relatively short space of time. As is the case for adult second language learning of any language, the parents would vary in their ability to acquire sign language and no doubt vary in the way they adapted to the very different grammatical rules of Auslan. These limitations will be taken into account when determining the quantity and quality of the parents' bimodal bilingual input to their children.

A review of the literature confirmed that acquisition of a first language is a natural, but complex task that is made even more challenging when a child is born with a significant, permanent hearing loss. The literature also confirmed that the process and stages of first language acquisition are not constrained by modality, with theories of language acquisition applying in the same way to spoken languages as to sign languages. This is an important point for this study, as it allows for the same developmental framework to be used to guide the measurement of the children's bimodal bilingual skills. Sign language acquisition by deaf children is also an area that is greatly misunderstood by the general public, with many misconceptions abounding about sign language being a loose collection of gestures and pantomime used for rudimentary communication rather than the rich language numerous research studies have found it to be (Hickok, Bellugi, & Klima, 2001). These misconceptions are often shared by the parents of deaf children, the great majority of whom are hearing and have usually had no exposure to deafness before their deaf child was born. In response to these findings, this study made use of several parent-rated assessment tools that serve to increase parents' awareness of the complexity of bimodal language acquisition and act as a guide to the children's developmental sequence of skills in both languages.

The literature on the role played by parents in supporting their deaf children's language development was reviewed and highlighted that parental responsiveness plays an important role in a young child's communication experiences and future language outcomes. However, studies have also found that deaf children frequently experience significant delays in their communication and language development when interactions with their parents are not effective. This study therefore pays particular attention to the quality of parental language input in relation to the children's language competence and the extent to which the children's outcomes are predicted by the parents' sensitivity to their children's communication needs. In many respects the quality and quantity of input will be dependent on the children's access to both languages and this will be related to their auditory skills, attention control and motivation to communicate. The literature contains many studies that identify strategies that are effectively used by parents when communicating with their deaf

children in either spoken or sign language. These findings provide an evidence base for this study in terms of fostering parents' skills in gaining and maintaining the children's attention, use of child-directed speech and sign and reciprocating children's utterances.

Chapter Three will now review the literature related to the place of bilingualism in the deaf child's world and will identify the conditions under which deaf children acquire bimodal bilingual skills. Attention will be given to research findings that contribute to our understanding of the nature of effective parental bimodal input in hearing families and the ways in which young deaf children are supported in determining language use that is best suited to their communication needs.

CHAPTER THREE

The place of bilingualism in the deaf child's world

3.0 Bilingualism

The acquisition of two or more languages is a common occurrence in many countries, with some indications that more than half the world's population is bilingual (Grosjean, 2008). The reasons individuals and communities around the world learn more than one language include social language contact, colonization, trade and education (Genesee, 2004). There appears to be no single definition of bilingualism that covers the breadth of bilingual practice, with descriptions ranging from possessing minimal communicative skills in a second or foreign language to native-like control of two or more languages (Hakuta, 1990). Amongst the more negative findings reported in the literature in the past were suggestions that bilingual children were weaker in a range of abilities. Deficits were reported for skills related to vocabulary, articulation and written expression, in addition to non-verbal abilities such as numeracy (Carrow, 1957). However, Peal and Lambert (1962) identified that previous research findings had been affected by a failure to control for socio-demographic and cognitive factors, as well as to account for the degree of bilingualism of the subjects. They subsequently were instrumental in redirecting the somewhat negative view of bilingualism into a more positive one, embracing aspects of cognitive domains such as intelligence, creativity, concept formation, classification, analogical reasoning, and visual-spatial skills (Bialystok, 1988; Hakuta & Diaz, 1985). In more recent times, many researchers in the field of bilingualism view bilinguals as individuals who have various degrees of proficiency in both languages (Bialystok, 2009; Carlson & Meltzoff, 2008). This broader definition of bilingualism allows for the inclusion of second language learners (Hakuta, 1986) and for bilinguals who use one language actively, but the second language is dormant and no longer used in daily life (Grosjean, 2001).

3.1 Bilingual competence

Bilinguals tend to use their two languages for different purposes, in different contexts and with different people (Baker & Prys Jones, 1998; Grosjean, 2001; Hakuta, 1990; Yip & Matthews, 2006). However, the use of two languages does not imply that competence must be equal in both. 'Balanced bilingualism', the attainment of equal proficiency in two languages across a range of contexts, is an uncommon occurrence amongst bilinguals, as it is rare for proficiency levels to be equal in both languages. In many cases, the difference between the level of competence in the two languages can be developmentally quite normal, and may occur naturally when children lose skills in one language as the other is becoming more dominant (McLaughlin, Blanchard, & Osanai, 1995). There is also a possibility that, if a child's language level is assessed when skills in one language are weaker, or if the language proficiency tests are insensitive to the qualitative aspects of language, the general impression may be that neither language is competent (Cummins, 1979; MacSwan, 2000; McLaughlin et al., 1995; Skutnabb-Kangas, 2007). More often, the implicit idea of balanced bilingualism has been the attainment of reasonable competence in both languages (Baker & Prys Jones, 1998; Cummins, 1984; Genesee, 2004; Grosjean, 2008; Hakuta, 1990; McLaughlin et al., 1995).

In the field of bilingualism, the notion of native language ability differences among children from minority language groups owes its popularity to Cummins' theory of linguistic interdependence (Cummins, 1991) and his classification of language competence in terms of BICS (Basic Interpersonal Communication Skills) and CALP (Cognitive Academic Language Proficiency). At the BICS level, sufficient for face-to-face interaction, the speaker can rely heavily on context, with the content often being somewhat predictable. On the other hand, CALP is the level of language competence needed for critical or abstract thinking, problem solving, and assimilating new information, and is crucial to academic success. Cummins (2000) also uses the terms 'conversational language' for BICS and 'academic language' for CALP, suggesting that social conversations require a lower level of language skills than is required in academic situations. Academic language usually involves a larger vocabulary, more

complex grammatical structures and higher levels of cognitive processes. This linguistic distinction is frequently used when considering the language competence of deaf students and serves as a framework for explaining the difference between the more superficial speech skills and deeper underlying language proficiency needed for abstract thought and academic learning (Cummins, 1984; Mashie, 1995).

Much of the current research into bilingualism focuses on aspects of proficiency which include competence in the four basic abilities of listening, speaking, reading, and writing (Baker, C., 2006). Cummins (2000) has added a fifth proficiency, that of 'cognitive competency', or the ability to think and reason and use language abstractly. Skutnabb-Kangas (2007) also refers to this proficiency as an ability to use both languages as thinking tools. There is also the consideration of the structural properties of the particular languages under acquisition, with some evidence that the second language (L2) may be easier to acquire if it structurally similar to the first language (L1). For example, in most cases, a native speaker of Spanish will acquire English more rapidly than a native speaker of Chinese because of the linguistic similarity between Spanish and English (Hakuta, 2001; Waxman, 2006). This is of particular interest in the case of a spoken language such as English and a signed language such as Auslan, because of their very different grammatical structures.

3.2 Bilingual use

The field of bilingualism has come a long way since the time of Brunner (1929), who determined the degree of bilingual proficiency according to the place of birth of a person's parents. Other societal definitions in the past classified people as bilingual according to their foreign last name (Hakuta, 1986). In more recent times, bilingual use has been widely studied and is now considered to be considerably broader in its scope, so much so that García (2009) claims that "throughout the world, bilingual children are the norm" (p. 140).

Bilingual use may involve markedly different levels of activity in both languages, for example when there is infrequent use of the expressive mode, but active use of the receptive mode, sometimes termed passive bilingualism (Köpke, 2007). Such a situation occurs in the case of children of migrants who understand but don't speak their home language and deaf people who become literate in English but are unable to express the language verbally. In most cases, dominant bilingualism is the norm, where one of the languages is used in most contexts and is the one in which the speaker has attained the greatest proficiency. The notion of language dominance is often defined in terms of proficiency (Yip & Matthews, 2006), with the extent and maintenance of dual language exposure shown to have an impact on an individual's proficiency in each language. In turn, Kovelman, Baker and Petitto (2008) suggest that proficiency can influence dual language representation in the brains of bilinguals, with early, extensive and sustained bilingual exposure typically resulting in optimal dual language competence. However, Kovelman and colleagues acknowledge that there is some controversy about the time in which the two languages are acquired and whether highly proficient bilinguals will process language differently from monolinguals across all language contexts. For example, when early-exposed, highly proficient Spanish–English bilinguals were compared to English monolingual controls, Kovelman et al.'s study found that extensive early bilingual exposure modified language organization in the brain and contributed to a specific 'bilingual signature'. This bilingual signature referred to the different way in which bilinguals neurally process language compared to monolingual language processing. Their findings supported their hypothesis that the bilingual brain develops specific mechanisms that facilitate the concurrent processing of two languages when operating in the bilingual mode (p. 1468).

When considering bilingualism's impact on language development, some studies have found that bilingual immigrant children were restricted in their language growth, as measured by standardized tests of language development (García, Kleifgen, & Falchi, 2008; Hakuta & McLaughlin, 1996). Similar views continue to be prevalent in some areas of deaf education relating to language choice, with a belief by some that use of sign language will reduce the development of oral language competence (see Hyde (2005), and Mayer and Leigh (2010) for a discussion on this topic). However, other

research findings suggest that the opposite might in fact be true, with reports that many students who are competent in spoken language continue to appreciate the positive benefits sign language provides, particularly when the interlocutor's speech intelligibility is poor (Preisler,Tvingstedt, & Ahlström, 2002, 2005; Yoshinaga-Itano, 2006).

3.3 Relationship between languages

Over the years, bilingual terms such as *additive* and *subtractive* have been used to describe the relationship between languages in bilingual programs (Lambert, 1975). In the case of additive bilingual models, a second language is added whilst maintaining use of the first, native language, whereas in subtractive models, the first language is replaced with the majority second language, thus essentially creating a monolingual language environment. However, García (2009) suggests that such an approach is no longer appropriate for current times as it fails to take into account the complex linguistic challenges facing bilinguals in the 21st century. García's belief is that, in this age of globalization and advanced technology, a linguistic model that regards languages as 'first' or 'second' is too simplistic. She proposes that, if bilingualism were to be perceived as a more mainstream practice, there would be no need to identify first or second languages, as bilingualism "becomes the heart of the matter" (p. 143). The ramifications of García's bilingual paradigm are also relevant to educators of deaf children, some of whom regard sign language as the first language of bilingual deaf students, irrespective of their ability to process and use spoken language effectively (Napier et al., 2007).

Further evidence of a changing context of bilingual use has come from García and her colleagues who have adopted the concept of *emergent bilinguals* (García, Kleifgen, & Falchi, 2008). They use this term to describe children whose home language is a minority language in the community and who become bilingual in order to access the school curriculum which is taught in the majority language. Furthermore, García et al. suggest that the inequity that arises from educating and assessing emergent bilingual

children emanates from a lack of understanding of the nature of these children's bilingual learning needs by policy makers and educators. In the past, many parents were advised not to use the native language at home because it might lead to 'linguistic retardation' (Thompson, 1952), and even in current times the issue of language delay caused by bilingual practices continues to receive attention. However, Colin Baker (2006) suggests that the notion that such language delays are influenced by bilingualism is not supported by linguistic and cognitive research evidence. Rather, he proposes that the communicative differences of bilingual children are not taken into account when they are assessed in their second, weaker language, which in turn leads to erroneous assumptions of language abilities. A similar situation prevails in the deaf education sector when bilingual deaf children are assessed in their weaker language, with measurement tools that have been developed for hearing children who have had unrestricted access to spoken language from birth (see Rinaldi, Caselli, Onofrio, & Volterra, 2014).

3.4 A broader view of bilingual use

With the prevalence of bilingual use in diverse communities throughout the world, a wide range of terms has been introduced to describe the way the languages are used. These terms include *code switching and code blending* (Genesee & Nicoladis, 2006; MacSwan, 2000), *diglossia* (Baker, 2003), *parallel monolingualism* (Heller, 1999) *bilingualism through monolingualism* (Swain, 1983), *separate bilingualism* (Creese & Blackledge, 2008) and *cross-language interaction* (see Ormel & Giezen, 2014). Cummins (2007) has further contributed to the bilingual literature with his *two solitudes* assumption that refers to the French immersion programs as described by Lambert (1984). In these bilingual programs, the two languages are kept totally separate and bilingual use is fostered through distinctly monolingual paths.

However, these terms do not go far enough to describe the complex and spontaneous nature of dynamic bilingual interactions. Many of these terms denote a separateness of the languages that belies the very strength of bilingualism, namely the ability to

communicate with two or more languages in dynamic, flexible ways. García (*2009*) refers to the notion of dynamic bilingualism as the use of a wide range of abilities and language practices by bilinguals when they engage in communicative interactions. Furthermore, in an effort to provide a more suitable description for a broader spectrum of bilingual behaviour, researchers such as Blackledge and Creese, (2010), Baker, C. (2011) and García (2009) have begun to use the term *translanguaging.* Translanguaging is viewed by García as "a powerful mechanism to construct understandings, to include others, and to mediate understandings across language groups" (pp. 307-8) and by Baker as a way of "making meaning, shaping experiences, gaining understanding and knowledge through the use of two languages" (p. 288). The term encompasses a fluid relationship between the languages and reinforces the idea that the interplay of languages depends on the skills brought to the discourse by the communication partners. Translanguaging, therefore, is viewed by García as promoting the notion that bilinguals have a single language repertoire from which they select the features that best support their communicative intent and learning needs.

In their investigation into the origins and development of translanguaging, Lewis, Jones and Baker (2012) described the term's Welsh origins in the 1980s (known by the Welsh term 'trawsieithu') and its use as a pedagogical practice in which the input language often differed from the output language. Following the translanguaging principle, Lewis et al. suggested that both languages are used in a dynamic, integrated way that promotes a deeper understanding of the concepts being discussed, allows for more effective communication and augments the child's ability in both languages. The authors also linked the concept of translanguaging to Cummins' theory of linguistic interdependence (Cummins, 1991) which describes cross-linguistic transfer across languages and has been mentioned earlier in this chapter. In fact, in response to the more monolingual approach that Cummins (2007) refers to as the 'two solitudes' assumption, he notes that bilingual students risk losing valuable opportunities to benefit from using their metalinguistic skills to identify the contrastive features of both languages which would further develop their language processing abilities.

García and Wei (2013) suggest that the inclusion of translanguaging in the bilingual paradigm not only has the potential to change the nature of learning, but fosters an environment in which languages are learned and used through social interaction. A feature of this model, according to García and Wei, is the bilingual learners' ownership of their language uptake and the opportunities they are provided with "to engage and interact socially and cognitively in the learning process in ways that produce and extend the students' language and meaning-making" (p. 79). A broadening of the bilingual paradigm adds a much needed dimension to the field that will support a better understanding of the learning needs of children with diverse language experiences. Hornberger & Link (2012) state this well in saying "Moreover, the concept of translanguaging broadens the research lens by focusing not just on spoken language but on a variety of communicative modes" (p. 263).

In many parts of the world, educators are being challenged to embrace flexible language practices that respond appropriately and sensitively to the communication and language needs of bilingual and multilingual children (Blackledge & Creese, 2010). The literature offers a rich spectrum of ideologies, methodologies and pedagogies that influence bilingual acquisition and use, however in order to better understand the place of bilingualism in the deaf child's world, it is now important to review the literature related to bilingual and bimodal first language acquisition and the role parents play in the input they provide to their deaf children.

3.5 Bilingual first language acquisition

Numerous research studies have investigated the simultaneous acquisition of two languages from birth, also known as 'bilingual first language acquisition' (Bialystok, 2001; De Houwer, 1995; Genesee & Nicoladis, 2006; McLaughlin, 1978; Macnamara, 1966). Attitudes towards bilingualism have changed dramatically over the past decades, with views ranging from considering that exposure to two languages as harming the mind and the soul of the child (Jespersen, 1922), to acknowledging the intellectual and educational benefits for the developing child (Bain & Yu, 1980;

Katchan, 1985; Peal & Lambert, 1962). It is now believed that children who are exposed to two languages from infancy are able to learn two phonological systems, two lexicons and two grammars (Kovács & Mehler, 2009; Petitto et al., 2001; Petitto & Kovelman, 2003; Werker & Byers-Heinlein, 2008). However, there continues to be a level of uncertainty regarding whether children exposed to two languages typically acquire them at the same rate as monolingual children learn one language (Genesee & Nicoladis, 2006; Marchman, Fernald, & Hurtado, 2010).

Studies on bilingual first language acquisition generally refer to children's acquisition of two languages as either 'simultaneous' or 'successive' (or 'sequential') bilingualism (De Houwer, 1995; McLaughlin, 1978). McLaughlin's definition refers to simultaneous bilingual acquisition occurring when there is exposure to both languages before the age of three, with successive bilingualism being the case if the child is more than three years of age. De Houwer (1995) described an infant's exposure to the second language no earlier than one month after birth, but before the age of two, whilst Deuchar and Quay (2000) considered simultaneous bilingual acquisition to mean exposure to two languages within the first year of life. Regardless of the preferred definition for bilingualism, there is agreement that early, extensive, bilingual exposure during early childhood results in the greatest dual language proficiency and the most similar neural organization for the two languages (Johnson & Newport, 1989; Petitto & Kovelman, 2003; Weber-Fox & Neville, 1999).

In order to further investigate the features of bilingual first language acquisition, Petitto and Dunbar (2004) conducted a series of cognitive and developmental behavioural studies with very young bilingual infants. In these studies, Petitto and Dunbar tested aspects of language delay and confusion and examined the age at which the infants began to show differentiation in their languages. In addition, they investigated the children's simultaneous bilingual mastery as compared to successive bilingual exposure from three, five, seven and nine years of age, all significant stages of brain myelinization and maturation. The results of these studies demonstrated that, firstly, simultaneous bilingual exposure is optimal for dual language development and dual language mastery (Kovelman & Petitto, 2002). Secondly, children who are

introduced to their second language between two and nine years of age are able to achieve the basics of morphology and syntax of the new language within their first year of exposure. This will happen only if there is extensive and systematic exposure to the new language across multiple contexts, for example, in the community and home (Kovelman & Petitto, 2003; Petitto, Kovelman & Harasymowicz, 2003). Thirdly, Petitto and Dunbar found that bilingual children exposed to two languages from birth achieved their linguistic milestones in both languages at the same time and, crucially, at the same time as monolinguals (Holowka, Brosseau-Lapré, & Petitto, 2002; Petitto & Kovelman, 2003; Petitto et al., 2001). Fourthly, it was found that the children who were exposed to their second language at between two and nine years of age tended to exhibit 'stage-like' language development in their new language, similar to that of a monolingual child's developmental path, but at an older age (Kovelman & Petitto, 2003). Lastly, the introduction of the new language did not seem to interfere with the child's first language (Petitto, Kovelman, & Harasymowycz, 2003), an important point for many parents and educators. These findings further suggested that bilingual children should not experience difficulty when engaging in phonological word segmentation in the two languages, a capacity that is crucial for bilingual language learning and literacy. Plaza-Pust (2014) further supports these findings and adds that exposure to sign language will not cause confusion or delay, nor reduce a deaf child's motivation to learn spoken language. On the contrary, bilingual deaf learners use their languages in diverse ways that suit their specific learning and communication needs.

There are numerous studies published in the literature pertaining to bilingual acquisition in early childhood. For example, Padilla and Lindholm (1984) observed bilingual children living in the USA who were exposed to Spanish and English and found that some acquired both languages simultaneously because their parents and extended family consistently used both languages with the children from birth. Other children in this group were seen to have acquired sequential bilingual skills in that they were not exposed to English until they went to school. Similarly, studies of early bilingual acquisition have been undertaken with children exposed to various other language partnerships, including Norwegian and English (Lanza, 2001), German and English (Döpke, 1992), German and Italian (Taeschner, 1983) and Welsh and English

(Vihman, Thierry, Lum, Keren-Portnoy, & Martin, 2007). In order to explain the simultaneous development of two languages in early childhood, Taeschner (1983) proposed a three-stage hypothesis after having observed bilingual children's mixed structures during their third year of life. She suggested that the initial state of the developing bilingual child is essentially monolingual in that bilingual children progress from being unable to differentiate between their two languages (Volterra & Taeschner, 1978) to differentiating them on the lexical but not the structural level, to fully differentiating them on both the lexical and the structural level. However, Taeschner's hypothesis met criticism when other research showed that children are quite able to differentiate between the two languages in their environment in spite of some mixing (De Houwer, 1990; Döpke, 1993; Genesee, 1989; Meisel, 1990; Schlyter, 1993). For example, there is evidence in the literature that infants are able to segment sounds into phonemic categories when exposed to Swedish and English, and are able to segment the vowel continuum in ways that corresponded to the language of exposure (Eimas et al., 1987; Kuhl, Williams, Lacerda, Stevens, & Lindblom, 1992).

A modification of Taeschner's hypothesis was developed by De Houwer (1994), who argued that children who are simultaneously bilingual develop the grammatical structures in each of their two languages based on the language specific input. She based this hypothesis on empirical evidence from her own study of an English-Dutch bilingual child aged between 31 months and 40 months (De Houwer, 1990). Meisel (1994) went further and developed yet another version of the separate development hypothesis, with a longitudinal study of seven French-German bilingual children. He followed the children's development from the pre-two word stage and suggested that bilingual children, acquiring their languages simultaneously, take up each of their two languages in the same way as monolingual children. This premise is supported by Pinker (1984), Rizzi (1989) and Clahsen and Penke (1992), who suggest that bilingual children are able to use the syntactic structures in the respective languages without cross-linguistic errors because of the association of particular lexical items with their language-specific structures. Some may disagree with this notion, however, with accounts from linguists such as Leopold (1949), Redlinger and Park (1980) and

Saunders (1988), who concur that cross-linguistic structures are a normal feature of bilingual children's speech productions.

When considering children's language use, Waxman (2006) questioned whether a bilingual child was able to use the syntactic structures in the respective languages when the grammars are distinctly different, such as with English and Korean or Spanish (or indeed, English and Auslan). She also considered the relationship between both languages and whether there is a feedback effect between L1 and L2, each one lending support to the other. Additionally, there is the consideration of the essential interplay between the child's motivation to communicate and the scaffolding of language by parents and primary caregivers (Bloom, 2000; Gleitman, Cassidy, Nappa, Papafragou, & Trueswell, 2005; Vygotsky, 1978), regardless of the specific languages or their modalities. One of the ways in which parents facilitate their children's bilingual acquisition is through the use of code switching, mixing and blending. This linguistic feature uses phonological, lexical and morphosyntactic elements from the two languages within the same utterance or between a sequence of utterances in a conversation (Genesee & Nicoladis, 2006).

Rather than being regarded as a sign of language incompetence or confusion (Volterra & Taeschner, 1978), code-mixing is considered by many linguists to be a sophisticated strategy used widely by bilingual adults. Very young bilingual children have also been observed to use this linguistic feature (Genesee, Boivin, & Nicoladis, 1996; Paradis, Nicoladis, & Genesee, 2000; Petitto & Kovelman, 2003; Poulin-Dubois & Goodz, 2001) and know when to use each language, when to code mix and how to repair communication breakdowns (Lanza, 1997b). It therefore appears that bilinguals can be semantically primed in one language to produce a word in the other language (Kerkhofs, Dijkstra, Chwilla, & De Bruijn, 2006), with even young bilinguals differentiating their dual lexicons from their very first words.

3.6 Quality of bilingual input

There is considerable research evidence to support the fact that the extent and maintenance of dual language exposure and age of acquisition have an impact on the level of proficiency in each language (Kovelman et al., 2008). There is also evidence that the age of bilingual acquisition has an influence on semantic and grammatical processing of sentences (Wartenburger et al., 2003) and phonological and lexical processing of words and sounds in bilingual brains (Chee, Soon, Lee, & Pallier, 2004; Golestani et al., 2006; Meschyan & Hernandez, 2006). Furthermore, Hakuta and McLaughlin (1996) reported that input frequency is more important in second language acquisition than in first language acquisition, with first language learners of English mastering many structures based on their syntactic and semantic complexity, rather than the input frequency (Brown, 1973).

Children exposed to two languages from birth are reported to reach important milestones within the same age span as their monolingual peers (Petitto & Holowka, 2002). These milestones include the onset of canonical babbling (Oller et al., 1997), first words (Nicoladis & Genesee, 1997), and rate of vocabulary growth (Pearson, Fernández, Lewedag, & Oller, 1997). In addition, morpho-syntactic development is more like that of monolinguals for the most part and appears to occur within the same timeframe, at least in the dominant language (Paradis & Genesee, 1996). Moreover, these aspects of language development may be relatively robust in the face of considerable variation in input because of the important role played by biological or cognitive maturation (Oller et al., 1997; Wexler, 1998). Petitto and Dunbar (2004) reported that, contrary to suggestions that bilingual babies demonstrate atypical or delayed development when exposed to two languages from birth (Burns, Werker, & McVie, 2003), there was in fact a phonetic processing 'bilingual advantage' (Norton, Baker, & Petitto, 2003). Compared to monolinguals, bilingual babies showed an increased sensitivity to a greater range of phonetic contrasts and an extended developmental window of sensitivity for perceiving these phonetic contrasts. Petitto and Dunbar (2004) also suggested the possibility that bilingual phonetic perception early in life may act as a kind of 'perceptual wedge' to maintain a child's capacity to

discriminate phonetic units. It now needs to be questioned whether this bilingual advantage extends to bimodal bilingualism and whether the perception of signed phonemes bootstraps phonemic and phonological awareness of English, an important element in the attainment of literacy, but a skill often out of reach for many deaf children.

It is important to acknowledge that in addition to the quality and quality of input that parents make available to their deaf children, it is necessary to determine the level of access the children have to both languages (Van den Bogaerde, 2000). For deaf children, their access to language will depend on their sensory constraints, language processing abilities, attention to communication and the quality of their parents' linguistic input. Kanto, Huttunen and Laakso (2013) also suggest that the amount of language exposure and the parents' linguistic choices will influence the children's bilingual use. Moreover, when Van den Bogaerde (2000) investigated the role of bilingual input in children's language acquisition, she found that attention needs to be paid to the parents' linguistic skills, particularly if they are using a language that is not their first language, a view also supported by Grosjean (1982). This point takes on greater significance in the case of deaf children who have limited ability to comprehend spoken language and are provided with parental sign language input that lacks fluency, structure and lexical diversity.

Mayberry and Lock (2003) investigated the English grammatical abilities of deaf and hearing adults who had different spoken or signed linguistic experiences during their early childhood. They found that the adults who acquired a language in early life performed at near-native levels on a second language, irrespective of whether they were hearing or deaf or whether the early language was spoken or signed. By contrast, deaf adults who experienced little or no accessible language in early life performed well below the norm, indicating that the onset of language acquisition in early human development dramatically alters the capacity to learn language throughout life, regardless of language modality. Although there is evidence that older language learners achieve better outcomes due to their greater cognitive maturity (Hakuta, 1990; Snow & Hoefnagel-Hohle, 1977), the deaf adults in Mayberry and Lock's (2003)

study could not be regarded as acquiring a second language. Although an infrequent occurrence in hearing populations, the deaf adults had experienced little or no accessible first language in early life, thus were unable to take advantage of linguistic or cognitive maturity. Individuals who are unable to access adequate language before the age of seven usually do not attain monolingual-like language proficiency and experience enhanced difficulty acquiring language later in life (Mayberry, Lock, & Kazmi, 2002; Neville et al., 1997). Collier (1988) added that children between the ages of eight and 12 are the most advantaged second language learners, citing studies of older people with limited-English proficiency who began studying English at a mature age. These studies showed that age does not limit the acquisition of a second language and that the acquisition of phonological and grammatical skills in a second language decline with age, but that this decline is characterized as relatively slow and linear.

3.7 Bilingual environments in early childhood

An important feature of a young child's bilingual environment is the level of commitment of the parents and caregivers to exposing their child to two languages. In her study of children raised in bilingual families, De Houwer (2007) found that parental language input patterns are significant contributing factors to raising bilingual children, but it is not necessarily the case that frequency of input produces positive bilingual outcomes. Parents often find bilingualism a difficult process that requires dedication and hard work (Francis, 2011; Okita, 2002) and they are often affected by societal attitudes towards minority languages (De Houwer, 2007; Hammer, Miccio, & Rodriguez, 2004). One aspect of language exposure that De Houwer did not account for in the child's bilingual environment is that of the status of the languages within the community and whether they are used, valued and generally accessible to others (Lanza, 1997b).

The relationship between a bilingual child's languages and the wider community is an important aspect of early bilingualism. Vihman and McLaughlin (1982) distinguished

between the home and community environments and the three types of languages use: one person using one language, mixed use by each person and an environment-bound language, in which one language is used at home and the other in community. Further to this categorization, Romaine (1995) proposed expanding Vihman and McLaughlin's three categories and elaborated on six basic types of bilingualism in early childhood. These categories were seen to vary according to the language of the community, the parents' native language and how they address and communicate with their child. One type referred to as 'mixed languages' involved the parents' use of code switching and language mixing when communicating with their child. Code-switching refers to the alternation or mixing of languages within a conversation and is a communicative resource used by many bilingual users in their interactions (Lanza, 1992). Romaine (1995) also claimed that mixed input of languages may produce a 'third system' which emerges during intense language contact. This additional language system demonstrates features that do not belong to either of the input languages, but are the product of a merging of the two. Nevertheless, although viewed as a frequent occurrence in bilingual interactions, Nicoladis and Secco (2000) suggested that parents' language mixing could also make it harder for their bilingual children to learn a new word from a mixed-language sentence (Byers-Heinlein, 2013). In another study on dual language exposure and early bilingual development, Place and Hoff (2011) found that language input from native speakers was the only predictor of vocabulary size after the total amount of input had been accounted for.

Other factors that influence children's bilingual outcomes may include the amount of exposure to each language, the parents' consistency of language use and the personality and learning strategies of the child. Additionally, the language the parents use to address each other may have an impact on the child's bilingual acquisition (Lanza, 1992, 1997a). Lanza's 1992 study investigated the language use and code-switching of two-year old bilingual children and found that, before being able to draw conclusions on the child's bilingual output, it was necessary to first determine the type of language input from the parents. Furthermore, Lanza's findings questioned the previous belief by many linguists that, although adult bilinguals frequently engaged in code-switching and language mixing, infant bilinguals' language mixing was interpreted

as linguistic confusion because they were considered to be unable to deal with two languages in one discourse. Her study found that even two-year old children are able to differentiate their language use, although their code-switching strategies are not as pragmatically sophisticated as those used by older bilinguals.

As previously mentioned, one of the types of language input in bilingual environments is the 'one parent- one language' approach (see Döpke, 1998). This approach ensures that the languages are presented separately because each parent communicates with their child only in that language. Proponents of this type of parent-child bilingual input believe that there will be less linguistic interference because young bilingual children will associate each language with a different person. Other bilingual researchers such as Byers-Heinlein (2013) support the separation of languages and suggest that the rhythm of each utterance provides the child with cues to the language and therefore an increased ability to recognize and decode the meaning of the words. However, Döpke (1992) proposes that the 'one parent–one language' principle is not always effective in that it is common for children to attain only passive competence in the minority language. Moreover, in her study of parental language mixing in bilingual families, Goodz (1989) found that, even though parents may follow a language-separation approach, they still engage in a proportion of language mixing and switching. Along with other researchers such as Genesee and Nicholadis (2006) and Lanza (1997a), Goodz suggested that the type of language input will depend on whether the parents actively discourage cross-language influences or opt for a more balanced bilingual context for their children's language input. In many respects, separating the languages following the 'one parent–one language' principle is regarded by some linguists as constraining natural interaction and limiting language experiences for bilingual children (Döpke, 1998).

In addition to the approach adopted by parents in their bilingual input, attitudes and ideology play a significant part in a child's bilingual acquisition (Kroskrity, Schieffelin, & Woolard, 1992). Therefore, it is important to identify whether the languages used by the parents and family have community support and are generally valued by others. In the past, sign languages used in Deaf communities have been a victim of diglossia

(Baker, 2003), a sociolinguistic term describing the separation of high and low prestige languages. Because visual-gestural languages were generally dismissed as inferior or lower than the higher status spoken languages (Petitto, 1999), they were given scant attention by linguists and consequently not respected for their linguistic merit. With the advent of sign language linguistics (Johnston, 1989a, 1989b), more attention has been paid to the manner in which sign languages are acquired, which has in turn has informed the design and implementation of bimodal bilingual educational programs.

3.8 Bimodal Bilingualism

Bimodal bilingualism involves the use of spoken language and sign language and often includes the printed form of the spoken language (Grosjean, 1982, 1992; Nover, Christensen, & Cheng, 1998; Strong, 1997). For unimodal bilinguals using spoken languages, the vocal tract is the only output channel and therefore cannot simultaneously produce two spoken utterances. In contrast, the output channels used by bimodal bilinguals involve the vocal tract, the hands and a wide variety of body movements. In addition, in unimodal oral bilingualism, both languages are perceived by the same auditory sensory system, whereas for bimodal bilinguals, one language is perceived auditorally and the other is perceived visually (Emmorey et al., 2008).

Although the practice of bilingualism is well reported in the literature, the vast majority of bilingual studies have focused on two spoken languages, with much less attention given to the study of a bimodal perspective of bilingualism (Cummins, 1998; Hakuta, 1992; Lambert, 1985; McLaughlin, 1984; Skutnabb-Kangas, 2007). Nevertheless, there is sufficient evidence in the literature to indicate that there are considerable benefits associated with bimodal bilingual development for deaf children (Cummins, 2006; Goldin-Meadow & Mayberry, 2001; Graney, 1998; Grosjean, 2001; Mashie, 1995; Yoshinaga-Itano, 2006). Grosjean (2001) goes so far as to suggest that "Every deaf child, whatever the level of his/her hearing loss, should have the right to grow up bilingual. By knowing and using both a sign language and an oral language (in its written and, when possible, in its spoken modality), the child will attain his/her full

cognitive, linguistic, and social capabilities" (p.110). Grosjean believed that, through exposure to sign language and spoken language, deaf children would be afforded opportunities early in their development to communicate with their parents, family members and their surrounding world, to develop cognitively and acquire world knowledge and to become acculturated into the deaf world and the hearing world. Similarly, Cummins (2006) states that access to sign language and spoken language enables young deaf children to form relationships and establish a strong identity through linguistic interactions.

3.8.1 Bimodal bilingualism in deaf children's learning environments

Over the years, educators have questioned whether exposing young deaf children to bimodal bilingual input would impair their ability or motivation to achieve age-appropriate language and literacy levels (Mayer & Leigh, 2010) and to learn spoken English (Hyde & Punch, 2011). Recent research has found that many parents of deaf children share a perception that the use of sign language is incompatible with the development of speaking and listening skills (Geers, Nicholas, & Sedey, 2003; Geers, Strube, Tobey, Pisoni, & Moog, 2010). Furthermore, when evaluating the effectiveness of bilingual programs for deaf children, there has been a dearth of empirical evidence of improved language and academic outcomes that are equivalent to hearing peers (Mayer & Leigh, 2010). Mayer and Leigh suggest that, with the introduction of universal infant hearing screening and ready access to cochlear implantation in many countries, there will probably be fewer deaf children who will need to sign or enrol in bilingual programs. Mayer and Leigh emphasized that their findings were not a criticism of bilingualism in general, but queried the efficacy of a bimodal bilingual approach to literacy in which many deaf children did not have auditory access to the spoken language for phonological purposes. They therefore contend that bimodal bilingual education will need to adapt to these changes and will be more likely to cater for children who, for a variety of reasons, have not developed adequate spoken language skills in oral and mainstream programs.

On the other hand, there is evidence to be found in the literature that exposure to sign language enhances, rather than reduces, spoken language development (Marschark, 2001; Preisler et al., 2005; Yoshinaga-Itano, 2006). Yoshinaga-Itano reported on three children whose early development of American Sign Language appeared to facilitate their development of spoken language after cochlear implantation and suggested that any modality plays a major role in the development of spoken-language development. Furthermore, Hyde and Punch (2011) investigated the modes of communication used by deaf children who had received cochlear implants and reported that access to both spoken and sign language does not lessen the proficiency of children's spoken language development. Hyde and Punch claimed that exposure to a bimodal bilingual input in fact optimized deaf children's cognition and language at critical stages in their development. Furthermore, there is considerable research evidence that children who are bimodal bilinguals use both languages as part of a language continuum rather than their communication mode remaining static (Petitto & Holowka, 2002; Petitto et al., 2001, 2003; Watson et al., 2008). This finding is further supported by reports of interviews with deaf young people with cochlear implants, who stated that they use whichever language is best suited to their needs at the time (Wheeler et al., 2009). From all accounts, therefore, deaf children are able to make use of both language modalities to an extent determined by the level of their sensory impairment, the quality and frequency of input and their motivation to communicate.

When considering the communication and language needs of deaf children, the development of literacy and associated academic skills is seen by some educators as an important reason to embrace a bimodal bilingual model (Cummins, 2006; Grosjean, 2001). Cummins' linguistic interdependence theory (Cummins, 1991) proposes that, if sign language is well established as a child's first language (L1), literacy in English (L2) can be achieved by means of reading and writing. According to this model, linguistic transfer occurs without necessarily being exposed to spoken or signed English (see Marschark, 2001). This means that signing deaf students engage in text-based activities via a language that has no written form (Johnson, Liddell, & Erting, 1989; Johnston & Schembri, 2007) and is syntactically very different from the structure of

spoken language (Akamatsu & Mayer, 1999; Mayer & Wells, 1996). This bilingual approach, in which natural sign language is seen as a deaf learner's first language, was prevalent in many countries for over two decades. Early exposure to sign language was seen as particularly beneficial for supporting the reading abilities of deaf children by giving them the advantage both of early exposure to sign language as well as positive linguistic experiences relevant to the spoken language (Akamatsu & Mayer, 1999; Singleton et al., 1998; Tomblin, Spencer, Flock, Tyler, & Gantz, 1999). However, it should be noted that the principles underpinning many bimodal bilingual programs were reportedly focused more on sociolinguistic values, such as recognition of educational equality, Deaf culture and language than on academic achievements (Swanwick & Gregory, 2007).

A number of research studies on the relationship between sign language proficiency and academic development have shown that deaf students with strong signing proficiency had significantly better prospects for developing adequate literacy skills (Cummins, 2006). Cummins pointed to the importance of deaf students acquiring strong skills in their first language in order to maximize future language and literacy development. He therefore recommended that all deaf students be given the opportunity to acquire a conceptual and linguistic foundation through sign language in their first five years of life. Cummins also suggested that the importance of acquiring a strong first language applies equally to children who receive cochlear implants. Nevertheless, despite Cummins (2006) and Grosjean (2001) proposing that sign language forms the conceptual and linguistic basis for future learning, neither spoken language nor sign language has been shown to be a panacea for the observed lags in the language development of deaf children (Marschark, 2001; Mayer & Leigh, 2010; Powers, 2002). Other researchers have queried whether the use of bimodal bilingual programs (also referred to as sign bilingual in the literature) effectively support age-appropriate language and literacy levels (Mayer & Leigh, 2010). In the past, a number of research studies found that deaf children of signing deaf parents tended to be better readers than deaf children of hearing parents (Johnson et al., 1989; Padden & Ramsey, 2000). However more recently it is thought that the linguistic advantages of early sign language input may not necessarily provide a direct link to decoding the

printed form of an oral language (Mayer & Leigh, 2010). In their investigation into the changing context for sign bilingual education programs, Mayer and Leigh explored the issues related to deaf children's development of language and literacy. They found that, although there are social-emotional, cultural and community benefits to be derived from programs incorporating a sign bilingual approach, there is insufficient empirical evidence for improved language and literacy outcomes for deaf students. Mayer and Leigh acknowledged that sign bilingual/bimodal bilingual programs now need to modify this approach and embrace the recent development in diagnostic and amplification technology. They also proposed that there needs to be an increased focus on the development of phonological processes through audition if age-appropriate language and literacy levels are to be attained by deaf children.

3.8.2 Use of speech and sign modalities

It is well established that children raised in bilingual or multilingual spoken language environments generally have greater language competence relative to children from single-language environments (Gregory, Smith & Wells, 1997). The literature also reports that early acquisition of sign language can foster English language skills, both spoken and written (Akamatsu & Mayer, 1999; LaSasso & Metzger, 1998; Wilbur, 2000). As is the case amongst bilinguals using spoken language, there is a wide variation in the levels of competence and proportion of sign and spoken language use by deaf individuals engaging in bimodal bilingual communication. Grosjean (2001) refers to this type of language use as a 'bilingual continuum', with bilinguals intuitively deciding which modality and proportion of language is needed for specific communication events.

To a great extent, the choice between the two languages will also depend on the linguistic input to which the child is exposed (Volterra & Caselli, 1986) and the quality of that input. In many cases, there will be a degree of code-switching, mixing and blending, a communication strategy known to be used frequently amongst bilinguals (Genesee & Nicoladis, 2006). Code-blending is regarded as perhaps the most

frequently used linguistic strategy in bimodal bilingual discourse (Rinaldi et al., 2014). Another linguistic feature of bimodal use is that of *sandwiching* (Nussbaum, Waddy-Smith, & Doyle, 2012), a technique that preserves the integrity of the grammars of both languages and serves to provide a direct link between sign and spoken language. With this strategy, the modalities are presented sequentially, rather than being blended or overlaid. For example, an utterance may be presented first in speech, then sign, then speech again, or vice versa. Proponents of the sandwiching strategy caution against using a code-blend or simultaneous approach as it is regarded as a compromise of both grammars.

In terms of young deaf children acquiring language in a bimodal bilingual context, it is anticipated that the variability in their language competence for both languages may also be influenced by their auditory status (Swanwick & Tsverik, 2007). In language acquisition studies of hearing bilingual children, it has been found that parents very often mix their languages (Bialystok, 2001; De Houwer, 1990; Lanza, 2001; Quay, 1995), which in turn has an impact on the way their children use their own language (Van den Bogaerde & Baker, 2005). With bimodal code-switching and code-blending, Emmorey et al., (2008) found that the semantic features involved when switching or mixing modalities contributed to a unique level of communication which is very different from unimodal practices. It is often the case that unimodals use code-switching to enhance discourse and social interactions in addition to reinforcing identity, increasing linguistic proficiency or signaling topic changes (e.g. Romaine, 1995).

Language or code mixing also occurs in deaf and deaf-hearing families when sign language and spoken language are used (Pruss-Ramagosa, 2001) and, as research with hearing children has indicated, the type of code mixing that children produce will depend on the input from the parents and caregivers (Nicoladis & Secco, 2000). In Petitto et al.'s 2001 study of infants' bilingual sign and spoken language acquisition, they found that the signing-speaking bilinguals exploited the modality possibilities and simultaneously mixed their signs and speech, but in semantically principled and highly constrained ways. It was therefore concluded that very young bilingual infants have

distinct representations of their two input languages in place prior to first words, and it is hypothesized that this capacity may result from biological mechanisms that permit the discovery of early phonological representations. Petitto et al. also highlighted the fact that the children in the study demonstrated language skills that were directly related to their parents' use of language mixing, in addition to their own emerging language preferences.

The literature is unambiguous on the prevalence of language mixing and blending in bimodal bilingual practice (Emmorey at al., 2008; Petitto et al., 2001; Van den Bogaerde, 2000) and translanguaging (Blackledge & Creese, 2010; García, 2009, 2011; Lewis et al., 2013). However, some bimodal bilingual researchers, (e.g. Kanto, Huttunen, & Laakso, 2013; Singleton & Tittle, 2000; Van den Bogaerde, 2000) are cautious about parents mixing their language modes as it may result in what Kanto and colleagues suggest is "asymmetrical discourse and may not serve as an optimal linguistic model for the child" (p.256). Singleton & Tittle support this finding in their review of the conditions under which Deaf parents raise their children in bilingual environments. When considering the parent-child communication patterns, the authors found that Deaf parents often used fragmented speech when communicating with their hearing children and in some cases may not have been proficient in sign language, but expected the child to communicate with them in sign. Further to this point, in her study on input and interaction in deaf families, Van den Bogaerde (2000) found that parents' reduced use of multisign utterances and frequent use of language mixing contributed to a reduction in the syntactic complexity of sign language used by their children.

No matter whether the parent or child is deaf or hearing, the use of code-mixing or blending in speech and sign modalities is undoubtedly dependent on a level of fluency in both languages (Appel & Muysken 1987). However, in most cases a high level of fluency in sign language is rarely attained by deaf children from hearing families. In a study of hearing parents' input and interactions with their deaf children, Van den Bogaerde (2000) found that the children's code mixing was still at a basic level by three years of age. Due to the fact that most hearing parents are still in the process of

acquiring fluency in sign language while their children are young, it is therefore doubtful that their deaf children's bilingual experiences would support the level of code switching and blending reported for native bilinguals (Van den Bogaerde & Baker, 2002).

3.8.3 English-based signing

With respect to bimodal language mixing, 'contact signing', or 'English-based signing' has been identified as a third language system that appears to function as a way of bridging the modalities of both languages (Bishop, 2005; Lucas & Valli, 1992). Contact signing is often used in conversations between Deaf native signers and hearing people, as well as between deaf native signers and incorporates the use of code-blends, rather than code-switches (Emmorey et al., 2005). This hybrid system results from the contact between the signed and spoken languages and consists of features from both languages with a mixture of syntactic and morphological structures from the signed and spoken language and mouthed or spoken words (Van den Bogaerde & Baker, 2005). Emmorey et al. (2005) suggest that some bimodal bilinguals do not stop speaking to sign or stop signing to speak, but blend sign and speech simultaneously when in a bilingual mode of communication. In general, code-blends are semantically equivalent in the signed and spoken languages and differ from natural bimodal interactions in that the languages are delivered simultaneously, rather than separately and sequentially (Emmorey at al., 2008).

It is important to differentiate between the naturally occurring linguistic devices of code-blending and contact sign that are features of bimodal bilingual discourse (Emmorey et al., 2005) and the various artificially contrived systems that support spoken language. One such hybrid communication system is *SimCom* (Simultaneous Communication), in which the spoken and sign languages are always delivered concurrently (Emmorey et al., 2008). SimCom is a system frequently used by teachers in education programs for deaf children, using language that follows spoken language

word order and grammatical structure. Although SimCom involves the simultaneous production of spoken and sign language, it lacks the sociolinguistic features of native sign languages and is quite different from contact sign or other sign systems such as SSE (Sign Supported English) which are used to support the learning of English grammar in educational programs (Sutton-Spence & Woll, 1998).

Although there is much evidence in the literature on the use of language mixing and blending in bimodal bilingual practice, there is very little research that informs the deaf education field with respect to how effectively young deaf children process language when it is presented simultaneously. When considering deaf children's development of attention skills for the purpose of processing languages in different modalities, Spencer (2000) supported Reynell's (1977) findings that young children are not yet developed sufficiently to allow for dual-channelled attention. In other words, Spencer suggested that the simultaneous presentation of two languages, combining visual and auditory modalities such as is used in SimCom or sign-supported speech, could be particularly demanding and over-stimulating of the child's attention. When Tevenal and Villanueva (2009) investigated the effects of SimCom on deaf and hearing students' comprehension, they found that when spoken and signed information was presented simultaneously, the inputs were not equivalent and both languages were compromised. They also found that the students' comprehension rates reflected these discrepancies, with the hearing signing students showing the highest rate of comprehension because they had full access to both components of the message.

3.8.4 Translanguaging in a bimodal bilingual context

In addition to the well-established practices of code-switching, mixing and blending in bilingual practice, translanguaging has been mentioned previously in this chapter as a term that encompasses a wider range of bilingual skills and use (see 3.2.2). This term is being used more frequently in the literature to better account for the fluid relationship between the two languages during bilingual interactions. García (2009, 2011) suggests that code-switching differs from translanguaging in that it makes the

assumption that bilinguals access their two languages as separate monolingual codes that may not interact with each other in any way. Translanguaging therefore provides a broader scope for considering the interplay of languages and the linguistic features contributed by the interlocutors. The concept of translanguaging is particularly relevant when considering the complex relationship between sign language and spoken language in bimodal bilingual exchanges. In the context of educational programs, García (2009) described translanguaging practice as incorporating 'multiple' bilingual teaching, during which two or more languages are always used in combination, in a blended approach rather than presented concurrently or separately. In this respect, García suggested that bilingual education for deaf children would always be considered to be multiple bilingual teaching, in that one language may be received in one modality (such as spoken language via listening, lipreading, print), and in turn may be expressed in another modality such as sign language. For deaf bimodal bilinguals, there is evidence in the literature that deaf children also make language choices based on the nature of their interlocutor's language use, modality and communication skills (Fortgens, 2003; Klatter-Folmer, van Hout, Kolen, & Verhoeven, 2006). In their study of language acquisition by bilingual deaf preschoolers, Rinaldi, Caselli, Onofrio and Volterra (2014) suggested that a deaf child's bilingual strategies may change according to their competence in expressing concepts, irrespective of the language modality used by interlocutor.

Despite the number of studies devoted to bimodal bilingual communication, there continues to be a significant gap in our understanding of the ways in which young bimodal deaf children with hearing parents make use of linguistic devices such as code blending, cross-language activation and translanguaging. Of particular interest is firstly, whether bimodal deaf children with hearing parents receive sufficient exposure to attain and use these skills in spontaneous discourse and secondly, identifying the nature of parental input when supporting their children's bimodal interactions. Ormel and Giezen (2014) echo this thought and go further to say that "As yet we are uninformed as to how precisely a sign language and a spoken language integrate into an interactive language system as well as how the integration process depends on the

varying degrees of exposure in the first years" (p. 90). To address these questions, more research is needed to investigate the issue of age of language acquisition and bilingual exposure in a deaf child's formative developmental years. Although the literature reports some studies on parents' role in mediating their deaf children's language following cochlear implantation (see Cramér-Wolrath, 2013) in many cases the parents were native deaf signers themselves or the studies were more focused on the spoken language development of the children rather than their bimodal bilingual development.

3.8.5 Children's language modality preferences

.

Although the term 'modality preference' may at first appear to be in conflict with the translanguaging model that promotes a more fluid interplay between the bilingual's languages, a young child's preference for a particular modality should not be considered as creating a dichotomy. One of the features of translanguaging is the deliberate switching of the language mode of input and output in bilingual practice. In other words, information may be received in one language and analyzed or expressed in the other language (Lewis et al., 2012). In the context of bimodal bilingual first language acquisition, the notion of modality preference, language choice or language dominance is not unusual and takes its place on the bilingual spectrum along with many other linguistic features (see Rinaldi et al., 2014, p.59). Measurement of the dominant language or language of choice in bimodal bilingual interactions has been reported in several studies (Kanto et al., 2013; Klatter-Folmer et al., 2006; Van den Bogaerde, 2000). Kanto et al. viewed the dominant language as being the more proficient mode (see Paradis, Emmerzael, & Duncan, 2010), whilst Klatter-Folmer and colleagues based their definition of language dominance on the token frequencies of the children's use of the two languages, in addition to the lexical diversity and length of utterance. For Van den Bogaerde, language choice was measured so as to gain a sense of the relationship between parent input and the children's output and the proportion of use was matched against the children's access to each language.

As has been mentioned in the previous chapter, the interactions deaf children share with their parents are mediated by many factors, including language modality, communicative competence, auditory functioning and the parents' sensitivity to their children's communication needs. In addition, young deaf children's modality use is influenced by the same factors that affect hearing children's linguistic achievements, such as auditory processing skills, perceptual abilities, attention skills and memory (Bates, 2004). In order to determine the ways in which parents scaffold their deaf child's language development, it is important to explore the relationship between the parents' sensitivity to their deaf child's communication needs and the child's agency in determining preferences for language modality.

Modality choice for deaf children is a topic frequently raised in early intervention literature and continues to provoke passionate discussions amongst parents and professionals (Hyde & Punch, 2011). For many years, advocates of an oral-aural approach believed that there would be a reduction in the rate of oral language development if the deaf child were exposed to sign language (Hyde, 2005; Power & Hyde, 1997). However, recent research findings suggest that this may not be the case, with evidence indicating that bimodal bilingual approaches could lead to optimizing a child's cognitive and linguistic development at critical stages in language acquisition (Preisler et al., 2002; Preisler, Tvingstedt & Ahlstrom, 2005; Vonen, 2007; Yoshinaga-Itano, 2006). In many cases it is seen as the responsibility of professionals to participate in making the important decision of spoken language versus sign language for communicative and educational purposes (Stredler-Brown, 2010). On the other hand, several studies have found that better language outcomes are achieved when parents facilitate child-led modality preferences, as opposed to parents or professionals choice the most suitable modality for the child (Nelfelt & Nordqvist Palviainen, 2004; Preisler et al., 2005; Uhlén, Bergman, Hägg, & Eriksson, 2005; Watson, Hardie, Archbold, & Wheeler, 2008; Yoshinaga-Itano, 2006). In their study of parents' approaches to their children's use of communication modes after cochlear implantation, Watson and colleagues (2008) found that the parents showed flexibility in being led by their children's communication needs and language preferences. In another qualitative study, Wheeler et al. (2009) reported findings from interviews with

12 families who changed from communicating with their children in sign-supported speech to oral communication once the children developed spoken language after cochlear implantation. In this study, some families later resumed communicating in sign language as their children matured and became interested in Deaf culture and their identity as a Deaf individual.

An important factor to consider when investigating use of language modality by deaf children and their hearing parents is the fact that most parents will be unlikely to have had prior experience of adapting to a deaf child's communication needs (Hintermair, 2006). This situation introduces a significant challenge to the level of communication frequency and language fluency between the children and their primary caregivers in both the spoken and sign languages. Moreover, the quality and breadth of language access is problematic when the children are in the process of acquiring auditory skills and their parents are still in the process of acquiring sign language (Moeller & Schick, 2006). Realistically, many deaf children will be exposed to only a single language in the home, and research has shown that the language is likely to be that of the mother (LaSasso & Metzger, 1998). Even when families do use sign language with their children, they continue to use a very basic level of signing for several years (Yoshinaga-Itano, 2003) and rely on more fluent language models to provide their children with exposure to sign language. However, on a more positive note, some hearing parents do develop effective signing skills with support and resources (Erting, 1992) and often show a high level of commitment to learning how to communicate in sign with their children. Additionally, in their study of parents' views on changing communication after cochlear implantation, Watson and colleagues (2008) found that many parents chose to continue communicating bilingually with their deaf children for reasons including their child's language preference or a decision related to their child's future. Wheeler et al. (2009) also found that parents used a variety of communication approaches at different times following their child's cochlear implantation. In this respect, the child's modality preferences were acknowledged and supported as part of a dynamic bilingual approach that changed over time.

3.9 Measuring bimodal bilingual competence

Although there is a keener awareness of the nature of first language bimodal bilingual development for deaf children in recent times, there are very few assessment tools which accurately describe the full repertoire of the children's language skills, their blended language use and their changing modality preferences. Regardless of whether unimodal or bimodal skills are measured, the assessment of competencies for both languages needs to take into account the relationship between the two languages in terms of code mixing, switching and blending (Rinaldi et al., 2014).

Professionals in the deaf early childhood intervention field acknowledge that there are numerous factors that influence effective assessment of young deaf children's language skills (Rhoades, 2003). In her investigation into language assessment protocols for children acquiring spoken language, Rhoades suggests that "It is important to employ, at the minimum, a standard of practice that prescribes appropriate, efficient, and systematic performance assessments that link assessment to effective intervention and decision making" (p. 170). However, when assessing language competence in young children, particularly their pragmatic skills, many formal tests provide only a limited view of the rich and complex nature of communicative interactions in their natural environments (see Lichtig et al., 2011; O'Neill, 2007). Moreover, many norm-referenced standardized language measures do not provide sufficient data on the outcomes of language use and interventions. In addition, most standardized instruments are typically designed to be only administered once a year and therefore are not suitable for deriving data from repeated measurements. In this respect, an alternative assessment protocol should therefore include a variety of measures, such as informal, functional criterion-referenced materials which can be used repeatedly throughout the year. These tools will also yield valuable data and provide another perspective to the children's development of language skills (Fewell, 2000).

In the case of bimodal assessment, there are very few materials reported in the literature that suitably measure the sign and spoken language skills of young deaf

children. In addition, those that are available have been used with small numbers of deaf children and focused on sign or spoken (or written) language, but not both modalities together (Pizzuto, 2002; Rinaldi & Caselli, 2009). For this reason, many sign language researchers have used a variety of existing tools and adapted them for use with other sign languages, or created test materials for their own specific purposes. This is particularly true of assessment of Auslan development because the population of first language Auslan users is very small (Schembri et al., 2002). The challenge of measuring bimodal competence in young deaf children is to find effective ways of eliciting the subtle use of language blending and non-manual markers that characterize bimodal use. Studies have highlighted that there are methodological challenges for research and practice in reliably measuring bimodal children's linguistic abilities as well as identifying the relationship between the two languages. In this respect, single language scores may not elicit the diversity of the child's language skills (Rinaldi et al., 2014). There is also a need to standardize the representation of the linguistic features of sign language when recording results of language assessments so that an accurate picture of developmental skills is obtained (Petitta et al., 2013). Rinaldi and colleagues suggest that, in many instances a valid assessment of young deaf children's bimodal skills can be achieved by using a combination of approaches, including parent interviews and informal descriptive evaluation.

As has been mentioned previously in this chapter, the languages in a bilingual partnership develop at different rates and are influenced by a wide range of factors such as age of acquisition, parents' education level and quality of input. Due to the fact that a child's dominant language is likely to fluctuate and will not necessarily be stronger for all language skills, assessment tools also need to be sensitive to the qualitative aspects of the child's language (Cummins, 1979; MacSwan, 2000; McLaughlin et al., 1995; Skutnabb-Kangas, 2007). For bilingual deaf children of hearing parents, the variables contributing to their bimodal language outcomes may also include the parents' commitment to bilingualism, their attitudes towards deafness, the age at which the child was introduced to sign language, the quality and quality of language input and the child's auditory skills (Rinaldi et al., 2014).

3.10 Parent participation in the assessment process

There is considerable evidence in the literature of the benefits of parent participation in their children's assessment process (Brown & Barrera, 1999; Rhoades, 2003). From a family-centred early childhood intervention perspective, parents increase their ownership of the intervention process when they participate in measuring their children's language skills and are able to share their perceptions with professionals. A further benefit is that parental participation in their children's assessment facilitates their knowledge of the hierarchy of communication skills which in turn increases their understanding of their children's use of language (Yoshinaga-Itano, 2000). These benefits are echoed by the international consensus on the principles that guide family-centred early intervention (Moeller et al., 2013) which proposed that service providers should work in partnership with families to assess the children's communication and language skills. Moeller and colleagues stated that "authentic assessments with emphasis on strengths-based perspective are designed to capture real-life competencies in everyday routines and are helpful in documenting incremental improvements in developmental skills for the purpose of intervention planning" (p.442).

Parent participation in the assessment process may involve the use of a variety of instruments ranging from standardized criterion-referenced tests to norm-referenced language scales (Rhoades, 2003), informal evaluations of sign language and parent interviews (Rinaldi et al., 2014). However, Kanto et al. (2013) cautioned that there may be challenges when evaluations of deaf children's linguistic milieu are based on parental interviews. In their study of the relationship between the child's linguistic environment and their bimodal bilingual development, Kanto and colleagues found that the language beliefs parents expressed in interviews were not necessarily observed in natural bilingual interactions within the family. Therefore, parent-rated measurement tools need to be devised in an explicit, functional way so that parents are clear about the meaning of the descriptors and understand how they specifically relate to their child's communication.

A concern raised by researchers in relation to structured language assessments has been the issue of 'ecological validity'. This term refers to the need for the methods, materials and settings of the study to approximate the real world of the participants (see O'Neill, 2007). In response to this concern, O'Neill suggests that standardized parent-report measures meet this need and are now accepted as a valid component of many language screening tools and structured assessments. Moreover, parent-reports provide an alternative to structured tests which have been criticized as failing to elicit the richness and complexity of the child's use of language in their familiar home environments. In defense of the use of parent reports, as used in assessments such as the MacArthur-Bates CDI, Fenson et al. (1993) believe that this type of parent participation in their children's assessment has been demonstrated to be accurate, reliable and valid, particularly as it draws on a wide range of language experiences in the child's own home.

3.11 Summary

Chapter Three provided an overview of the relevant literature on bilingualism and how it relates to the communication and language needs of deaf children. It is acknowledged in the research literature that unimodal and bimodal bilinguals use their two languages in a variety of ways and that the level of competence is very often different in both languages. Bimodal bilingualism has been a feature of deaf education programs for some time, however additional terminology has been introduced more recently in the bilingual field that broadens the parameters of unimodal and bimodal practice. Terms such as 'emergent bilinguals' and 'translanguaging' have given rise to a better understanding of the flexible ways in which bilinguals use their languages and help to explain the subtle language mixing and blending that are features of bilingual communication, particularly bimodal practice.

A broader focus on bilingualism suited the purpose of this study in that it encouraged a deeper understanding of the ways the children used their emerging skills in spoken and sign language. An important feature of this research was to determine the extent

to which the parents were able to adapt to their children's modality preferences or language choices. This did not mean to imply that one language was used to the exclusion of the other, as in a more 'monolingual bilingual' approach, but encouraged parents to become more sensitive to the ways in which their deaf child used both modalities to maximize their communication. In some instances children would be exposed to spoken or sign language being used exclusively by one person, such as in the case of a Deaf sign language tutor only using Auslan, or a parent only using speech. Alternatively, the parents in this study were encouraged to incorporate the 'sandwiching' technique into their bilingual utterances so that their children were aware of the different grammatical features of each language. It was expected, however, that this technique could be too challenging for some parents, but it was nevertheless modelled in early intervention sessions as common practice.

One of the features of the philosophy adopted by the intervention program attended by the participants in this study was that modality use and preference was led by the children, not the parents or professionals. This child-led model differs from most other intervention programs which are normally modality-specific, such as oral-aural or bilingual-bicultural, in which sign language is considered to be the deaf child's first language. Therefore, parents in this study were encouraged to be sensitive to their child's language needs by following their changes in modality use and responding reciprocally to their child's utterances in either language.

An important point to note in this study was that the emphasis on modality choice took on a more urgent nature when there was a risk of significant language delay for deaf children who were less able to access spoken language. It was expected that, by systematically assessing the ways parents responded to their children's language use, a clearer picture would be gained of the effectiveness of their parent-child communication and adjustments could be made to their type of input if necessary. It was also reasonable to expect that, if a child demonstrated a clear preference for one modality over another by school age, parents would be more confident to choose an educational program that best suited their child's future learning and language needs.

A challenge currently facing research involving bilingual deaf children is the scarcity of suitable assessment tools. Recent studies report that this continues to be the case, particularly for bimodal testing. Similarly, the measurement of parental input requires tools that will elicit the range of communicative and interactive behaviours that contribute to the children's language outcomes. The literature provides evidence that children's communication and language competencies are influenced by their parents' fluency with modality use. However, collecting data on the type of parental input in both languages has been problematic in the past, as it has often relied on parental interviews and anecdotal evidence. For the purposes of this study, it was important to use assessment tools that identified the parents' sign language proficiency and the way in which they incorporated Auslan with their English input in natural child-focused interactions. In turn, the data collected from the children's assessment results provided important information about the impact of the parental input on their language development.

A notable feature of this study was the strong philosophy of family-centred practice followed by the early intervention program in which all participants were enrolled. In this type of model, parents work closely with professionals and are involved in the assessment process in collaborative and supportive partnerships. It is expected that this high level of participation increases the parents' knowledge of the developmental sequence of communication skills and fosters a deeper understanding of their children's use of language. Through the systematic measurement of parent input and children's language development, this study aimed to contribute a unique dimension to the existing literature on young deaf children's bimodal bilingual experiences and to provide a framework for future practice in early intervention programs.

3.12 Research questions

In Chapters Two and Three, a review of the current literature provided important information about childhood deafness, the role parents play in supporting their children's communication and language development and the place of bilingualism in a

deaf child's world. Having considered these research findings, it was apparent that there were very few studies that focused on deaf children's bimodal bilingual communication and the nature of parental input. Therefore, this study provided a unique opportunity to contribute to research in the early intervention field by investigating the impact of parental bimodal bilingual input on the language outcomes of their young deaf children. A feature of the study was that it gave insight into the language experiences of deaf children and their parents that occurred within the familiar surroundings of their own homes.

The research questions devised for the study focus on several areas, such as the quality of the parents' input, their sign language proficiency and their sensitivity to their children's communication, the children's language outcomes and their modality preferences.

Specifically, the research questions devised for this study are:

1. What is the nature of parental input in a bimodal bilingual intervention approach during a period in which parents are still acquiring Auslan skills?

2. To what extent are child outcomes predicted by the quality of the bimodal bilingual input and/or parental sensitivity to their child's communication?

3. What are the outcomes for the children in terms of both languages, including their modality preferences?

These research questions will be explored within a framework of a case study design for the eight children and their parents who participated in the study. The details of the method used for the study and the instrumentation used to elicit and analyse the data will be outlined in Chapter Four.

CHAPTER FOUR

Method

This chapter describes the methodology used for the study and outlines the instrumentation used to elicit the data. The framework in which the research questions are explored is also described, as are the background of the participants and the settings in which the data were collected.

4.1 Ethics

This study was reviewed and approved by the University of Melbourne Human Research Ethics Committee prior to commencement of the research. In addition, because the participants in this study were enrolled in a Victorian Department of Education and Training early childhood intervention program, approval from the Department's Early Childhood Research Committee (ECRC) was also obtained before the research commenced. A final report to the ECRC will be provided at the completion of the research, together with a summary of the outcomes and how it relates to the Department of Education and Training. A letter of invitation to potential families to participate in the study was sent by the Principal of the school for the deaf which incorporates the early intervention program. A Plain Language Statement and Consent Form were included with the invitation. Examples of these documents are provided in Appendix 4.1.1 to 4.1.3.

4.2 Researcher role

The researcher for this study was also the early intervention Teacher of the Deaf for the families who participated. As part of the regular state-wide service delivery, the families enrolled in the bimodal bilingual early intervention program received sessions

in their homes from a Teacher of the Deaf. The teacher's role was to work in partnership with families to encourage the development of the children's communication through exposure to the family's home language (in this case English) and Auslan. In order to avoid compromising the researcher and teacher roles, care was taken to ensure that assessment procedures, data collection and review of hard copy and video data were carried out at a time separate from the regular home-based early intervention sessions. All assessment records and case notes related to the research were stored separately from session notes taken for the early intervention sessions and were not accessed by any other early intervention team member. In most cases, the participants were not aware of each other's identity, although some parents and children met together at bilingual playgroups and events organized by the intervention program.

4.3 Research design

Research in the special education sector is generally considered to be complex, due to the heterogeneity of the participants and low incidence of most disabilities. In order to meet the challenges of controlling a wide range of variables known to impact on the language outcomes of young deaf children, a single case design approach (Odom et al., 2005; Wolery, Dunlap, & Ledford, 2011) was chosen for this study. These variables include: audiological, linguistic, cultural, social, cognitive, and developmental characteristics (Leigh, 2008); age of diagnosis; age, type and use of device fitting; communication mode; presence of additional needs; cognitive ability and maternal education (Baker et al., 2008; Beer, Pisoni, & Kronenberger, 2009; Ching et al., 2010). By using a single case design, each case (i.e. parent or child) acts as their own control and, typically, detailed descriptions about each case are provided. This approach allows for a deep level of understanding of the research questions and the degree to which the results can be generalized (Shadish, Cook, & Campbell, 2002). Furthermore, the single case design approach provides opportunities for the researcher to identify the ways in which the participants responded to a particular intervention and the factors contributing to their responses (Kratochwill & Levin, 2010). In this study, data

were gathered over a period of 20 months so that patterns of results could be compared over time and would provide a basis for drawing valid inferences about development. The study's research questions promoted an in-depth investigation into the bimodal bilingual early intervention approach and provided opportunities for understanding the language outcomes of the children under specific, repeated conditions (Horner & Spaulding, 2010).

4.4 Background to the study

All families were enrolled in the same bimodal bilingual early intervention program and received home-based support. The program followed a Family-Centred Early Intervention (FCEI) approach (Moeller et al., 2013) which promotes strong family–professional partnerships and collaboration to achieve optimal language and developmental outcomes for the children. In order to investigate the impact of hearing parents' bimodal bilingual input on their young deaf children's language skills, bi-monthly data were collected for each case in their home environments.

4.5 Participants

Eight deaf children: 'Peter', 'Andrew', 'Tiffany', 'Oscar', 'Sam', 'Lachlan', 'Oliver' and 'Max', together with their hearing, English-speaking parents, were invited to participate in the study. Pseudonyms were used throughout the study so as to preserve anonymity of the participants. The families were identified from the program database of children in Victoria who were receiving a bimodal bilingual early intervention program. The families were amongst sixteen families who responded to an invitation to participate in the study and were selected on the basis of the following eligibility criteria:

- The primary caregivers of the children were their hearing biological parents, both of whom were living in the family home.
- The families spoke only English in the home
- The parents had little or no prior exposure to Auslan (Australian Sign Language)
- The parents had no experience with deafness or the use of a bilingual approach in communicating with their children
- The children were all diagnosed with bilateral sensorineural deafness, ranging in degree from severe to profound
- The children were cognitively normal
- The children had no known additional developmental challenges

For a variety of reasons during the early planning phase of the study, several parents of girls could not continue their participation, therefore Tiffany was the only girl in the study. Gender differences for deaf children are generally similar to those found for hearing students in terms of language and learning outcomes (Martin & Bat-Chava, 2003; Powers, 2003; Wauters & Knoors, 2008; Yoshinaga-Itano, 2003). An additional feature of the participants' background was the mothers' level of education, a variable known to significantly contribute to children's language outcomes (Dollaghan et al., 1999). In this study, all mothers had completed secondary school education and two had attained tertiary degrees (Lachlan's and Max's).

Table 1 below summarizes the ages (in months) of the children during the study, their age at diagnosis, aetiology of deafness, age at enrolment in the early intervention program, degree of deafness, type of listening devices, age at which the devices were issued and frequency of device use.

Table 1: Details of children participating in the study.

DETAILS OF CHILDREN IN STUDY (ages in months)										
CHILD	**Age range**	**Age at Diagnosis**	**Aetiology of deafness**	**Entry to EI**	**Degree of Deafness**		**Listening Devices**		**Age at issue of devices**	**Frequency of device use**
					L	**R**	**L**	**R**		
Peter	17-36	2	Unknown	3	S	P	HA	HA/CI	2*/36	Seldom
Andrew	23-42	3	Meningitis	6	SP	SP	HA	HA	4	Often
Tiffany	37-56	2	Genetic	5	P	P	CI	CI	4*/24	Always
Oscar	22-37	11	Genetic	22	P	P	CI	CI	12*/22	Seldom
Sam	23-42	3	Premature	12	P	P	CI	CI	3*/15	Always
Lachlan	27-46	19	Unknown	21	SP	SP	HA	HA	20	Always
Oliver	27-46	16	Unknown	18	S	P	HA	HA/CI	17*/43	Always
Max	33-52	12	Unknown	13	S	P	HA	CI	13*/24	Sometimes

Note: EI=early intervention; L=left ear; R=right ear; S=severe; P=profound; HA=hearing aid; CI=cochlear implant
*age first fitted with binaural hearing aids

Table 1 shows that the ages of diagnosis of deafness for the eight children ranged from two months to 19 months. Despite investigative genetic testing following diagnosis, the aetiology of deafness remained unknown for Peter, Lachlan, Oliver and Max. Meningitis was identified as the cause of Andrew's deafness, genetic mutation (Connexin 26) was implicated for Tiffany and Oscar and prematurity was identified as the likely cause of deafness for Sam. The children's ages of enrolment in the early intervention program varied, with only Peter, Andrew and Tiffany receiving early intervention by six months of age, the recommended age for supporting optimal language development (White & White, 1987; Yoshinaga-Itano, 2003; Yoshinaga-Itano et al., 1998). Oscar, Lachlan and Oliver did not receive early intervention support until they were over 18 months of age, due to the late diagnosis of their deafness. All children were diagnosed with a severe, severe-profound or profound bilateral sensorineural hearing loss and were fitted with high-gain digital hearing aids shortly after diagnosis. Tiffany, Oscar, Sam and Max had received cochlear implants before they commenced their participation in the study and Peter and Oliver received a cochlear implant in the final stages of the study. Andrew was being considered for possible implantation in the future. Lachlan was initially considered as a candidate for cochlear implants, but subsequent audiological testing determined that his hearing aids were providing optimal amplification for his hearing loss and he would not benefit from implantation.

4.6 Procedure

4.6.1 Data collection

The children and their parents were assessed and videotaped in familiar play settings in their natural home environments. Some of the families live in rural or seaside areas, so their natural surroundings include farm animals, tractors, ducks and boats. Data were collected bi-monthly, with 10 data collection points in total over a 20 month period. At each of the 10 points, information was collected from eight different measurement tools (see 4.6.2 Instrumentation). These included a standardized parent report on child language, an adult second language sign language proficiency scale, several parent-rated scales, a children's auditory skills inventory, and videotaped records of parent-child interactions. A second data collection session was made available during the week before and/or after each bi-monthly data point if the parents required more time to complete the scales.

At the commencement of the study, a range of toys and activities was identified that would encourage free play and elicit effective communication and interaction between the children and their parents. The initial protocol was to videotape 20 minutes of continuous interactions in a designated play area, using standard play materials that suited young children of either gender. The parents were encouraged to interact naturally with their children and engage them in conversation to the best of their ability. However, it soon became apparent that the planned play activities were impeding natural, spontaneous interactions, particularly with the more active children. Therefore the methodology was modified to become a more spontaneous event, with play materials differing for each family. The videotaping schedule of parent-child interactions was modified to capture 20 non-consecutive minutes during each bi-monthly session, usually in five to 10 minute segments. In most cases the play materials included books, dolls, tea sets, building sets and blocks, play doh, puzzles, toy cars and toy farm animals. The only instructions parents were given were to

encourage natural interactions, to follow their child's lead in their choice of play events and to reward communication bids as frequently as possible.

The parent-child interactions were recorded with a small, hand-held camera and uploaded to the researcher's computer after each data collection session. Due to the fact that videotaping of interactions was not an unusual event in the households of the participating families, the presence of a small camera did not appear to impede spontaneous interactions. The data collected via videotaped records were representative of the types of interactions that commonly occurred between the parents and their children. This was supported by feedback from the parents after they viewed each of the 10 videotapes recorded over the 20 month period of data collection. Hand written ratings and assessments were transcribed by the researcher and entered on computer spreadsheets at each data point. Hard copy (results of assessments, scales and annotations of interactions) and digital (videotaped) data were kept confidentially and securely stored. Digital data were stored in password-protected files on the researcher's computer and printed hard-copies of assessments were kept in a locked filing cabinet in the researcher's home.

4.6.2 Instrumentation

One of the conditions for eligibility to participate in this study was that the children were to have no known cognitive delay or additional developmental challenges. In order to ensure that the children were cognitively normal, they were assessed by an educational psychologist prior to the commencement of data collection. Assessment tools used to measure the children's cognition were the Bayley Scales of Infant and Toddler Development, Third Edition [Bayley–III] (Bayley, 2006) or the Developmental Activities Screening Inventory-II [DASI-II] (Fewell & Langley, 1984). The Bayley Scales measure the developmental skills of young children, aged one to 42 months. The DASI-II has been designed to detect developmental disabilities in children between the ages of birth and 60 months. Developmental skills assessed by DASI-II cover 15 skills

categories ranging from sensory intactness, means-end relationships, and causality to memory, seriation and reasoning.

Whilst there is a variety of assessment tools available to assess young deaf children's speech and hearing (Nott, Brown, Cowan, & Wigglesworth, 2006), very few assessments have been designed to assess the signing skills of deaf children, particularly those under three years of age (Herman & Roy, 2006; Mason et al., 2010; Schick et al., 2006). This is particularly true for the assessment of Auslan development because the population of first language Auslan users is very small. Similarly, to date there have been no standardized assessment tools developed to measure young deaf children's bimodal bilingual skills. Furthermore, of the published tests that are available, most have focused on spoken or sign language as separate languages, not both modalities used bilingually (Rinaldi et al., 2014). Researchers have therefore been required to use the small number of existing tools or develop their own for their specific research purposes (Boudreault & Mayberry, 2006; Haug, 2005; Hermans, Knoors, & Verhoeven, 2010). For this reason, this researcher devised several assessment tools and rating scales for the study to ensure that the richness of the parents' and children's interactions and language skills was appropriately identified and sensitively measured.

As was mentioned in Chapter Three, when assessing young children's language competence, there are valid reasons for using assessment protocols such as functional criterion-referenced materials which can be used repeatedly throughout the year (see 3.9). Many of the assessment materials developed for this research are criterion-referenced parent-rated scales that have been adapted from other scales published in the deaf early intervention literature. The scales in this category are the Bilingual Rating Scale, the Parent-Child Communication Scale, the Listening Device Rating Scale and the Sign Intelligibility Scale. Another scale developed specifically for this study, the Bimodal Bilingual Development Scale, is not parent-rated per se, but is designed to be completed by a professional in collaboration with the parents (more details are provided for these assessment tools later in this section). In order to ascertain validity and reliability, the assessment materials devised for this study went through several

phases of scrutiny and review. These materials were: the Bilingual Rating Scale, the Parent-Child Communication Scale, the Bimodal Bilingual Development Scale, the Sign Intelligilbility Checklist and the Listening Device Rating Scale. In the first phase, the materials were used over a two year period by professionals from the early intervention program attended by the participants. The feedback they provided led to several modifications of the scales, such as adjusting the descriptions for various items and including functional examples of target behaviours. These changes improved the level of usability for parents and increased their understanding of developmental and language concepts related to their children's bimodal bilingual use. Once these modifications were made, the scales were further tested with a number of families over a period of several months to confirm that they elicited appropriate responses and were parent-friendly. The validity and reliability of the Bimodal Bilingual Development Scale was also trialled by early interventionists over two years and the children's bimodal skills were matched to the scores gained on the Macarthur-Bates CDI. Results recorded for all assessment materials were further validated by being matched to the videotaped parent-child interactions and through discussions with the researcher. This aspect of checking occurred at each data collection session and ensured that the parents' ratings were a valid and reliable representation of their own skills over the 20 months. The assessment tools used in this study are described in more detail below.

4.6.2.1 Bilingual Rating Scale

The Bilingual Rating Scale, based on a five point Likert-style scale, was devised specifically for this study. The scale measures the level of the family's participation in the bilingual program and engagement with various aspects of the bilingual environment. A particular focus is given to the frequency of their use of English and Auslan, use of Auslan resources and use of auditory stimulation techniques to encourage their child's spoken language. The Bilingual Rating Scale was adapted from an existing scale of parents' participation in early intervention programs for deaf children, developed by Moeller (2000). Additional items specific to bilingual practice

were based on research findings by de Hoewer (2007), whilst items related to the facilitation of children's listening skills and spoken language were based on a rating scale Geers and Brenner (2003) developed to reflect the degree of speech and auditory focus in a range of communication approaches. The ratings for the Bilingual Rating Scale range from 1: 'minimal level of participation and bilingual use', to 5: 'exemplary level of participation and fluent, frequent use of English and Auslan'. The parents record their rating scores on hard copies of the scale and these scores are then copied to a spreadsheet on the researcher's computer. The descriptors for the five rating levels of the Bilingual Rating Scale are shown below in Table 2.

Table 2: Bilingual Rating Scale

Rating 5 Exemplary participation	All family members use both languages most of each day, utilizing opportunities to involve a range of fluent English & Auslan users as language models for the child. Adults' competence levels are appropriate for the child's general developmental level. Family actively engages in Auslan tutorials and accesses appropriate Auslan resources to improve skills. Family members are highly effective bilingual conversational partners with the child & use a range of language expansion strategies in both languages. Extended family members are involved and supportive of bilingual communication. Child's spoken language is actively encouraged through listening activities and effective auditory management.
Rating 4 Above average participation	Mother uses Auslan effectively when communicating with child but few other family members or visitors use fluent Auslan. Adults' competence levels are more 'formulaic' than native signers but are appropriate for the child's general developmental level. Family uses a range of Auslan resources to improve skills. Family members serve as effective bilingual models for the child and make an effort to use a range of communication strategies. Extended family members are occasionally involved. Family understands the sequence of auditory skills development and incorporates listening strategies into daily routines.
Rating 3 Average participation	Family has adequate competence in Auslan to communicate about routine events but predominately communicates with the child in gesture and English, using other visual and situational cues. Child is exposed to fluent Auslan models at bilingual playgroups & events. Family members use language expansion techniques for speech and encourage the child's device wearing and attention to sound.
Rating 2 Limited participation	Family has limited competence in Auslan and communicates predominately in English with some signs, gestures, contextual and visual cues. Communicative interactions with the child are basic. Family facilitates the child's device wearing but does not frequently implement auditory skills strategies.
Rating 1 Minimal participation	Family communicates verbally with limited use of gestures or visual cues. Accepts Auslan use by others e.g. EI workers, but has developed no purposeful Auslan skills themselves. Family faces significant life stresses that may take precedence over the child's deafness. Parent-child communication is limited to very basic needs. Minimal attention is given to the child's listening skills and device wearing.

To complement the data from the Bilingual Rating Scale, the Auslan Proficiency Rating Scale was used to identify and describe the parents' Auslan skills and to rate their level of sign language uptake. Although the ratings were determined by the parents, they engaged in much discussion with the researcher, who assisted in clarifying the linguistic terminology. A description of this scale is given below.

4.6.2.2 Auslan Proficiency Rating Scale (APRS)

The Auslan Proficiency Rating Scale (Power & Carty, 1999) provides standardized descriptions of second language acquisition skills in Auslan. The levels of proficiency in receptive and expressive sign language range from 'Zero Proficiency' (1), a level at which there is no ability to communicate in, or understand Auslan, to 'Native-like Proficiency' (8), a level that demonstrates complete fluency, accuracy and use of grammar as used by native or native-like signers. Each level has an explanation of the level of expertise and a detailed account of the skills expected for that level. Table 3 below summarises the skills described in the APRS.

Table 3: Summary of Auslan Proficiency Rating Scale levels.

1. ZERO PROFICIENCY *Unable to communicate in or understand Auslan*	Essentially no communicative ability in Auslan. May use some pantomime or gestures in an attempt to communicate with signers. Essentially no comprehension of Auslan utterances. Relies on contextual and situational cues
2. FORMULAIC PROFICIENCY *Limited signing ability, using formulaic language related to basic topics. Understands a limited range of simple signed utterances.*	Vocabulary limited to simple needs. Most utterances rarely more than 2 or 3 signs & may be difficult to understand – long pauses. Can fingerspell own name and knows all letters of the alphabet. Understands face-to-face signing with a signer sensitive to unskilled signers. Does not understand non-manual features. Needs much repetition of interlocutors' signs.
3. BASIC TRANSACTIONAL PROFICIENCY *Uses formulaic language to satisfy immediate, predictable needs. Understands familiar or predictable utterances within the areas of immediate needs.*	Uses limited grammar. Some hesitation but becoming more flexible and spontaneous, with slightly longer utterances. Showing some creativity. Asks simple questions, expresses likes and dislikes. Uses some facial expressions inappropriately. Responds to simple questions. Understands common non-manual features, but cannot comprehend modifying devices e.g. adjectives, adverbs. Developing understanding of simple classifiers.
4. TRANSACTIONAL PROFICIENCY *Satisfies everyday transactional needs and limited social needs.*	Shows some spontaneity but fluency is uneven. Limited use of grammar. Uses most question forms appropriately and can generally use pronouns correctly. More sensitive to morphology, but has difficulty understanding long discussions. Understands fingerspelling when heavily supported by context. Follows simple relationships between clauses.
5. MINIMUM SOCIAL PROFICIENCY *Satisfies routine social demands and limited work requirements.*	Communicates confidently in most situations, but has restricted register flexibility. Can converse about familiar events, but often hesitates when unsure of grammar or vocabulary. Uses simple possessive pronouns. Understands most conversations, but has limited ability to understand specific registers. Follows sequential instructions containing fingerspelling of names of people/locations.
6. INTERMEDIATE SOCIAL PROFICIENCY *Uses Auslan with adequate vocabulary & grammatical accuracy in most conversations. Follows most discourse with native signers on topics relevant to interests and experiences.*	Able to discuss interests with broad vocabulary and confident use of grammar. Fluency rarely disrupted by hesitations. Modifies language to suit different registers and uses colloquialisms in a range of social situations. Understands most conversations between native signers. Rarely asks for signed utterances to be repeated. Follows most fingerspelling and numerals at a moderate pace and understands complex time signs.
7. ADVANCED SOCIAL PROFICIENCY *Signs fluently and accurately in most social, community, recreational and vocational situations. Confidently follows conversations in most contexts relevant to own experience.*	Participates in a wide range of conversations with fluency, precision of vocabulary and depth of meaning. Despite fluency, has a discernible 'accent'. Uses loan translations and a range of registers to convey meaning. Fingerspells fluently. Understands rapid rate of signed utterances and fingerspelling. Follows complex discussions with changes of register and dialectic differences. Responds appropriately to questions and directions.
8. NATIVE-LIKE PROFICIENCY *Signing proficiency equivalent to that of a native signer of the same socio-cultural variety.*	Has developed full fluency, accuracy and grammatical flexibility. Uses colloquialisms, registers and cultural references. Fingerspells fluently, with few errors. Shows use and understanding of humour and innuendo. Signing 'accent' culturally appropriate. Understands all varieties and registers of signed utterances and fingerspelling. Discerns different accents in signed discourse.

In addition to measuring the parents' level of participation in the bilingual program and their proficiency in communicating in Auslan, it was also important to understand the degree to which they showed sensitivity to their children's communication needs. In order to explore this issue further, the Parent-Child Communication Scale was devised to measure the ways in which the parents facilitated their deaf children's communication and interactions. The scale is described in more detail below.

4.6.2.3 Parent-Child Communication Scale

The Parent-Child Communication Scale is a five point Likert-style scale adapted from various existing tools that measured parent-child interaction (Brown, 2002; Hafer & Topolosky, 1995; Kyle, Woll & Ackerman, 1989; Mohay, 1988; Spencer, 2001). Parents rated aspects of their interactions every two months on a scale from 1 (weak) to 5 (strong), based on their estimation of the frequency of use of the strategy and the approximate number of hours they devoted to using these strategies each day. Strategies included attention gaining, sensitivity to their children's communication bids and the modality of language use. The parents' responsiveness to their children's communication was measured using four criteria: Visual Attention, Responding to Communication, Adapting Communication and Gaining Attention. The scores derived from all items rated on the scale were calculated as percentages of the full score possible for each item.

Table 4 below shows descriptions of these four communication strategies and the parents' use of language modality.

Table 4: Parent-child communication strategies and language use.

Parent-child communication strategy	Parent interactive behaviour
Visual Attention	communicating when child makes eye contact; supporting joint attention by responding within child's visual field; relating responses to what child is looking at
Responding to communication	responding contingently to child's communication bids, imitating gestures and facial expressions. Encouraging communication 'repairs', expanding utterances
Adapting communication	waiting for optimal times to communicate, being aware of child's attention span and communicating when attention is gained.
Gaining attention	calling child's name to gain attention, waving and tapping or moving an object to alert child to attend to referent
Parent language use (English & Auslan)	questioning, requesting, directing attention, negotiating, labelling objects, expressing emotions, referring to past events and future events

In the Parent Language Use section, the parents rated their modality use for various communicative functions: questioning, requesting, directing attention, negotiating, labelling objects, expressing emotions and referring to past and future events.

The next section of this chapter describes the instruments used to measure the children's communication and language outcomes.

4.6.2.4 MacArthur-Bates Communicative Development Inventories (CDI)

The Toddler Scale of the MacArthur-Bates Communicative Development Inventories (Fenson et al., 1993), Words and Sentences, 16-30 months, was used to assess the children's English and Auslan vocabulary and grammatical skills. The MacArthur-Bates Communicative Development Inventories (CDI) is a standardized parent reporting system that assesses children's lexical growth. The questionnaires are designed to

systematically utilize the parents' knowledge of their own child's development and give them the opportunity to take responsibility for identifying and recording their children's progress, usually in collaboration with the researcher. Although several of the children in this study were older than 30 months, the scale may also be used with children older than the norming sample. Due to the small population of Australian deaf children and the challenges of collecting normative data for sign language (Schembri et al., 2002), an American Sign Language version [ASLCDI] (Anderson & Reilly, 2002) was used for this study. Items include a vocabulary checklist which comprises 680 words and signs organized into 22 semantic categories.

In addition to measuring the children's English and Auslan vocabulary scores, assessments were made of their bimodal bilingual skills. Although the sign language version of the MacArthur-Bates CDI contained sections that measured the children's use of sentences and grammar (Part II, Sentences and Grammar), more detailed data were required in order to gain a deeper insight into the use of English and Auslan grammar and the bilingual relationship between the children's languages. Therefore, the children's bilingual skills were also measured with the Bimodal Bilingual Development Scale, described below.

4.6.2.5 Bimodal Bilingual Development Scale

As has been previously mentioned in Chapter Three, there are very few assessment materials available for measuring the communication and language skills of young bimodal bilingual deaf children (Rinaldi et al., 2014). The Bimodal Bilingual Development Scale was developed specifically for this study to address the scarcity of appropriate assessment tools and to provide parents of deaf children with a way of understanding how their children are developing skills in both languages. The scale also provides an opportunity to focus on both languages in a bilingual relationship, rather than using available scales that focus on spoken and sign languages separately. However, it is worth noting that this scale does not effectively measure the proportion of language mixing in the children's utterances, nor the ways in which children make

use of translanguaging features in their bilingual practice. Information about the children's use of these bilingual features and modality use is provided by ELAN video analysis and annotations (see 4.7.1 Videotaped data) and augments the data yielded from the Bimodal Bilingual Development Scale.

Due to the fact that very little research has been conducted on the development of Auslan to date, the Bimodal Bilingual Development Scale is based on existing scales and inventories devised for British and American sign languages and approved by Auslan linguists (Johnston & Schembri 2007). This measurement tool is a criterion-referenced scale that measures English, Auslan and general pragmatic language skills for children from birth to five years in six monthly stages, then from five to eight years in a single stage. By presenting the language indicators for English, Auslan and pragmatics side by side in developmental stages, the parents become familiar with their child's sequence and rate of acquisition. Language skills are recorded on the individual children's scales and are colour-coded to signify the date of observation and assessment. The developmental indicators in this scale were derived from two sources. The first source was existing scales: The Cottage Acquisition Scales for Listening Language & Speech (Wilkes, 1999), Early Support Monitoring Protocol for Deaf Babies and Children (Lewis, 2006) and the MacArthur-Bates Communicative Developmental Inventories (Fenson et al., 1993). The second source was published articles on monolingual and bilingual language development in young deaf children: Anderson and Reilly (2002), Brown (1973), Johnston and Schembri, (2007), Maller, Singleton, Supalla, and Wix (1999), Mayberry and Squires (2006) and Woll (1998). Table 5 shows an example of the language items measured on the Bimodal Bilingual Development Scale, at the 12-18 month developmental level (Stage 3).

Table 5: Bimodal Bilingual Development Scale 12-18 month stage.

Age	English	E C	Auslan	E C	Pragmatic language skills	E C
1;0-1;6 **Stage 3**	**Receptive Language** ▪ understands up to 50 words ▪ follows 2 word commands ▪ listens to favourite story ▪ points to pictures/objects when asked (1;0-1;3) ▪ turns when name called ▪ responds appropriately to wide range of sounds, words, phrases through listening **Expressive Language** ▪ intonation and jargon babbling ▪ makes animal sounds (1;0-1;3) ▪ longer vocalizations have recognizable words and sounds, but meaning is unclear ▪ vocalizations sound more like speech ▪ plays vocal games with adult, copies their sounds ▪ first words over/under generalized ▪ uses 10-15 words ▪ imitates familiar words ▪ combines single words + point ▪ gestures similar to words (1;2-1;4); different to words (1;4-1;6) ▪ uses single words with intonation to ask simple questions		**Receptive Language** ▪ understands up to 50 signs by 1;6 ▪ follows simple instructions, e.g. book (point) + give + Daddy ▪ sustains attention to favourite story ▪ points to objects when asked (signed) ▪ responds consistently to visual and tactile attention-gaining strategies **Expressive Language** ▪ 'unmarked' handshapes: flat, point, spread, fist, good, cup, 1 handed O'  ▪ joints closest to torso e.g. shoulder, elbow, usually used:'proximalization' ▪ location usually correct; movement correct about 50% of time; handshapes correct less than 25% of time - depends on complexity of sign ▪ first signs over/under-generalized ▪ uses 10-15 signs ▪ imitates familiar signs ▪ combines sign & point; points to objects – not always people ▪ some signs similar to gestures ▪ yes/no questions use non-manual features; 'wh' signs may emerge		▪ imitates other children ▪ initiates routines ▪ uses words/signs to: - request information - label - comment - respond - greet - call ▪ responds to adult conversation but often not topically contingent ▪ chatters/signs to self while playing ▪ more evidence of initiation of/response to joint attention	

Another important aspect of the children's language skills was the intelligibility of their communication. The ability for parents to understand their children's utterances is an important factor contributing to their reciprocity and positive interactions (Ertmer, 2011; Warren & Brady, 2007) and the extent to which others can understand children's communication plays a vital part in language outcomes, especially for deaf children (Yoshinaga-Itano, 2003).

4.6.2.6 Speech Intelligibility and Sign Intelligibility checklists

Two checklists are used to rate the children's intelligibility in speech and sign: the Speech Intelligibility checklist (Sedey, 1996) and the Sign Intelligibility checklist. The latter was adapted by the researcher for this study from the Speech Intelligibility checklist, with brief descriptions of sign phonology included for each level. A seven point Likert-style scale is used, with rating 1 representing the least intelligible utterances and 7 the highest level of intelligibility. When completing the intelligibility scales, the parents are instructed to determine the proportion of each utterance that they readily understood. They are then asked to match their perception to a rating between 1 and 7 on the scales. All parents are considered to be experienced in listening to their child's speech or observing their gestures and signs and are familiar with the contexts of their child's communication. For other adults using this scale, there would be expected to be a significant difference between experienced and inexperienced listeners as is often case for people who are unfamiliar listeners to deaf speech (McGarr, 1983). It is also worth noting that these intelliibilty checklists do not measure the proportion of language mixing in the children's utterances, although parents may comment on this aspect when they are completing the scales at each data point. For this study, ELAN video analysis and annotations captured bilingual features such as code-switching and blending, simultaneouos communication and 'sandwiching' of the languages in an utterance (see 4.7.1 Videotaped data).

Table 6 below shows the seven intelligibility rating levels for both language modalities.

Table 6: Speech and Sign intelligibility rating levels.

Rating	Speech Intelligibility	Sign Intelligibility
7	I always or almost always understand my child's speech with little or no effort.	I always or almost always understand my child's signing with little or no effort. Handshapes, orientation, location & movement more consistent. Sign production closer to adult target.
6	I always or almost always understand my child's speech but need to listen carefully.	I always or almost always understand my child's signing but need to watch carefully. Some sign approximations unclear, but more correct use of space, phrasing.
5	I typically understand about half of my child's speech.	I typically understand about half of my child's signing. Handshapes, movement more differentiated. More rhythm, phrasing.
4	I typically understand about a quarter of my child's speech.	I typically understand about a quarter of my child's signing. Placement of signs more correct and consistent, but frequent use of jargon.
3	I typically understand only occasional, isolated words and/or phrases. My child's speech is very hard to understand.	My child's signing is very hard to understand. I typically understand only occasional, isolated signs and/or phrases. Limited variety of handshapes & movement. Location more consistent.
2	I never or almost never understand my child's speech.	I never or almost never understand my child's signing. Handshapes, movement are inconsistent and difficult to discern.
1	Speech intelligibility cannot be judged because my child is producing few or no word approximations.	Signing intelligibility cannot be judged because my child is producing few or no sign approximations.

The parents determined their ratings after discussing their children's language skills with the researcher and viewing the video records taken every two months. It should be noted that a high intelligibility rating does not necessarily indicate a high level of language skills.

4.6.2.7 Children's auditory skills

One of the variables identified as contributing to the language outcomes of young deaf children is their ability to make use of auditory input (Leigh, 2008). In order to understand more about the children's use of audition to process spoken language, it was important to know about their access to amplification and their frequency of hearing aid or cochlear implant use. The parents rated their children's device use every two months, using the Listening Device Rating Scale, a five point Likert-style scale designed specifically for this study. This instrument was adapted from the P.E.A.C.H - Parents' Evaluation of Aural/Oral Performance of Children (Ching & Hill, 2007), a questionnaire designed to record a child's listening behaviours and the frequency of device use. Scores ranged from a rating of 5 for 'always (76%-100% of the time), 4 for 'often' (51%-75%), 3 for 'sometimes' (26%-50%), 2 for 'seldom' (1%-25%) and 1 for 'never'.

The children's auditory skills were measured bi-monthly with the Functional Auditory Performance Indicators (FAPI, Stredler-Brown & Johnson, 2001), which can be used by parents, therapists, early interventionists and teachers. The profile presents listening skills in an integrated hierarchical order across seven categories: auditory awareness, auditory feedback and integration, localizing sound source, auditory discrimination, auditory comprehension, short-term auditory memory and linguistic auditory processing. The children's skills were ranked through direct observation of responses to specific stimuli and from data collected from parents' reports and video records**,** using a four-tiered scoring paradigm. The assigned weighted scores indicate the level of attainment and the degree to which the skill occurs:

a. Skill not present (NP) = 0-10% occurrence (Score value = 0)
b. Skill emerging (E) = 11-35% occurrence (Score value = 1)
c. Skill in process (P) = 36-79% occurrence (Score value = 2)
d. Skill acquired (A) = 80-100% occurrence (Score value = 3)

The children's skills were also assessed in a variety of conditions, such as when auditory stimuli are paired with visual cues, quiet listening conditions, stimuli that are presented close to the child, and prompted responses. More challenging listening conditions include auditory-only stimuli, listening from a distance and in noisy situations and unprompted responses. A percentage score is then calculated for each category which identifies the child's listening skills at that level of the listening hierarchy. Each child's profile of auditory skills is generated after all items on the profile have been presented. In many cases, it is appropriate that children are simultaneously using several skills and developing their auditory skills in an integrated manner. The children's auditory profiles are shown below in Figures 1 to 8.

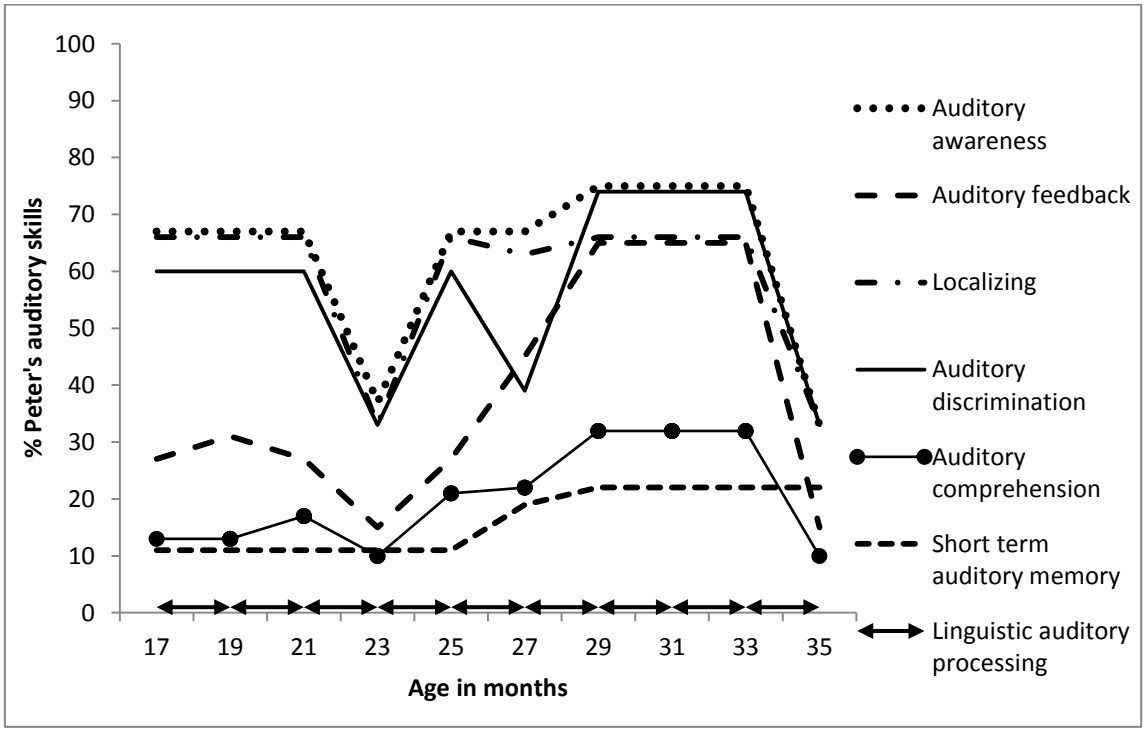

Figure 1: Peter's auditory skills profile, measured with the Functional Auditory Performance Indicators.

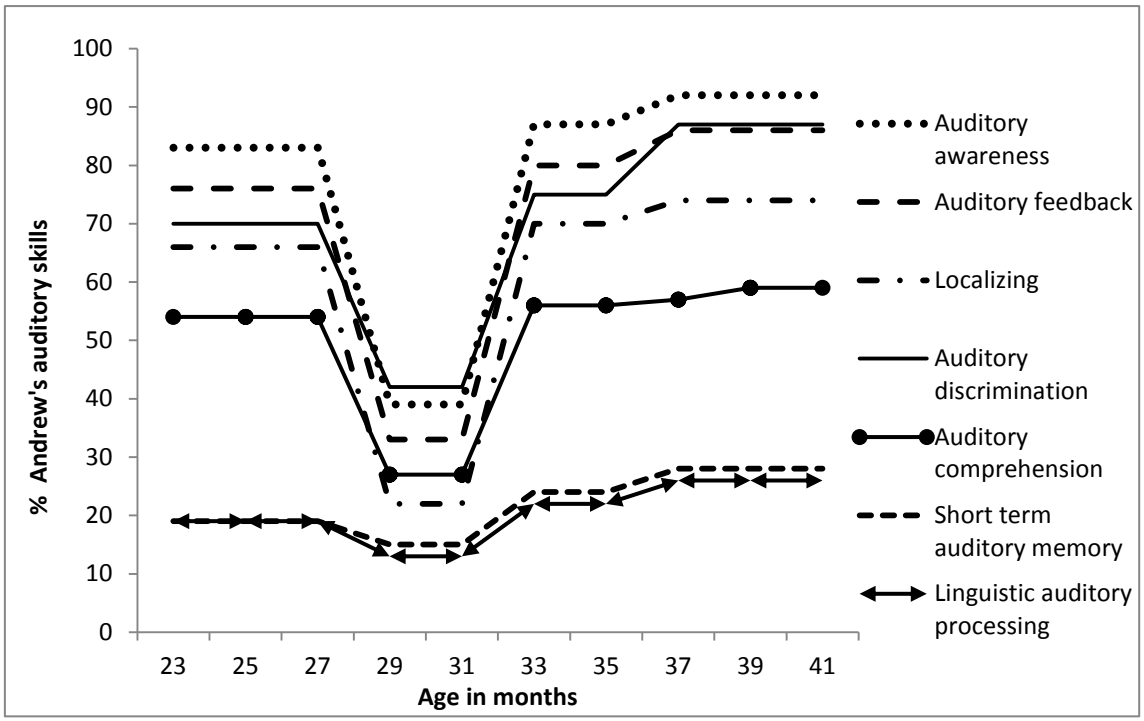

Figure 2: Andrew's auditory skills profile, measured with the Functional Auditory Performance Indicators.

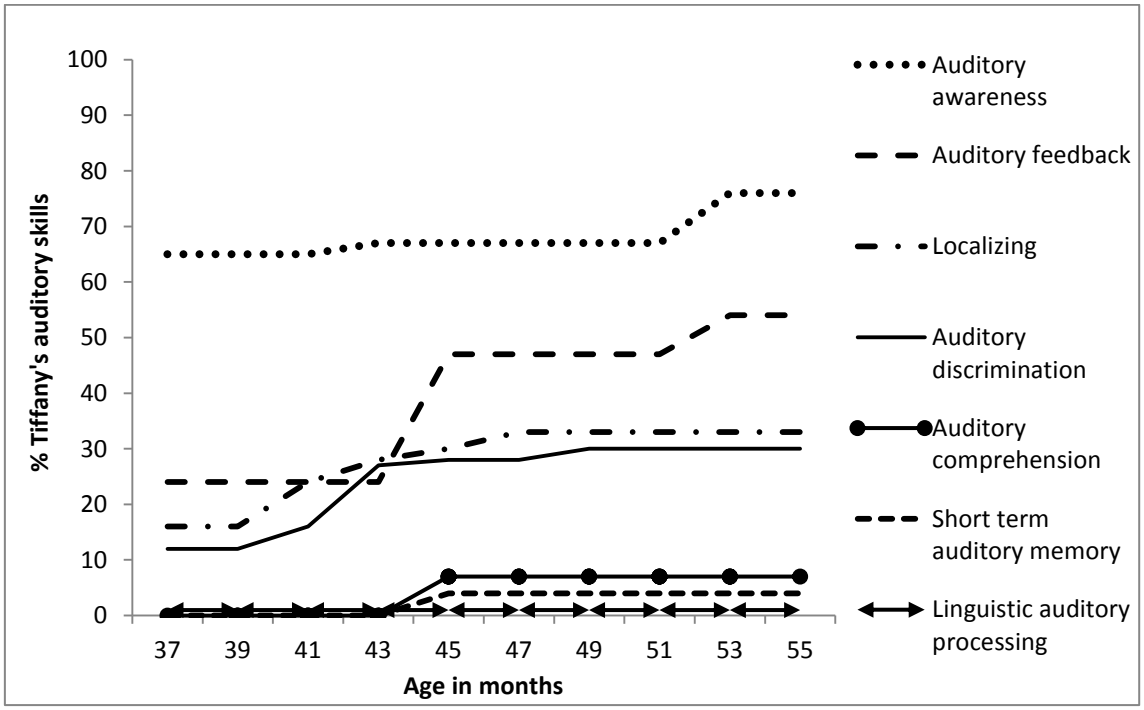

Figure 3: Tiffany's auditory skills profile, measured with the Functional Auditory Performance Indicators.

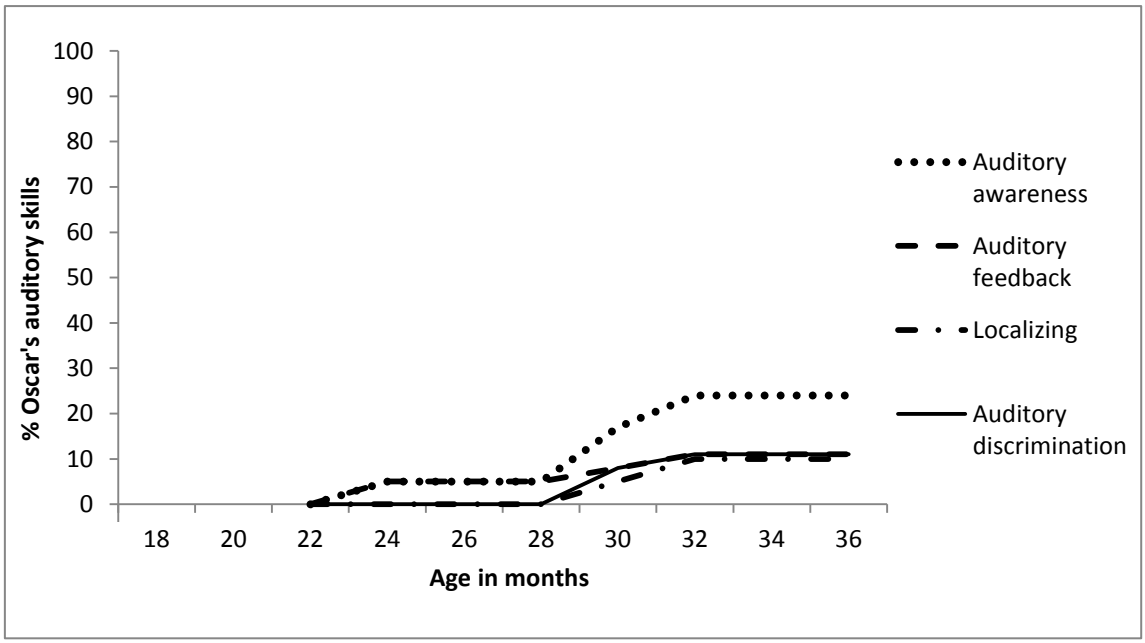

Figure 4: Oscar's auditory skills profile, measured with the Functional Auditory Performance Indicators.

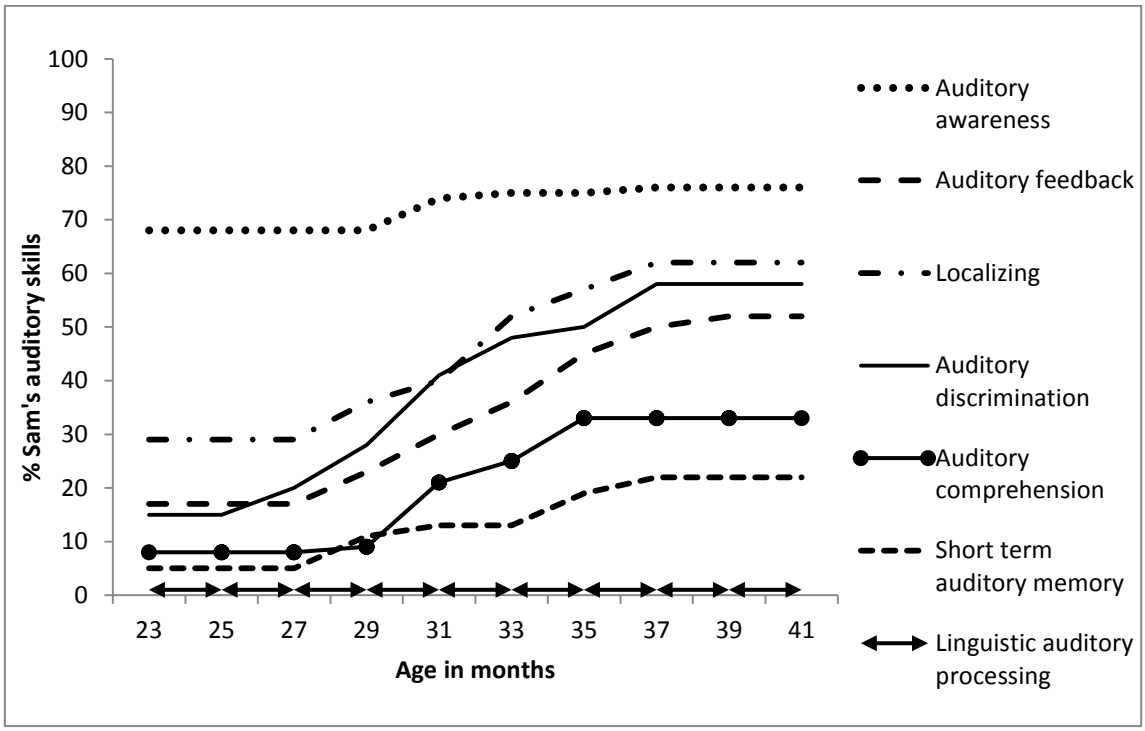

Figure 5: Sam's auditory skills profile, measured with the Functional Auditory Performance Indicators.

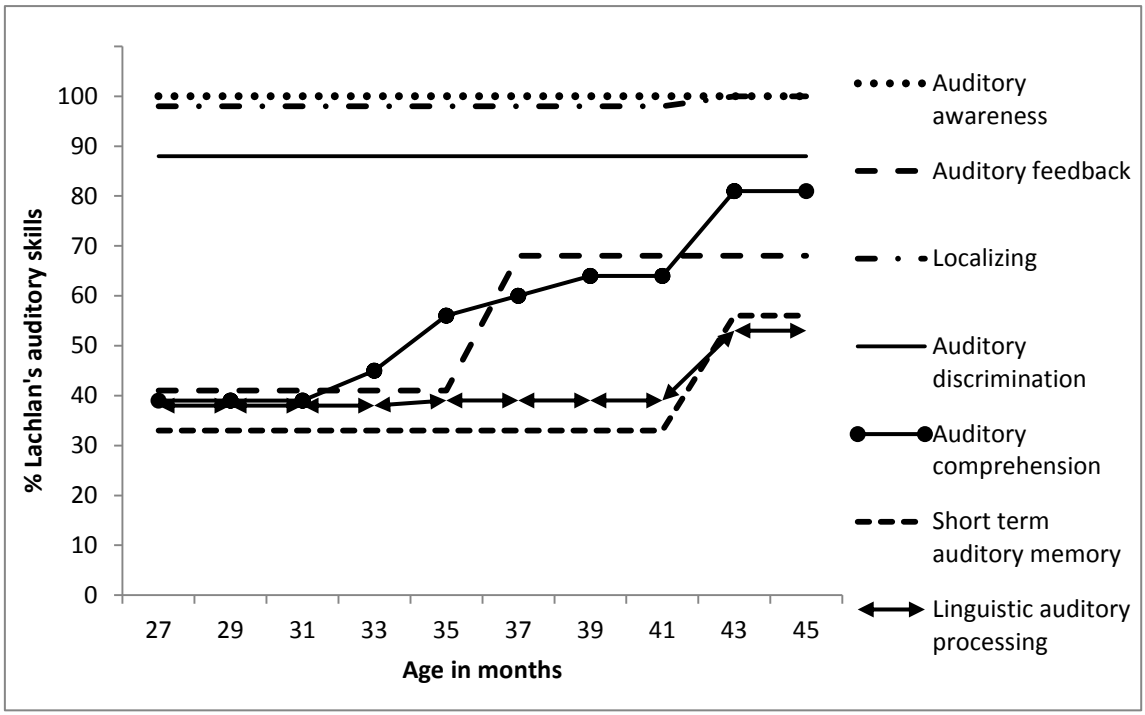

Figure 6: Lachlan's auditory skills profile, measured with the Functional Auditory Performance Indicators.

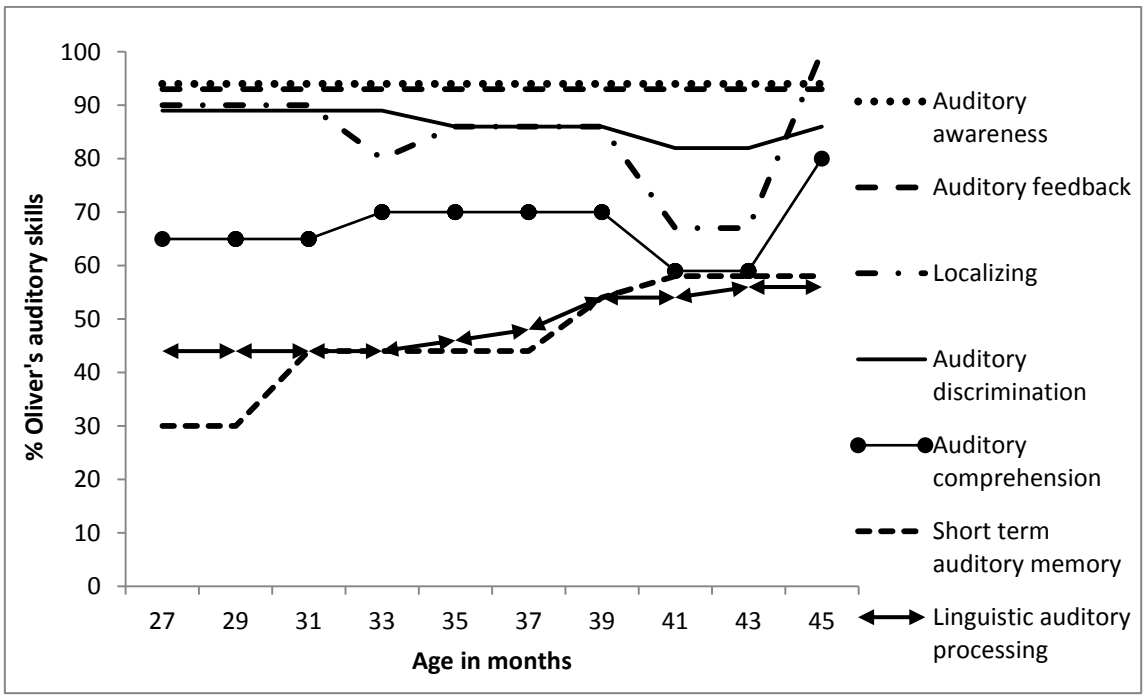

Figure 7: Oliver's auditory skills profile, measured with the Functional Auditory Performance Indicators.

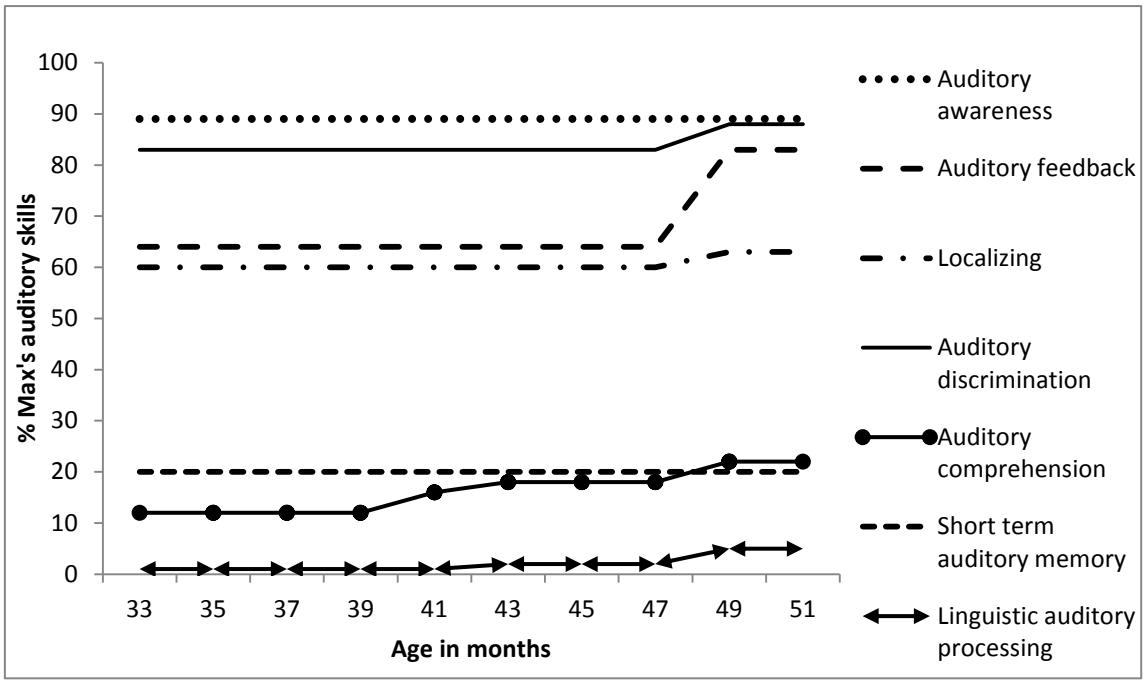

Figure 8: Max's auditory skills profile, measured with the Functional Auditory Performance Indicators.

4.7 Data Analysis

Data yielded from assessments and scales were analysed quantitatively. The parent data were analysed for increases in ratings for their participation in the bilingual program, their Auslan proficiency and for the frequency of use of specific parent-child communication and interaction skills. The child data were analysed for increases in vocabulary and bimodal bilingual skills. In order to investigate whether parent sensitivity changed over time, the Pearson's Product-Moment Correlation Coefficient was used to determine if there was a significant relationship between duration of the study and parent sensitivity to communication variables. A more stringent probability level of 0.01 was used to determine statistical significance since a series of correlations was computed and there were likely associations between variables. Two-tailed tests were used in order to account for the possibility of changes in either direction. The Pearson's Product-Moment Correlation Coefficient was also used to determine whether there were statistically significant changes in English and Auslan scores over time and associations between these language scores and parent sensitivity scores.

4.7.1 Videotaped data

Spontaneous parent-adult communication events were filmed bi-monthly in the families' homes by the researcher using a small, hand-held video camera. Interactions were filmed for approximately 20 minutes, depending on the type of communication event and the natural timeframe of the parent-child interaction. Video data were then uploaded to the researcher's computer and were analyzed using ELAN (EUDICO Linguistic Annotator), a computer-based annotation tool that allows video and audio data to be annotated, edited and documented. The video files were named, dated and stored in individual family folders on the researcher's computer. Back-up copies of the videos were also stored on a portable hard-drive for safe-keeping.

Analysis of video data was made both quantitatively (the number of utterances) and qualitatively (annotations of oral and signed utterances). The eight categories of analysis for the parent-child interactions were parent English, child English, parent English reciprocal utterances, parent Auslan, child Auslan, parent reciprocal Auslan utterances, child pragmatic behaviours and parent reciprocal responses to these behaviours. Pragmatic behaviours included eye gaze, gesture, pointing, pausing and turn-taking. In this study, reciprocity was defined as a topically linked response to a child's verbal, signed or non-verbal communication bid within four seconds. The parent's reciprocal response could be in English, Auslan or non-verbal behaviours, such as eye gaze, gestures or facial expressions. One minute samples of these utterances were selected at each data point as representative of typical interactions, with annotations entered in tables for each of the eight children and their parents. An example of 30 seconds of annotated parent-child interaction is shown below in Table 7. Arrows represent Oliver's mother's reciprocal responses to his verbal and nonverbal communication.

Table 7: Oliver's parent's reciprocal responses in 30 seconds of interaction.

Time (min)	Mother speech	Time	Mother Auslan	Time	Oliver speech	Time	Oliver Auslan	Time	Oliver pragmatics
1								1	eye gaze-Mum
4	tomorrow	4	tomorrow						
				5	tomorrow				
6	tomorrow								
7	Is mummy going to work?			7	tomorrow	7	tomorrow		
				9	tomorrow				
10	tomorrow	10	tomorrow						
		11	Mummy					11	eye gaze-Mum
12	Mummy work?	12	Work						
				13	tomorrow	13	tomorrow		
14	tomorrow yeah								
14	Where's daddy?								
				16	Daddy gone	16	Daddy		
						16	gone		
17	Daddy's gone where?								
19	Where's daddy gone?	19	Gone					19	Looks at sign
				20	Gone	20	gone		
21	Gone where?							21	eye gaze-Mum
				22	Work	22	Work		
27	Where's H?					27	Where		
				28	Ber ih	28	Go hit		
29	Pardon?								
30	Where's H?			30	What?				
31	where - she's at kinder					31	Where		
32	is she at kinder?	32	Kinder garten						
						33	yeah		

Note: Arrows represent parent's reciprocal responses to Oliver's verbal and nonverbal communication.

These data were summarized in tables for each child and showed the number of utterances in English and Auslan for parents and children, together with the parents' reciprocal responses to their children's English and Auslan utterances and non-verbal communication.

Summaries of utterances and reciprocal responses for all eight families are provided in Appendix 4.7.1. An example of a summary is shown below in Table 8 below.

Table 8: Summary of Oliver's parent-child English and Auslan utterances and parents' reciprocal responses over 20 months.

Oliver										
Data points	1	2	3	4	5	6	7	8	9	10
Number of utterances and parent-to-child reciprocal responses (RU) in 1 minute										
Parent English	18	26	12	23	19	13	13	15	19	17
Child English	8	16	14	16	15	23	14	10	19	9
Parent English RU	4	9	8	5	9	8	6	10	10	9
Parent Auslan	23	10	0	0	0	0	2	0	0	6
Child Auslan	15	11	10	5	6	10	6	4	0	4
Parent Auslan RU	7	5	5	4	5	4	2	2	0	4
Child pragmatics	9	11	9	13	5	8	11	7	11	4
Parent pragmatics RU	3	2	3	1	2	2	3	1	3	1

4.8 Participants' personal profiles

An important feature of single-case research is the inclusion of detailed descriptions of the participants' characteristics (Horner et al., 2005). By providing specific contextual details, opportunities are provided to determine the degree to which individuals' results can be generalized to a wider population (Kratochwill & Levin, 2010). In order to allow for a deeper understanding of the context in which the eight children and their parents interacted, detailed descriptions are provided below.

4.8.1 Peter

Peter lives with his parents and three older siblings in a rural town, several hours' drive from Melbourne. He was 17 months old at the commencement of the study. Peter's parents report that he is an engaging boy when amongst family members and familiar people and adopts the role of the 'family clown'. They also report that he has a keen sense of humour and shows a high level of determination and independence in satisfying his immediate needs. The family enrolled in the early intervention program shortly after Peter's diagnosis and commenced home sessions when he was three months old. Peter's sensorineural hearing loss was detected shortly after his birth, following his mother's concern that he was not responding to sound. The diagnosis of a profound loss in his right ear and a severe loss in his left ear was confirmed when he was two months of age. The aetiology of Peter's deafness was not identified, although he was later diagnosed with Large Vestibular Aqueduct (LVA) Syndrome, a condition often implicated in the fluctuation or permanent decrease in hearing thresholds due to an enlarged vestibular aqueduct, endolymphatic duct and sac (Okumura, Takahashi, Honjo, Takagi, & Mitamura, 1995). Peter was subsequently fitted with high gain binaural digital hearing aids when he was two months old.

After diagnosis of his deafness, Peter experienced numerous lengthy episodes of ear infections, middle ear effusion and, during the first 12 months of the study, suffered from chronic breathing constraints and fluctuating hearing thresholds related to the effects of persistent tonsillitis, enlarged adenoids and otitis media. During these periods, Peter rarely wore his hearing aids and was therefore receiving minimal auditory input. His parents reported that he was often very tired, due to severe sleep apnoea and he subsequently underwent surgery at 28 months to remove his tonsils and adenoids and received bilateral grommets. These procedures contributed to an improvement in the hearing thresholds in Peter's left ear, with his parents reporting that, together with his improved sleeping and general health and wellbeing, he was happier and was more interested in communicating, he paid more attention to auditory input and began to wear his left hearing aid more frequently for a number of months. However, his acceptance of amplification lasted only a short time – he also

resisted wearing the cochlear implant that was fitted in his right ear in the final month of the study.

Peter's parents both work, although his mother stays home one day a week and schedules the various early intervention, speech therapy and audiology appointments for Peter on those days while his siblings are at school. Peter's grandmother cares for him in her home on the other weekdays, but does not insist that he wears his hearing aids during these times. Case notes show that the family endeavours to meet the commitments of fortnightly early intervention sessions and attend audiology and speech therapy appointments at the Cochlear Implant Clinic. However, their ability to participate in the bilingual early intervention program is limited due to the work and family commitments.

4.8.2 Andrew

Andrew, together with his parents and two older hearing siblings, live in a small rural town many hours' drive from Melbourne. He presents as a lively, engaging little boy who is confident to initiate communication with a wide range of familiar and unfamiliar people, using a variety of communication modes. Audiological reports indicate that he was diagnosed at five months of age with a bilateral severe–profound sensorineural hearing loss, following meningitis at three months of age. Records also show that, due to chronic episodes of otitis media, an ongoing conductive overlay has been present to varying degrees during the study. This middle ear condition periodically reduces Andrew's access to auditory input further. Shortly after diagnosis, Andrew was fitted with high-gain binaural digital hearing aids. The family initially enrolled in an oral early intervention program when Andrew was nine months old, but changed to a home-based bilingual program nine months later because they wished to expose him to sign language and preferred a home-based program. Andrew's parents organize their work commitments so both can attend the early intervention sessions, signing tutorials and other events related to their son's needs. Extended family

members on both sides of the family are also involved in Andrew's care and support and frequently attend events related to early intervention and Auslan development.

Andrew attends a local child care centre for two days a week in which basic Auslan has been introduced to the staff working with him. His family is keen to access Auslan resources and share them with members of their extended families, child care staff and teachers at the local school where Andrew's siblings attend. At the commencement of the study, the parents were attending evening sign language classes at a local school and organized an Auslan home tutor to visit weekly, however these initiatives did not continue beyond the eighth month of the study as their business commitments increased. They continued to encourage members of their extended family to improve their Auslan skills, with several family members enrolling in local Auslan classes and attending home-based Auslan dinners. Andrew and his siblings also participate in these events whenever possible. In addition to fortnightly home-based intervention sessions, Andrew sees a local speech therapist who focuses on his speech production and concept acquisition. He is also visited fortnightly for one hour by a Deaf Auslan tutor and attends a weekly two-hour Auslan playgroup in a nearby town with his grandmother, facilitated by the same Deaf tutor. During these sessions, Andrew is exposed to 'voice-off' Auslan, with no accompanying speech.

4.8.3 Tiffany

Tiffany lives with her parents and younger sibling in a suburb of Melbourne. She was 37 months old at the commencement of the study. Her sibling was born during the last six months of the study, also diagnosed with a profound bilateral sensorineural hearing loss. Tiffany's hearing loss was detected while she was still in hospital, following a very premature birth at 24 weeks' gestation, but was not confirmed until she was 4 months of age (corrected age one week). Her premature birth was initially considered to be the aetiology of her deafness, however subsequent genetic testing revealed that Tiffany's deafness was caused by a mutation in the Connexin 26 gene (Cx26). She was fitted with high gain binaural digital hearing aids when she was four months old.

Tiffany received bilateral cochlear implants at two years of age which she wore consistently from the time she was three, but initially resisted any increase in volume during mapping sessions. Her parents acknowledge that she is an anxious little girl, who lacks confidence to communicate with people other than familiar family members. They believe this lack of confidence is a consequence of her extreme prematurity and fragility in her early months of life.

Tiffany's parents both work – father full time and mother three days a week. For the first six months of the study, on mother's work days, Tiffany was cared for by various caregivers, including maternal and paternal grandmothers and a family friend. For the following 12 months of the study, Tiffany attended a local child care centre for five days a week. The family enrolled in the bimodal bilingual early intervention program for deaf children shortly after Tiffany's diagnosis and she also attended fortnightly speech sessions towards the conclusion of the study. Tiffany also went to a fortnightly English-Auslan bilingual playgroup with either her mother or grandmother.

4.8.4 Oscar

Oscar lives with his parents and older sibling in a country town, many hours' drive from Melbourne. He was aged 22 months of age at the start of the study. Oscar is physically strong with well-developed motor skills and often presents with rigid, oppositional behaviour, particularly when he is frustrated in his communication attempts. His profound bilateral sensorineural deafness was diagnosed when he was 11 months of age and was subsequently attributed to a mutation in the Connexin 26 gene (Cx26). Oscar was fitted with high gain binaural digital hearing aids at 12 months of age. He consistently rejected these aids and essentially had no access to sound until he received bilateral cochlear implants at 22 months. He also rejects wearing his cochlear implants and frequently damages the devices by throwing them or stepping on them. His parents report that he is a visually alert child and learns many new skills by watching how a task is done and imitating the process shortly afterwards.

Oscar's family enrolled in the early intervention program when he was 22 months old, despite his initial diagnosis at 11 months. They received no other early intervention support before this and decided to enroll in a bilingual program after meeting other parents who were signing to their deaf children. The family entered the study four months after the commencement of data collection because they had only recently enrolled in the early intervention program. They requested to participate because they were acquainted with one of the other families in the cohort. Both parents were keen to be present at fortnightly early intervention sessions, with Oscar's father changing his work commitments to accommodate these times each fortnight. Both parents belong to a strong extended family group and have numerous family members who care for Oscar and his sibling when necessary. Towards the end of the study, Oscar's grandparents, aunts and uncles expressed interest in learning Auslan and requested copies of Auslan resources. Some extended family members also attended local Auslan classes each week. Oscar and his mother attended a weekly Auslan playgroup in a nearby town and were also visited on a fortnightly basis for one hour by the same Deaf Auslan tutor who facilitated the playgroup.

4.8.5 Sam

Sam, an only child, was 23 months old at the commencement of the study and lives with his parents in an outer suburb of Melbourne. He is happiest when playing with his favourite toys, usually train sets and toy vehicles, and less comfortable when required to communicate with others. Parent reports and case notes reveal that, in general, Sam's interactions are more object-oriented and somewhat repetitive and he often ignores attempts by parents or caregivers to scaffold his language through play.

Sam was born prematurely, at 30 weeks' gestation and spent several weeks in an intensive care nursery. He was screened for hearing loss during this time and was diagnosed with a profound bilateral sensorineural hearing loss. The aetiology of Sam's deafness is unknown. He was fitted with high-gain binaural digital hearing aids at three months of age and bilateral cochlear implants when he was 15 months old and

generally wore his devices consistently. The family enrolled in the early intervention program when Sam was eight months old, having delayed their enrolment for several months following diagnosis while they decided on the most appropriate program to suit their needs. Sam is cared for primarily by his mother at home each day, but his father was able to be present for many early intervention sessions, depending on his work shifts. Extended family members often visit, but do not live close by. Sam looks forward to seeing these familiar family members on the computer, via Skype. In order to promote Sam's bimodal bilingual skills, he and his parents attend a fortnightly bilingual playgroup and Parent-Child Mother Goose group, a program for parents and young children based on the oral traditions of rhymes, songs and storytelling. They also participate in local play events with hearing children, but Sam finds socializing with a larger group more challenging and often resists engaging with other children.

4.8.6 Lachlan

Lachlan lives with his parents and older sibling in an outer suburb of Melbourne. He was 27 months old at the commencement of the study. Lachlan's parents report that he is reticent to communicate with unfamiliar people and peers and is content to engage himself in a variety of self-driven activities, usually involving construction toys, drawing, writing or music. He displays a talent for music and rhythm, with an ability to imitate drum beats, intonation patterns and tonal sequences on a piano keyboard.

Lachlan's deafness was diagnosed relatively late, at 19 months of age after his parents noticed that his communication and language skills were delayed. Lachlan's bilateral sensorineural hearing loss was confirmed as profound in the low and mid frequencies and severe in the high frequencies. The aetiology of Lachlan's deafness is unknown. Following diagnosis, Lachlan was fitted with binaural digital hearing aids at 20 months and he responded positively to these devices from that point. The family initially had enrolled in an oral early intervention program, but changed to a bimodal bilingual program because they believed that sign language would help Lachlan learn to speak. Case notes reveal that Lachlan's parents reacted to the diagnosis of their son's

deafness with much concern, particularly as they were aware of the impact of a 'late' diagnosis on Lachlan's language development.

Lachlan is cared for primarily by his mother at home; his father is self- employed and is therefore able to arrange his work schedule so as to be present at the home early intervention sessions as often as possible. Lachlan attends a fortnightly bilingual playgroup and bilingual Parent-Child Mother Goose group, a weekly local music group, a twice-weekly local kindergarten group and family Auslan weekend camps twice a year. He also attends a local childcare centre twice a week, where he is supported by an inclusion assistant who is proficient in using Auslan.

4.8.7 Oliver

Oliver lives with his parents and older sibling in an outer suburb of Melbourne. He was aged 27 months at the start of the study. Case notes and video records show that Oliver presents as an engaging little boy who initiates communication with a wide range of familiar and unfamiliar people and persists to make himself understood. His mother cares for him at home while his father works regular hours during the week and is therefore unable to attend early intervention sessions at home. Oliver's grandmother lives nearby and frequently cares for him and his sibling.

Oliver was diagnosed with a severe sensorineural hearing loss his in his left ear and a profound loss in his right ear when he was 16 months of age. The aetiology of his deafness remains unknown. He was fitted with binaural digital hearing aids when he was 17 months old, and has worn his hearing aids consistently. Oliver tolerates all environmental and speech sounds when wearing his listening devices. He received a cochlear implant in his right ear when he was 43 months old and has adapted positively to the new sound input very quickly. He continues to wear a hearing aid in his left ear and tolerates the different types of amplification well.

The family enrolled in the early intervention program when Oliver was 18 months old and currently supplement home-based sessions with a fortnightly bilingual playgroup, weekly music group, a twice-weekly local kindergarten group and family Auslan activities such as family days and weekend camps. Oliver's mother is committed to improving her signing skills by gaining qualifications through an accredited Auslan course, which she attends for four hours each week.

4.8.8 Max

Max lives with his mother and father in a suburb of Melbourne and has an older sibling who does not live with the family. His parents and childcare staff report that he is an active child with a short attention span and limited ability to self-regulate. He is often frustrated when he cannot communicate effectively to satisfy his needs and expresses this frustration in physical ways, or focuses intently on his play with his favourite toys. Max's family enrolled in the early intervention program when he was 13 months old and he became involved in the study when he was 33 months. His bilateral sensorineural hearing loss was diagnosed at 12 months and confirmed as severe in his left ear and profound in his right ear. The aetiology of Max's deafness is unknown, although MRI scans identified that he has Large Vestibular Aqueduct (LVA) Syndrome, an inner ear condition that can bring about fluctuation or permanent decrease in hearing thresholds. Following diagnosis, Max was fitted with high-gain binaural digital hearing aids at 12 months and a cochlear implant in his right ear at 24 months. He wears the devices intermittently, frequently taking one or both off when playing and often resisting adults' attempts to put them back on him.

Max is cared for by his mother at home for two days a week and attends a local child care centre for three days a week, while his mother is at work. His father works full time and is not able to participate in the home-based early intervention sessions. In order to increase his exposure to Auslan, Max attends a fortnightly bilingual playgroup and to promote his listening and speech skills, he attends weekly speech therapy sessions with a private speech therapist.

4.9 Summary

In this chapter, an overview was given of the single-case design method used to measure the communication and language outcomes of the children who were exposed to a bimodal bilingual input. Despite the potential limitations of the relatively small number of participants in this study, the single-case design provided opportunities to understand more about each participant's behaviour, particularly the children's responses to their parents' language input. The study design also allowed for a better understanding of how the research questions impacted on each child and the conditions under which the outcomes were achieved. Assessment instruments were used by the parents each two months, which provided them with information on the incremental growth of their children's language skills. It was acknowledged that very few standardized assessment tools for bimodal children are available and that this situation has necessitated the development of several scales and checklists for this study. These materials have been designed to be more sensitive to the bimodal language use of children and their parents than tools that are currently available. The results of all assessments used to measure the skills of the children and their parents will be reported in detail in Chapter Five.

CHAPTER FIVE

Results

This chapter first describes the parental communicative input for the eight children and second, the children's communication and language outcomes. There were two major aspects to the parents' input: the extent to which they used the bimodal bilingual approach, and their sensitivity to their children's communication needs. The parents' use of the bimodal bilingual approach was measured in three ways: their level of participation in the bimodal bilingual approach, their level of Auslan proficiency and the amount of bilingual input they provided to their children. Parent sensitivity was measured, firstly, by their use of four communication strategies that are fundamental to parental responsiveness. These communication strategies were: visual attention (establishment of mutual gaze and joint attention), responding to the child's communication, adapting communication and gaining the child's attention. Secondly, parent sensitivity was identified by measuring their ability to accommodate the language modality preferences of their children by showing evidence of bimodal code-switching and code-mixing. The children's outcomes were measured in terms of their English and Auslan vocabulary development, their bilingual communication skills and their emerging language modality preferences. Their levels of intelligibility in speech and sign are also reported, based on their parents' ratings of their ability to understand their children's utterances. In addition to these parent and child data, videotapes of parent child interactions were analysed and augment the data yielded from the parents' and children's assessments.

5.1 Bimodal bilingual approach

5.1.1 Parental participation in the bilingual program

The parents' level of participation in the bilingual program was self-rated with the five-point Bilingual Rating Scale. The ratings in this scale described the level at which the parents communicated bilingually with their children and the degree to which they engaged in bilingual events and made use of Auslan resources to support their skill development. Figure 9 shows an overview of the level of participation of the parents of the eight children.

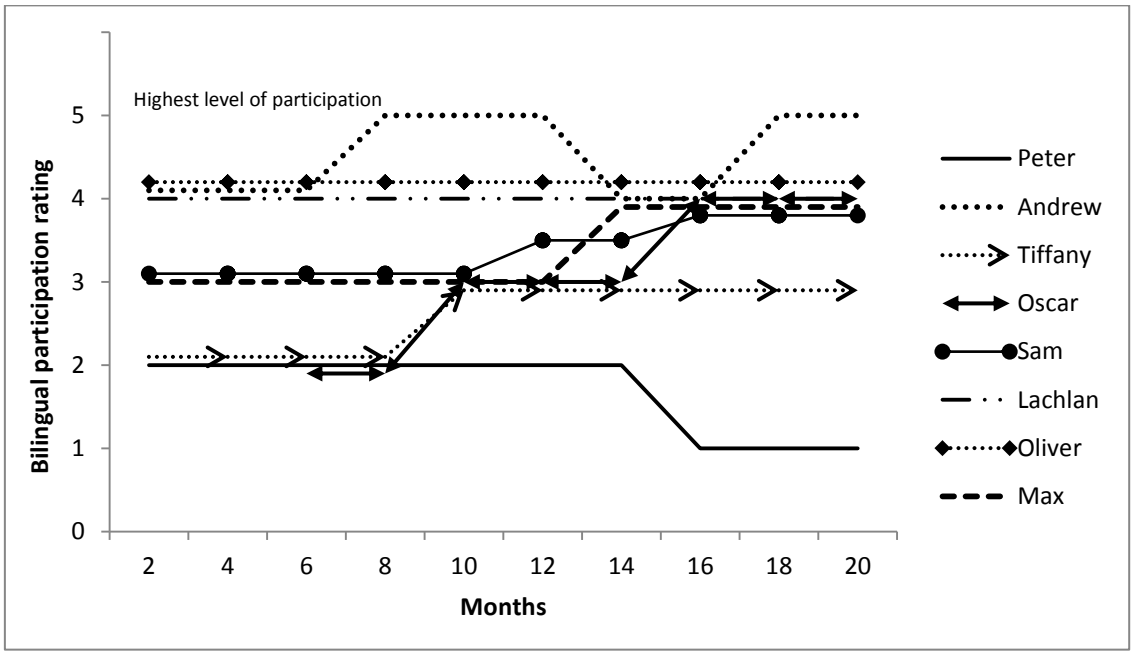

Figure 9: Parental participation in the bilingual program, as measured by the Bilingual Rating Scale.

The results indicate considerable variability in the parents' level of participation in the bilingual program. Andrew's parents had the highest participation ratings for most of the 20 months' data collection period, varying between levels 4 and 5. At rating level 4, the family showed strong commitment to engaging bilingually with Andrew, with his parents as the primary communicators in Auslan, a criterion for this rating. Their rating

increased to level 5, the highest rating on the Bilingual Rating Scale because multiple family members were communicating in Auslan. Family members also attended weekly Auslan classes and the parents provided a weekly home-based play session for Andrew with an Auslan tutor. Andrew's speech and listening skills were also being actively encouraged within bilingual interactions. The drop back to level 4 between the 14th and 16th months coincided with Andrew's improved hearing thresholds. During that time, his parents reported that they had decided to focus more on his speech and listening skills than bilingual communication. Rating 5 was once again recorded in the final four months as the parents re-introduced Auslan, reporting at that time that they wanted Andrew to be able to socialize and communicate in Auslan with other signing deaf children in the future.

Lachlan's and Oliver's parents rated their participation consistently at level 4 throughout the study and were committed to exposing their sons to a range of bilingual experiences. Lachlan's parents attended weekly bilingual playgroups and Parent-Child Mother Goose groups, family Auslan camps and other bilingual events. They also sent Lachlan to a childcare centre two days a week, where an Auslan assistant was provided. Oliver's parents frequently took him to bilingual playgroups and events with other family members and encouraged the use of Auslan during his neighbourhood play sessions. His mother also enrolled in a certified Auslan course in order to gain a higher level of conversational skills and grammatical structures. Both boys' parents were well aware of how to incorporate listening strategies into their sons' daily routines and showed an understanding of the sequence of auditory developmental skills when reviewing their auditory profiles. The only criterion that excluded Lachlan's and Oliver's parents from achieving a level 5 rating was the fact that they did not have the same opportunities to include other family members in communicating with their children in Auslan.

Max's parents' ratings increased from level 3 in the first 12 months to level 4 in the final eight months. They demonstrated this improved participation by increasing their attendance at a local bimodal bilingual playgroup and using a wider variety of Auslan resources to improve their signing skills. They reported that, after the 12th month of

the study, they realised that Max paid more attention to oral communication when it was paired with Auslan and that the visual input assisted in extending his attention span. Sam's parents' participation ratings also increased from level 3 to level 4 after the 10th month, as they began to expose Sam to fluent Auslan models at bilingual playgroups, bilingual Parent-Child Mother Goose groups and other bilingual events organized by the early intervention program. Auslan picture cards were also placed around the house to remind adults to sign to Sam.

Oscar's parents showed a marked increase in their bilingual participation after the eighth month, from level 2 to level 4. They demonstrated this increase by employing a deaf home tutor on a weekly basis to communicate with Oscar and to teach them Auslan. In addition, they attended a weekly Auslan playgroup with other signing deaf children. After eight months in the study, Tiffany's parents increased their use of Auslan resources and attended more bilingual events organized in the community, so rated their level of participation at 2, then 3. Peter's parents' ratings were the lowest recorded for the eight families and were the only example of a sustained decline in the latter phase of the study. They reported that they found Auslan too hard to learn and preferred to focus on Peter's speech and listening skills.

5.1.2 Parents' Auslan Proficiency

In order to investigate the level of the parents' Auslan proficiency, data were collected from the Auslan Proficiency Rating Scale over the 20 months of the study. Figure 10 provides an overview of the levels of proficiency attained by the parents of the eight children throughout the study.

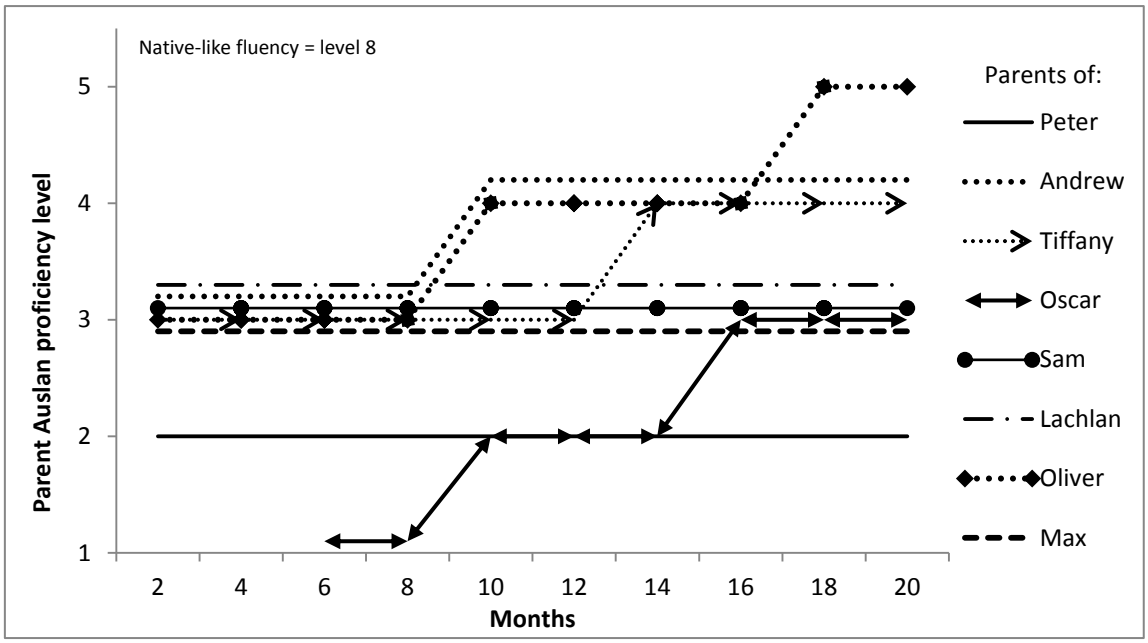

Figure 10: Levels of Auslan proficiency attained by parents over time, measured with the Auslan Proficiency Rating Scale.

The data presented in Figure 10 show that Peter's parents had the lowest level of Auslan proficiency out of the eight families in the study, with their Auslan skills remaining constant at level 2 ('formulaic proficiency') out of a possible eight levels, in expression (production) and comprehension. Peter's parents demonstrated limited signing ability and were able to use some basic greetings, label basic objects and people and communicate only about the most immediate, predictable topics, using formulaic language. Most utterances consisted of isolated signs, with an occasional two-sign utterance and no evidence of Auslan grammar. Their understanding of Auslan was also restricted to short phrases in a familiar context, containing one or two key signs and clear contextual cues such as pointing and other visual information. Although the family used some Auslan resources to increase their Auslan skills in the first six months of the study, their ratings decreased as their focus shifted to an oral-aural approach for the duration of the study.

Sam's, Lachlan's and Max's parents maintained level 3 Auslan proficiency throughout the 20 months of data collection, described as 'basic transactional proficiency'. At this level, the parents were able to use simple, formulaic phrases to satisfy their child's

immediate and predictable needs. Although their spontaneity and flexibility were still emerging, the information they signed was often somewhat ambiguous due to under-developed grammar and lack of understanding of the use of modifying devices such as adjectives, adverbs, phrases and clauses. They used a limited vocabulary, using correct handshapes, but occasionally were confused when signs changed handshapes midway and were apt to reverse signs when copying from others. Despite these limitations, the parents were able to maintain simple conversations on familiar topics and could recast and expand their children's simple Auslan utterances to encourage turn-taking, topic maintenance and reciprocal utterances. With regard to their comprehension of Auslan, the parents of Sam, Lachlan and Max could understand short signed utterances such as commands and instructions and could follow information containing numbers, time phrases and slow-paced fingerspelling. They had not developed an awareness of register sensitivity and were more challenged by longer utterances containing more complex grammar.

Andrew's, Tiffany's and Oscar's parents acquired level 4 Auslan proficiency by the conclusion of data collection, showing a gradual increase in their proficiency over time. These parents were assigned this level of 'transactional proficiency' because they had demonstrated a higher level of receptive and expressive Auslan in tutorial settings. With this level of signing skills, the parents had developed an ability to use Auslan spontaneously and flexibly and were able to engage in longer signed conversations with signing partners. They had acquired a broader vocabulary and included a wider range of lexical items in their utterances. Although grammatical structures at level 4 are not yet sophisticated, these parents were able to use simple discourse markers and could negotiate with their signing interlocutors to repeat, clarify or modify specific lexical items or grammatical structures. They also demonstrated an increased confidence in engaging in discourse with a variety of signing partners.

Oliver's parents' Auslan skills were measured as level 5, 'minimum social proficiency', by the conclusion of the study, having attained these skills through enrolment in an accredited Auslan certificate course and frequent use of Auslan resources. Their signing skills showed gradual improvement over time, from level 3 during the first

eight months, to level 4 during the next eight months and finally to level 5 over the last four months of the study. These increases in skill development were characterized by an expanding lexicon and a gain in confidence to discuss routine events with native signers, to express personal opinions and to use classifier signs and spatial referents. Fingerspelling skills were also used with moderate speed and intelligibility for indicating names and places and occasionally when they were unsure of a correct sign or grammatical construction. In terms of comprehension, Oliver's parents were able to discriminate broadly the 'tone' of signed utterances, could follow sequential instructions and were becoming more confident to follow fingerspelling when produced at a modified pace by native signers.

5.1.3 Parents' bilingual input

The parents' English and Auslan input was measured bi-monthly with the 'Parent Language Use' category of the Parent-Child Communication Scale. Figure 11 shows the parents' English input over the 20 months of data collection.

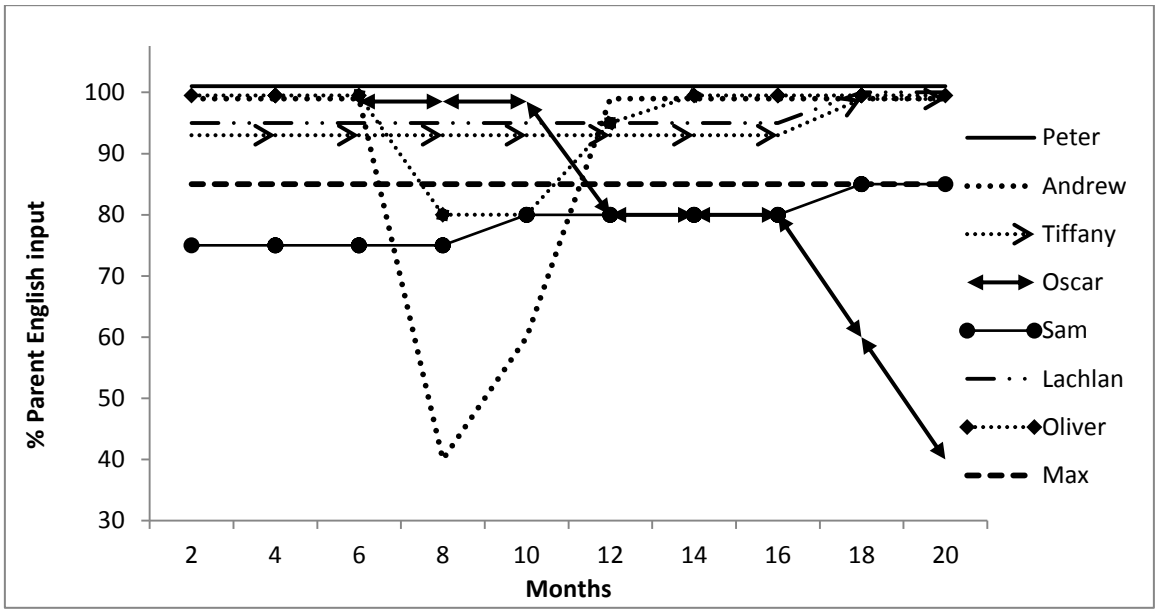

Figure 11: Parents' English input as measured with the Parent-Child Communication Scale, 'Parent Language Use' category.

In most cases, English use remained consistently high for all parents, ranging from 75 percent to 100 percent of use. Andrew's, Oscar's and Oliver's parents' English use decreased significantly during the periods when their Auslan use increased (see Figure 12 below). Andrew's parents' English input decreased considerably between the sixth to 12th months of the study, in response to his reduced hearing thresholds, due to a protracted period of middle ear infections. A less dramatic decrease in English input between the sixth and 14th months was recorded for Oliver's parents. During this time, their Auslan input increased to a maximum of 100 percent, but decreased to 40 percent in the last four months, at which point English was the dominant language input. Oliver's case notes and auditory skills profile show that the reason for the decrease in parental English input and increase in Auslan input could have been related to a decrease in the hearing thresholds in his right ear during this period. Oscar's parents' language input showed similar changes, with a marked increase in Auslan use from the 12th month, once they realised that Oscar needed more sign input. Figure 12 below shows the parents' Auslan input over the 20 months.

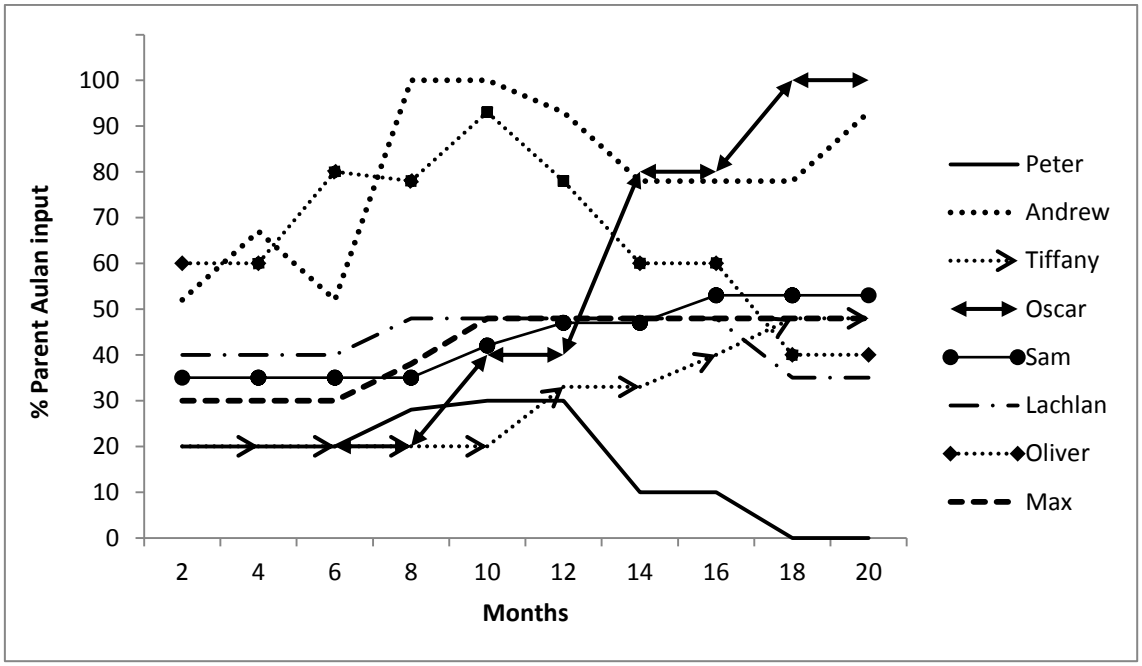

Figure 12: Parents' Auslan input as measured with the Parent-Child Communication Scale, 'Parent Language Use' category.

Figure 12 shows that overall, parental Auslan input was more varied than English input. Andrew's and Oliver's parents showed the highest sustained level of Auslan input, although there were periods of considerable fluctuation of input throughout the study, during which decreased input in one language modality was matched by increased input in the other modality. Andrew's parents reported that they had increased their Auslan input in the final four months of the study because the family had decided to focus more on his bilingual skills. Oliver's parents decreased their signed input over time in response to his reduced reliance on Auslan for communication. Lachlan's parents gradually increased their sign input after the sixth month, then showed a decrease in the last four months, during which time their English input increased. Tiffany's, Sam's and Max's parents also showed an increase in Auslan input over time, however these increases were not matched by decreases in their English input, which remained static for most of the study.

The most significant sustained increase in Auslan input was recorded for Oscar's parents, particularly from the 12th to 20th months of the study. During this time, their Auslan input increased dramatically from 40 percent to 80 percent from one bi-monthly data collection to the next, followed by a further increase after two months to 100 percent of input in the last four months. This marked increase coincided with Oscar's parents reporting that they had decided to use more Auslan with their son in an effort to reduce his communicative frustration, which they felt was a result of his inability to comprehend spoken language. The greatest decrease in Auslan input was recorded by Peter's parents, with a drop from a maximum of 30 percent during the eighth to 12th months to a total absence of Auslan input during the last eight months. Case notes show that their decision to decrease their Auslan input was based on their belief that Peter needed to learn to listen and speak when he received his cochlear implant and that Auslan was too difficult for them to learn. These results also indicate that the parents who recorded the highest level of Auslan input - Andrew's, Oscar's and Oliver's, also attained the highest Auslan proficiency levels. The exception to this trend was Tiffany's parents, who attained the same level of Auslan proficiency as Andrew's and Oscar's parents (APRS level 4), but whose Auslan input remained at 20 percent for the first half of the study.

When reviewing the results of the parents' scores for participation in the bilingual program, Auslan proficiency and English and Auslan input, three distinct groups of skills were identified. The parents' bilingual scores were classified as firstly, high-level (Andrew's, Lachlan's and Oliver's), secondly, medium-level (Oscar's, Sam's and Max's) and thirdly, low-level (Peter's and Tiffany's). These skill-groups were then used to determine the degree to which the parents' level of bilingual engagement and sensitivity to communication contributed to the children's language outcomes.

5.2 Parents' responsiveness to their children's communication

In addition to identifying the level of the parents' bilingual input to their children, it was important to consider whether their responsiveness to their children's communication was also a contributing factor to language outcomes. In order to identify their level of responsiveness, the parents used the Parent-Child Communication Scale to rate their use of four strategies that are known to support effective parent-child communication (Mohay, 1988; Spencer, 2001). These strategies were 'Visual Attention', 'Responding to Communication', 'Adapting Communication' and 'Gaining Attention'. 'Visual Attention' was defined as parents making eye contact with their child and supporting joint attention by adding visible language to their child's play. 'Responding to Communication' included responding contingently to, recasting, and expanding their child's cues and comments, imitating their gestures and facial expressions and encouraging them to repair their communication bids. Adapting Communication' involved strategies such as waiting for optimal times to communicate, being aware of their child's attention span and using appropriate lengths of utterance. 'Gaining Attention' consisted of strategies such as calling their child's name, waving and tapping or moving an object to gain their child's attention. Results of the parents' use of the communication strategies show that 'Visual Attention' and 'Responding to Communication' were used more frequently throughout the study. Percentage scores for the parents' use of the four communication strategies are shown in Figures 13 to 16.

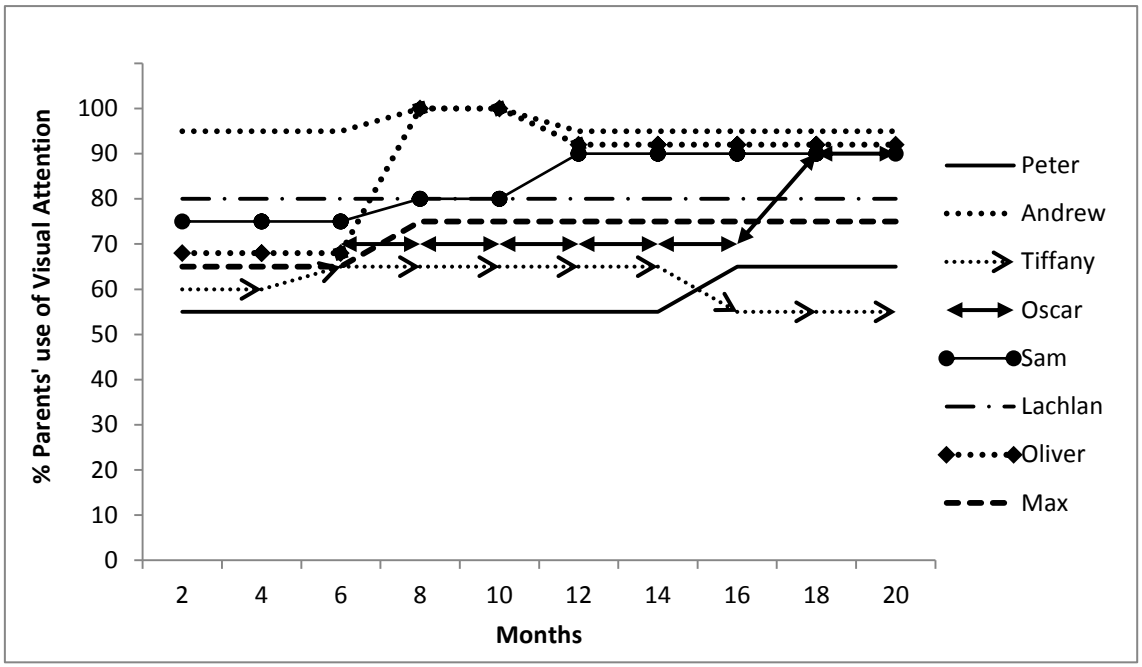

Figure 13: Parents' use of 'Visual Attention', measured with the Parent-Child Communication Scale.

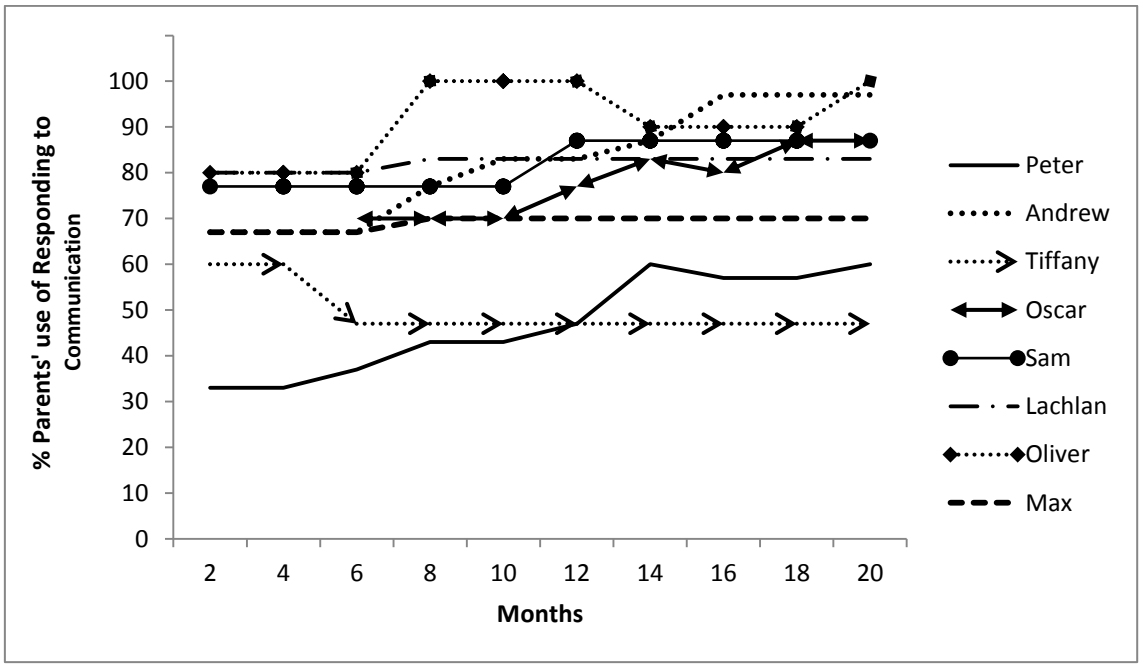

Figure 14: Parents' use of 'Responding to Communication', measured with the Parent-Child Communication Scale.

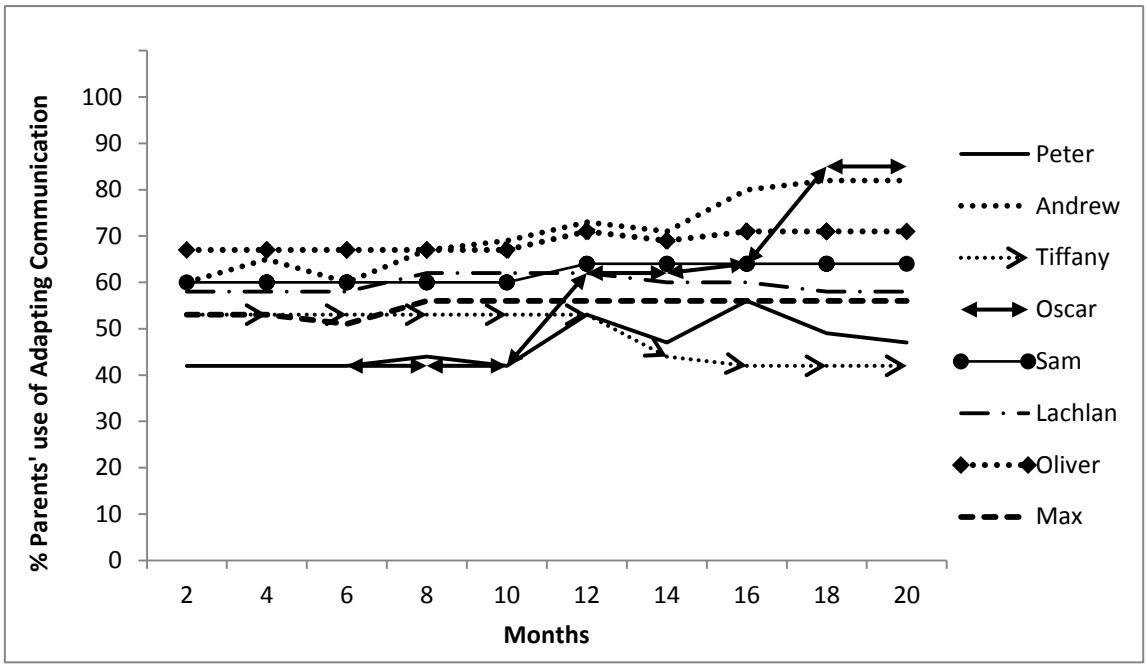

Figure 15: Parents' use of 'Adapting Communication', measured with the Parent-Child Communication Scale.

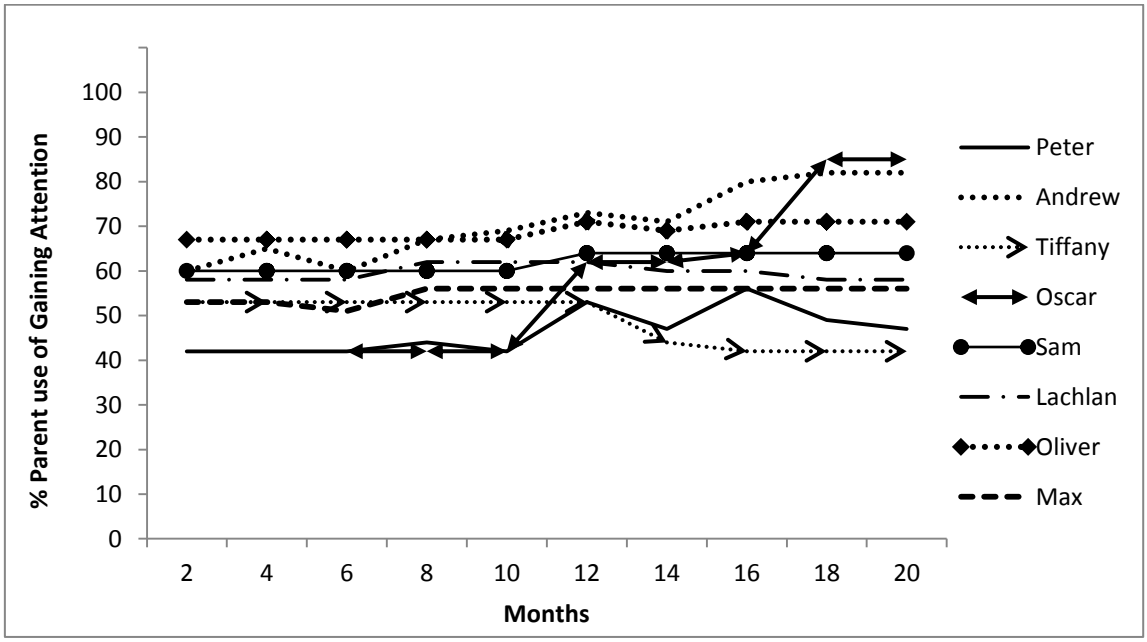

Figure 16: Parents' use of 'Gaining Attention', measured with the Parent-Child Communication Scale.

To investigate whether the parents' responsiveness to their children's communication changed over time, the Pearson's Product-Moment Correlation Coefficient was used to determine any association between each of the communication strategies and duration of the study. Table 9 shows the correlations and probability levels (0.01, two-tailed) for the four communication strategies that increased significantly over the duration of the study.

Table 9: Correlations between parents' use of communication strategies and time.

Parents of:	Visual attention	Responding to communication	Adapting communication	Gaining attention
Peter	r=.798, p=.003	r=.956, p=.000		
Andrew		r=.970, p=.000	r=.954, p=.000	
Tiffany			r= -.868, p=.001	
Oscar	r=.809, p=.002	r=.814, p=.002	r=.948, p=.000	r=.846, p=.001
Sam	r=.919, p=.000	r=.870, p=.001	r=.870, p=.001	
Lachlan		r=.798, p=.003		r=.798, p=.003
Oliver			r=.867, p=.001	r= -.853, p=.002
Max	r=.798, p=.006	r=.798, p=.006	r=.723, p=.009	

The correlation coefficients in Table 9 indicate that, overall, there were statistically significant changes over the duration of the study for many of the parent communication variables. Oscar's parents' scores showed change over time for all four variables. For the parents of the other seven children, significant changes over time are evident for different variables. 'Responding to Communication' changed significantly for all parents except Tiffany's and Oliver's, and 'Adapting Communication' changed for all parents except Peter's and Lachlan's. Interestingly, two parental scores were negatively correlated with time: Tiffany's for 'Adapting Communication'

(indicating that this score decreased) and Oliver's for 'Gaining Attention' (also decreasing).

In summary, the parents' responsiveness to their children's communication was measured by their level of use of the four communication strategies over the 20 months of data collection. In general, there was variable use of these strategies, however for the most part, Andrew's, Lachlan's and Oliver's parents showed consistently higher scores than the parents of the other five children. When the parental responsiveness scores recorded for the group as a whole were reviewed, it was apparent that they could be separated into the same three groups of parent input levels as were identified for parent bilingual participation. That is, parents of Andrew, Lachlan and Oliver were in the high input-level group, parents of Oscar, Sam and Max were in the medium input-level group and parents of Peter and Tiffany were in the low input-level group. In addition, when the parents' English and Auslan language input scores were included, these groupings remained the same overall, despite slight variations in the scores. Table 10 below shows the parents' level of input for their participation in the bilingual program, Auslan proficiency, English and Auslan use and for each of the four communication strategies. The composite ratings indicate their overall input-level group.

Table 10: Parents' levels of input.

Category	**Peter**	**Andrew**	**Tiffany**	**Oscar**	**Sam**	**Lachlan**	**Oliver**	**Max**
Participation in prog.	Low	High	Low	Medium	Medium	High	High	Medium
Auslan proficiency	Low	High	High	Medium	Medium	Medium	High	Medium
English input	High	High	High	Low	Medium	High	High	Medium
Auslan input	Low	High	Low	High	Medium	Medium	Medium	Medium
Visual attention	Low	High	Low	Medium	Medium	High	High	Medium
Respond to comm.	Low	High	Low	Medium	High	High	High	Medium
Adapting comm.	High	High	Low	Medium	Medium	Medium	High	Medium
Gaining attention	Low	High	Low	Medium	Medium	Medium	High	Medium
Composite level	Low	High	Low	Medium	Medium	High	High	Medium

It should be noted that, although Tiffany's parents recorded 'high' level for Auslan proficiency, they tended not to use these skills when communicating with their daughter. They therefore recorded a 'low' level of Auslan input and 'high' level of English input. In Oscar's case, although his parents recorded lower scores for some communication strategies, the changes in their scores matched a higher degree of responsiveness to his communication needs over the second half of the study. Oscar's parents were therefore included in the medium-input group to reflect their increased input and responsiveness over time. Similarly, Lachlan's parents were given a composite input level of 'high' because they demonstrated skills in adapting to his specific communication needs throughout the study.

The parent data reported above were then matched to the children's language scores in order to determine whether their language outcomes were predicted by the parents' bimodal bilingual input and responsiveness to their communication needs.

5.3 Children's outcomes

5.3.1 Children's vocabulary skills

The children's vocabulary skills in English and Auslan were measured as separate lexicons with the Productive Vocabulary section of the Words and Sentences scale of the MacArthur-Bates Communicative Development Inventories (CDI). Summaries of the children's English and Auslan vocabulary development over 20 months of data collection are shown in Figures 17 and 18 respectively.

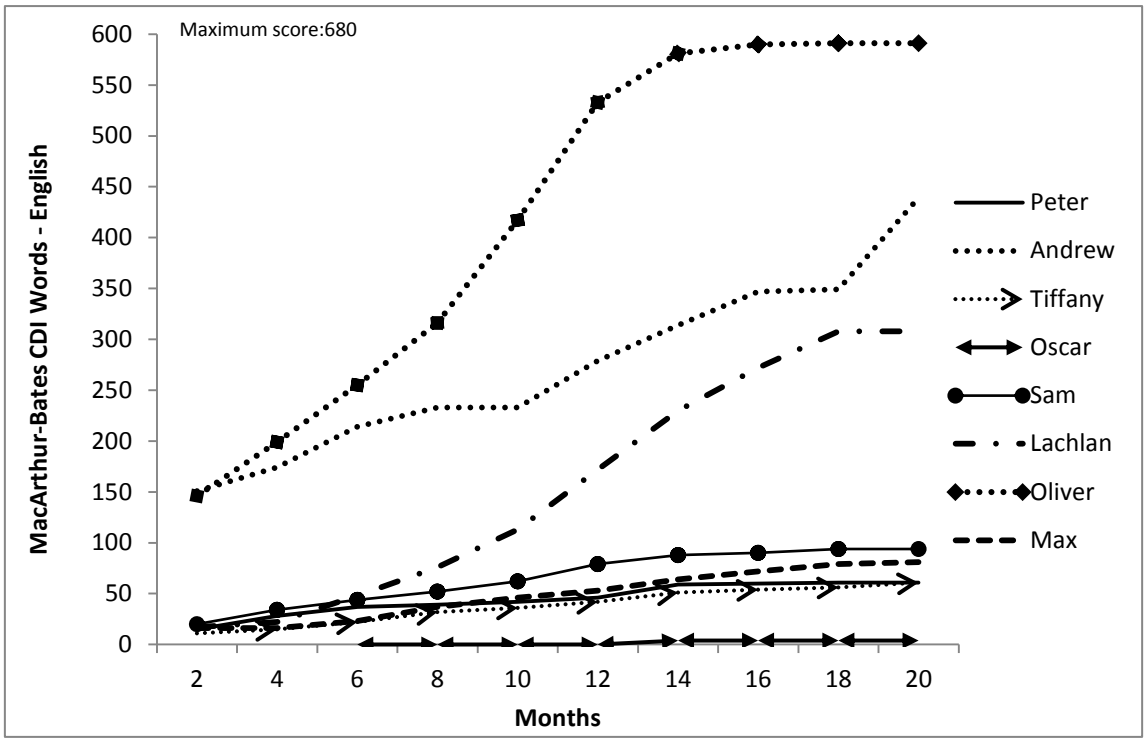

Figure 17: Children's English vocabulary skills, measured with the MacArthur-Bates Communicative Development Inventories (CDI), Productive Vocabulary section, Words and Sentences scale.

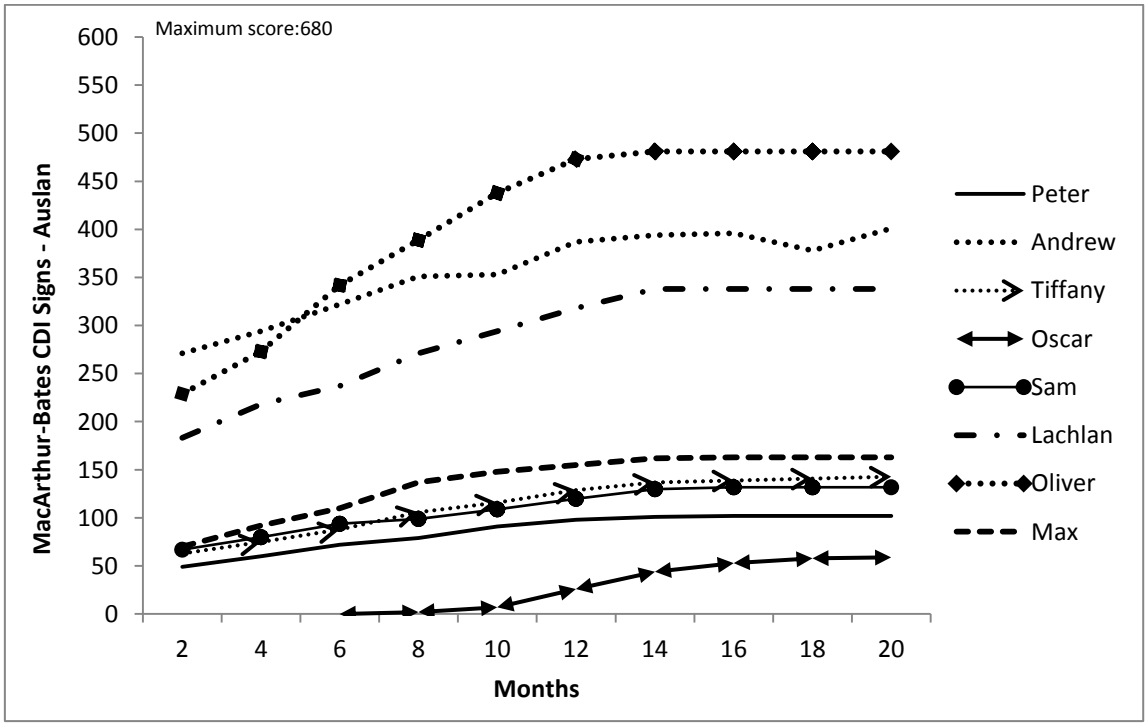

Figure 18: Children's Auslan vocabulary skills, measured with the MacArthur-Bates Communicative Development Inventories (CDI), Productive Vocabulary section, Words and Sentences scale.

The MacArthur-Bates CDI scores revealed that, by the conclusion of the study, Oliver had made the strongest gains out of the eight children for English vocabulary skills, with a score of 591 out of a possible 680. He also made the strongest gains in Auslan vocabulary, with a score of 481 out of a possible 680. Andrew and Lachlan showed steady progress for vocabulary development in both languages, but their scores were lower than Oliver's. Andrew's scores for English and Auslan were 439 and 401 respectively, whilst Lachlan scored 308 and 338 respectively. Interestingly, Andrew's, Lachlan's and Oliver's parents comprised the high input-level group that identified parents with the highest scores for the various aspects of bilingual engagement and level of responsiveness to their children's communication. Overall, Andrew's, Lachlan's and Oliver's English and Auslan skills were significantly better than the remaining five children – Peter, Tiffany, Oscar, Sam and Max, who showed much slower growth in their vocabularies in both languages. These children's parents were classified as medium and low in their input levels in terms of their bilingual engagement and level of responsiveness to their children's communication.

The Pearson's Product-Moment Correlation Coefficient was used to investigate associations between vocabulary increases in both languages over time for the eight children. Two-tailed correlations at the 0.01 level between the children's MacArthur-Bates CDI English and Auslan scores and time are shown in Table 11 below.

Table 11: Correlations between children's MacArthur-Bates CDI English and Auslan scores and time.

	English CDI	Auslan CDI
Peter	r=.960, p=.000	r=.932, p=.000
Andrew	r=.980, p=.000	r=.903, p=.000
Tiffany	r=.990, p=.000	r=.961, p=.000
Oscar	r=.853, p=.002	r=.948, p=.000
Sam	r=.974, p=.000	r=.960, p=.000
Lachlan	r=.985, p=.000	r=.946, p=.000
Oliver	r=.958, p=.000	r=.873, p=.001
Max	r=.991, p=.000	r=.910, p=.000

Results of correlations shown in Table 11 indicate that the children's English and Auslan vocabulary scores changed significantly over the duration of the study. Furthermore, these scores were also strongly correlated with each other for all of the children. It should be noted however, that although the result for Oscar showed a significant change over time, his score was zero for the first six data points, increasing to four for the remaining four data points, indicating very slow progress. In order to determine whether the children's language outcomes were influenced by their parents' use of specific communication strategies, the Pearson's Product-Moment Correlation Coefficient was used to investigate relationships between the children's MacArthur-Bates CDI English and Auslan scores and the parents' responsiveness to their children's communication. As previously mentioned in this chapter, the parents' responsiveness was determined from their rating scores derived from the Parent-Child Communication Scale. With this scale, they rated their use of 'Visual Attention', 'Responding to Communication', 'Adapting Communication' and 'Gaining Attention'. Table 12 below shows an overview of the correlations between the children's English and Auslan scores and the parents' use of the four communication strategies.

Table 12: Correlations between children's MacArthur-Bates CDI English and Auslan scores and parents' use of communication strategies.

		Visual attention	Responding to communication	Adapting communication	Gaining attention
Peter	English		r=.920, p=.000		
	Auslan		r=.916, p=.000		
Andrew	English		r=.928, p=.000	r=.920, p=.000	
	Auslan		r=.914, p=.000	r=.875, p=.001	
Tiffany	English			r= -.852, p=.002	
	Auslan		r= -.805, p=.005		
Oscar	English				
	Auslan			r= .853, p=.002	
Sam	English	r=.959, p=.000	r=.905, p=.001	r=.905, p=.000	r=.775, p=.009
	Auslan	r=.939, p=.000	r=.874, p=.001	r=.874, p=.001	
Lachlan	English		r=.754, p=.006		r=.754, p=.006
	Auslan		r=.896, p=.000		r=.896, p=.000
Oliver	English			r=.871, p=.001	r= -.928, p=.000
	Auslan				r= -.826, p=.003
Max	English	r=.833, p=.003	r=.833, p=.003	r=.774, p=.009	
	Auslan	r=.929, p=.000	r=.929, p=.000	r=.820, p=.004	r= -.860 p=.001

The correlations shown in Table 12 confirm that, for most of the children, there was a significant relationship between their English and Auslan scores and their parents' use of the four communication strategies. Sam's scores for English were found to be significantly correlated with all four parent sensitivity variables and his Auslan scores were correlated with all variables except 'Gaining Attention'. Similarly, Max's English scores were found to be significantly correlated with all variables except 'Gaining Attention', whilst his Auslan scores showed strong correlations with three of the communication strategies, but a negative correlation with 'Gaining Attention'. The lack of a significant correlation between Sam's and Max's vocabulary scores and 'Gaining Attention' could have been due to the fact that this strategy may be less effective as a means of gaining the attention of children who engage more in object-orientated play. However, Sam and Max were the only children for whom 'Visual Attention' was significantly correlated with their English and Auslan scores. Again, the reason for this result could be related to their need for explicit attention-gaining strategies, due to their tendency to resist interpersonal communication. English and Auslan scores for Peter, Andrew, Oscar, Lachlan and Oliver were found to be correlated with at least one of the parent communication strategies Negative correlations were found for Tiffany's English scores with 'Adapting Communication' and her Auslan scores with 'Responding to Communication' and 'Adapting Communication'. Oliver's vocabulary scores were also found to be negatively correlated with 'Gaining Attention'. This was possibly due to the fact that, with his increasing language skills and motivation to communicate, he did not require external attention-gaining strategies to be used by his parents.

Although there is evidence of significant correlations between the parents' use of specific communication strategies and their children's vocabulary skills, caution must be taken when interpreting these relationships. For example, Sam's and Max's language scores were correlated with more parent communication strategies than the other six children, but both children showed relatively slow growth in vocabulary skills. On the other hand, Oliver's vocabulary skills in both languages were the most advanced of the eight children, but a significant correlation was found only between 'Adapting Communication' and English and a negative correlation between 'Gaining Attention' and both languages. In other words, the fact that there were more

significant correlations between communication strategies and language scores for some parents and children did not necessarily signal a higher quality of input or communicative competence. In some cases, increased use of strategies was related to the parents' need to use a greater variety of strategies to effectively engage with their children. For this reason, the three input-level groups were not applicable to this aspect of the parents' input. In order to gain more insight into the ways in which the children used their English and Auslan vocabularies, their communication and language skills were measured with the Bimodal Bilingual Development Scale.

5.3.2 Children's bimodal bilingual skills

The Bimodal Bilingual Development Scale measured the children's bilingual English and Auslan skills, together with their pragmatic language skills, which were not modality specific. The scale also served as a measure of the bilingual developmental relationship between the children's English and Auslan skills and their pragmatic language skills. In the context of this study, pragmatic language skills included the children's use of eye gaze, gesture, pointing, joint attention, turn-taking and clarifying utterances. The language skills measured with the Bimodal Bilingual Development Scale elicited the children's use of grammatical structures in both languages, rather than specific lexical items as is the case with the MacArthur-Bates CDI. The scale also highlights the sequence of development for both languages and shows the dominant language at each stage of development. Figures 19 to 21 show an overview of the children's bimodal bilingual skills throughout the study.

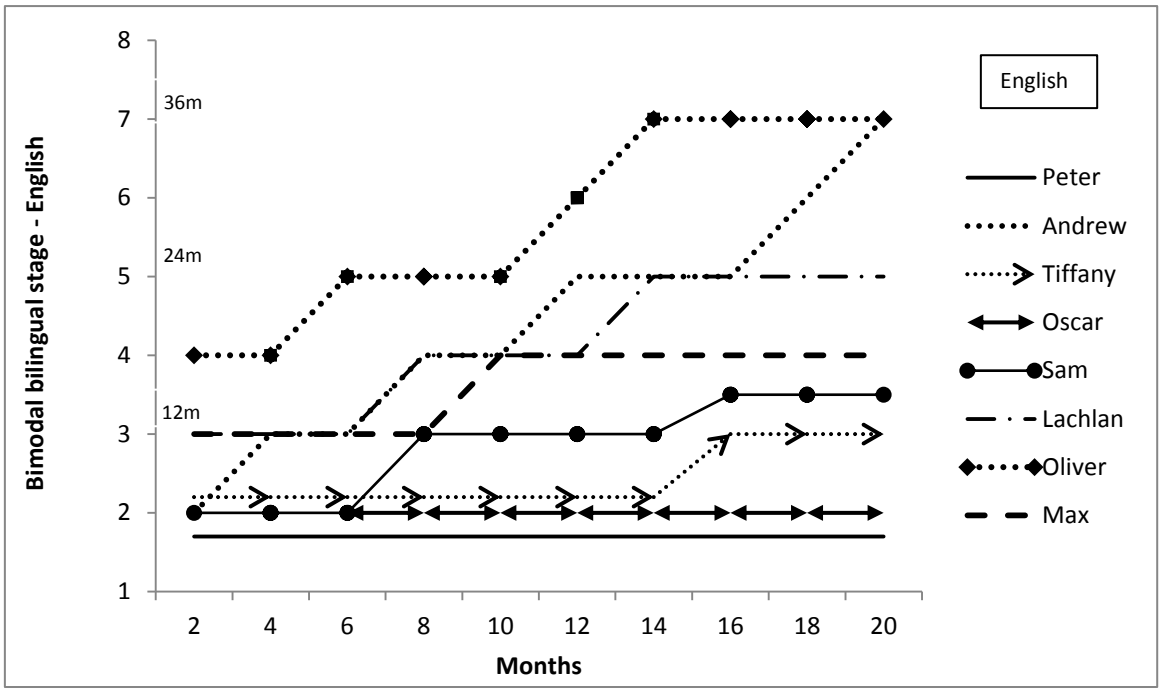

Figure 19: Children's English skills, measured with the Bimodal Bilingual Development Scale.

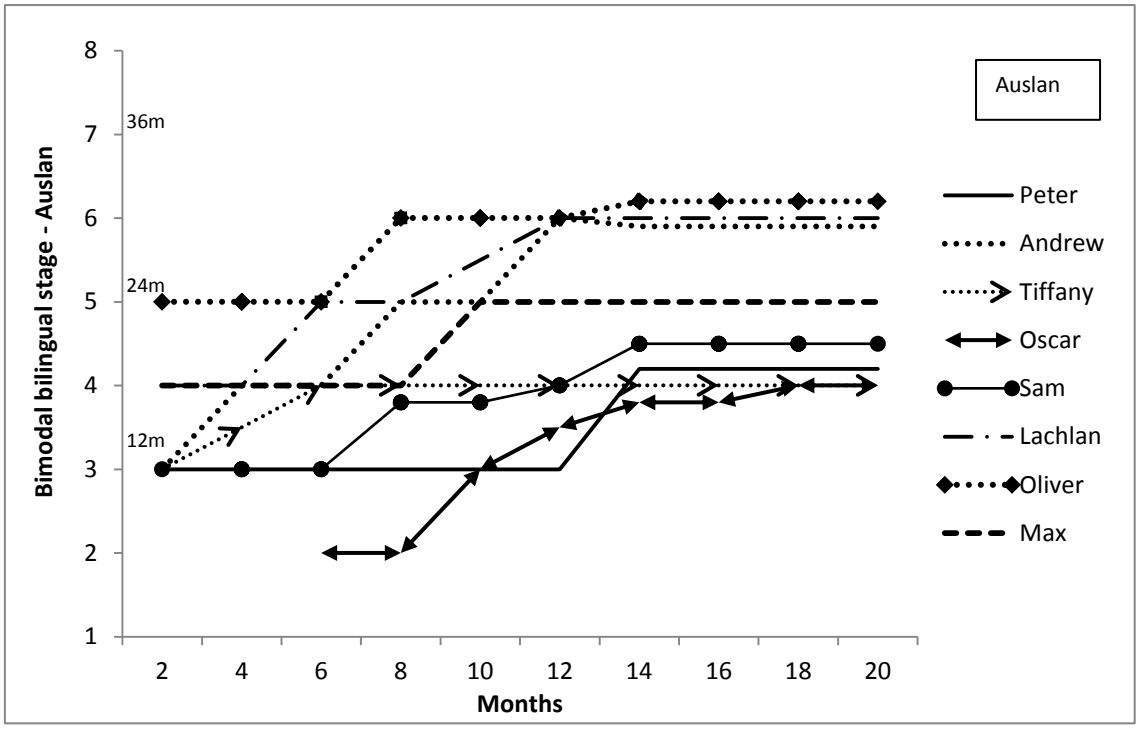

Figure 20: Children's Auslan skills, measured with the Bimodal Bilingual Development Scale.

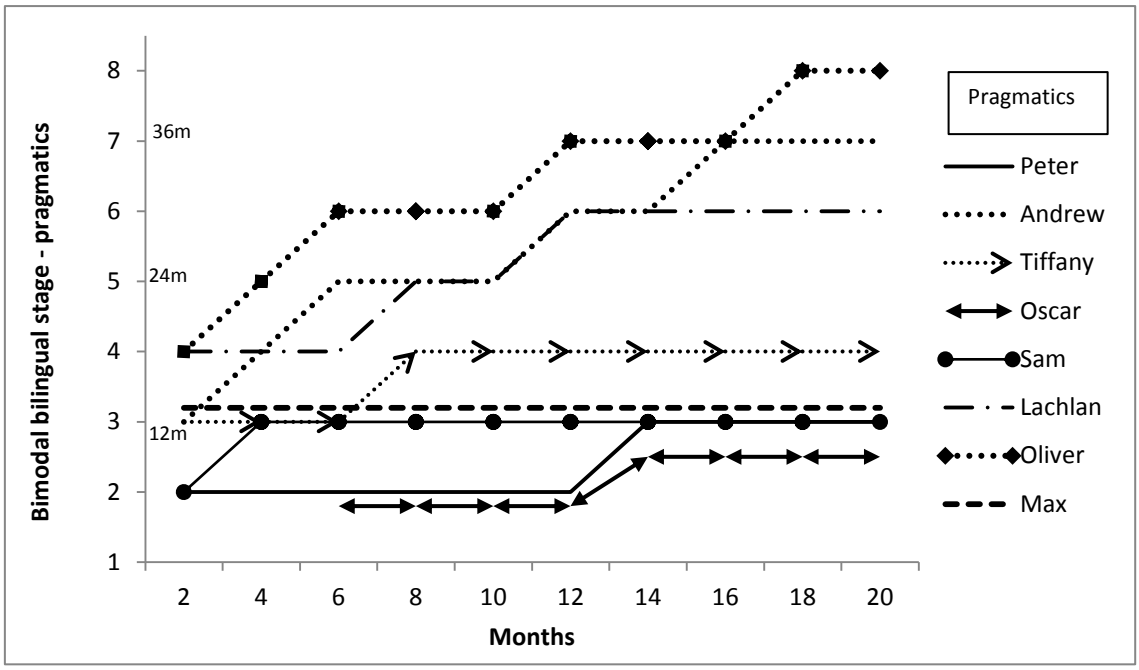

Figure 21: Children's pragmatic language skills, measured with the Bimodal Bilingual Development Scale.

Figures 19 to 21 show that, by the conclusion of the study, Andrew and Oliver achieved the highest scores of the eight children for bilingual skills, with English measured as stage 7, typical of a 42 month-old child and Auslan as stage 6, typical of a 36 month-old child. Stage 6 Auslan competence included utterances consisting of five or six signs and emerging use of pronouns, classifiers and depicting signs. With stage 6 proficiency, the children could comprehend longer utterances with more complex grammar and could follow stories with simple plots. Andrew and Oliver were able to talk about plurality, ownership and emotion using typical Auslan grammatical structures such as adding signs to denote number (LOTS OF), possession (YOURS) and emotion (JENNY+CRY+SAD). When Andrew was 23 months old, he could use Auslan sentences containing three key signs, e.g. 'TEDDY+SLEEP+CAR' ('Teddy's asleep in the car'). At 29 months of age, Oliver could request assistance (MUMMY+HELP+OLIVER+PLEASE) and from 33 months of age he was able to could express emotions (EMMA+SAD+CRY). Oliver's pragmatic language skills were measured at stage 8 in the last four months, which represented almost age-appropriate competence. This pragmatic language score was higher than his language scores due to his ability to use other nonverbal

strategies to repair his utterances and maintain conversation topics. Andrew's pragmatic language skills, at stage 7, were equivalent to the language skills of a 36 to 42 month-old child, close to his chronological age.

Lachlan's assessment results show that his bilingual scores progressed at a steady rate throughout the study, but were significantly delayed for his age. Auslan was his stronger language at all times, reaching stage 6 by the 20th month of the study, with his English competence gradually improving over time and ultimately reaching stage 5. Although Lachlan's amplified hearing thresholds were adequate for speech perception, his receptive and expressive English skills were delayed, suggesting the presence of a specific oral language impairment. Consequently, his expressive language was predominantly Auslan and fingerspelling for most of the study, with occasional key words added to his signed utterances. Despite his oral language delay, Lachlan's pragmatic language skills were scored as stage 6 due to his ability to find novel, nonverbal ways of making himself understood. These strategies included signing, fingerspelling, writing and drawing to communicate his needs.

As was the case for results reported for the children's English and Auslan vocabulary measured with the MacArthur-Bates CDI, Andrew's, Lachlan's and Oliver's bimodal bilingual scores were also the highest out of the eight children. Once again, their parents were classified as the high input-level group, thus showing a distinct trend for higher level parental input and responsiveness contributing to higher level language outcomes for their children. In the medium input-level group, Max's Auslan skills were stronger than his English, but assessment results indicate that most of his expressive language was in the form of elicited responses rather than spontaneous, natural language. When prompted to sign his request rather than using a point and vocalization, his signed utterances were typically formulaic and contained one or two signs, such as ME+BISCUIT, or DADDY+WHERE? For this reason, his pragmatic language scores were lower than his English and Auslan scores. Sam's bilingual assessment results indicate that he gained English and Auslan skills at a slow, steady pace throughout the study. However, his pragmatic language skills remained at stage 3 for 18 out of the 20 months of the study and case notes revealed that he required much

prompting to communicate formally. Auslan was his stronger language over the 20 months, with skills reaching stage 4.5, equivalent to a 24 month-old child. The children whose parents were identified as low in their input levels – Tiffany, Peter and Oscar, demonstrated slow progress in their language development. By the conclusion of data collection, Tiffany's English skills were measured as stage 3, typical of an 18 month-old child and her Auslan and pragmatic language skills were at stage 4, equivalent to a 24 month-old child. Typical signed phrases contained two signs, such as DRINK+PLEASE or MUMMY+HOME, but were basically formulaic and usually required prompting by an adult communication partner. Peter and Oscar acquired minimal skills in English, with scores recorded at stage 2, equivalent to those of a nine to 12 month-old child. Both these boys reached stage 4 for Auslan skills, equivalent to those of an 18 month-old native signing child. Peter's use of pragmatic language skills (stage 3) was slightly higher than Oscar's (stage 2.5), but these outcomes reflect a severe delay for both children.

5.3.3 Children's speech and sign intelligibility

In order to rate their ability to understand their children's utterances in English and Auslan, the parents completed the Speech Intelligibility and Sign Intelligibility checklists bi-monthly. With these checklists, a rating of 1 represented the least intelligible utterances and 7 represented the highest level of intelligibility. Figure 22 shows the parents' ratings of their children's levels of speech intelligibility.

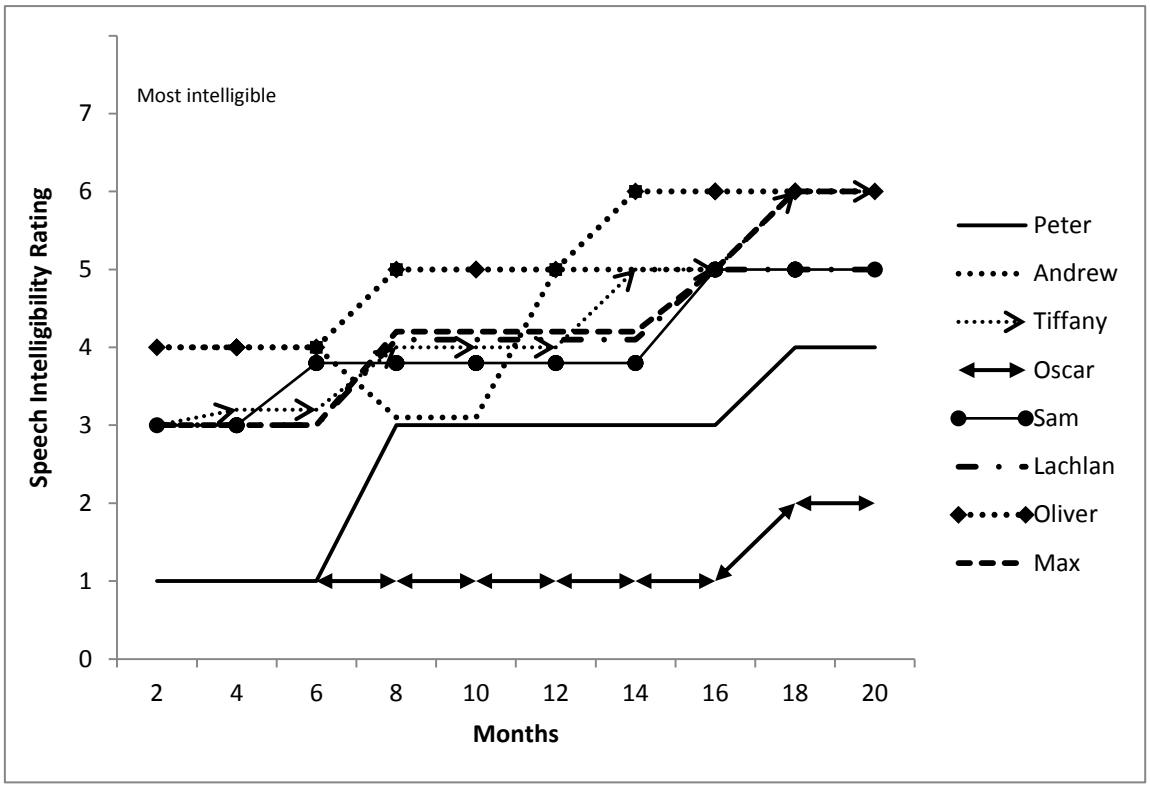

Figure 22: Children's parent-rated speech intelligibility, measured with the Speech Intelligibility Checklist.

Speech intelligibility ratings were varied, with seven showing increases over the duration of the study. Andrew's intelligibility dropped during his period of chronic otitis media, from level 4 to level 3 from the sixth month to the 10th month, with an increase to level 5 in the 12th month. Oliver's intelligibility was consistently the highest in the group, increasing from 4 to 6 over the 20 months of data collection, matching his English language skills. Andrew's speech intelligibility ratings increased noticeably in the second half of the study, once his chronic middle ear problems had been resolved. Not surprisingly, the two children who communicated minimally in speech, Peter and Oscar, were rated by their parents as least intelligible, although both scored an increase in ratings in the last four months. Despite Tiffany, Sam and Max showing very slow growth in oral language skills, their parents rated their speech intelligibility as between 3 and 6 out of a possible 7. However, it should be noted that these ratings were based on the parents' frequent listening to their children's speech, therefore the same level of intelligibility would not necessarily be perceived by less familiar listeners.

Parents completed a similar checklist to rate their children's sign intelligibility. Figure 23 shows an overview of the parents' ratings of their ability to understand their children's Auslan over the 20 months of data collection.

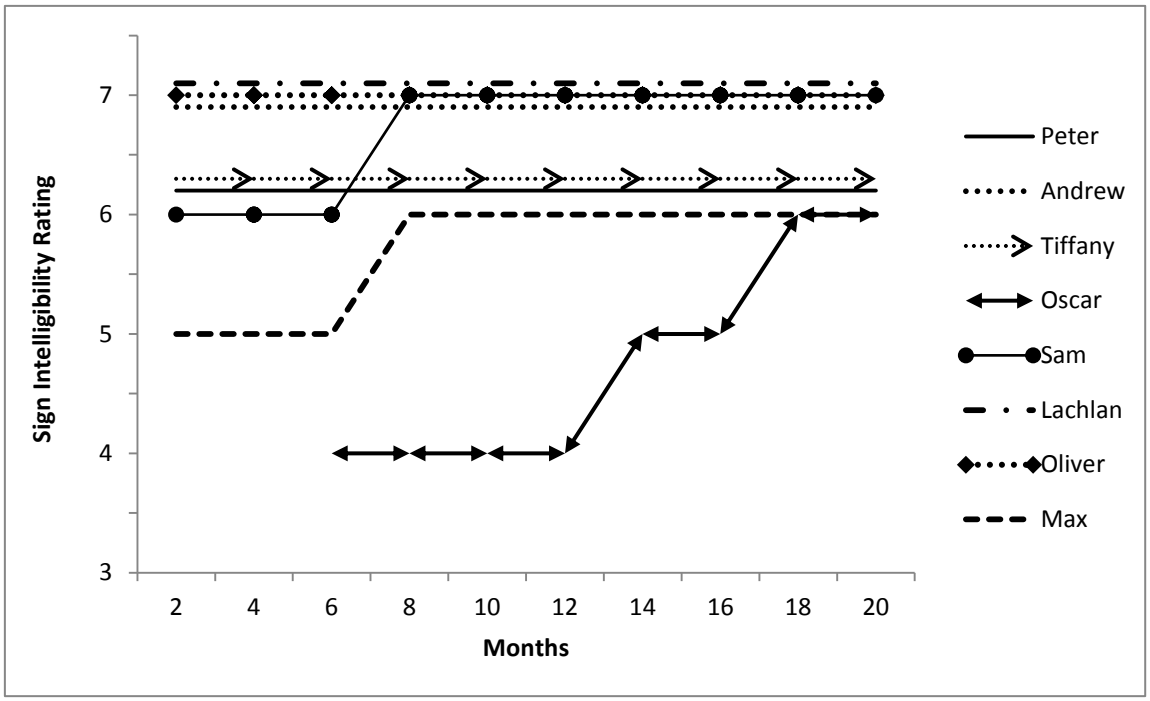

Figure 23: Children's parent-rated sign intelligibility, measured with the Sign Intelligibility Checklist.

For the most part, the parents perceived their children's Auslan as more intelligible than English. By the end of the study, the sign intelligibility of all children was rated as either 6 or 7. Sam and Max showed a gradual increase in their sign intelligibility in the sixth month, whilst Oscar's parents increased their rating of his intelligibility in the 12th month and again in the 16th month. However, as was previously mentioned when reporting the ratings of the children's speech intelligibility, these results were not representative of the children's sign language skills per se, but only the perception of the parents in terms of their ability to comprehend their children's communicative intent.

5.3.4 Children's language modality preferences

Using the 'Child Language Use' section of the Parent-Child Communication Scale, the parents rated their children's language modality use bi-monthly. The rating scores were then converted to percentages of the full scores. The children's modality preferences were based on their dominant language use at each data point, shown in Figures 24 and 25 below.

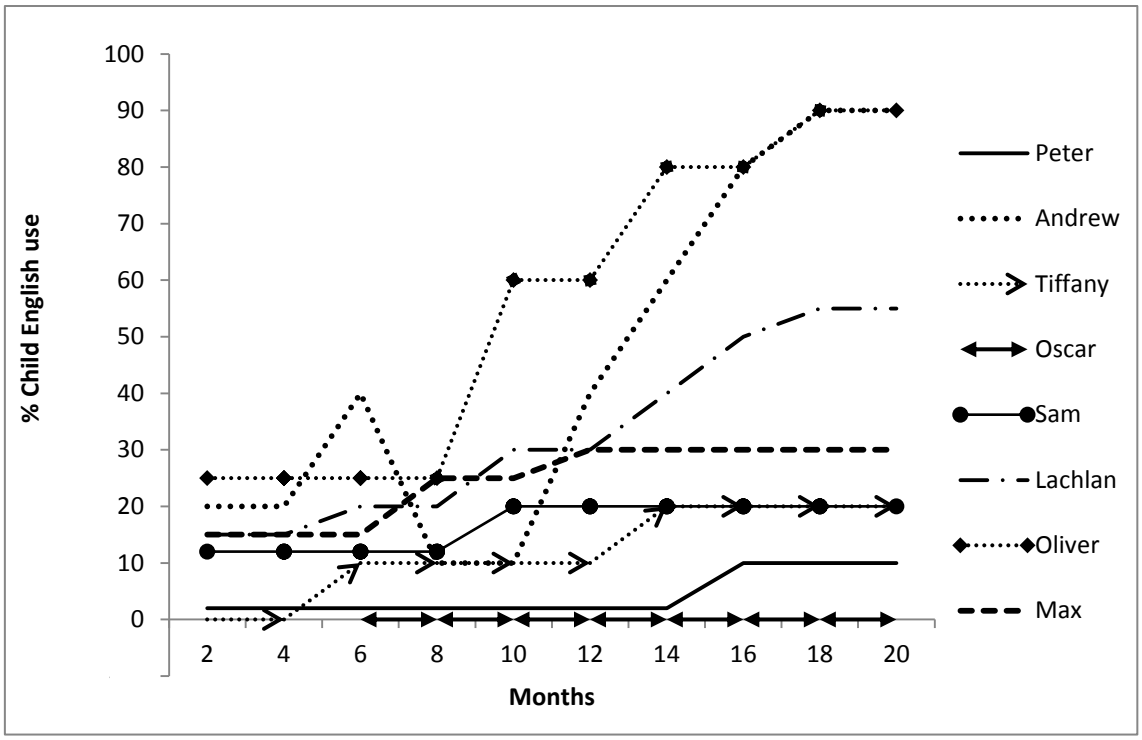

Figure 24: Children's English language use, measured with the Parent-Child Communication Scale, Child Language Use category.

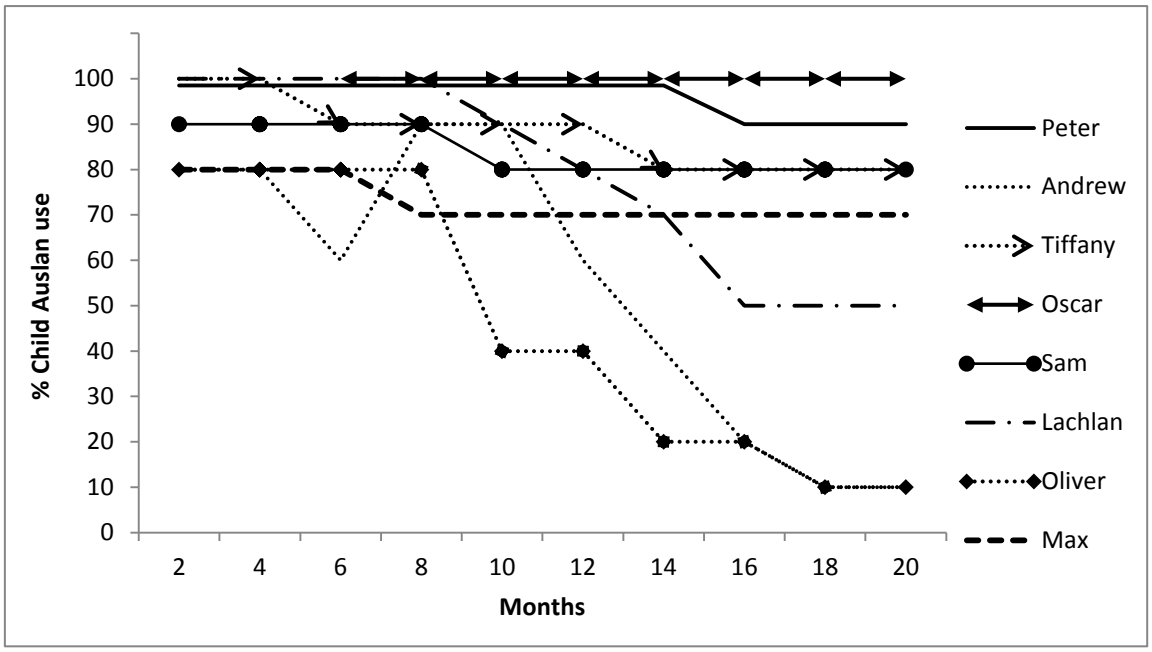

Figure 25: Children's Auslan language use, measured with the Parent-Child Communication Scale, Child Language Use category.

By the conclusion of data collection, Andrew, Lachlan and Oliver were rated by their parents as using English as their dominant language and preferred modality, whilst Peter, Tiffany, Oscar, Sam and Max were rated as using more Auslan and showing a preference for a signed modality. Rating scores from the Parent-Child Communication Scale and language assessment results showed that English and Auslan preferences changed over the duration of the study for many of the children. For example, Figure 24 shows that Andrew's percentage scores for English use varied between 20 percent, 40 percent and 10 percent, before increasing steadily to 90 percent by the conclusion of data collection. Between the 10th and 16th months, Figure 25 shows that Andrew's Auslan use decreased from 90 percent to 20 percent, indicating a sustained change of modality preference from Auslan to English. Similarly, Figure 24 shows that Oliver's English use increased from 25 percent to 60 percent from the eighth to the 10th month, indicating a marked change in his modality preference from Auslan to English. Language assessment results indicate that Oliver showed the most sustained increase over the 20 months, with the strongest English skills recorded by the conclusion of the study (see Figures 17 and 18). His preference for Auslan decreased markedly after the eighth month and continued to decrease for the remainder of the study, as is shown in

Figure 25. Lachlan's English use increased to 55 percent by the end of the study, but he also maintained his Auslan use, with a level of 50 percent of use at the conclusion of the study. Case notes and video analysis show that the reasons for Lachlan maintaining the use of both languages were related to his oral language processing disorder at the time and his need to accompany spoken utterances with sign support. Peter, Tiffany, Sam and Max showed minimal variation in their modality preferences, with Peter's Auslan use ranging between 90 percent and 100 percent, Tiffany's between 80 percent and 100 percent, Sam's 80-90 percent and Max 70-80 percent. Oscar showed no change in his modality preference for sign language, with Auslan recorded at 100 percent of use and English as 0 percent over the duration of the study.

These results reflect the same grouping of children whose parents were classified according to their level of bimodal bilingual input and responsiveness to communication. Andrew's, Lachlan's and Oliver's language scores were the highest of the eight children and these children demonstrated wider variations in their language use than Sam, Max, Tiffany, Peter and Oscar. These five children, whose parents were identified as belonging to the medium and low-input groups, showed less variation in their modality use, with Auslan recorded as their dominant language use throughout the study.

When reviewing the data for the parents' bimodal bilingual input and the children's language outcomes, there was evidence that an important factor contributing to these outcomes was the level of parent sensitivity to their children's communication. In order to gain more information about why some of the children were more communicatively competent than others, it was therefore necessary to understand the nature of parental sensitivity and the ways in which it was demonstrated in this study.

5.4 Parents' sensitivity to their children's communication

The parents' sensitivity to their children's communication was determined by analysis of their data for their participation in the bilingual program, Auslan proficiency and

bilingual input in relation to their use of four specific communication strategies and accommodation of their children's modality preferences. Sensitivity was particularly demonstrated when the parents' modality input was in harmony with their child's modality use, that is, when the child's use of a modality increased or decreased, the parents' input increased or decreased accordingly. Data showing the relationships between the parents' input and the children's modality use are shown in Figures 26 to 33 below. The data are presented in the three parent input-level groups identified for the cohort of parents: high-input (Andrew's, Lachlan's and Oliver's, Figures 26-28), medium-input (Oscar's, Sam's and Max's, Figures 29-31) and low-input (Peter's and Tiffany's, Figures 32-33).

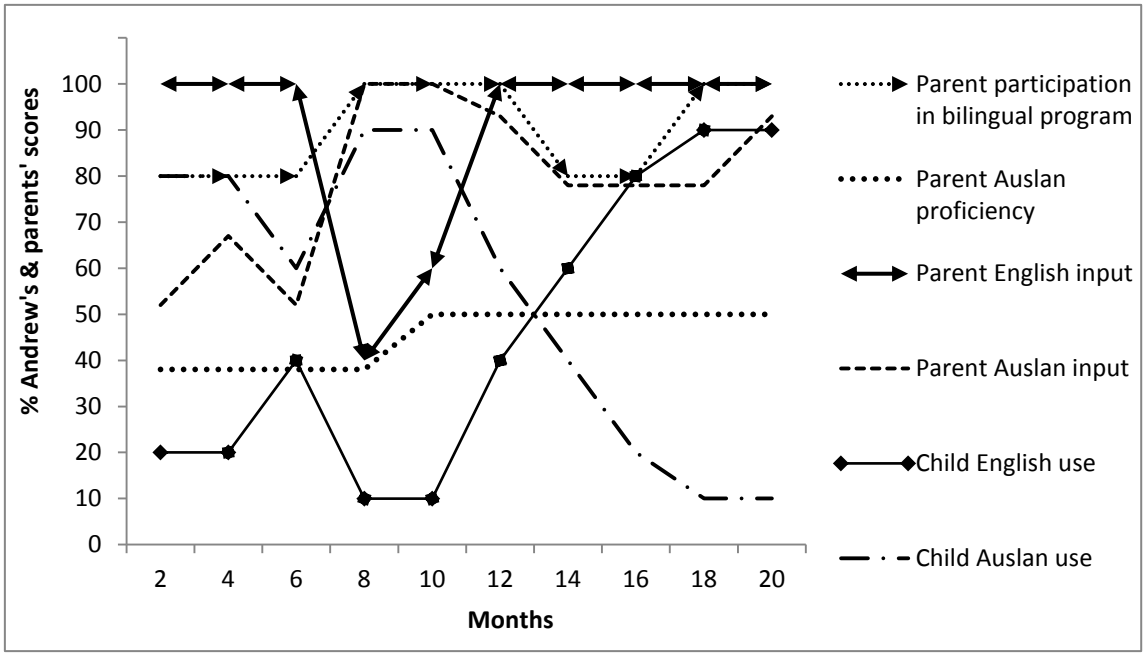

Figure 26: Andrew's modality use and parent bilingual input for high-input parent group.

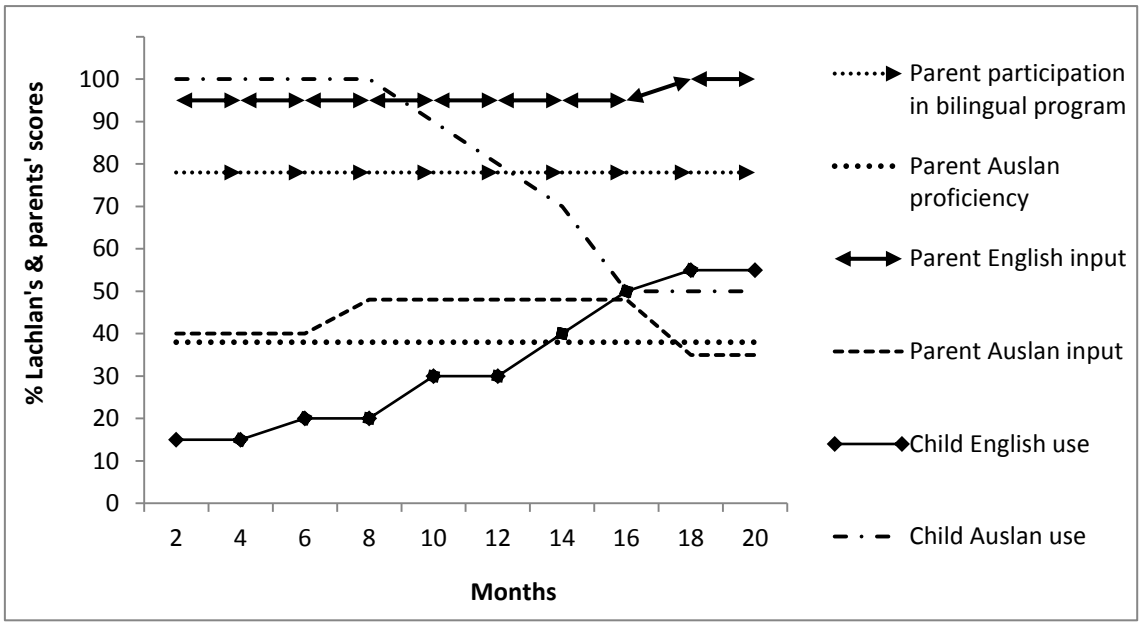

Figure 27: Lachlan's modality use and parent bilingual input for high-input parent group.

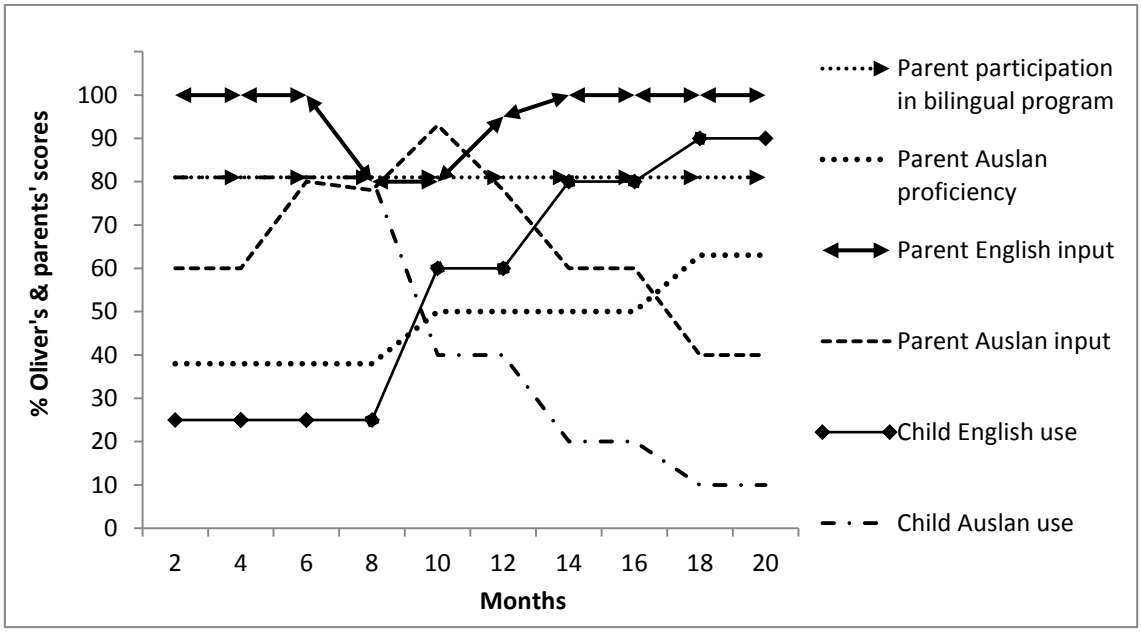

Figure 28: Oliver's modality use and parent bilingual input for high-input parent group.

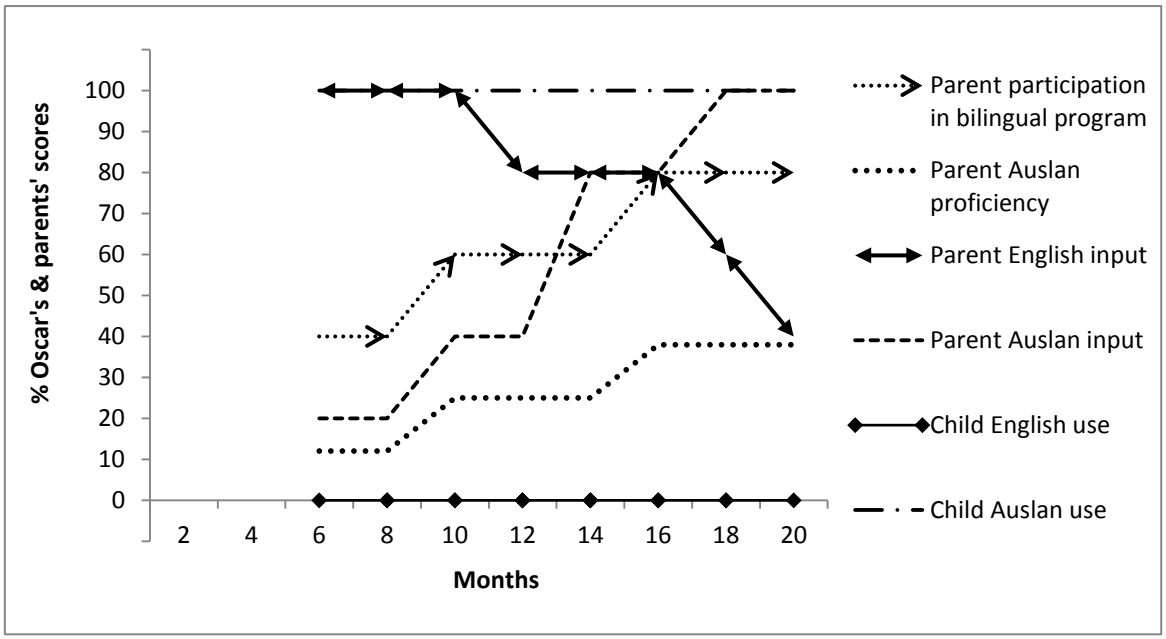

Figure 29: Oscar's modality use and parent bilingual input for medium-input parent group.

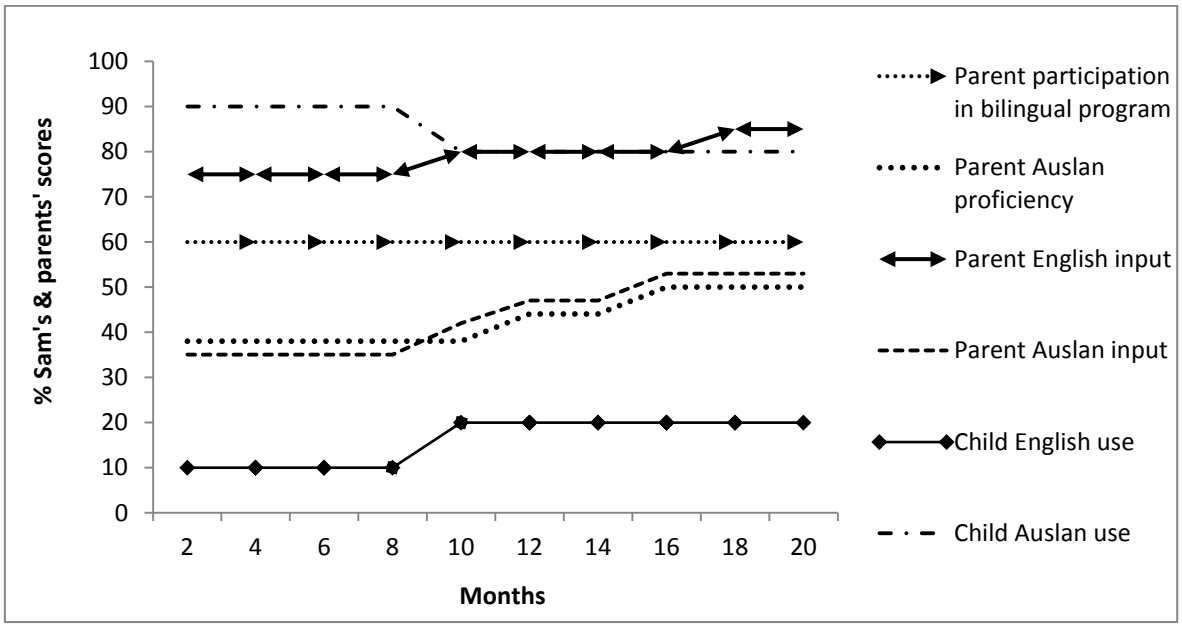

Figure 30: Sam's modality use and parent bilingual input for medium-input parent group.

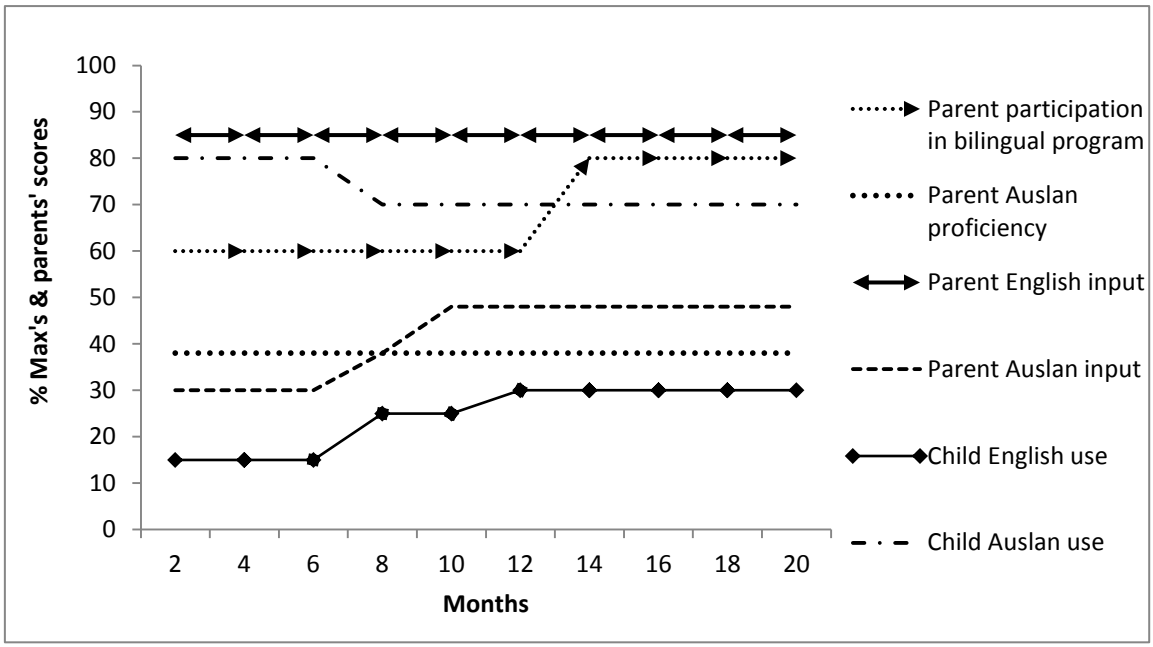

Figure 31: Max's modality use and parent bilingual input for medium-input parent group.

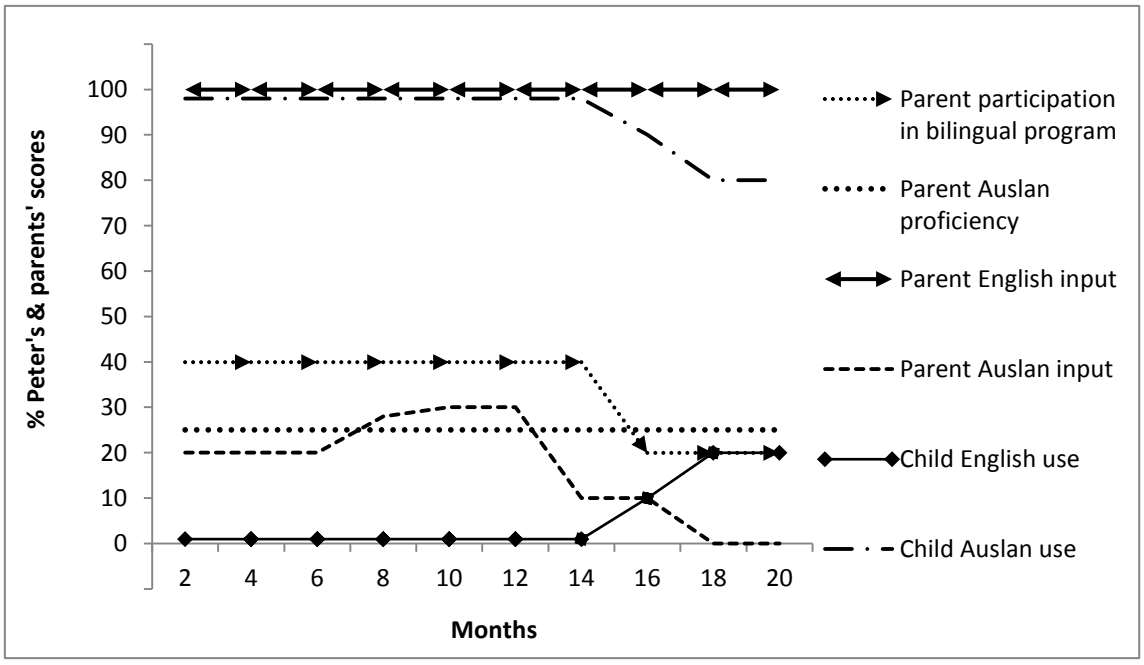

Figure 32: Peter's modality use and parent bilingual input for low-input parent group.

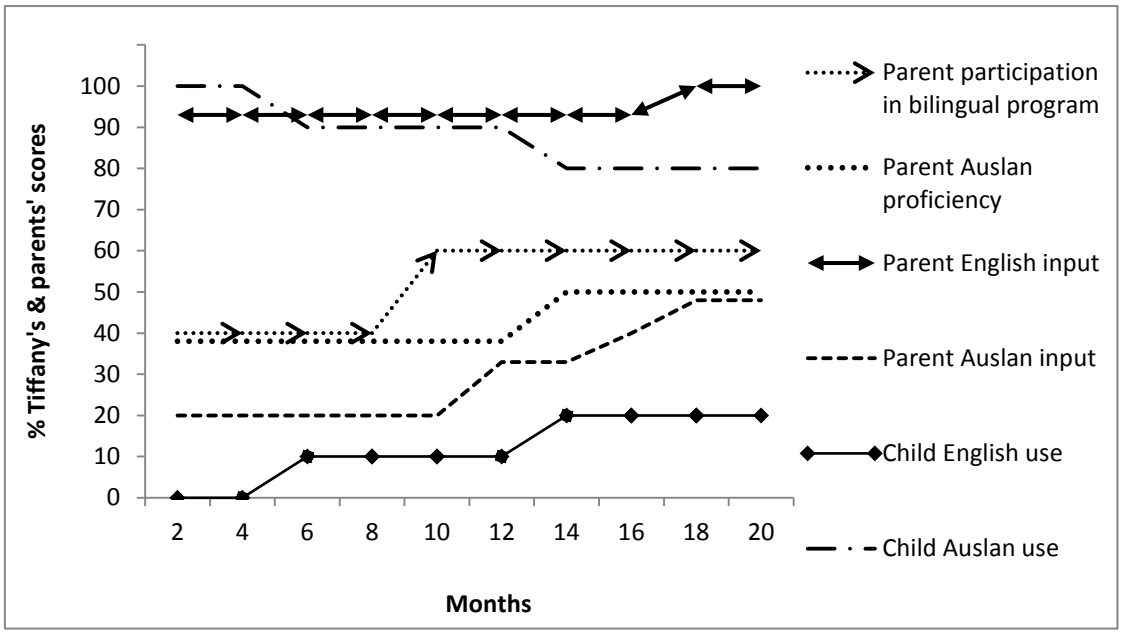

Figure 33: Tiffany's modality use and parent bilingual input for low-input parent group.

Data shown in Figures 26 to 33 above indicate that the parents' level of sensitivity was demonstrated by their ability to respond to their children's modality preferences. The overview of parent-child data in the high-input group shows that Andrew's and Oliver's parents demonstrated a high level of sensitivity to their children's modality preferences. Lachlan's parents' data did not reflect the same level of modality sensitivity, although video data and case notes confirm that their quality of input facilitated the steady increase of Lachlan's language scores over time. The parents of the children in the medium and low-input groups demonstrated variable levels of sensitivity, but in general did not accommodate their children's modality preferences to the same extent as the parents in the high-input group. Oscar's parents showed a marked increase in their sensitivity in the second half of the study when they became more aware of his inability to comprehend or express spoken language, however his language scores remained very low.

5.5 Relationship between parent bilingual input, parent sensitivity and children's language outcomes

Further analysis of the results of the parents' bilingual input and their sensitivity to accommodating their children's modality preferences revealed that these variables were predictors of the language outcomes of their children. Moreover, there was evidence that the three groups that classified parents according to levels of input and sensitivity remained the same for all aspects of their bimodal bilingual input: participation in the bilingual program, Auslan proficiency, English and Auslan input, use of specific communication strategies and accommodation of the children's modality preferences. When reviewing the data from the children's MacArthur-Bates CDI (see Figures 17 and 18) and bimodal bilingual assessments (see Figures 20 and 21), it was found that the children with the better language outcomes – Oliver, Andrew and Lachlan – were facilitated by parents with high-input levels and higher sensitivity to communicating with their children. The findings of this study therefore support a relationship between the level of parent bilingual input, parent sensitivity and the children's language outcomes. In other words, the parents' levels of input and sensitivity were predictors of their children's language outcomes.

Videotaped data were also analysed and augmented the assessment data reported in this chapter. These videotaped data provided valuable insight into the nature of parent-child interactions in their home environments.

5.6 Videotaped data

Videotaped records of parent-child interactions were analysed, annotated and coded for English and Auslan utterances, children's pragmatic behaviours and parents' reciprocal responses at each of the 10 data points. One minute samples of these utterances were selected at each data point as representative of typical parent-child interactions. Tables showing a summary of the number of English and Auslan

utterances, children's pragmatics and the parents' reciprocal responses are provided in Appendix 4.8.

There was a wide variation in the quantity and quality of utterances and reciprocal responses for each interaction sample and the number of utterances and parents' reciprocal utterances did not increase over the duration of the study. This could have been partly due to the spontaneous nature of the filming which recorded parent-child interactions that did not always reflect the parents' or children's optimal interactions or communication skills. One of the benefits of analysing the qualitative data yielded from the videos was that they provided additional insight into the home environments and the ways in which the parents facilitated their children's language experiences through play. These data also highlighted the differences in the parents' communication styles and the linguistic quality of their utterances.

5.6.1 Quality and quantity of utterances

The data analysed from the videos showed that the children who demonstrated the strongest communicative competence were Andrew, Lachlan and Oliver, whose parents were in the high-input group. These parents were also more likely to respond reciprocally to their children's speech and encourage them to take turns. Their English utterances were longer, contained greater lexical diversity and used more complex grammar than the parents in the medium and low-input groups. The videos also showed that English utterances were more prevalent than Auslan during these spontaneous filmed interactions. The reasons for the difference in proportion of modality use could be due to the fact that the parents who were more likely to provide a higher level of input – Andrew's, Lachlan's and Oliver's – were accommodating their children's modality preferences for English in the second half of the study and thus using less Auslan in their conversations. Another reason offered by many of the parents was that they felt somewhat self-conscious signing when they knew they were being filmed, so tended to use less Auslan during these times.

In the medium-input group of children, the majority of Sam's utterances were English, although most of his words were verbal approximations which were intelligible only when accompanied by strong contextual cues. Max used minimal Auslan in his interactions and many of his English words were direct imitations of his parent's targets. The video data also shed light on possible reasons for Sam's and Max's language scores being so much lower than Andrew's, Lachlan's and Oliver's, despite their parents' Auslan proficiency being the same as Lachlan's parents' (level 3). Although Sam's and Max's parents gradually increased their Auslan input to accommodate their children's preference for Auslan, their video records showed that the boys were particularly object-oriented in their play and often resisted their parents' attempts to communicate visually during these play times. Their attention control was single-channelled, specifically for visual input and they both had difficulty in shifting their attention from toys and objects of interest. By the conclusion of the study, both boys were being assessed for a pervasive developmental disorder such as Autism Spectrum Disorder.

When reviewing the transcripts for all eight children and their parents, there was evidence that a higher number of spoken utterances for each language sample did not necessarily indicate a higher level of language skill. In many cases, the children in the lower language group, Peter, Tiffany and Oscar, recorded a higher number of utterances in their samples than the children in the other two groups. However, their higher scores were a result of considerable imitation and repetition of their parents' language models. Moreover, most of their vocalizations and utterances were only intelligible when supported by contextual and situational cues. For example, Peter's transcripts revealed that most of his words were vocalizations such as 'ahhehh' and 'oo oo' when looking at a picture of a dog and pointing to its features. His videos show that he predominantly used signs, gestures and facial expressions to communicate with his parents and did so with much enthusiasm and confidence. Analysis of Tiffany's videos showed that, in general, her utterances were very hesitant, repetitive and barely audible. They were usually approximations and imitations of the parent's model, for example: 'awww' (horse), 'eheheh' (neigh), 'pi' (pig), 'bo bo bo' (lots lots lots) and she frequently used the same word 'yeah' when she knew she was expected to respond to

her parent's communication. In Oscar's case, a transcript taken from a language sample of 19 vocal utterances at the final data point showed that he produced only three types of vocalizations 'er der', 'ahh' and 'ger' – one was repeated 12 times, one five times and the other twice. In the same language sample, Oscar produced 15 signs repetitively: 'ME, 'BISCUIT' and 'PLEASE'. An example of Oscar's interactions with his parent is as follows (Auslan utterances in capitals):

Mother: What?
Oscar: ME+ME
Mother: What? Tell mummy
Oscar: ME+ME ME+ME+BISCUIT
Mother: BISCUIT
Oscar: BISCUIT
Mother: Say please PLEASE
Oscar: BISCUIT
Mother: BISCUIT+PLEASE
Oscar: BISCUIT+PLEASE+PLEASE

In comparison, a typical conversation between Oliver and his mother contained longer spoken utterances, wider variation in vocabulary and more complex grammar. For example:

Mother: what's she got on her arm?
Oliver: inside her bones
Mother: what did she break?
Oliver: Her arm
Mother: she tripped over on a stick
Oliver: her trip other one at stick at school
Mother: has she got plaster and a sling?
Oliver: um poor Anna I make it better

These examples demonstrate the difference between typical parent-child interactions in the low and high language groups, particularly in terms of the length of utterances, lexical diversity and general communicative competence of the children. They also highlight that, despite improved levels of sensitivity to Oscar's communication needs over time, his parents were challenged by his very limited lexicon, short attention span and basic pragmatic language skills. Video records confirm that Oliver's interactions with his mother were positive, engaging and reciprocal, whilst those recorded for Oscar indicate that communication was often a negative experience for him, especially when his needs were not met.

5.6.2 Reciprocal utterances

Annotations of videotaped parent-child interactions also provided opportunities to identify the parents' level of reciprocity to their children's English and Auslan utterances. Reciprocity was defined as a topically linked response to the child's verbal, signed or non-verbal communication bid within four seconds. The mean number of parents' and children's utterances and the parents' reciprocal responses are shown in Figures 34 and 35 below.

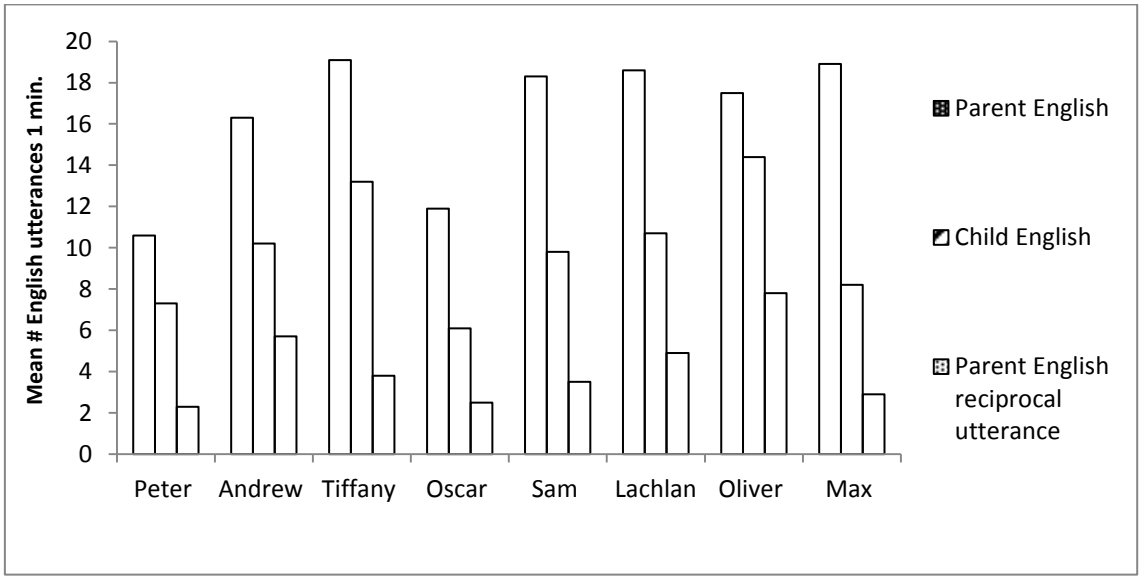

Figure 34: Mean number of parents' and children's English utterances and parents' reciprocal utterances in one-minute samples of parent-child interaction videos.

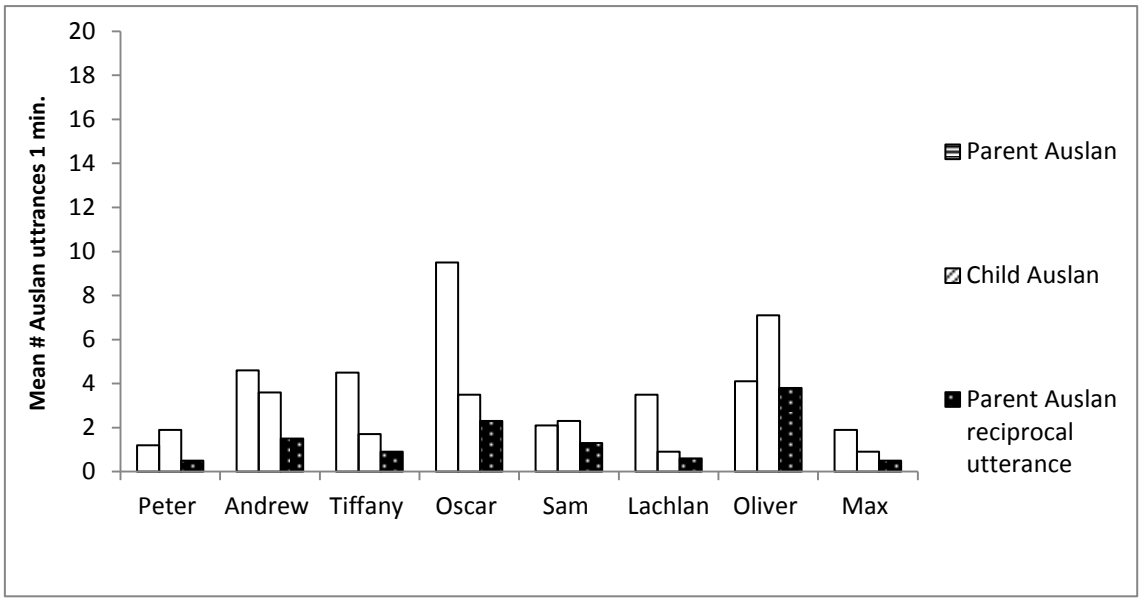

Figure 35: Mean number of parents' and children's Auslan utterances and parents' reciprocal utterances in one-minute samples of parent-child interaction videos.

Figure 34 shows that the highest number of parents' reciprocal responses to their children's English utterances was recorded for Oliver, Andrew and Lachlan. However, reciprocity for Auslan utterances, shown in Figure 35, revealed a different pattern, with many of the parents' mean scores not matching their usual parent-input groupings. For example, Oscar's parents, classified as medium-input, recorded the second highest number of responses and Lachlan's parents, in the high-input group, recorded scores lower than Tiffany's (low-input) and Sam's (medium-input). Further investigation into the reason for these differences revealed that, in many instances, the mean scores did not represent the true nature of some of the interactions. In Oscar's case, most of his Auslan utterances occurred in the last two video samples and were highly elicited and repetitive in those contexts.

The videotaped data also contributed valuable information about the parents' responses to their children's pragmatic and nonverbal behaviours, shown in Figure 36 below.

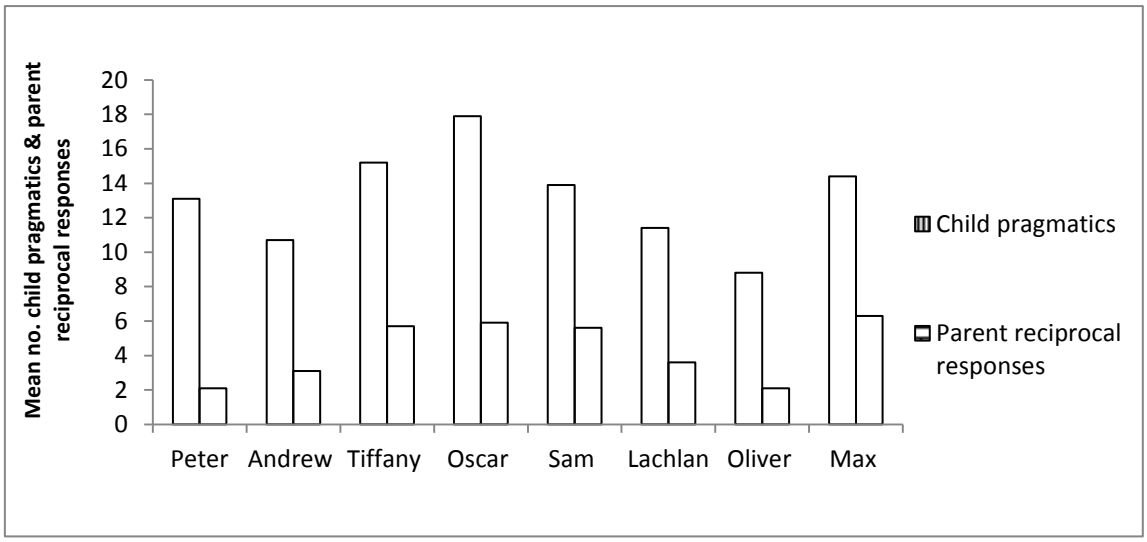

Figure 36: Mean number of children's pragmatic behaviours and parents' reciprocal utterances in one-minute samples of parent-child interaction videos.

Pragmatic behaviours recorded for parent-child interactions included eye gaze, gesture, pointing, pausing and turn-taking. These behaviours were also considered to be valid reciprocal responses from the parents, together with spoken or signed responses. The data shown in Figure 36 do not differentiate between the types of parental reciprocal utterances. Interestingly, when the mean number of children's pragmatic behaviours was calculated, the children in the high-input group, Andrew, Lachlan and Oliver, reported lower scores than those in the medium and low-input groups. The reason for this was most likely because Andrew, Lachlan and Oliver had developed higher language skills and relied less on non-verbal behaviours to communicate with their parents. The relatively low mean scores for their parents' reciprocal responses therefore need to be considered in this light, rather than a reflection on the parents' reduced sensitivity to their children's communication. For the children with more delayed language, Peter, Tiffany, Oscar, Sam and Max, their nonverbal behaviours were important aspects of their repertoire of communication skills. Figure 36 shows that Oscar reported the highest mean number of pragmatic behaviours, followed by Tiffany, Max, Sam and Peter. In general, their parents responded reciprocally to approximately a third of their children's non-verbal behaviours, except for Peter's parents, who responded to approximately one out of six.

These qualitative data added a depth of understanding of the children's dispositions, their parents' interactive styles and the language environments in which their parents' bimodal bilingual input was demonstrated. The videos not only complemented their assessment results, but provided the parents with opportunities to view their own interactions and consider the effectiveness of their input. In doing so, some parents were able to modify their interactive strategies to achieve better outcomes for their children.

5.7 Summary

In reporting the results of the assessments and rating scales used with the parents and children, this chapter addressed the three research questions posed for this study. Analysis of the data provided valuable information about the impact of the parents' bimodal bilingual input on their children's language outcomes. The richness of the data was made possible by the use of a case study approach that explored the extent to which the parents facilitated their children's bimodal bilingual skills through the quality of their input and their sensitivity to their children's communication needs. Quality of input included the degree to which the parents participated in the bilingual program, their Auslan proficiency and their use of both language modalities. Sensitivity was determined by measuring their use of a range of communication strategies and the degree to which they accommodated their children's modality preferences. The results show that the relationship between the children's language outcomes and the parents' bimodal bilingual input is not simply a case of the quantity of language input and specific modality use, but is characterized by the parents' sensitivity to their children's communication needs.

There are numerous variables identified in the literature that have been found to contribute to the language outcomes of young deaf children. These factors include aetiology of deafness, age at onset of deafness and diagnosis, use of listening devices (Harrison et al., 2001) and ability to make use of auditory input (Leigh 2008). Other important factors to be considered are the mothers' educational background

(Dollaghan et al., 1999), the parents' ability to effectively scaffold their children's language, level of sensitivity and responsiveness to their children's communication (Bernier et al., 2010) and levels of involvement, particularly in the children's development of auditory skills (Sarant, Holt, Dowell, Rickards, & Blamey, 2009; Spencer 2004). This study found that only some of these factors were found to contribute to the children's language outcomes. Contrary to numerous research studies that found that deaf children's language outcomes are enhanced by early diagnosis, early intervention and advances in audiological technology (Apuzzo & Yoshinaga-Itano, 1995; Yoshinaga-Itano, 2003), there was no evidence of better language outcomes for the earlier-diagnosed children in this study. Similarly, the results of this study found that the children who consistently wore their listening devices did not necessarily achieve better language outcomes, nor did their auditory profiles show that frequent device wearing resulted in a higher level of auditory skills. In fact, results reported in this chapter replicate Ching et al.'s findings from their 2010 study of the language development of young deaf children, in that many of the children who were diagnosed early and promptly enrolled in an early intervention program still experienced delays in language development.

Although maternal education level is frequently reported in the literature as significantly influencing child language outcomes, this factor was not a strong predictor in this study. The two children whose mothers had attained tertiary qualifications, Lachlan and Max, achieved very different language outcomes, however it should be noted that both boys were challenged by developmental issues that had not been identified at the commencement of the study. The highest language scores were achieved by Oliver and Andrew, whose mothers completed secondary school, but were not tertiary educated. Their ability to engage with the many facets of the bimodal bilingual program, together with their intuitive sense of their children's communication needs, were stronger predictors of language outcomes than their educational achievements.

A factor that emerged as a strong contributor to the children's language outcomes was the parents' level of sensitivity and responsiveness to their children's communication.

Significant correlations were found between the children's English and Auslan vocabulary skills and the parents' use of specific communication strategies. However these results also highlight that not all of the parents needed to use attention-gaining behaviours in order to engage their children effectively. The results showed that, in some cases, the parents whose communication was more effective were less inclined to require the use of these explicit communication strategies. One of the strongest factors contributing to the children's language outcomes was the parents' ability to accommodate their children's modality preferences and to adapt their language input accordingly. Out of the eight children participating in this study, the three who showed stronger language outcomes, Andrew, Lachlan and Oliver, were supported by parents who were more involved in the bilingual program and were more sensitive to their children's modality preferences.

Analysis of the videotaped parent-child interactions revealed that, although all parents expressed their commitment to communicating bilingually, most used a much higher proportion of English than Auslan with their children. This difference of input was no doubt influenced by the difficulties faced by the parents in acquiring sign language skills, the lack of available resources and the scarcity of signing role models and communication partners. Most parents achieved a level of Auslan proficiency that facilitated basic parent-child interactions, but more support was needed if they were to increase their fluency and confidence.

In summary, the three research questions posed for this study guided the in-depth investigation into the level of the parents' bimodal bilingual input and the impact on their children's language outcomes. The investigation focused on the relationships between the children's language outcomes, the quality of the parental bimodal bilingual input and the sensitivity of the parents to their children's communication. In reporting the results of assessments and rating scales, the data showed that the most important aspect of parental input was not so much the quantity of their English and Auslan input, or even their Auslan proficiency, but was related to their responsiveness to the communication needs of their children and their sensitivity to modality preferences. Analysis of the data confirmed that the impact of the bimodal bilingual

experience was different for each of the children and their parents and that a variety of factors contributed to the children's outcomes. As the study progressed, there were noticeable differences in the skills acquired by the parents and their children, with three distinct groups of parent-input levels identified amongst the eight cases. The data showed that these groups remained the same for nearly all aspects of parent input and that input levels predicted the language outcomes for the children.

In addition to addressing the three research questions, other developmental factors emerged over the duration of the study that shed light on possible reasons for the wide variation in the children's language outcomes. Despite their best efforts, some parents were limited in their ability to improve their children's outcomes due to developmental challenges that were not apparent at the outset of the study. In short, the findings of this study have revealed that one language modality was not inherently better than another, but ready access to the child's preferred modality supported better outcomes.

The implications of these results for the field of deaf education will be discussed in Chapter Six, along with limitations of the study, recommendations for practice and future research.

CHAPTER SIX

Discussion

In Chapter Five, the quantitative and qualitative findings for each of the eight children and their parents were presented. In this chapter, the findings are discussed in relation to the three research questions proposed for this study. In addition, the implications and limitations of the study are discussed, together with recommendations for practice and future research in the field. The research questions guiding this study aimed to identify the conditions under which the eight deaf children achieved their language outcomes when receiving bimodal bilingual input from their hearing parents. Specifically, the research questions were:

1. What is the nature of parental input in a bimodal bilingual intervention approach during a period in which the parents are still acquiring Auslan skills?

2. What are the outcomes for the children in terms of both languages, including their modality preferences?

3. To what extent are the children's outcomes predicted by the quality of bimodal bilingual input and parental sensitivity to their child's communication?

The discussion focuses on the findings of this study which identified two major factors that influenced the children's language outcomes. The first of these factors was the composite variable of parent involvement in the bimodal bilingual intervention program, which includes the level of parent participation, their Auslan proficiency and their English and Auslan input. The second factor was the parents' sensitivity to their children's communication, which includes their use of specific communication strategies and their accommodation of their children's language modality preferences.

6.1 Nature of parental input in a bimodal bilingual intervention approach

The first research question relates to the nature of bimodal bilingual input by this group of hearing parents who were in the process of acquiring Auslan at the same time as their young deaf children. This situation is somewhat of a phenomenon in bilingual terms due to the fact that, in dual language partnerships for spoken languages, it is normally assumed that the children are provided access to both languages, albeit in varying proportions. It is also assumed in bilingual practice that the adults providing language input to their children will have at least conversational competence in one language and minimal communicative skills in the second language (Hakuta, 1990). As is the case for most deaf children, the children in this study were being raised by hearing parents who had no prior experience with deafness or bilingual communication. As a group they showed wide variation in the way they adapted to the challenges of learning to be bilingual and they also showed very different levels of motivation and persistence in developing skills in the second language, Auslan. Although many variables were controlled in this study such as home language, family structure, experience regarding childhood deafness and type of early intervention support, the variation in the parents' level of input indicated that there were additional factors that contributed to the children's communication and language outcomes. When the results of all parent assessments were reviewed, it emerged that the eight sets of parents could be classified into three discrete groups of input: high-input (Andrew's, Lachlan's and Oliver's), medium-input (Oscar's, Sam's and Max's) and low-input (Peter's and Tiffany's).

6.1.1 Parental participation in the bimodal bilingual early intervention program

In order to understand the factors contributing to effective bimodal bilingual input, it was important to identify the parents' level of participation and involvement in the early intervention program. Parental participation in this study was determined by measuring a range of factors that indicated the level to which they a) engaged with both languages and b) encouraged bilingual use by their children. These factors

included the proportion of language modality use, involvement in bilingual activities, Auslan learning and use of resources and active encouragement of the children's attention to and use of spoken and sign language. Although the parents used English as their home language, it could not be assumed that they were necessarily aware of the strategies that are most effective in encouraging their children's development of language. In addition, the level of the parents' commitment to engaging bilingually tended to be changeable. In some instances, a fluctuation in participation signalled a change in the child's modality preference or hearing thresholds, while at other times it was the result of parents making decisions that best suited their family's needs and circumstances. This sometimes ambivalent relationship is also supported by the bilingual literature, with numerous studies finding that parents often find raising a child bilingually to be a challenging task (Francis, 2011; Okita, 2002).

When reviewing the parents' participation as measured with the Bilingual Rating Scale, the parents who scored the highest ratings also belonged to the high-input group. These outcomes replicate findings from Moeller's (2000) study in which she identified that there was a strong relationship between the provision of early intervention and subsequent language outcomes for deaf children. However Moeller's finding that significant language delays were associated with children whose parents demonstrated a lower level of involvement was not true for all families in this study. For example, Oscar's and Tiffany's parents showed a marked increase in their bilingual participation in the second half of the study, yet their children's language outcomes were very delayed. In Oscar's case, his parents showed commitment to increasing their bilingual input by employing a Deaf Auslan home tutor and attending an Auslan playgroup on a weekly basis and Tiffany's parents increased their use of Auslan resources and attended bilingual events in the community. It was apparent that there were other factors to consider with these children, particularly in terms of the parents' sensitivity to their children's communication bids, modality preferences and attention states. In general, although there was a range of sign language resources and bilingual events made available to the families, not all of the parents could make use of these resources. In some cases a lower rating for participation in the bilingual program was due to constraints of time, finances or general community support. In this respect,

Moeller's (2000) Family Participation Rating Scale recognized this constraint on participation by including in the descriptor for the lowest rating that the family may be facing significant stresses in life that divert their attention from the deaf child's needs.

6.1.2 Parental Auslan proficiency

Perhaps the most challenging aspect for the parents engaging in the bimodal bilingual intervention program was the need to acquire Auslan as a second language at the same time as their children were acquiring one of their first languages. There was also a concern that the children would be limited in the breadth of language they could acquire from parents who were themselves learning sign language, a finding supported by Moeller and Schick (2006). Implicit in the first research question for this study is whether the parents were able to take up a second language in a different modality and use it with a level of fluency that would promote their children's language skills. A daunting task for some, however the parents participating in this study had chosen to enrol in a bilingual early intervention program because they believed that exposing their deaf children to sign language as well as speech would be beneficial for their communication and language development. They therefore accepted that sign language would be part of bilingual family life and adapted to this idea in varying degrees. The results of this study show that, although the parents did not necessarily become fluent in sign, most reported that their level of Auslan competence allowed for satisfying interactions with their children.

In many respects, the parents experienced similar challenges to other hearing adults learning sign language, with variability in skill development and limited exposure to fluent sign language models (Ellis & Sagarra, 2010; Napier et al., 2007; Quinto-Pozos, 2011). The parents reported that much of the difficulty they faced in learning Auslan was the need to adjust to the very different grammatical rules of a visual-gestural language, yet some showed considerable progress, irrespective of their educational background. These findings are similar to those reported by Quinto-Pozos (2011) and reinforce the notion that some adults are possibly better visual learners than others

and are able to put these skills to good use when communicating with their children. Another challenge to the parents' uptake of Auslan in this study was the dearth of resources and opportunities to learn sign language in a relatively short space of time. The lack of appropriate, child-focused Auslan materials has been reported in the literature as a widespread problem in Australia. This issue is highlighted by Napier and her colleagues (2007), who investigated the barriers faced by parents wanting to learn Auslan and found that families with young deaf children were at a disadvantage due to the lack of sign language resources.

Hearing parents committed to learning sign language are often constrained by factors such as the extent and maintenance of language exposure (Kovelman et al., 2008), coupled with a dearth of financial and instructional support available to access sign language classes and resources. The financial costs experienced by the parents in this study frequently related to the cost of Auslan classes, tutorials and resources, including the purchase of electronic devices such as computers and tablets compatible with specific sign language software. Due to the visual nature of sign languages, tutorial support often takes the form of on-line interactions, video-conferenced classes and video files attached to on-line dictionaries. Families were therefore required to have access to the necessary equipment to support the use of these materials and needed to acquire technological skills to engage with the programs. In addition, although government disability funding is currently available in Australia for deaf children eligible for early intervention, funding models currently do not include parent Auslan tuition in their scope of service because they are not regarded as 'therapy' for the child. Under these funding models, some families were unable to cover the costs of Auslan classes and therefore accessed a reduced level of Auslan support compared to other families who were financially more secure.

A further constraint often mentioned by the families participating in this study was that the Auslan courses available in their communities did not focus on early childhood language or ways in which to engage in typical signed conversations with their young deaf children. Other research studies have reported similar findings and suggest that variable pedagogy and methodology is practiced in many advertised courses, with

many teachers unqualified in their role as sign language instructors (Quinto-Pozos, 2011). Despite the difficulties of learning sign language, most of the parents in this study nevertheless accepted the challenge of dedication and hard work and reported that they believed that the benefits to their bilingual parent-child interactions were worth the effort. However, the parents also reported that, although they were able to communicate in Auslan with their children to varying degrees, they did not have sufficient opportunities to practice with more skillful Auslan communication partners, and therefore could not progress to a higher level of proficiency. They also found that they needed to learn to adapt their signing to a register that incorporated more child-directed language, rather than the more general conversational language usually taught in second-language learning classes (Napier et al., 2007).

6.1.3 Parental language input

Considering the fact that all parents in this study were hearing and that English was their first and only home language, it was not surprising that English was the dominant language use with their children. However, it is important to note that some of the families, particularly those in the high-input group, were able to modify their language input to accommodate the specific communication needs of their child which in turn supported increased language development. In some instances this meant that their Auslan input increased while their English input decreased, and vice versa. The parents who scored high ratings for participation in the bilingual program also frequently supplemented their Auslan input with fluent sign language models in their home and at playgroups. However, despite strong commitment by many families to use both languages, the reality was that many of the children were not receiving adequate Auslan input. This outcome is supported by Yoshinaga-Itano (2003), whose study of predictors to successful outcomes for deaf children found that few families actually used sign language as the primary mode of communication in the home and families did not have sufficient opportunities to rapidly develop fluency or grammatical complexity in a new language.

An important issue highlighted in this study was the impact of reduced language input on deaf children who are reliant on sign language from parents still in the process of learning the language themselves (Moeller & Schick, 2006). On the one hand, limited amounts of sign input can be expected to result in reduced language abilities (Spencer, 1993), but on the other hand this study has shown that, when used in a bilingual partnership, even basic Auslan input can be beneficial for some children. This benefit may have more to do with the parents' sensitivity to engage their child visually than from the use of Auslan per se, but it is nevertheless a valuable communicative experience for children who would otherwise have very few positive exchanges. When the parents were questioned about the reasons for variations in their Auslan input, they gave several explanations. Peter's parents had made a decision that Auslan 'was too hard to learn' and that, with the probability that he would receive a cochlear implant in the coming months, they opted for more oral-aural input than signing. Peter showed a strong preference for Auslan throughout the study, mainly due to very limited auditory experiences, and could not comprehend the spoken language input from his parents unless clear visual and contextual information was present. His language outcomes were amongst the lowest of the eight children. The other parents adjusted their proportion of signing input to match the communication needs and modality preferences of their children. These results also support findings in other studies for changing patterns of modality use by young deaf children (Watson, Hardie, Archbold, & Wheeler, 2008; Yoshinaga-Itano, 2006) and provide support for the importance of child-led modality use, as opposed to adult-directed choice (Stredler-Brown, 2005, 2010). Results of this study also indicate that the parents who recorded the highest Auslan proficiency levels did not necessarily demonstrate the highest levels of Auslan input. This is surprising, as it would normally be expected that higher proficiency levels in a language would result in a higher level of use, but again could be related to the parents' level of sensitivity to their child's communication.

Although imbalance in the proportion of language use is reportedly quite normal in a bilingual context (Baker & Prys Jones, 1998; Genesee, 2004; Grosjean, 2008), an imbalance in bimodal bilingual input by parents who are novice sign language learners has a different connotation for deaf children's language experiences. This is of

particular concern if a deaf child has limited auditory access to spoken language and receives insufficient input in sign language, as was the case for Tiffany and Peter and Oscar. In this respect, it would be more than likely that the main reason for lower input of sign language was due to the lower levels of parents' Auslan proficiency or lack of use of their signing skills, as was the case for Tiffany. However, as noted by Spencer (1993), the level of a parent's sign language proficiency was often less important than the frequency with which they attached meaning to interactions with their children. In other words, the parents' level of sensitivity to what their children were communicating about contributed more to better language outcomes than Auslan proficiency alone.

6.1.4 How the languages were used

With respect to use of grammar, although the parents in this study were aware of the merits of separating the language modalities in order to preserve their different grammatical structures, they commented that 'voice off' Auslan and 'sandwiching' the two modalities in an utterance was often difficult for them to master. When spontaneously communicating with their children at home, the parents therefore tended to use spoken language and added varying proportions of signs to their utterances. This communication approach is similar to the 'third system' proposed by Romaine (1995), who used this term to describe a merging of the two input languages. However, there was a concern in this study, echoed by Van den Bogaerde (2000), that the mixing of spoken and sign language in this way undoubtedly had an impact on the way in which the children acquired the languages. Although there is evidence in the literature that bimodal bilinguals frequently blend spoken and sign language in their discourse (Rinaldi et al., 2014), the type of simultaneous communication used by the parents in this study differed sociolinguistically from the type of code-blending that naturally occurs during bimodal bilingual interactions (Emmorey et al., 2005). Furthermore, it was questionable whether the parents who were in the early stages of learning sign language were blending the languages or merely overlaying English with key Auslan signs.

It is well documented in the literature that sign-supported speech is a natural feature of contact between deaf and hearing interlocutors and is often used between deaf children and their hearing parents (Sutton-Spence & Woll, 1998). However, although simultaneous communication is a common practice in many deaf education programs, there may be problems associated with its use with young deaf children who are still in the process of acquiring their first language. Research studies have found that, when information is presented simultaneously, the messages are not equivalent and the grammars are often compromised (Tevenal & Villanueva, 2009). Tevenal and Villanueva found strong evidence that presentation of language using sign-supported speech severely limited the level of comprehension for deaf students who did not have adequate auditory access to spoken language.

With regard to the eight young deaf children in this study receiving simultaneous input, it was difficult to determine whether the language delays for a number of the children were a consequence of their inability to comprehend the spoken language or due to a reduced level of Auslan input. The auditory profiles of Peter, Tiffany, Oscar and Sam indicated that they were not using their auditory skills sufficiently to process spoken language and they therefore needed increased Auslan input. These children all demonstrated delayed language skills over the course of the study. On the other hand, Andrew and Oliver, whose English language skills increased over the 20 months of the study, benefitted from early Auslan input during a period of time when their access to auditory input was very limited. Their language skills were the highest of the eight children and their parents were in the high-input group for all aspects measured in the study. These outcomes were supported by VanDam et al. (2012), who investigated the quantity of parental language in the home environments of young deaf children. The authors found that, despite access to amplification, many of the children experienced reduced audibility of speech and were especially disadvantaged during periods when amplification acoustic conditions were compromised. Spencer (1993) further supported the findings of this study in suggesting that there is a strong likelihood that deaf children will face severe challenges in acquiring language if they are not able to access spoken language effectively through auditory means and their parents use a limited amount of signing.

Another important issue to consider when discussing the children's ability to process language bimodally was their development of attention control. As has been mentioned earlier, the development of attention control is still emerging in young children and is essentially still at a single-channel stage until they are between four and five years of age (Reynell, 1977). The implication for the children in this study was that most of the children were still in the process of developing the ability to attend to simultaneous dual sensory input. It was therefore debatable whether their attention control was sufficiently developed to allow for the effective processing of two languages while their language skills were still not well developed. This constraint needed to be carefully considered when evaluating the quality of the children's language input, but was not able to be measured with existing assessment materials. It is certainly an area that deserves further research.

A further feature of bimodal input for some of the children in this study was the parents' use of fingerspelling as part of their Auslan discourse. The literature reports that fingerspelling plays an important supporting role in sign language use (Erting, Thumann-Prezioso, & Sonnenstrahl, 2000; Schembri & Johnston, 2007) and is acquired by children aged between two and three years of age if they are exposed to this form of communication from birth (Padden, 1991). Although fingerspelling is regarded as a difficult skill to learn for most adults learning sign language (Quinto-Pozos, 2011), there were several parents in this study who mastered the skill sufficiently well to be able to model the fingerspelling of names and other proper nouns and to encourage their children to imitate or approximate the patterns. Interestingly, their children achieved the highest language outcomes of the eight children. Although these children were not native signers, they realized that fingerspelling was used to name a thing or a person and they incorporated encoded approximations of the manual patterns with their signing.

In summary, when determining the nature of parental bimodal bilingual input during a period in which they are acquiring Auslan skills themselves, this study found that the parents' input to their children was influenced by a number of factors. Firstly, the parents who demonstrated a higher level of participation in the bilingual early

intervention program also attained higher scores for input across a range of measures. Secondly, because the parents' language skills were stronger in spoken language, they were more likely to simultaneously use spoken English combined with Auslan when communicating with their children. Their proficiency in the use of sign language contributed to the proportion of language use, although this factor was found to be less significant than the way in which the parents responded to their child's communication bids. Thirdly, the considerable variation in the parents' quantity and quality of input was influenced by their ability to modify their language input to accommodate the specific communication needs of their child. Analysis of assessment results and videotaped interactions indicated that quantity of input did not necessarily indicate the presence of quality of input. An awareness of their child's auditory functioning was also a factor contributing to quality of input. These factors were taken into account when considering the extent to which the children's outcomes were predicted by the quality of the bimodal bilingual input and the parental sensitivity to their child's communication. These issues will be discussed below.

6.2 Children's language outcomes

6.2.1 Assessing children's language

Although more attention has been paid to the area of deaf children's speech and hearing in recent years, there are very few suitable assessment tools available for assessing the signing skills of deaf children (Rinaldi et al., 2014; Schick, Marschark, & Spencer, 2006; Woolfe, Herman, Roy, & Woll, 2010). Even more of a challenge for this study was to identify bilingual assessment tools that would assess both modalities together (Pizzuto, 2002; Rinaldi & Caselli, 2009) and effectively measure the children's skills in cross-modal language use, language blending and modality preferences. To address the scarcity of appropriate test materials, several assessment tools were designed for this study to measure the dual language skills of the children and the interactive skills of the parents. These specifically designed tools augmented existing

tools such as the MacArthur-Bates CDI (Fenson et al., 1993) and the Functional Auditory Performance Indicators (Stredler-Brown & Johnson, 2001). Due to the fact that the design of the study required assessments to be repeated at bi-monthly intervals, many of the test materials used in this study were informal, functional criterion-referenced materials which could be used repeatedly throughout the year. These assessment tools were developed to be used by and with the parents and incorporated a wide range of communicative interactions that can be effectively used in the natural home environments.

The systematic assessment of children's and parents' skills also provided a way for parents to better understand the impact of their input on their children's language outcomes and gave them opportunities to modify their input and interactions where possible. It was important to present the test materials in such a way that the parents were not intimidated by technical jargon and dense language. The materials were designed so that quantitative data could be depicted in graphs and figures that clearly explained the relationship between variables and helped parents understand the results of the assessments. Analysis and annotation of the videotaped parent-child interactions provided a further way in which parents could directly engage with assessment of the quality of their input. This assessment protocol proved to be an effective tool for many parents, particularly when arrows linked reciprocal utterances and the proportion of language use could be seen in samples of conversations (see Table 7, p.126). Many of the parents commented that, by becoming involved in the process of assessing the impact of their bimodal bilingual input on their children's language outcomes, they learned more about the hierarchy of communication, listening and language skills and could build on this knowledge to improve the quality of interactions with their children (Yoshinaga-Itano, 2000). This was an important outcome for a family-centred early intervention program and reinforced the benefits of parents' participation in their children's assessment process (Brown & Barrera, 1999; Rhoades, 2003).

6.2.2 Children's bilingual outcomes

Analysis of the various assessments and rating scales revealed that the language skills measured for the eight children showed wide variation, both with regard to the size of their vocabularies and the ways in which they communicated bilingually. One of the drawbacks of reporting on separate vocabulary scores such as with the MacArthur-Bates CDI was that the results did not provide enough information about the ways in which the children used their lexicons in bilingual discourse. However, the videotaped records of parent-child interactions did provide valuable data in this regard, with annotations of sample interactions showing the relationship between the two languages in discourse. In addition, data derived from the Bimodal Bilingual Development Scale provided information about the developmental sequence and rate of acquisition of both languages and use of pragmatic skills.

Differences in vocabulary size for the eight children were found to be influenced by the quality of their parents' input and by the richness of language experiences available to each child. Videotaped interactions reveal that Andrew, Lachlan and Oliver harnessed effective bimodal skills to ensure that their conversations with their parents were rich and meaningful. Although their language scores could not be regarded as comparable to typically developing hearing peers, they showed a healthy pattern of growth throughout the study in response to the high level of input from their parents. These children also demonstrated strong pragmatic language skills and made use of strategies such as repairing utterances and maintaining conversation topics in either language to promote richer conversations with their parents. Videotaped records showed that the parent-child interactions in the medium input group lacked the breadth of vocabulary, lexical diversity and topic maintenance of the high-input group, whilst the interactions from the low input group were very rudimentary and repetitive, using basic language in both English and Auslan. The children in this group achieved very low levels of vocabulary growth and minimal use of grammar in either English or Auslan, despite being diagnosed shortly after birth. Although these children met the three primary conditions for positive language outcomes: diagnosis of deafness by three months, provision of amplification devices

and enrolment in an early intervention program by six months (Yoshinaga-Itano, 2003), these advantages did not support enhanced opportunities for language development. Interestingly, the two children whose deafness was the latest to be diagnosed, Lachlan and Oliver, recorded amongst the best language outcomes. Their parents demonstrated a high level of engagement and input throughout the study, possibly in response to a sense of urgency following their children's relatively late diagnosis.

Overall, the children whose parents were classified as high-input level - Andrew, Lachlan and Oliver, developed stronger language skills than the other five children when their skills were measured with the MacArthur-Bates CDI and the Bimodal Bilingual Development Scale. Sam and Max showed slower growth in their vocabularies in both languages, whilst Oscar, Peter and Tiffany recorded very slow growth, indicating a severe delay in English and Auslan. These children's parents were classified as medium and low in their input levels in terms of their bilingual engagement and level of responsiveness to their children's communication. All children's English and Auslan vocabulary scores changed significantly over the duration of the study. In many cases there was a significant relationship between their English and Auslan scores measured with the MacArthur-Bates CDI and their parents' use of the four communication strategies, measured with the Parent-Child Communication Scale: Visual Attention, Responding to Communication, Adapting Communication and Gaining Attention. Although the MacArthur-Bates CDI has been adapted for use with sign language (Anderson & Reilly, 2002), the inventory relies on parents understanding how to describe their child's grammatical structures in Part II, Sentences and Grammar. Whilst this task is not difficult when describing English utterances, most parents unfamiliar with Auslan grammar are not be able to identify or describe the grammatical features of sign language. It was therefore important to provide a developmental framework that incorporated language items in both modalities, which assisted the parents to understand their children's assessment results while at the same time to learn how to describe their bimodal bilingual skills. The scale also included information about the sequence of sign language grammar development and presented language indicators in developmental stages, to match the developmental

sequence of English. The results taken from the Bimodal Bilingual Development Scale were also a useful measure of the children's nonverbal, pragmatic language skills which gave more insight into the functional ways in which they were using their language. In addition, information about the children's development of Auslan handshapes, depicting signs and fingerspelling provided a deeper level of understanding of the stages the children were attaining alongside their English skills.

An additional factor contributing to the effectiveness of parent-child interactions and subsequent language outcomes was the level of intelligibility of the children's utterances. In general, the children's sign intelligibility in this study was consistently rated higher and showed less variability than speech intelligibility. In some cases the parents rated their children's speech as intelligible when in fact the utterances consisted of intonation patterns or jargon that were not intelligible to less familiar listeners. This was particularly true for Tiffany, Sam and Max. It should be noted at this point that the speech and sign intelligibility checklists were not designed to elicit the children's mixed use of the two languages, but only a rating of the parents' ability to understand the child's utterances in a particular modality. However, videotape analysis effectively supplemented the data derived from the scales and showed that the children with the least intelligible speech in fact supplemented their output with gestures and signs, even though most times they were not reciprocated by the parent. In bimodal bilingual terms, it is more likely that the parents were able to discern their children's signed utterances, not because children develop sign language before spoken language developmentally, but because the visual-gestural channel makes use of communication that is more 'visible' by the parents (Fusellier-Souza, 2006).

6.2.3 Children's language modality preferences

The current view with regard to language modality use by deaf children is that most children, regardless of degree of deafness, should be able to communicate in spoken language due to access to cochlear implant technology (Marschark, Lang, & Albertini, 2002). Although there are many studies reported in the literature that suggest that

deaf children who communicate in spoken language develop better language than signing children (Eisenberg, Kirk, Martinez, Ying, & Miyamoto, 2004; Johnson & Goswami, 2010), to date there is no empirical evidence that identifies the best approach to language learning for deaf children (Stredler-Brown, 2010). The findings of this study reinforce the fact that there is no single communication approach that suits all deaf children and that parents' choice for their child's mode of communication is not necessarily the right choice for the child. Despite controlling many of the variables that contribute to language outcomes, the eight children in this study developed their auditory and language skills at different rates and demonstrated a range of communication needs. One of the important findings that emerged from this research was that the children who achieved better language outcomes were those whose parents supported them to lead their own modality preferences. This model of child-led modality differs from many bilingual early intervention programs in which parents and professionals determine the modality their children are to use (Stredler-Brown, 2010). As previously mentioned, this model also differs from other sign bilingual programs, (Knight & Swanwick, 2002; Morgan & Woll, 2009; Schick, Marschark, & Spencer, 2005), in which the sign language is deemed to be the first language of the deaf child and the spoken language, or its written form, is the second language.

It is important to clarify at this point in the discussion that the notion of modality preference by young bilingual deaf children does not discount the use of translanguaging strategies that are features of effective bilingual practice. Within the bimodal bilingual model followed by the parents in this study, the children were encouraged to continue to flexibly use both modalities for a range of communicative functions, a practice that is well supported by current bilingual research (García, 2009; García & Wei, 2013; Plaza-Pust, 2014). It was expected that the children would change their language preferences according to prevailing factors such as their hearing thresholds, device management and environmental constraints such as acoustic conditions. However, the need to determine a deaf child's preferred modality takes on a more urgent dimension in the current deaf education field because most educational programs do not cater for flexible bilingual practices such as those supported by the early intervention program attended by the children in this study. Parents are

therefore faced with the task of selecting a school program that caters to their child's dominant language for learning rather than continue with a child-led approach that supported communication and language development during the early childhood years. Swanwick et al. (2014) suggest that this dilemma requires educational programs to shift from a language policy approach to a 'pluralistic perspective' (p. 305) that supports a less restrictive environment for deaf children's learning and language development.

Analysis of the children's language use revealed that, as a group, they all showed a preference for Auslan in the early stages of the study, although Andrew reduced his Auslan use briefly at the sixth month. At around the eighth month, Andrew, Lachlan and Oliver showed a marked change in modality preference from Auslan to English and sustained this preference, whilst the other five children's preference for Auslan continued for the remainder of the study. Analysis of the assessment data showed that the parents who were more sensitive to their children's communication needs were more likely to adapt their modality use when appropriate. In some instances, the children provided behavioural signals that indicated a need for a modality preference, such as when Andrew persisted in speaking to his Auslan tutor despite her requesting him to "sign to me please" and Oliver remarking: "I don't want to sign any more, Mummy". It is interesting to note that the parents of these two children attained relatively high levels of Auslan proficiency compared to other parents, but their children led their preference for English by the conclusion of the study. The other children were not as explicit in announcing their modality preferences, although their videotaped interactions provided valuable information about the way they preferred to communicate. For example, Oscar's level of engagement improved markedly when his parents began to accommodate his preference for Auslan and increased their sign input in the second half of the study. He began to show delight in participating in simple exchanges and readily imitated and approximated signs that were used in the conversations. Peter's videos also provided insight into his communication needs and showed that his parents were not matching their input to suit his modality preference. The video records showed that he was frequently using gestures and one and two-sign utterances in his interactions, but responses to his communication bids were almost

entirely in English, with occasional reference to visual supports such as objects and pictures to support his understanding.

6.2.4 Children's auditory skills and language outcomes

Many studies have found that deaf children's language development has significantly benefitted from advances in hearing aid and cochlear implant technology (Ching et al., 2013). However, despite ready access to high quality amplification from the point of diagnosis and ongoing auditory management, a number of the children in this study did not develop the auditory skills necessary to process spoken language and therefore required more visual input to support their language development. An review of the children's frequency of device wearing revealed that there was considerable variation in their use of amplification. Peter and Oscar seldom wore their hearing aids or cochlear implants, Max's use of his hearing aid and cochlear implant was inconsistent, Andrew suffered from chronic otitis media for several months which prevented him from wearing his hearing aids and the other four children wore their devices for most of every day.

The children's auditory skills were measured with the Functional Auditory Performance Indicators in the categories of auditory awareness, auditory feedback and integration, localizing sound source, auditory discrimination, auditory comprehension, short-term auditory memory and linguistic auditory processing. Analysis of the children's scores in the hierarchy of listening skills (see Chapter Four, pp. 109-113) revealed that the children who gained effective spoken language skills, Andrew, Lachlan and Oliver, scored considerably higher than the other children in the category of auditory comprehension. At this level they were able to understand linguistic information, identify critical elements in a spoken message and follow developmentally appropriate verbal directions. Peter, Tiffany, Sam and Max attained low levels of auditory comprehension skills, but showed stronger skills in auditory discrimination, in which they could distinguish between environmental sounds and suprasegmental characteristics of speech such as intensity, duration and pitch, but not necessarily

comprehend the meaning of utterances using these features. Attainment of this level of skill indicated that these children were able to access auditory information and detect temporal patterns in the input, but were not yet able to process the information linguistically. Oscar's auditory skills were rudimentary across all categories and were scored predominantly in the auditory awareness category throughout. He appeared to have minimal awareness of the meaning of sound and did not appear to attend to auditory input unless directly prompted to do so.

The scope of this study did not extend to exploring reasons for the variation in the children's language outcomes, other than limitations to amplification and the quality of parental input. Possible reasons could have included limited access to spoken language due to reduced device wearing, auditory processing problems, specific language impairment or a slower pace in adapting to the encoded speech signal from the cochlear implant speech processor. Several research studies support the variability in language outcomes for this study with findings that the degree of a child's hearing loss was not a significant predictor of language outcomes (Davis et al., 1986; Yoshinaga-Itano, 2000), particularly when compared with the mother's communication skills (Moeller, 2000). For some children, their reduced auditory profiles may also have been influenced by the fact that profound congenital deafness may affect the ability to process temporal or serial order information (Dawson, Busby, McKay, & Clark, 2002; Horn et al., 2005; Marschark et al., 2006; Pisoni & Cleary, 2004). Conway, Pisoni, and Kronenberger (2009) proposed that exposure and access to sound may provide a type of 'auditory scaffolding' in which a child learns to identify and use sequential patterns in their environment. In the case of deaf children who have had very few, if any, opportunities to access this temporal information early in their lives, their ability to process spoken language may be severely compromised. Conway et al. also suggested that findings of individual differences in sequencing abilities may explain why some deaf children with cochlear implants attain close to age-appropriate speech and language outcomes, whereas other children with cochlear implants do not.

6.3 Children's outcomes, quality of bimodal input and parental sensitivity

An important finding of this study was that the quality of the parents' input and their sensitivity to their children's communication needs contributed significantly to language outcomes. The findings of this study also reinforced the fact that it was difficult to identify specific factors that singly contributed to the children's language outcomes due to the heterogeneity of the participants and the challenge of controlling the variables that impact on deaf children's language development.

Over the course of the 20 months of data collection, the quality of input the parents provided to their children varied considerably. As has been discussed earlier, when the parents' ratings for the various assessments were considered across the 10 data collection points, a composite level of parental input was identified and the parents were assigned to one of three input levels: high-input, medium-input or low-input. These groups basically remained the same for all aspects of the study: level of participation in the bilingual program, Auslan proficiency, English and Auslan input, use of specific communication strategies and sensitivity to the children's communication, including accommodation of the children's modality preferences. Overall, the children demonstrated very different patterns of language growth and these variations in skills were found to be influenced by their parents' sensitivity to their language needs. Parental sensitivity was demonstrated by the level of response to the children's communication and by the extent to which they modified the modality of their input to match their child's demonstrated language preferences. Sensitivity also involved the parents' awareness of their children's auditory skills and how effectively they were using their listening devices in their home environments. These aspects of parental behaviour were measured with the Bilingual Rating Scale and the Auditory Management section of the Parent-Child Communication Scale. The parents who demonstrated a higher level of sensitivity were more alert to following their child's lead in conversation, play and modality use and utilized non-verbal cues to extend their conversations. In turn these children were more likely to seek further interactions which gave them opportunities to practice their skills more frequently.

Parent-child interaction is a transactional process in which the child contributes personal attributes such as communicative competence, social-emotional skills and disposition (Paavola, 2006). Andrew, Lachlan and Oliver demonstrated many of these attributes and were persistent in maintaining their topics of interest, often changing from spoken to sign language or fingerspelling to achieve joint understanding. The other five children exhibited a different set of attributes, ranging from diffidence to resistance, which impacted on the nature of their interactions with their parents. Analysis of the parents' and children's assessment data provides evidence for a relationship between the interactive behaviour of the parents and the language outcomes of their children. This finding is supported by Janjua et al., (2002) in their study of the effects of parental style of interaction on the language development of very young severe and profoundly deaf children. Janjua and colleagues found that parents facilitated their children's language best when they were highly responsive to their children's interactions and provided a high level of contingency to their communication bids. In this study, videotaped interactions confirmed that there was a wide variation in parental interactive styles within the group, with particular note that the parents of the children with the higher language scores used a wider range of vocabulary, were more able to adapt to their child's topic of conversation, facilitated longer utterances and accommodated their children's modality preferences.

Although all parents were still in the process of learning Auslan, the parents of Andrew, Lachlan and Oliver in the high-input group were able to effectively adapt their emerging sign language skills to satisfy the communication needs of their children. The parents in the medium and low-input groups were not as skilled in facilitating their children's communication and language development and would have benefitted from explicit support in the form of interactive coaching from professionals trained in this area of intervention. For deaf children with minimal communication and language skills, it is paramount that interactive strategies are implemented so as to promote satisfying exchanges and rewarding experiences early in the child's development. However, it is important to question whether the parents of Oscar, Sam and Max in the medium-input group may have been constrained by developmental issues impinging on their children's communication. Videotaped data showed that these

three children were difficult to engage in conversation and needed frequent intervention to redirect their attention to communication. All three children tended to be more object-oriented in their play and frequently resisted interactions with people. Their fleeting attention also created challenges for effective input of sign language and other visual supports. Peter's and Tiffany's language outcomes were also influenced by the low quality of input they received from their parents. Neither of these children was making use of auditory input to process spoken language and they were not receiving adequate Auslan input to satisfy their language needs. Interestingly, although Oscar's auditory and language skills were the lowest in the group of eight children, his parents were included in the medium-input group due to their level of participation in the bilingual program and their change in modality use in the second half of the study. Again, interactive coaching would have been timely for Oscar's parents, for although they showed commitment to participating in the bilingual program and were developing their Auslan skills, they needed more guidance in the first half of the study to implement strategies that effectively engaged Oscar and limit his resistant and oppositional behaviour.

6.4 Videotaped data

Analysis of the videotapes taken of the parents and children provided insight into their natural interactions. The use of ELAN proved to be a valuable approach to annotating, analysing and documenting recorded audio and video data. Video clips of parent-child utterances and communicative behaviours could be mapped for ease of navigation and voiced and signed utterances could be annotated at the exact point of time at which they occurred (Goswell, 2012). Such a level of precision provided a chronology of sequenced utterances and enabled the parents to gain a deeper understanding of the quality of their interactions in the eight categories that were to be analysed.

Although the spontaneity of communication and play often created challenges in eliciting the true nature of the parent-child interactive and bilingual skills, in general the video analyses played a useful role in showing the parents the ways in which they

facilitated their children's communication. The video analyses also gave them insight into the ways in which they could modify or improve their interactions and language input, whether their language input was topic-controlled, didactic and repetitive or used minimal vocabulary variation. Analysis and annotation of the video records provided evidence of the children's attention to communication, their use of pragmatic language skills and the ways in which the parents reinforced turn-taking, pausing and eye contact. The videos also highlighted the importance of guiding parents' observations of their children's nonverbal communicative behaviours in order to maximize opportunities to respond reciprocally as frequently as possible. Importantly, when used as an accompaniment to assessment results, the video analyses provided a valuable visual dimension to the wide range of parental interactive styles and a deeper understanding of the environmental conditions that impinged on the children's language experiences.

6.5 Overview of children's participation in the study

The impact of the parents' bimodal bilingual input on their children's communication and language development was influenced by numerous factors. Although assessment results confirmed that each child's cognitive development was within the normal range, the children displayed marked differences in their temperaments, their communication styles and their auditory profiles. The following section provides an overview of each child's characteristics and the ways in which they responded to their parents' bilingual input.

6.5.1 Peter

Despite early diagnosis of his deafness at two months of age, Peter's communication and language skills were significantly delayed for the duration of the study. A range of factors have been identified as contributing to his language delay, including his home language environment, the level of parental language input, his parents' Auslan

proficiency, his infrequency of device wearing and his poor health in the first half of the study. Due to recurrent middle ear pathology, Peter was frequently unable to wear his hearing aids and had minimal access to spoken language during these times. He received a cochlear implant in his right ear in the final month of the study. An additional factor to be considered was Peter's mother's acknowledged difficulties in adapting to the diagnosis of her son's deafness shortly after his birth and the subsequent busy schedule of early intervention and audiology appointments following diagnosis. Although Peter's parents expressed their commitment to participating in a bimodal bilingual early intervention approach, they did not adapt well to this approach. Despite Peter's strong preference for Auslan, their sensitivity to his language needs did not reflect his modality preferences. Most of their language input was in English, despite Peter's inability to process spoken language through audition. Furthermore, due to his very limited communication skills, Peter was unable to socialize with his peers and was dependent on his immediate family for his interactive experiences. Unfortunately these experiences did not provide adequate opportunities for Peter to gain language.

6.5.2 Andrew

Andrew experienced episodes of chronic middle ear infections and effusion early in the study, with inconsistent device wearing during these times. His assessment results and video analyses indicate that his communication and language skills increased steadily over the 20 months of the study. He displayed positive growth in his bilingual skills and showed clear modality preferences during the study, with English his preferred modality by the conclusion of data collection. At this point, Andrew's intelligibility and confidence increased and he resisted communicating in Auslan. Andrew's parents demonstrated the highest level of participation in the bilingual program by acquiring a conversational level of Auslan skills, accessing a wide range of Auslan resources and involving extended family members in bilingual activities. His parents' high level of sensitivity to his communication also contributed positively to his language outcomes and effectively scaffolded his language development. His confidence to communicate

and socialize with a range of adults and peers were also factors that contributed to his positive outcomes.

6.5.3 Tiffany

Tiffany's parents' participation in the bilingual program increased during the study, reaching a level of 3 out of a possible 5 in the final months. Although Tiffany consistently wore her listening devices and her cognition and other developmental domains were within normal limits, her communication and language skills showed very slow progress throughout the study. Her Auslan skills showed more growth than English, but were very delayed for her age and she was reticent to express herself unless prompted. Despite her parents' relatively high level of Auslan proficiency, their signed input with Tiffany was surprisingly low. In terms of English skills, Tiffany showed minimal comprehension of spoken language unless it was accompanied by sign, gesture or contextual information and much of her communication was in the form of direct imitation. Her vocalizations were very soft and often barely audible and she resisted an increase in volume level during her cochlear implant mapping sessions. A factor contributing to Tiffany's lack of confidence to communicate was her diffident and anxious disposition, which her parents believed was a consequence of her extreme prematurity and her fragility in the early months of her life. Despite frequent attendance at childcare, her reticence to spontaneously communicate did not improve and remained as a significant limiting feature during this study.

6.5.4 Oscar

Oscar's communication and language skills were very slow to emerge during the study, particularly his spoken language. Lack of amplification since diagnosis of his deafness was undoubtedly a major factor contributing to his challenges in comprehending and expressing spoken language. Oscar received his bilateral cochlear implants just prior to his commencement in the study, but resisted wearing them in the same way that he

resisted wearing his hearing aids following his diagnosis. Consequently, his auditory skills were very slow to develop and did not progress to a level that was sufficient to support his language acquisition through audition. Another factor to be considered when evaluating Oscar's reduced communication and language development was his very limited attentional skills and his impulsive and oppositional behaviour. As a physically strong and active child, Oscar encountered a high level of frustration in his lack of ability to understand speech and communicate his thoughts and needs. He showed this frustration in physical ways, such as pulling off and damaging his speech processors and refusing to give eye contact. Parental language input was predominantly English during the first half of the study then gradually changed to become Auslan dominant after that time. Video records showed that Oscar's challenging behaviour lessened considerably later in the study, once his parents began to communicate with him more in Auslan. From the time they became more aware of his preference for Auslan, Oscar's parents showed higher levels of participation in the bilingual program and modified their interactive behaviours and sensitivity to their son's communication.

6.5.5 Sam

Sam's communication and language skills were significantly delayed throughout the study, due to a range of factors. These factors include his limited use of auditory information, his object-oriented play and his frequent resistance to engagement with communication partners. Sam wore his cochlear implants consistently and his mapping results indicated that he received stable auditory input through his speech processors. However, despite access to sounds across the speech spectrum, Sam showed no evidence of comprehending spoken language unless it was paired with visual supports such as Auslan, pictographs or contextual cues. Although he could discriminate discrete syllabic speech patterns, Sam's linguistic auditory processing skills were significantly delayed and most of his English utterances were in the form of intonation patterns or vocal imitations of an adult model. For the duration of the study, Sam showed a preference for Auslan and was more spontaneous with this modality, using

combinations of two or three signs in phrases. However, whilst his parents showed a moderately high level of participation in the bilingual program and were sensitive to his communication needs, Sam's preference for Auslan was not always acknowledged. This lack of sensitivity to modality choice resulted in many unsuccessful communication bids and reduced reciprocity and may have contributed to Sam's lack of spontaneity in initiating conversations with communication partners.

6.5.6 Lachlan

Lachlan's parents showed a high level of participation in the bilingual program, with frequent use of Auslan resources and attendance at bilingual events such as playgroups, camps and family days. Despite adequate auditory access to spoken language and consistent wearing of hearing aids, Lachlan's spoken language skills were slow to emerge. His modality preference for most of the study was Auslan and he showed an impressive ability to fingerspell names of people and objects. Lachlan was more likely to use a spoken word or phrase if he knew the sign for it and had previously signed it in spontaneous utterances. He demonstrated idiosyncratic communication needs and required parental awareness and support to assist him to communicate effectively. In the first year of the study, Lachlan was not able to comprehend spoken language unless it was accompanied by either Auslan or visual cues, such as photos or pictographs. He was unable to spontaneously express himself verbally, but could effectively communicate in sign using three-sign utterances and fingerspelled words. He could also hum and sing nursery rhymes and favourite songs with tuneful, melodic phrasing, but using only the vowels of the words in the songs.

Early on in the study, Lachlan's parents expressed their concern about his late diagnosis and the possible implications for his language development. The results of language assessments, however, indicated a possible auditory processing disorder or specific expressive language delay. By using augmentative strategies such as Auslan, pictographs, fingerspelling and drawing, Lachlan developed effective ways of

communicating and his spoken language skills gradually developed towards the end of the study.

6.5.7 Oliver

Oliver developed an effective repertoire of bilingual skills during the study, with steady growth in English and Auslan and strong pragmatic language skills, indicating his use of social communicative behaviours. His parents' Auslan proficiency was the highest level in the study, with Oliver's mother gaining her signing skills through an accredited Auslan certificate course. They showed a high level of participation in the bilingual program by attending bilingual playgroups, camps and family days and by making effective use of Auslan resources. Oliver's parents acknowledged his change in modality preferences from Auslan in the first eight months to English in the second half of the study, but continued to expose him to both languages. He was an attentive listener to spoken conversations and made effective use of his residual hearing and listening devices to develop spoken language skills. Oliver received a cochlear implant in his right ear in the final three months of the study and adapted well to the auditory input it provided. Undoubtedly, Oliver's parents' high level of sensitivity to his communication needs contributed positively to his language outcomes. They continually expanded his vocabulary in both languages and frequently encouraged him to repair and clarify his utterances. By the conclusion of the study, Oliver had become a competent communicator in spoken language, with confidence to interact with a wide range of communication partners.

6.5.8 Max

Max's parents showed commitment to participating in the bimodal bilingual program and accessed a variety of Auslan resources to improve their signing skills. Over the duration of the study, they gained a moderate level of proficiency in Auslan, with a rating level of 3 out of a possible 8. Despite adequate auditory access to spoken

language with his cochlear implant and hearing aid, Max was not able to process spoken language through audition alone. Max's parents found gaining and maintaining his attention to be a challenge and limited their utterances to formulaic phrases about familiar routines so as to accommodate his short attention span. His parents found that they had more success in gaining and maintaining his attention when they used Auslan, together with visual augmentative strategies such as pictographs. Max was able to produce short spoken utterances in highly structured and context-bound discourse, such as in speech therapy sessions, but was unable to transfer these skills to spontaneous conversations. Case notes and video data showed that, when augmentative strategies such as picture-based visual schedules and aided language displays were used, he was more able to retrieve words that he had acquired, but was unable to express these words spontaneously. Considering the results of his language assessments and his auditory profile at the conclusion of the study, Max's developmental pattern suggested the presence of a pervasive developmental disorder which would require further investigation.

6.6 Implications of the study

The single case approach used for this study provided many opportunities to explore the factors that contributed to the language outcomes of young deaf children exposed to a bimodal bilingual input from their hearing parents. Even though many of the variables known to influence deaf children's language outcomes were controlled, the children developed very different auditory and language profiles. The findings of this study will no doubt encourage parents of deaf children and professionals in the deaf education sector to consider issues related to choice of language modality, quality of parent-child interactions and the nature of bilingual early intervention support during the children's early years of language development. This study also challenges educators to consider the benefit provided by a bimodal bilingual early intervention program in identifying a deaf child's preferred language for future learning.

The research literature contains strong evidence for the benefits of bilingualism for deaf children in providing them access to a rich language environment during the early years of development (Knoors et al., 2014). Even though there are questions about the efficacy of previous claims made by educators on the merits of bilingual programs for deaf children (see Marschark, Tang, & Knoors, 2014; Mayer & Leigh, 2010), the fact remains that there are valid reasons for exposing young deaf children to both spoken and sign language in their early years of development. One of the many implications of this study's findings for hearing parents of deaf children is that raising a deaf child involves more than merely determining the modality of input. Despite the fact that the parents expressed a commitment to communicating bimodally with their children, there was a wide variation in their ability to adapt to this approach.

Several reasons were identified for the variations in the parents' adaptation to the bilingual program. Firstly, the uptake of sign language is easier for some parents than others, which impacts on the quality and quantity of sign language input to the children. The scarcity of high quality, readily available resources in many communities is also a matter that needs to be addressed. Secondly, parents differ in their knowledge of the developmental frameworks that underpin their children's skill development. Some parents are therefore more aware of the amount and type of input needed to satisfy their children's communication needs and are more alert to signals that additional or modified input is needed. Thirdly, the fact that most parents of deaf children are hearing does not assume that they understand the most effective ways to stimulate their deaf child's spoken language or auditory development. Structured language and listening activities, linked with Auslan, should therefore be a feature of the early intervention program. Parents need to understand that listening devices do not automatically assure a child of spoken language skills. Fourthly, even though a family-centred approach promotes parents as knowing their children best, some parents require more guidance and support than others to develop sensitivity to their children's communicate needs. In this study, several parents would have benefitted from explicit interactive coaching based on evidence-based principles such as those used in other early intervention programs for children with additional developmental needs (Rush & Shelden, 2011). However, the most important message

for parents should be that their interactions with their children need to be enjoyable and rewarding. Despite the numerous studies that have found that most hearing parents use sign language less frequently and with less grammar (Lederberg, Binz, Mclntyre, & McNorton, 1989; Swisher & Thompson, 1985), this study has shown that it is not so much about the fluency of the signed input, but the way in which the parent contributes to positive parent-child interactions by engaging the child and building on existing language skills.

A further implication of this study is that intervention professionals need to support parents to recognize the value of child-led modality preferences. The bimodal bilingual intervention program attended by the families participating in the study followed a strong philosophy that regarded children as the best determinants of the language modality that was appropriate for their communication needs. This approach differs from other early intervention models which assign the choice of modality to parents and professionals (Stredler-Brown, 2010). The outcomes indicate that young deaf children may benefit from leading their own modality choice, but that their parents need to be aware of when and why their language input needs to be modified. At the commencement of this study, the parents all expressed their wish that their children would acquire intelligible English as their dominant language, but they accepted the philosophy of the intervention program that promoted the use of both spoken and sign languages. At the time, they also accepted the premise that there is no research evidence that sign language interferes with speech development (Hyde & Punch, 2011; Preisler et al., 2005; Yoshinaga-Itano, 2006), so were comfortable in their decision to engage with the bilingual model of intervention. For this model to be effective, children's communicative and interactive behaviours, together with their auditory profiles, must be closely monitored so that their language needs are fully understood and appropriately catered for. Frequent attention must also be given to the children's audiological management, including their device use and acoustic environments, together with their development of attention control. The children's ability to shift attention between visual and auditory input is a skill that often requires facilitating in bimodal bilingual interactions and is frequently overlooked by parents and professionals.

An important issue to consider with young deaf children is the risk to their socio-emotional development when they experience ongoing frustration with communication breakdowns. Although shared communicative competence between parent and child has been found to promote a child's socio-emotional development (Hintermair, 2006), the outcomes of this study show that shared communicative competence does not occur if the child does not share the parents' language modality. In addition, the children's level of intelligibility is a factor to be considered, as it has been shown to influence the proportion of reciprocal utterances in parent-child interactions. The findings of this study confirmed that parents consistently rated their children's sign intelligibility higher than their speech intelligibility, but did not necessarily adjust their modality input to ease the communication process. For the children who were delayed in their linguistic auditory processing skills or who experienced periodic reduction in hearing thresholds, ready access to a visual-gestural language increased their engagement with their parents and allowed the communication process to continue. In many cases, when their auditory skills improved, their preference for sign language decreased and they engaged in more spoken conversations.

Finally, despite the numerous positive outcomes reported for some children in the study, it cannot be claimed that the bimodal bilingual approach produced optimal language outcomes for all the children. Although there did not appear to be any negative effect related to this intervention approach in general, the findings indicate that it is difficult to predict outcomes due the variability in parents' competencies and children's learning styles. With respect to age of diagnosis and early enrolment in early intervention, this study did not replicate the findings of other studies that found that early diagnosis of deafness, enrolment in early intervention and early amplification promoted better language outcomes (Apuzzo & Yoshinaga-Itano, 1995; Wake et al., 2005; Yoshinaga-Itano, 2003). The children in this group who matched these variables did not necessarily develop the stronger language skills and, interestingly, the child with the best language outcomes was one of the latest diagnosed children in the group. The reasons for these differences could be related to the fact that the parents

of the later-diagnosed children commented that they were 'making up for lost time' and were anxious to maximize opportunities for their children to gain language.

6.7 Limitations of the study

Although the case study design chosen for this study allowed for a deep level of investigation into the research questions, there were several limitations to the study. Firstly, the participants were enrolled in a bimodal bilingual intervention program that is not a mainstream intervention model, therefore cannot be considered as representative of the experiences of most parents of deaf children. Secondly, the small number of participants limited the degree to which the findings can be generalized for other deaf children. Thirdly, many variables were controlled in this study, but other factors such as home environments, styles of parental interaction, parental sign language learning abilities and children's unforeseen developmental challenges were not able to be controlled or assessed. In order to statistically demonstrate the influences of bimodal bilingual input on deaf children's language development, further studies with larger sample sizes will be needed. In addition, whilst there were strong correlations between parental sensitivity to communication and children's language outcomes in some cases, a more comprehensive inventory of parent communication strategies would have allowed for a deeper understanding of why some children were so delayed in their development of both languages.

6.8 Recommendations for practice

6.8.1 Modality choice

In the context of a bimodal bilingual early intervention model, it is important to clarify that modality choice does not imply that one of the languages is deactivated when a modality is 'chosen'. The outcomes of this study indicate that young bilingual deaf children are likely to change their modality preference or language choice frequently,

depending on a range of influences such as hearing thresholds, auditory processing abilities, language input and learning styles. In a similar way to the concept of translanguaging, modality choice in a bimodal program should be viewed as a dynamic, changing relationship between spoken and sign language and not a polarizing force that separates the languages. In unimodal bilingual programs, hearing children are able to access at least one of the languages at any given time, thus allowing for at least one language to be acquired. However, in the case of a bimodal bilingualism, it is very often not clear which language the child is able to access as many of the factors that support language access are often difficult to discern.

Irrespective of the degree of deafness or type of listening devices, determining the best language modality for a very young deaf child is a challenge for parents and professionals (Stredler-Brown, 2010). More recently, the prevalence of earlier diagnosis and cochlear implants has meant that fewer parents choose bilingual programs as educational options for their children with severe and profound deafness. However, although communicating with their deaf children in spoken language is certainly perceived as an 'easier' option for hearing parents, this study has highlighted that there may be unseen developmental challenges that impinge on a child's ability to develop spoken language naturally. Over 40 percent of deaf children are currently diagnosed with additional developmental needs (Fortnum et al., 1996; Holden-Pitt & Diaz, 1988; Stredler-Brown & Yoshinaga-Itano, 1994). This adds another layer of complexity to the issue of determining the most appropriate modality to use while the children are very young, especially when developmental issues emerge over time. It also highlights the risks involved for professionals whose role is to determine the communication mode to be used by the family (Stredler-Brown, 2010). The children in this study were all assessed at the outset as developing cognitive skills within the normal range, with no additional needs and aided hearing thresholds that were adequate for detection of sounds across the speech spectrum. Based on these factors, it could be assumed that spoken language would be developed by all eight children. However, there were other developmental challenges that emerged over time that impeded their acquisition of language through audition. These included health issues, undiagnosed auditory and language processing disorders and other pervasive

developmental disorders. It is not uncommon for many developmental challenges such as these to emerge in the second or third year of a child's life, conditions that may significantly affect their outcomes for language development (Edwards, Frost, & Whitham, 2006; Nikolopoulos, Archbold, Wever, & Lloyd, 2008).

Understanding the modality a deaf child prefers to use for specific language functions provides valuable information for future educational program choices. This knowledge also assists parents and educators to adjust their language input to accommodate the children's immediate communication needs. One of the recommendations to highlight from this study is that, if parents and educators are to determine the modality that best suits a deaf child's learning needs, the languages should be presented separately at least for part of the time. This may be achieved through 'sandwiching' the languages in the same utterance, 'one person, one language' (Döpke, 1992) or a designated language for specific routine daily activities. If young deaf children are only exposed to both modalities presented simultaneously, there is a concern about their ability to process two different modes of language input at the same time, due to limited memory and attention capacities (Marschark & Spencer, 2006). This strategy of separating the languages may at first be a challenge for the parents, so it is important that they are provided with language models who are skilled in this bilingual approach and who can guide interactions between parents and their deaf children.

In short, there is no 'one-size-fits-all' approach to communication – the best outcomes for deaf children will be achieved by supporting their specific language needs within a bilingual framework in which access is provided to both spoken language and sign language.

6.8.2 Developing language

The findings of this study have highlighted the risk of assuming that provision of high quality hearing aids and cochlear implants will guarantee that deaf children will develop spoken language. This may also be the case for children with milder hearing

losses, with evidence reported in the literature that there are also risks of language delay for these children (Davis et al., 1986). Despite the common belief that cochlear implants provide deaf children with ready access to spoken language, findings from research studies show evidence that there is great variability in deaf children's language outcomes (Belzner & Seal, 2009; Inscoe, Odell, Archbold, & Nikolopoulos, 2009; Pisoni, Conway, Kronenberger, Horn, & Henning, 2008). This variability was certainly found for the children in this study and highlights the need for a language 'safety net' that is provided by a visual language that is accessible to the child when auditory input is compromised. Professionals therefore need to be aware of why parents may choose a bilingual approach for their deaf child, rather than opt for an oral-aural approach from the outset. In many respects, the strength of this approach for parents appeared to be that it did not have to be a long-term option and that it was especially useful during a period of time when their children's communication skills were still developing. With this approach, by providing access to two languages in different modalities, children are given enhanced opportunities to process language, particularly when their hearing thresholds are unstable or if their linguistic auditory processing skills are under-developed.

6.8.3 Parent Auslan proficiency

An important recommendation for practice highlighted by this study is that, if deaf children are to be engaged in bimodal bilingual programs, parents must be facilitated in their learning of Auslan. Therefore, a range of sign language tutorials and materials that suit the learning needs of busy parents and extended family members needs to be made available. In addition, funding programs, both government and non-government, need to broaden their funding criteria to include Auslan tuition for parents, along with the current recognized therapy options for the children. The responsibility of identifying and supplying these resources will require a collaborative effort involving early intervention programs, Auslan linguists and agencies whose role includes supporting the learning needs of deaf children and their families. The use of video-

conferenced bilingual early intervention and sign language programs is also highly recommended as a way of providing access to geographically remote families.

6.8.4 Supporting parent-child interactions

A fundamental premise of the Family Centred Early Intervention approach is that parents support their children in the ways families know best (Moeller et al., 2013). One of the major findings of this study was that parental sensitivity to their children's communication needs was a strong contributing factor to language outcomes. However, the results of the study show that not all parents intuitively developed a high level of sensitivity, which ultimately led to reduced child-language skills and limited parent-child interactions. In retrospect, several of the parents in this study would have benefited from specifically targeted interactive-coaching strategies to help them identify the link between their children's slow language growth and their low level of sensitivity. By watching videotaped records of their own parent-child interactions, parents could be coached to increase their observation skills, to modify their communication strategies and to recognize their children's modality preferences. Furthermore, by guiding and collaborating with the parents to critically reflect on the effectiveness of their interactive strategies, timely modifications could be made to their quantity and quality of input and their communication style.

Rather than disempowering parents, the use of a coaching style of interaction is in fact seen as capacity-building and a way in which to identify families' existing skills, while at the same time support their development of new skills (Rush & Shelden, 2011). This model offers a more systematic approach for ensuring that new learning is planned jointly (Dinnebeil et al., 2001) and that productive feedback is used to further consolidate newly acquired skills. Early intervention programs should therefore provide a framework of collaborative parent-professional partnerships that promote a level of participation and engagement. Rush and Shelden (2011) have identified several research-based practices that facilitate optimal outcomes for children who are supported by early intervention services. The practices include joint planning,

observation, action, reflection and feedback. By incorporating these strategies in strength-based partnerships (Clabaugh, 2005) with parents, there will be many opportunities to gain a deeper insight into the ways in which to strengthen their parent-child interactions and communication.

6.8.5 Assessment tools

The data collected for this study showed the value of systematically measuring language outcomes of children exposed to bimodal bilingual input from their parents. The assessment tools were selected to elicit the skills the parents used to engage their children bilingually and to measure the impact of their input on their children's language outcomes. This was a significant feature of the study, in that very little research has been carried out on bimodal use with young deaf children in the past, particularly in relation to Auslan and English input. By using assessment tools specifically designed for parents and children engaging in bimodal bilingual programs, better early childhood intervention practices will be supported in the future. Practitioners should ensure that bilingual intervention programs are based on data collected from studies of young bilingual children, rather than merely adapting spoken language developmental scales or simplifying frameworks designed for older children.

If the impact of bimodal bilingual input on children's language outcomes is to be measured effectively in the future, more attention needs to be paid to the development of appropriate assessment tools, particularly for deaf children under six years of age. Use of annotated videotaped interactions is highly recommended, particularly for analysis of sign language use and nonverbal communication. In addition to child-focused assessments and developmental scales, a feature of this study was that many of the measurement tools were parent-rated, which provided the parents with valuable opportunities to reflect on the role they played in their children's language development. Furthermore, many of the scales in this study were parent-focused, an area of assessment that has been noticeably lacking in the early intervention field to date. This was valuable family-centred practice which helped

parents better understand their influence on their children's language development and allowed them to become more aware of the quality of their input to their children. This outcome was similar to the findings of Lichtig et al. (2011) in their study on the assessment of deaf and hearing children's communication. They found that mothers' observations and reports of their children's communicative skills made valuable contributions to understanding more about their children's language development and complemented other standardized and criterion referenced assessments.

6.9 Future research

The results of this study support the use of quantitative and qualitative data to measure the impact of English and Auslan input on the language skills of young deaf children. However, the findings are not specific to English and Auslan and it is suggested that the recommendations for practice apply to practitioners in programs using other spoken and sign languages. Due to the dearth of research studies devoted to this area of deaf education, there is much need for future research to be conducted into bilingual acquisition, particularly for deaf children aged between birth and six years. Suggested areas would include identifying appropriate assessment tools to augment those that were specifically developed for this study, particularly a video-based receptive and expressive sign language test for use with children under six years of age. One of the shortcomings of the bimodal bilingual assessment tools used in this study was that they did not accurately describe and assess the full repertoire of the children's bimodal language skills, particularly in terms of their mixed and blended language use and their changing modality preferences. Research is therefore needed to expand on the existing Bimodal Bilingual Development Scale, with attention paid to ways of recording language blending and identifying specific lexical features as they emerge.

Future research is also required on the learning styles of adults taking up sign language. Unlike other languages adults choose to learn for their personal interests, parents and caregivers who wish to communicate in sign language with young deaf

children need to learn quickly and efficiently, with ready access to resources. Research into the most effective methodology for structured, technology-based sign language tuition would be the most sensible solution to the scarcity of personal Auslan-fluent tutors and the wide geographical spread of the Australian population. Furthermore, additional research into a more robust measuring tool for adult second language Auslan acquisition would contribute to this area of parent learning.

Finally, with the volume of data collected for this research, a follow-up study on the eight children in this cohort would provide valuable information about their developing language skills, their ongoing modality preferences and the types of educational programs in which they were enrolled following early intervention.

6.10 Conclusion

This study explored the language outcomes of eight young deaf children exposed to bimodal bilingual input from their hearing parents. The impact of the English-Auslan bilingual approach was measured in terms of the quality of the bilingual input, which included the parents' level of engagement with the bilingual approach, their Auslan proficiency, their language use and their accommodation of their children's changing modality preferences over the duration of the study. An important finding was that the quality of the parents' input and their sensitivity to communication contributed significantly to their children's language outcomes. The study also found that, with the heterogeneity of deaf children and the numerous factors contributing to their language outcomes, there is no 'one size fits all' solution to communication. However, the results do indicate that there is merit in a flexible communication approach that promotes child-led modality preferences, particularly if developmental issues emerge that may impede access to spoken language. Furthermore, the study has shown that children with similar hearing thresholds and listening devices may develop very different auditory and language profiles, due to factors such as variable sensory processing abilities and learning styles.

In this study, the parents who were more sensitive to their children's communication needs facilitated better language outcomes. They demonstrated their sensitivity by incorporating a range of interactive strategies that maximized engagement and accommodated their children's changing language modality preferences. These parents adapted effectively to the bimodal bilingual approach and were able to provide rich language experiences that satisfied the children's bilingual communication needs. For the parents who demonstrated less effective interactive skills, it is recommended that additional support is provided with more focused interventions which improve their style of parent-child interaction. There is also a strong recommendation that parents have access to high quality Auslan tutorials that include early childhood vocabulary and phrases to support their conversational skills. In addition, the findings of this study reinforce the need for assessment tools that are sensitive to the communication and language needs of young deaf children, particularly in terms of bimodal language development.

Finally, this study has found that despite controlling many child language variables, the impact of bimodal bilingual input was different for each one of the eight children. The findings have provided insight into the developmental paths taken by deaf children as they determine the language modality best suited to their communication needs. The pivotal factor that emerged as the predictor of language outcomes was the sensitivity of the parents to provide an input that accommodated their children's changing communication skills and modality preferences. However, some parents were able to respond better than others to the challenge of adapting their communication and modifying their input when necessary. Intervention programs must therefore form strong partnerships with parents to ensure that their engagements with their deaf children are satisfying and reciprocal and to ensure that they maximize opportunities to achieve the best language outcomes for their children.

References

Abu Bakar, Z., Brown, P. M., & Remine, M. D. (2010). Sensitivity in interactions between hearing mothers and their toddlers with hearing loss: The effect of cochlear implantation. *Deafness and Education International, 12*(1), 2-15.

Ackerman, J., Kyle, J., Woll, B., & Ezra, M. (1990). Lexical acquisition in sign and speech: Evidence from a longitudinal study of infants in deaf families. In C. Lucas (Ed.), *Sign language research: Theoretical issues* (pp.337-345). Washington, DC: Gallaudet University Press.

Acredolo, L. P., & Goodwyn, S. W. (2000). *The long-term impact of symbolic gesturing during infancy on IQ at age 8.* Paper presented at the meetings of the International Society for Infant Studies, Brighton, UK.

Ainsworth, M. D. S., & Bell, S. M. (1970). Attachment, exploration, and separation: Illustrated by the behaviour of one-year-olds in a strange situation. *Child Development, 41,* 49-67.

Akamatsu, C., & Mayer, C. (1999). Bilingual-bicultural models of literacy education for deaf students: Considering the claims. *Journal of Deaf Studies and Deaf Education, 4*(1), 1-8.

Allen, B. M. (2002). ASL-English bilingual classroom: The families' perspectives. *Bilingual Research Journal, 26*(1), 1-20.

Anderson, D. E., & Reilly, J. S. (1997). The puzzle of negation: how children move from communicative to grammatical negation in ASL. *Applied Psycholinguistics, 18*(4), 411-429.

Anderson, D. E., & Reilly, J. S. (1998). 'PAH! The acquisition of adverbials in ASL. *Sign Language & Linguistics, 1(2)*, 117-142.

Anderson, D. E., & Reilly, J. S. (2002). The MacArthur communicative development inventory: Normative data for American Sign Language. *Journal of Deaf Studies and Deaf Education*, *7*(2), 83-106.

Appel, R., & Muyken, P. (1987). *Language contact and bilingualism.* London: Edward Arnold.

Apuzzo, M. L., & Yoshinaga-Itano, C. (1995). Early identification of infants with significant hearing loss and the Minnesota Child Development Inventory. *Seminars in Hearing, 16*(2), 124-139.

Bain, B., & Yu, A. (1980). Cognitive consequences of raising children bilingually: One parent, one language. *Canadian Journal of Psychology, 34*, 304-313.

Baker, A., van den Bogaerde, B., & Woll, B. (2008). Methods and procedures in sign language acquisition studies. In A. Baker & B. Woll (Eds.), *Sign language acquisition* (Vol. 14, pp.1-49). Amsterdam: John Benjamins Publishing Company.

Baker, A., & Woll, B. (Eds.). (2008). *Sign language acquisition* (Vol. 14). Amsterdam: John Benjamins Publishing Company.

Baker, C. (2003). Biliteracy and transliteracy in Wales: Language planning and the Welsh national curriculum. In N. Hornberger (Ed.), *Continua of biliteracy* (pp. 71–90). Clevedon, UK: Multilingual Matters.

Baker, C. (2006). *Foundations of bilingual education and bilingualism.* Bridgend: Multilingual Matters.

Baker, C. (2011). *Foundations of bilingual education and bilingualism (5th ed.)* Clevedon, UK: Multilingual Matters.

Baker, S. A., Golinkoff, R. M., & Petitto, L. A. (2006). New insights into old puzzles from infants' categorical discrimination of soundless phonetic units. *Language Learning and Development, 2*(3*),* 147-162.

Baker, C. & Prys Jones, S. (1998). *Encyclopedia of bilingualism and bilingual education*. Clevedon, Avon, UK: Multilingual Matters.

Baldwin, D. A., & Markman, E. M. (1989). Establishing word-object relations: A first step. *Child Development, 60*, 381–398.

Barnes, S. B., Gutfreund, M., Satterly, D. J., & Wells, C. G. (1983). Characteristics of adult speech which predict children's language development. *Journal of Child Language, 10*, 65–84.

Bates, E. (1976). *Language and context: Studies in the acquisition of pragmatics.* New York, NY: Academic Press.

Bates, E. A. (2004). Explaining and interpreting deficits in language development across clinical groups: Where do we go from here? *Brain and Language*, *88*, 248–253.

Bates, E., Camaioni, L. & Volterra, V. (1975). The acquisition of performatives prior to speech*. Merrill-Palmer Quarterly, 21*, 205-226.

Bavelier, D., Newport, E.L., & Supalla, T. (2003). Children need natural languages, signed or spoken. *Cerebrum, 5*, 19-32.

Bayley, N. (2006). *Bayley scales of infant and toddler development (3rd ed.).*San Antonio, TX: Harcourt Assessment, Inc.

Beer, J., Pisoni, D. B., & Kronenberger, W. (2009). Executive function in children with cochlear implants: The role of organizational-integrative processes. *Volta Voices, 16,* 18–23.

Belsky, J., Vandell, D. L., Burchinal, M., Moore, K. A., McCartney, K., & Owen, M. T. (2007). Are there long-term effects of early child care? *Child Development*, *78*, 681–701.

Belzner, K. A., & Seal, B. C. (2009). Children with cochlear implants: A review of demographics and communication outcomes. *American Annals of the Deaf, 154*(3), 311–333.

Bernier, A., Carlson, S. M., & Whipple, N. (2010). From external regulation to self-regulation: Early parenting precursors of young children's executive functioning. *Child Development*, *81*, 326–339.

Bernstein, M., Maxwell, M., & Matthews, K. (1985). Bimodal or bilingual communication? *Sign Language Studies, 47,* 127-140.

Bialystok, E. (1988). Levels of bilingualism and levels of linguistic awareness. *Developmental Psychology*, *24*, 560– 567.

Bialystok, E. (2001). *Bilingualism in development: Language, literacy, and cognition.* New York: Cambridge University Press.

Bialystok, E. (2009). Bilingualism: The good, the bad, and the indifferent. *Bilingualism: Language and Cognition, 12*(1), 3–11.

Bishop, M. (2005). Orange eyes: Bimodal bilingualism in hearing adults from Deaf families. *Sign Language Studies, 5*(2), 188-230.

Blackledge, A., & Creese, A. (2010). *Multilingualism: A critical perspective*. London: Continuum.

Blamey, P. J., Paatsch, L. E., Bow, C. P., Sarant, J. Z., & Wales, R. J. (2002). A critical level of hearing for speech perception in children. *Acoustics Research Letters Online, 3*, 18–23.

Blamey, P. J., Sarant, J. Z., Paatsch, L. E., Barry, J.G., Bow, C. P., Wales, R.J... Tooher, R. (2001). Relationships among speech perception, production, language, hearing loss, and age in children with impaired hearing**.** *Journal of Speech, Language, and Hearing Research, 44*, 264-285.

Bloom, P. (2000). *How children learn the meaning of words*. Cambridge, MA: MIT Press.

Bonvillian, J. D., Orlansky, M. D., & Novack, L. L. (1983). Developmental milestones: Sign language acquisition and motor development. *Child Development*, *54*(6), 1435-1445.

Boothroyd, A. (1991). Assessment of speech perception capacity in profoundly deaf children. *The American Journal of Otology, 12*, 67S-72S.

Bornstein, M. H., Tal, J., Rahn, C., Galperin, C., Lamour, M., Ogino, M…Tamis-LeMonda C. (1992).Functional analysis of the contents of maternal speech to infants of 5 and 13 months in four cultures: Argentina, France, Japan, and the United States. *Developmental Psychology. 28,* 593–603.

Boudreault, P., & Mayberry, R. I. (2006). Grammatical processing in American Sign Language: Age of first language acquisition effects in relation to syntactic structure. *Language and Cognitive Processes*, *21(*5), 608-635.

Braine, M. D. S. (1976). Children's first word combinations. *Monographs of the society for research in child development, 41(*1*),* 164.

Brentari, D. (1998). *A prosodic model of sign language phonology*. Cambridge, MA: MIT Press.

Brown, P. M. (2002). *Parent-child interaction checklist* (Unpublished manuscript). The University of Melbourne, Melbourne, Australia.

Brown, P. M., & Nott, P. (2006). Family-centered practice in early intervention for oral language development: Philosophy, methods, and results. In P. E. Spencer & M. Marschark (Eds.), *Advances in spoken language development by deaf children* (pp. 136-165). Oxford: Oxford University Press.

Brown, R. (1973). *A first language: The early stages.* Cambridge, MA: Harvard University Press.

Brown, W. & Barrera, I. (1999). Enduring problems in assessment: The persistent challenges of cultural dynamics and family issues. *Infants and Young Children, 12*, 34-42.

Bruner, J. (1975). The ontogenesis of speech acts. *Journal of Child Language, 2,* 1-19.

Bruner, J. S. (1983). *Child's talk.* New York: Norton.

Brunner, E. D. (1929). *Immigrant farmers and their children*. New York: Doubleday.

Buisson, G. J. (2007). Using online glossing lessons for accelerated instruction in ASL for preservice deaf education majors. *American Annals of the Deaf, 152*(3), 331-343.

Burns, T. C., Werker, J. F., & McVie, K. (2003). Development of phonetic categories in infants raised in bilingual and monolingual environments. In B. Beachley, A. Brown, & F. Conlin (Eds.), *Proceedings of the 27th Annual Boston University Conference on Language Development, (*Vol. 1, pp. 173–184). Somerville, MA: Cascadilla Press.

Busa, J., Harrison J., Chappell J., Yoshinaga-Itano, C., Grimes, A., Brookhouser, P. E. Mason, P. (2007). Year 2007 position statement: Principles and guidelines for early hearing detection and intervention programs. *Pediatrics, 120*(4), 898–921.

Byers-Heinlein, K. (2013). Parental language mixing: Its measurement and the relation of mixed input to young bilingual children's vocabulary size. *Bilingualism: Language and cognition, 16*(1), 32-48.

Calabrese, A. (1995). A constraint-based theory of phonological markedness and simplification procedures. *Linguistic Inquiry, 26,* 373-463.

Calderon, R., (2000). Parental involvement in deaf children's education programs as a predictor of child's language, early reading and social-emotional development. *Journal of Deaf Studies and Deaf Education, 5(*2), 141-55.

Calderon, R., & Greenberg, M. (1997). The effectiveness of early intervention for deaf children and children with hearing loss. In M. J. Guralnik (Ed.), *The effectiveness of early intervention* (pp. 455-482). Baltimore: Paul H. Brookes.

Camarata, S. M. (1996). On the importance of integrating naturalistic language, social intervention, and speech-intelligibility training. In L. K. Koegel, R. L. Koegel, & G. Dunlaps (Eds.), *Positive behavioral support* (pp. 333-352). Baltimore, MD: Paul H. Brookes.

Campbell, R., Martin, P., & White, T. (1992). Forced choice recognition of sign in novice learners of British Sign Language. *Applied Linguistics, 13*, 185-201.

Carey-Sargeant, C. L., & Brown, P. M. (2005). Reciprocal utterances during interactions between deaf toddlers and their hearing mothers. *Deafness and Education International,* 7(2), 77-97.

Carlson, S. M., & Meltzoff, A. N. (2008). Bilingual experience and executive functioning in young children. *Developmental Science*, *11,* 282–298.

Carpenter, M., Nagell, K., & Tomasello, M. (1998). Social cognition, joint attention, and communicative competence from 9 to 15 months of age. *Monographs of the Society for Research in Child Development, 63*(4), i-vi, 1-143.

Carrow, S. M. A. (1957). Linguistic functioning of bilingual and monolingual children. *Journal of Speech and Hearing Disorders, 22*, 371-380.

Charron, F., & Petitto, L. A. (1991). Les premiers signes acquis par des enfants sourds en Langue des Signes Québecoise (LSQ): Comparaison avec les premiers mots. *Revues Québecoise de Linguistique Théorique et Appliquée, 10*(1), 71-122.

Chee, M. W., Soon, C. S., Lee, H. L., Pallier, C. (2004). Left insula activation: a marker for language attainment in bilinguals. *Proceedings of the National Academy of Sciences of the United States of America, 101*, 15265–15270.

Ching, T. Y. C., Crowe, K., Martin, V., Day, J., Mahler, N., Youn…Orsini, J. (2010). Language development and everyday functioning of children with hearing loss assessed at 3 years of age. *International Journal of Speech-Language Pathology, 12*(2), 124–131.

Ching, T. Y. C., Dillon, H., Marnane, V., Hou, S., Day, J., Seeto, M.… Yeh, A. (2013). Outcomes of early- and late-Identified children at 3 years of age: Findings from a prospective population-based study. *Ear and Hearing, 34(*5), 535–552.

Ching, T. Y. C., & Hill, M. (2007). The parents' evaluation of aural/oral performance of children (PEACH) scale: Normative data. *Journal of the American Academy of Audiology,* 18(3), 221-237.

Ching, T. Y. C., Oong, R., & van Wanrooy, E. (2006). The ages of intervention in regions with and without UNHS and the prevalence of childhood hearing impairment in Australia. *Australian and New Zealand Journal of Audiology, 28*(2*)*, 137–150.

Christophe, A., Dupoux, E., Bertoncini, J., & Mehler, J. (1994). Do infants perceive word boundaries? An empirical study of the bootstrapping of lexical acquisition. *The Journal of the Acoustical Society of America, 95*(3), 1570-1580.

Clabaugh, G. (2005). Strengths based education: Probing its limits. *Educational Horizons*, *83*(3), 166–170.

Clahsen, H., & Penke, M. (1992). The acquisition of agreement morphology and its syntactic consequences: New evidence on German child language from the Simon- Corpus. In J. M. Meisel (Ed.), *The acquisition of verb placement* (pp. 181-223). Dordrecht: Kluwer Academic Publishers.

Clark, E. V. (1993). *The lexicon in acquisition*. New York: Cambridge University Press.

Clark, E. V. (2009). *First language acquisition (*2nd ed.). Cambridge: Cambridge University Press.

Clark, H. H., & Clark, E. V. (1977). *Psychology and language: An introduction to psycholinguistics.* New York: Harcourt Brace.

Clarke-Stewart, K., VanderStoep, L., & Killian, G. (1979). Analyses and replication of mother-child relations at two-years of age. *Child Development, 50*, 777–793.

Cogen, C., & Philip, M. (1981). On teaching American Sign Language as a second language. *Proceedings of 2nd NSSLRT (*pp. 143-169). Silver Spring, MD: NAD.

Cokely, D., & Baker, C. (1980). *American Sign Language: A teacher's resource text on grammar and culture.* Silver Spring, MD: T. J. Publishers, Inc.

Colgan, S., Gold, L., Wirth, K., Ching, T., Poulakis, Z., Rickards, F., & Wake, M. (2012), The cost-effectiveness of universal newborn screening for bilateral permanent congenital hearing impairment: systematic review. *Academic Pediatrics, 12*(3), 171-80.

Collier, V. P. (1988). The effect of age on acquisition of a second language for school. *New Focus, 2.* Wheaton, MD: National Clearinghouse for Bilingual Education.

Conrad, R. (1979). *The deaf school child.* London: Harper Row.

Conway, C. M., Pisoni, D. B., & Kronenberger, W. G. (2009). The importance of sound for cognitive sequencing abilities: the auditory scaffolding hypothesis. *Current Directions in Psychological Science, 18,* 275–279.

Cormier, K., Mauk, C., & Repp, A. (1998). Manual babbling in deaf and hearing infants: A longitudinal study. In E. Clark (Ed.), *Proceedings of the twenty-ninth annual child language research forum* (pp. 55 - 61). Stanford: CA.

Coulter, G. R., & Anderson, S. R. (1993). Introduction (Vol.3). In G. R. Coulter (Ed.), *Current issues in ASL phonology, phonetics and phonology* (pp. 1-17). New York: Academic Press.

Cramér-Wolrath, E. (2013). Sequential bimodal bilingual acquisition: Mediation using a cochlear implant as a tool. *Deafness & Education International*, *15*(4), 201–221.

Creese, A., & Blackledge, A. (2008). *Flexible bilingualism in heritage language schools*. Paper presented at Urban Multilingualism and Intercultural Communication, Antwerp, Belgium.

Cross, T. G. (1978). Mothers' speech and its association with rate of linguistic development in young children. In N. Waterson & C. Snow (Eds.), *The development of communication* (pp.199-216)*.* Chichester, U.K: Wiley.

Cross, T. G., Nienhuys, T. G., & Kirkman, M. (1985). Parent-child interaction with receptively disabled children: Some determinants of maternal speech style. In K. E. Nelson (Ed.), *Children's language* (pp. 247-290). Hillsdale, NJ: Lawrence Erlbaum.

Cummins, J. (1979). Cognitive/academic language proficiency, linguistic interdependence, the optimum age question and some other matters. *Working papers on bilingualism, 19,* 121-129.

Cummins, J. (1984*). Bilingualism and special education: Issues in assessment and pedagogy.* Clevedon, England: Multilingual Matters.

Cummins, J. (1991). Interdependence of first and second-language proficiency in bilingual children. In E. Bialystok (Ed.), *Language Processing in Bilingual Children (*pp.70-89*).*Cambridge: Cambridge University Press.

Cummins, J. (1998). *Beyond adversarial discourse*: *Searching for common ground in the education of bilingual students.* Presentation to the California State Board of Education.

Cummins, J. (2000). *Language, power and pedagogy: Bilingual children in the crossfire.* Clevedon: Multilingual Matters.

Cummins, J. (2006). *The Relationship between American Sign Language proficiency and English academic development: A review of the research.* Toronto: University of Toronto.

Cummins, J. (2007). Rethinking monolingual instructional strategies in multilingual classrooms. *The Canadian Journal of Applied Linguistics, 10*(2), 221-240.

Davis, J. M., Elfenbein, J., Schum, R., & Bentler, R. A. (1986). Effects of mild and moderate hearing impairments on language, educational, and psychosocial behavior of children. *Journal of Speech and Hearing Disorders, 51*, 53–62.

Dawson, P. W., Busby, P. A., McKay, C. M., & Clark, G. M. (2002). Short term auditory memory in children using cochlear implants and its relevance to receptive language. *Journal of Speech, Language, and Hearing Research, 45*, 789–801.

Deaf Australia Inc. (2010). *Terminology policy. Version 1.1.* Retrieved from http://www.deafau.org.au/info/policies.php

De Houwer, A. (1990).*The acquisition of two languages from birth: A case study.* Cambridge: Cambridge University Press.

De Houwer, A. (1994). The separate development hypothesis: Method and implications. In G. Extra & L. Verhoeven (Eds.), *The cross-linguistic study of bilingual development* (pp. 39-50). Amsterdam: Royal Netherlands Academy of Arts and Science.

De Houwer, A. (1995). Bilingual language acquisition. In P. Fletcher & B. MacWhinney (Eds.), *A handbook of child language* (pp. 219-250). Oxford: Blackwell.

De Houwer, A. (2007). Parental language input patterns and children's bilingual use. *Applied psycholinguistics, 28*(3), 411-424.

Dettman, S. J. (2006). *Primary caregiver input and communication development for children using the cochlear implant (*Unpublished doctoral thesis). The University of Melbourne, Australia.

Deuchar, M., & Quay, S. (2000). *Bilingual acquisition: Theoretical implications of a case study.* New York: Oxford University Press.

Dinnebeil, L. A., McInerney, W. F., Roth, J., & Ramaswamy, V. (2001). Itinerant early childhood special education services: Service delivery in one state. *Journal of Early Intervention, 24*, 35-44.

Dollaghan, C. A., Campbell, T. F., Paradise, J. L., Feldman, H. M., Janosky, J. E., Pitcairn, D. N., & Kurs-Lasky, M. (1999). Maternal education and measures of early speech and language. *Journal of Speech, Language, and Hearing Research, 43*, 1432–1443.

Döpke, S. (1992). *One parent one language: An interactional approach.* Amsterdam: John Benjamins.

Döpke, S. (1993). A bilingual child's struggle to comply with the 'one parent–one language' rule. *Journal of Multilingual and Multicultural Development 14*, 467–485.

Döpke, S. (1998). Can the principle of 'one person – one language' be disregarded as unrealistically elitist? *Australian Review of Applied Linguistics, 21*(1*),* 41–56.

Dore, J. (1978). Conditions for the acquisition of speech acts. In I. Markova (Ed.), *The social context of language* (pp. 87-111). London: Wiley.

Dumas, J. E., Lynch, A. M., Laughlin, J. E., Phillips-Smith, E., & Prinz, R. J. (2001). Promoting intervention fidelity: Conceptual issues, methods, and preliminary results from the early alliance prevention trial. *American Journal of Preventive Medicine, 20(Suppl. 1)*, 38–47.

Edwards, L. C., Frost, R., & Whitham, F. (2006). Developmental delay and outcomes in pediatric cochlear implantation: Implications for candidacy. *International Journal of Pediatric Otorhinolaryngology, 70*, 1593–1600.

Eimas, P. D., Miller, J. L., & Jusczyk, P. W. (1987). On infant speech perception and the acquisition of language. In S. Harnard (Ed.), *Categorical perception: The groundwork of cognition* (pp. 161-195). Cambridge, MA: Cambridge University Press.

Eisenberg, L. S., Kirk, K. I., Martinez, A. S., Ying, E. A., & Miyamoto, R. T. (2004). Communication abilities of children with aided residual hearing: comparison with cochlear implant users. *Archives of Otolaryngology - Head and Neck Surgery*, *130*, 563–569.

ELAN (EUDICO Linguistic Annotator). (2008). Max Planck Institute for Psycholinguistics, The Language Archive, Nijmegen, The Netherlands. (Version 3.4.0). Retrieved from http://tla.mpi.nl/tools/tla-tools/elan/.

Ellis, N. C., & Sagarra, N. (2010). The bounds of adult language acquisition: Blocking and learned attention. *Studies in Second Language Acquisition, 32*(4), 553-580.

Emmorey, K., Borinstein, H. B., & Thompson, R. (2005). Bimodal bilingualism: Code-blending between spoken English and American Sign Language. In J. Cohen, K. T. McAlister, K. Rolstad, & J. MacSwan (Eds.), *Proceedings of the 4th international symposium on bilingualism (*pp. 663-673). Somerville, MA: Cascadilla Press.

Emmorey, K., Borinstein, H. B., Thompson, R., & Gollan, T. H. (2008). Bimodal bilingualism. *Bilingualism: Language and Cognition, 11*(1), 43-61.

Emmorey, K., & Corina, D. (1993). Hemispheric specialization for ASL signs and English words: Differences between imageable and abstract forms. *Neuropsychologica, 31* (7), 645-653.

Erting, C. J. (1992). Deafness and literacy: Why can't Sam read? *Sign Language Studies, 75*, 97–112.

Erting, C. J., Prezioso, C., & O'Grady Hynes, M. (1990). The interactional context of deaf mother- infant communication. In V. Volterra & C. J. Erting (Eds.), *From gesture to language in hearing and deaf children* (pp. 97-106). Berlin: Springer-Verlag.

Erting, C. J., Thumann-Prezioso, C., & Sonnenstrahl, B. (2000). Bilingualism in a deaf family: Fingerspelling in early childhood. In P. Spencer, C. J. Erting, & M. Marschark (Eds.), *The Deaf child in the family and at school (*pp. 41–54). London: Lawrence Erlbaum.

Ertmer, D. J. (2011). Assessing speech intelligibility in children with hearing loss: Toward revitalizing a valuable clinical tool. *Language, Speech, and Hearing Services in Schools 42(*1), 52-58.

Farran, D. C., & Haskins, R. (1980). Reciprocal influence in the social interaction of mothers and three-year-old children from different socioeconomic backgrounds. *Child Development, 51*, 780–91.

Felser, C., & Clahsen, H. (2009). Grammatical processing of spoken language in child and adult language learners. *Journal of Psycholinguistic Research ,38,* 305-319.

Fenson, L., Dale, P. S., Reznick, J. S., Thal, D., Bates, E., Hartung, J. P…Reilly, J. S. (1993). *Technical manual for the MacArthur Communicative Development Inve*ntory. San Diego: Singular Press.

Fewell, R. R. (2000). Assessment of young children with special needs. *Topics in Early Childhood Special Education, 20*(1), 38-42.

Fewell, R. R., & Langley, M. B. (1984). *DASI-II: Developmental Activities Screening Inventory*. Austin, TX: Pro-Ed.

Figueras, B., Edwards, L., & Langdon, D. (2008). Executive function and language in deaf children. *Journal of Deaf Studies and Deaf Education, 13(*3), 362-377.

Fitzpatrick, E., Graham, I. D., Durieux-Smith, A., Angus, D., & Coyle, D. (2007). Parents' perspectives on the impact of the early diagnosis of childhood hearing loss. *International Journal of Audiology, 46,* 97-106.

Fleetwood, E., & Metzger, M. (1991). *Signed English and cued English: A contrastive analysis.* Paper presented at the Deaf Awareness Conference. Dothan, AL.

Fleetwood, E., & Metzger, M. (1998). *Cued language structure: An analysis of cued American English based on linguistic principles*. Silver Spring, MD: Calliope Press.

Folven, R. J., & Bonvillian, J. D. (1991). The transition from nonreferential to referential language in children acquiring American Sign Language. *Developmental Psychology, 27*, 806–816.

Fortgens, C. (2003). Taalkeuze van dove kinderen [Deaf children's language choices]. Gouda, The Netherlands: Koninklijke Auris Groep.

Fortnum, H., Davis, A., Butler, A., & Stevens, J. (1996). *Health service implications of changes in aetiology and referral patterns of hearing-impaired children in Trent 1985–1993.* Nottingham: Institute of Hearing Research, University of Nottingham.

Francis, N. (2011). Imbalances in bilingual development: A key to understanding the faculty of language. *Language Sciences*, 33(1), 76-89.

Fromkin, V., Rodman, R., Hyams, N., Collins, P., Amberber, M., & Cox, F. (2012*). An introduction to language (*7th ed.). Melbourne: Cengage.

Fuller, D., & Wilbur, R. (1987). The effect of visual metaphor cueing on recall of phonologically similar signs. *Sign Language Studies 54,* 59-80.

Fusellier-Souza, I. (2006). Emergence and development of signed languages: From a semiogenetic point of view. *Sign Language Studies, 7*(1), 30-56.

Gale, E., & Schick, B. (2009). Symbol-infused joint attention and language use in mothers with deaf and hearing toddlers. *American Annals of the Deaf, 153*(5), 484–503.

García, O. (2009). *Bilingual education in the 21st century: A global perspective.* Malden, MA: Wiley-Blackwell.

García, O. (2011). Theorizing translanguaging for educators. In C. Celic, & K. Selzter (Eds.), *Translanguaging: A CUNY-NYSIEB guide for educators.* New York: CUNY-NYSIEB, The City University of New York, NY.

García, O., Kleifgen, J. O., & Falchi, L. (2008). *From English language learners to emergent bilinguals.* Equity Matters**:** Research Review No. 1. New York: Columbia University.

García, O., & Wei, L. (2013). *Translanguaging: Language, bilingualism and education.* Basingstoke: Palgrave MacMillan.

Geers, A. E., & Brenner, C. (2003). Background and educational characteristics of prelingually deaf children implanted by five years of age. *Ear and Hearing, 24*, 2S-14S.

Geers, A. E., Nicholas, J. G., & Sedey, A. L. (2003). Language skills of children with early cochlear implantation. *Ear and Hearing, 24,* 46S–58S.

Geers, A. E., Strube, M. J., Tobey, E. A., Pisoni, D. B., & Moog, J. S. (2010). Epilogue: Factors contributing to long-term outcomes of cochlear implantation in early childhood. *Ear and Hearing, 32(*1), 84s–92s.

Genesee, F. (1989). Early bilingual development: One language or two? *Journal of Child Language*, *16,* 161-175.

Genesee, F. (2004). What do we know about bilingual education or majority language students. In T. K. Bhatia & W. Ritchie (Eds.), *Handbook of bilingualism and multiculturalism* (pp. 547-576). Malden, MA: Blackwell.

Genesee, F., Boivin, I., & Nicoladis, E. (1996). Talking with strangers: A study of bilingual children's communicative competence. *Applied Psycholinguistics*, *17*, 427-442.

Genesee, F., & Nicoladis, E. (2006). Bilingual acquisition. In E. Hoff & M. Shatz (Eds.), *Handbook of language development* (pp. 324-342). Oxford, England: Blackwell.

Gilkerson, J., & Richards, J. A. (2009). *The power of talk: Impact of adult talk, conversational turns, and TV during the critical 0-4 years of child development* (Technical Report LTR-01- 2). Retrieved from: http://www.lenababy.com/pdf/The Power of Talk.pdf.

Gleitman, L., Cassidy, K., Nappa, R., Papafragou, A., & Trueswell, J. C. (2005). Hard words. *Language Learning and Development, 1*(1), 23–64.

Goldin-Meadow, S. (2003). *The resilience of language: What gesture creation in deaf children can tell us about how all children learn language.* Hove, UK: Psychology Press.

Goldin-Meadow, S., & Mayberry, R. I. (2001). How do profoundly deaf children learn to read? *Learning Disabilities Research & Practice, 16*(4), 222-229.

Goldin-Meadow, S., & Saltzman, J. (2000). The cultural bounds of maternal accommodation: How Chinese and American mothers communicate with deaf and hearing children. *Psychological Science, 11*(4), 307-314.

Golestani, N., Alario, F., Meriaux, S., Le Bihan, D., Dehaene, S., & Pallier, C. (2006). Syntax production in bilinguals. *Neuropsychologia, 44*, 1029–1040.

Goodz, N. S. (1989). Parental language mixing in bilingual families. *Infant Mental Health Journal* 10, 25–44.

Goswell, D. (2012). Do you see what I see?: Using ELAN for self-analysis and reflection. *International Journal of Interpreter Education, 4(*1), 72-81.

Graney, S. (1998). *Where does speech fit in? Spoken English in a bilingual context*. Washington, DC: Laurent Clerc National Deaf Education Center.

Greenfield, P. M., & Smith, J. H. (1976). *The structure of communication in early language development.* New York: Academic Press.

Gregory, S. (1996, June). *Bilingualism and the education of deaf children: Advances in practice.* Conference paper presented at Bilingualism and the Education of Deaf Children: Advances in Practice, University of Leeds.

Gregory, S., Smith, S., & Wells, A. (1997). Language and identity in sign bilingual deaf children. *Journal of the British Association of Teachers of the Deaf, 21*, 31-38.

Grosjean, F. (1982). *Life with two languages: An introduction to bilingualism*. Cambridge, MA: Harvard University Press.

Grosjean, F. (1992). Another view of bilingualism. In Harris, R. (Ed.), *Cognitive processing in bilinguals* (pp. 51-62). Amsterdam: North-Holland.

Grosjean, F. (2001). The bilingual's language modes. In Nicol, J. (Ed.), *One mind, two languages: Bilingual language processing* (pp. 1-22). Oxford: Blackwell.

Grosjean, F. (2008). *Studying bilinguals*. Oxford: Oxford University Press.

Hafer J., & Topolosky, A. (1995). *Facilitating language through play.* Paper presented at the conference of American instructors of the deaf, Minneapolis, MN.

Hage, C., & Leybaert, J. (2006). The development of oral language through cued speech. In P. Spencer & M. Marschark (Eds.), *The development of spoken language in deaf children (*pp. 193-211). Psychology Press.

Hakuta, K. (1986). *Mirror of language: The debate on bilingualism.* New York: Basic Books.

Hakuta, K. (1990). Bilingualism and bilingual education: A research perspective. *Occasional Papers Series, 1*. Washington, DC: National Clearinghouse for Bilingual Education.

Hakuta, K. (1992). Bilingualism. *International encyclopedia of linguistics,* (Vol. 1, pp. 175-178). Oxford University Press.

Hakuta, K. (2001). A critical period for second language acquisition? In D. Bailey, J. Bruer, F. Symons, & J. Lichtman (Eds.), *Critical thinking about critical periods* (pp. 193-205). Baltimore: Paul Brookes Publishing Co.

Hakuta, K., & Diaz, R. M. (1985). The relationship between degree of bilingualism and cognitive ability: A critical discussion and some new longitudinal data (Vol.5). In K. E. Nelson (Ed.), *Children's language* (pp.319-344). Hillsdale, NJ: Erlbaum.

Hakuta, K., & McLaughlin, B. (1996). Bilingualism and second language learning: Seven tensions that define the research. In D. Berliner & R. Calfee (Eds.), *Handbook of educational psychology* (pp. 603-621). New York: Macmillan Publishing Co.

Halliday, M. A. K. (1975). *Learning how to mean.* London: Edward Arnold.

Halpin, K. S., Smith, K. Y., Widen, J. E., & Chertoff, M. E. (2010). Effects of universal newborn hearing screening on an early intervention program for children with hearing loss, birth to 3 yr of age. *Journal of the American Academy of Audiology, 21*, 169–175.

Hamilton, H. (1986). Perception of sign features by deaf children. *Sign Language Studies, 50,* 73-77.

Hammer, C. S., Miccio, A. W., & Rodriguez, B. L. (2004). Bilingual language acquisition and the child socialization process. In B. A. Goldstein (Ed.), *Bilingual language development and disorders in Spanish–English speakers* (pp. 21–50). Baltimore, MD: Paul H. Brookes.

Harris, M. (1992). *Language experience and early language development: From input to uptake.* Hove: Lawrence Erlbaum Associates.

Harris, M. (2001). It's all a matter of timing: Sign visibility and sign reference in deaf and hearing mothers of 18-month-old children. *Journal of Deaf Studies and Deaf Education, 6*(3), 177-185.

Harris, M., Clibbens, J., Chasin, J., & Tibbitts, R. (1989). The social context of early sign language development. *First Language, 9,* 81-97.

Harris, M., Jones, D., Brookes, S., & Grant, J. (1986). Relations between the non-verbal context of maternal speech and rate of language development. *British Journal of Developmental Psychology, 4,* 261–268.

Harris, M., & Mohay, H. (1997). Learning to look in the right place: A comparison of attentional behavior in deaf children with deaf and hearing mothers. *Journal of Deaf Studies and Deaf Education 2(*2), 95-103.

Harrison, R. V., Panesar, J., El-Hakim, H., Abdolell, M., Mount, R. J., & Papsin, B. (2001). The effects of age of cochlear implantation on speech perception outcome in prelingually hearing impaired children. *Scandinavian Audiology, 30*, 73–78.

Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experience of young American children*. Baltimore, MD: Paul H. Brookes Publishing.

Haug, T. (2005). Review of sign language assessment instruments. *Sign Language and Linguistics, 8,* 61-98.

Heller, M. (1999). *Linguistic minorities and modernity: A sociolinguistic ethnography*. London: Longman

Herman, R., & Roy, P. (2006). Evidence from the extended use of the BSL Receptive Skills Test. *Deafness & Education International, 8*(1), 33-47.

Hermans, D., Knoors, H., & Verhoeven, L. (2010). Assessment of sign language development: The case of deaf children in the Netherlands. *Journal of Deaf Studies and Deaf Education, 15*(2), 107-119.

Hickok, G., Bellugi, U., & Klima, E. S. (2001). Sign language in the brain. *Scientific American, 284*(6), 58-65.

Hintermair, M. (2006). Parental resources, parental stress, and socioemotional development of deaf and hard of hearing children. *Journal of Deaf Studies and Deaf Education*, *11*, 493–513.

Hodges, T., & Clifton, D. (2006). Strengths-based development in practice. In A. Linley & S. Joseph. (Eds.), *Handbook of positive psychology in practice* (pp. 361–376). Hoboken, New Jersey: John Wiley and Sons.

Hoff, E. (2003). The specificity of environmental influence: Socioeconomic status affects early vocabulary development via maternal speech. *Child Development, 74*, 1368–78.

Hoff, E., & Naigles, L. (2002). How children use input in acquiring a lexicon. *Child Development, 73,* 418–33.

Hoffmeister, R., & Wilbur, R. (1980). The acquisition of American Sign Language: A review. In H. Lane & F. Grosjean (Eds.), *Recent perspectives on sign language (*pp. 61-78*)*. Hillsdale, NJ: Erlbaum.

Hoiting, N., & Slobin, D. (2002). What a deaf child needs to see. Advantages of a natural sign language over a sign system. In R. Schulmeister & H. Reinitzer (Eds.), *Progress in sign language research. In honor of Siegmund Prillwitz (*pp. 268-277). Hamburg: Signum.

Holden-Pitt, L., & Diaz, J., A. (1998). Thirty years of the annual survey of deaf and hard-of-hearing children & youth: A glance over the decades. *American Annals of the Deaf, 142*(2), 72–76.

Holowka, S., Brosseau-Lapré, F., & Petitto, L. A. (2002). Semantic and conceptual knowledge underlying bilingual babies' first signs and words. *Language Learning*, *52*(2), 205-262.

Holte, L., Walker, E., Oleson, J., Spratford, M., Moeller, M. P…Tomblin, J. B. (2012). Factors influencing follow-up to newborn hearing screening for infants who are hard of hearing. *American Journal of Audiology, 21,* 163–174.

Holzrichter, A. S., & Meier, R. P. (2000). Child-directed signing in American Sign Language. In C. Chamberlain, J. Morford, & R. Mayberry (Eds.), *Language acquisition by eye.* (pp. 25-40). Mahwah, NJ: Lawrence Erlbaum Associates.

Horn, D. L., Davis, R. A. O., Pisoni, D. B., & Miyamoto, R. T. (2005). Behavioral inhibition and clinical outcomes in children with cochlear implants*. Laryngoscope, 115*, 595-600.

Horner, R. H., Carr, E. G., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional Children, 71,* 165–179.

Hornberger, N. H., & Link, H. (2012) Translanguaging and transnational literacies in multilingual classrooms: A biliteracy lens. *International Journal of Bilingual Education and Bilingualism, 15*(3), 261-278.

Hughes, C. (1998). Executive function in preschoolers: Links with theory of mind and verbal ability. *British Journal of Developmental Psychology*, *16*, 233–253.

Hurtado, N., Marchman, V. A., & Fernald, A. (2008). Does input influence uptake? Links between maternal talk, processing speed and vocabulary size in Spanish learning children. *Developmental Science*, *11*, 31–39.

Huttenlocher, J., Haight, W., Bryk, A., Seltzer, M., & Lyons, T. (1991). Early vocabulary growth: Relation to language input and gender. *Developmental Psychology*, *27*, 236–248.

Huttenlocher, J., Vasilyeva, M., Waterfall, H. R., Vevea, J. L., & Hedges, L. V. (2007).The varieties of speech to young children. *Developmental Psychology, 43*(5), 62-83.

Hyde, M. L. (2005). Newborn hearing screening programs: Overview. *Journal of Otolaryngology, 34*(Suppl 2), 570–81.

Hyde, M., & Punch, R. (2011)**.** The modes of communication used by children with cochlear implants and the role of sign in their lives. *American Annals of the Deaf*, *155*(5), 535-549.

Inscoe, J. R., Odell, A., Archbold, S., & Nikolopoulos, T. (2009). Expressive spoken language development in deaf children with cochlear implants who are beginning formal education. *Deafness and Education International, 11*, 39–55.

Iverson, P., & Kuhl, P. K. (1995). Linguistic experience and the "perceptual magnet effect." In W. Strange (Ed.), *Speech perception and linguistic experience* (pp. 233-272). Baltimore, MD: York Press.

Jacobs, R. (1996). Just how hard is it to learn ASL?: The case for ASL as a truly foreign language. In C. Lucas (Ed.), *Multicultural aspects of sociolinguistics in deaf communities* (pp. 183–226). Washington, DC: Gallaudet University Press.

Jakobson, R. (1968). *Child language, aphasia, and phonological universals.* The Hague: Mouton.

Jamieson, J. R. (1994). Instructional discourse strategies: Differences between hearing and deaf mothers of deaf children. *First Language, 14,* 153–171.

Janjua, F. (2005). Hearing impairment: Age at diagnosis, severity, and language outcomes. *Archives of Disease in Childhood, 90*, 1202–1209.

Janjua, F., Woll, B., & Kyle, J. (2002). Effects of parental style of interaction on language development in very young severe and profound deaf children*. International Journal of Pediatric Otorhinolaryngology 64,* 193–205.

Jeanes, R. C., Nienhuys, T. G., & Rickards, F. W. (2000). The pragmatic skills of profoundly deaf children. *Journal of Deaf Studies and Deaf Education, 5(*3), 237-247.

Jespersen, O. (1922). *Language: Its nature, development, and origin*. London: George Allen & Unwin Ltd.

Johnson, J. S., & Newport, E. L. (1989). Critical period effects in second-language learning: The influence of maturational state on the acquisition of English as a second language. *Cognitive Psychology*, 21, 60–99.

Johnson, R., Liddell, S. K., & Erting, C. (1989). Unlocking the curriculum: Principles for achieving access in deaf education. *Gallaudet Research Institute Working Papers,* 89-93. Washington, DC: Gallaudet University Press.

Johnston, J. C., Durieux-Smith, A*., &* Bloom, K. (2005). Teaching gestural signs to infants to advance child development: A review of the evidence. *First Language, 25*(2), 235–251.

Johnston, T. (1989a). *Auslan dictionary: A dictionary of the sign language of the Australian Deaf community*. Sydney, Australia: Deafness Resources Australia.

Johnston, T. (1989b). *Auslan: The sign language of the Australian Deaf community*. Unpublished doctoral dissertation, University of Sydney, Sydney, Australia.

Johnston, T. (2003a). W(h)ither the Deaf community? Population, genetics, and the future of Auslan (Australian Sign Language). *American Annals of the Deaf, 148,* 358–375.

Johnston, T., & Schembri, A. (2007). *Australian Sign Language. An introduction to sign language linguistics.* Cambridge: Cambridge University Press.

Jusczyk, P. W., Luce, P. A., & Charles-Luce, J. (1994). Infants' sensitivity to phonotactic patterns in the native language. *Journal of Memory and Language, 33,* 630-645.

Kanto, L., Huttunen, K., & Laakso, M. (2013). Relationship between the linguistic environments and early bilingual language development of hearing children in Deaf-parented families. *Journal of Deaf Studies and Deaf Education 18*(2), 242-260.

Katchan, O. (1985). Early bilingualism: Friend or foe? In J. Kurcz, G. W. Shugar, & J. H. Danks (Eds.), *Knowledge and language*. North Holland: Elsevier.

Kemp, M. (1998). Why is learning American Sign Language a challenge? *American Annals of the Deaf, 143*, 255–259.

Kennedy, C. R., McCann, D. C., Campbell, M. J., Law, C. M., Mullee, M., Petrou, S…. Stevenson, J. (2006). Language ability after early detection of permanent childhood hearing impairment. *New England Journal of Medicine, 354,* 2131–2141.

Keren, R., Helfand, M., Homer, C., McPhillips, H., & Lieu, T. A. (2002). Projected cost-effectiveness of state-wide universal newborn hearing screening. *Pediatrics, 110,* 885–864.

Kerkhofs, R., Dijkstra, A., Chwilla, D., & De Bruijn, E. (2006). Testing a model for bilingual semantic priming with interlingual homographs: RT and ERP effects. *Brain Research.* 1068, 170–183.

Khan, S., Edwards, L., & Langdon, D. (2005). The cognition and behaviour of children with cochlear implants, children with hearing aids and their hearing peers: a comparison. *Audiology and Neuro-Otology, 10*(2), 117-26.

King, A. M. (2010). The national protocol for paediatric amplification in Australia. *International Journal of Audiology*, *49(Suppl 1)*, S64–S69.

Klatter-Folmer, J., van Hout, R., Kolen, E., & Verhoeven, L. (2006) Language development in deaf children's interactions with deaf and hearing adults: A Dutch longitudinal study. *Journal of Deaf Studies and Deaf Education 11*(2), 238-251.

Klima, E., & Bellugi, U. (1979). *The signs of language.* Cambridge, MA: Harvard University Press.

Knight, P., & Swanwick, R. (2002). *Working with deaf pupils: Sign bilingual policy into practice.* London: Fulton Press.

Knoors, H., Tang, G., & Marschark, M. (2014). Bilingualism and bilingual deaf education: Time to take stock. In M. Marschark, G. Tang, & H. Knoors (Eds.), *Bilingualism and bilingual deaf education* (pp. 1-20). Oxford/New York: Oxford University Press.

Köpke, B. (2007). Language attrition at the crossroads of brain, mind, and society. In B. Köpke, M. S. Schmid, M. Keijzer, & S. Dostert (Eds.), *Language attrition: Theoretical perspectives (*pp. 9–37). Philadelphia, PA: John Benjamins.

Kovács, A. M., & Mehler, J. (2009). Flexible learning of multiple speech structures in bilingual infants. *Science, 325,* 611–612.

Kovelman, I., Baker, S. A., Petitto, L. A. (2008). Age of first bilingual language exposure as a new window into bilingual reading development. *Bilingualism: Language and Cognition, 11*, 203–223.

Kovelman, I., & Petitto L. A. (2002). *Bilingual babies' maturational and linguistic milestones as a function of their age of first exposure to two languages*. Poster presented at the conference for the Society for Neuroscience, Orlando, FL.

Kovelman, I., & Petitto, L. A. (2003). *States of language development in bilingual children exposed to their other language at different ages.* Poster presented at the International Symposium on Bilingualism, Phoenix, AZ.

Kovelman, I., Shalinsky, M. H., Berens, M. S., & Petitto, L. A. (2008). Shining new light on the brain's "bilingual signature": A functional Near Infrared Spectroscopy investigation of semantic processing. *NeuroImage 39,* 1457–1471.

Kratochwill, T. R., & Levin, J. R. (2010). Enhancing the scientific credibility of single-case intervention research: Randomization to the rescue. *Psychological Methods, 15*(2), 124–144.

Kroskrity, P., Schieffelin, B., & Woolard, K. (Eds.). (1992). Language ideologies. *Special Issue of Pragmatics, 2*(3), 235-453.

Kuhl, R., Williams, K., Lacerda, E., Stevens, K., & Lindblom, B. (1992). Linguistic experience alters phonemic perceptions in infants by 6 months of age. *Science, 255*, 606-608.

Kushalnagar, P., Mathur, G., Moreland, C., Napoli, D., Osterling, W., Padden, C., & Rathmann, C. (2010). Infants and children with hearing loss need early language access. *Journal of Clinical Ethics, 21s*(2), 143–154.

Kyle, J., Woll, B., & Ackerman, J. (1989). *Gesture to sign and speech: Final report to ESRC*. Bristol: Centre for Deaf Studies, University of Bristol.

Lacroix, V., Pomerleau, A., & Malcuit, G. (2002). Properties of adult and adolescent mothers' speech, children's verbal performance and cognitive development in different socioeconomic groups: A longitudinal study. *First Language*, *22*, 173–196.

Lambert, W. E. (1975). Culture and language as factors in learning and education. In A. Wolfgang (Ed.), *Education of immigrant students: Issues and answers* (pp. 55-83). Toronto, Canada: Ontario Institute for Studies in Education.

Lambert, W. E. (1985). Some cognitive and sociocultural consequences of being bilingual. In J. E. Alatis & J. J. Staczek (Eds.), *Perspectives on bilingualism and bilingual education* (pp. 116-131). Washington, DC: Georgetown University Press.

Lanza, E. (1992). Can bilingual two-year-olds code-switch? *Journal of Child Language, 19*, 633–658.

Lanza, E. (1997a). Language contact in bilingual two-year-olds and code-switching: Language encounters of a different kind? *International Journal of Bilingualism, 1*, 135-162.

Lanza, E. (1997b). *Language mixing in infant bilingualism: A sociolinguistic perspective.* Oxford, UK: Clarendon Press.

Lanza, E. (2001). Bilingual first language acquisition: A discourse perspective on language contact in parent-child interaction. In J. Cenoz & F. Genesee (Eds.), *Trends in bilingual acquisition* (pp. 201-230)*.* Amsterdam: John Benjamins.

LaSasso, C., & Metzger, M. (1998). An alternate route for preparing deaf children for bibi programs: The home language as L1 and cued speech for conveying traditionally spoken languages. *Journal of Deaf Studies and Deaf Education, 3*(4), 264-289.

Lederberg, A. R. (1993). The impact of child deafness on mother-child and peer relationships. In M. Marschark & M. D. Clark (Eds.), *Psychological perspectives on deafness (*pp. 93-119). Hillsdale, NJ: Erlbaum.

Lederberg, A., Binz, L., Mclntyre, C., & McNorton, M. (1989, April). *The impact of child deafness on mother-toddler conversation.* Poster presented at the Biennial Meetings of the Society for Research in Child Development, Kansas City, KS.

Lederberg, A. R., & Everhart, V. S. (2000). Conversations between deaf children and their hearing mothers: Pragmatic and dialogic characteristics. *Journal of Deaf Studies and Deaf Education, 5(*4), 303-322.

Lederberg, A., & Mobley, C. (1990). The effect of hearing impairment on the quality of attachment and mother-toddler interaction. *Child Development, 61*, 1596-1604.

Leigh, G. (2007). *Changing parameters in deafness and deaf education: Greater opportunity yet greater diversity.* Paper presented at International Conference: Cognitive Underpinnings of Learning by Deaf and Hard-of-Hearing Students, NTID, Rochester, NY.

Leigh, G. (2008). Changing parameters in deafness and deaf education: Greater opportunity but continuing diversity. In M. Marschark & P. C. Hauser (Eds.), *Deaf cognition: Foundations and outcomes (*pp. 24-51). New York: Oxford University Press.

Leopold, W. (1949). *Speech development of a bilingual child* (Vol. 4). Evanston, IL: Northwestern University Press.

Lewis, S. (2006). Early support monitoring protocol for deaf babies and children. http://www.ncb.org.uk/early-support/resources/developmental-journals/monitoring-protocol-for-deaf-babies-and-children.

Liberman, A. M, & Mattingly, I. G. (1985). The motor theory of speech perception. *Cognition, 21*(1), 1-36.

Liberman, A. M., & Mattingly, I. G. (1989). A specialization for speech perception. *Science, 243*(4890), 489-494.

Lichtig, I., Couto, M. I. V., Mecca, F. F. D. N., Hartley, S., Wirz, S., & Woll, B. (2011). Assessing deaf and hearing children's communication in Brazil. *Journal of Communication Disorders 44,* 223–235.

Lieberman, P. (1984). *The biology and evolution of language.* Cambridge, MA: Harvard University Press.

Limb, S. J., McManus, M. A., Fox, H. B., White, K. R., & Forsman, I. (2010). Ensuring financial access to hearing aids for infants and young children. *Pediatrics, 126*(Suppl. 1), S43–S51.

Locke, J. L. (1990). Structure and stimulation in the ontogeny of spoken language. *Developmental Psychobiology, 23*, 621–644.

Loots, G., & Devisé, I. (2003). An intersubjective developmental perspective on interactions between deaf and hearing mothers and their deaf infants. *American Annals of the Deaf, 148,* 295–307.

Lucas, C. & Valli, C. (1992). *Language contact in the American Deaf community.* San Diego: Academic Press.

Luetke-Stahlman, B. (1991). Following the rules: Consistency in sign. *Journal of Speech and Hearing Research, 34*, 1293-1298.

Lynas, W. (1994). Choosing between communication options in the education of deaf children. *Journal of the British Association of Teachers of the Deaf, 18*(5), 141-153.

Macnamara, J. (1966). *Bilingualism and primary education*. Edinburgh: Edinburgh University Press.

MacSwan, J. (2000). The architecture of the bilingual language faculty: Evidence from codeswitching. *Bilingualism: Language and Cognition, 3*(1), 37-54.

Maller, S. J., Singleton, J. L., Supalla, S. J., & Wix, T. (1999). The development and psychometric properties of the American Sign Language Proficiency Assessment (ASL-PA). *Journal of Deaf Studies and Deaf Education, 4*(4), 249-269.

Manrique, M., Cervera-Paz, F. J., Huarte, A., & Molina, M. (2004). Advantages of cochlear implantation in prelingual hearing impaired children before 2 years of age when compared with later implantation. *Laryngoscope, 114*, 1462–1469.

Marchman, V. A., Fernald, A., & Hurtado, N. (2010). How vocabulary size in two languages relates to efficiency in spoken word recognition by young Spanish–English bilinguals. *Journal of Child Language, 37*, 817–840.

Marentette, P. F., & Mayberry, R. I. (2000). Principles for an emerging phonological system: a case study of early ASL acquisition. In C. Chamberlain, J. Morford, & R. Mayberry (Eds.), *Language acquisition by eye* (pp. 71-90). Mahwah, NJ: Lawrence Erlbaum Associates.

Marschark, M. (2001). *Language development in children who are deaf: A research synthesis. Prepared for Project Forum: National Association of State Directors of Special Education (NASDE).* Alexandria, VA. Office of Special Education Programs (OSEP), U.S. Department of Education.

Marschark, M. (2007). *Raising and educating a deaf child*. New York: Oxford University Press.

Marschark, M., Convertino, C. M., & LaRock, D. (2006). *Optimizing academic performance of deaf students: Access, opportunities and outcomes.* In D. F. Moores & D. S. Martin (Eds.) *Deaf Learners: New developments in curriculum and instruction* (pp. 179-200). Washington, DC: Gallaudet University Press.

Marschark, M., Knoors, H., & Tang, G. (2014). Perspectives on bilingualism and bilingual education for deaf learners. In M. Marschark, G. Tang, & H. Knoors (Eds.), *Bilingualism and bilingual deaf education* (pp. 445-476). Oxford/New York: Oxford University Press.

Marschark, M., Lang, H., & Albertini, J. (2002). *Educating deaf students: From research to practice*. New York: Oxford University Press.

Marschark, M., & Spencer, P. E. (*2006*). Advances in the spoken language development of deaf and hard-of-hearing children. In P. E. Spencer & M. Marschark (Eds.), *Spoken language development of deaf and hard-of-hearing children: Historical and theoretical perspectives* (pp. 3-21). *New York:* Oxford University Press.

Marschark, M., Tang, G., & Knoors, H. (Eds.). (2014). *Bilingualism and bilingual deaf education.* Oxford/New York: Oxford University Press.

Marschark, M., & Wauters, L. (2011). Cognitive functioning in deaf adults and children (Vol. *1*, 2nd ed). In M. Marschark & P. E. Spencer (Eds.), *The Oxford handbook of deaf studies, language, and education* (pp. 486–499). New York, NY: Oxford University Press.

Martin, D., & Bat-Chava, Y. (2003). Negotiating deaf-hearing friendships: Coping strategies of deaf boys and girls in mainstream schools. *Child: Care, Health and Development, 29(6),* 511-521.

Masataka, N. (1996). Perception of motherese in a signed language by 6-month-old deaf infants. *Developmental Psychology, 32*(5), 874-879.

Mashie, S. N. (1995). *Educating deaf children bilingually*. Washington DC: Gallaudet University Pre-college programs.

Mason, K., Rowley, K., Marshall, C. R., Atkinson, J. R., Herman, R., Woll, B., & Morgan, G. (2010). Identifying specific language impairment in deaf children acquiring British Sign Language: Implications for theory and practice. *British Journal of Developmental Psychology, 28,* 33–49.

Mayberry, R. I. (2002). Cognitive development in deaf children: the interface of language and perception in neuropsychology (2nd ed., Vol.8*).* In S. J. Segalowitz & I. Rapin (Eds.), *Handbook of neuropsychology* (pp. 71-107). Oxford: Elsevier.

Mayberry, R. I. (2006). Learning sign language as a second language. In B. Woll (Ed.), *Sign Language, (Vol.6*), *Encyclopedia of language and linguistics* (2nd ed., pp. 739-743).) Oxford: Elsevier.

Mayberry, R., & Eichen, E. (1991). The long-lasting advantage of learning sign language in childhood: Another look at the critical period for language acquisition. *Journal of Memory & Language,* 30, 486-512.

Mayberry, R. I., & Lock, E. (2003). Age constraints on first versus second language acquisition: Evidence for linguistic plasticity and epigenesist. *Brain and Language, 87*, 369–84.

Mayberry, R. I., Lock, E., & Kazmi, H. (2002). Development: Linguistic ability and early language exposure. *Nature, 417*(6884), 38.

Mayberry, R. I., & Squires, B. (2006). Sign language: Acquisition. In E. Lieven (Ed.), Language Acquisition, Vol. 11, *Encyclopedia of language and linguistics* (2nd ed., pp. 291-296). Oxford: Elsevier

Mayer, C., & Wells, G. (1996). Can the linguistic interdependence theory support a bilingual bicultural model of literacy education for deaf students? *Journal of Deaf Studies and Deaf Education, 1*, 93-107.

Mayer, C., & Leigh, G. (2010). The changing context for sign bilingual education programs: issues in language and the development of literacy. *International Journal of Bilingual Education and Bilingualism, 13*(2), 175-186.

McCracken, W., & Pettitt, B. (2011). *Complex needs, complex challenges*. *A report on research into the experiences of families with deaf children with additional complex needs.* London, UK: The National Deaf Children's Society.

McGarr, N. S. (1983). The intelligibility of deaf speech to experienced and inexperienced listeners. *Journal of Speech and Hearing Research*, 26, 451-458.

McIntire, M. L. (1977). The acquisition of American Sign Language hand configurations. *Sign Language Studies, 6*, 247-266.

McIntire, M., & Reilly, J. (1988). Nonmanual behaviors in L1 & L2 learners of American Sign Language. *Sign Language Studies,* 61, 351-375.

McKee, R. L., & McKee, D. (1992). What's so hard about learning ASL? Students' and teachers' perceptions. *Sign Language Studies, 21*, 129–158.

McLaughlin, B. (1978). *Second language acquisition in childhood.* Hillsdale, NJ: Lawrence Erlbaum.

McLaughlin, B. (1984). *Second language acquisition in childhood: Volume.1. Preschool children (*2nd ed.). (pp. xiv+261). Hillsdale, NJ: Erlbaum Associates.

McLaughlin, B., Blanchard, A. G., Osanai, Y. (1995). Assessing language development in bilingual preschool children. *NCBE Program Information Guide Series. No.22.* Washington, DC: National Clearinghouse for Bilingual Education.

McNeill, D. (1970). *The acquisition of language.* New York: Harper & Row.
Meadow, K. P., Greenberg, M. T., Erting, C., & Carmichael, H. (1981). Interactions of deaf mothers and deaf preschool children. Comparisons with three other groups of deaf and hearing dyads. *American Annals of the Deaf, 126*, 454-468.
Mehl, A. L., & Thomson, V. (1998). Newborn hearing screening. The great omission. *Pediatrics, 101*(1), E4.
Mehl, A. L., & Thomson, V. (2002). The Colorado newborn hearing screening project, 1992-1999: On the threshold of effective population-based universal newborn hearing screening*. Pediatrics,* 109(1), E7.
Meier, R. P. (2002). The acquisition of verb agreement: Pointing out arguments for the linguistic status of agreement in signed languages. In G. Morgan & B. Woll (Eds.), *Current developments in the study of signed language acquisition* (pp. 115-141). Amsterdam: John Benjamins.
Meier, R. P., Cormier, K. A., & Quinto-Pozos, D. (2002). *Modality and structure in signed and spoken languages.* Cambridge: Cambridge University Press.
Meier, R. P., Mauk, C., Mirus, G. R. & Conlin, K. E. (1998). Motoric constraints on early sign acquisition. In E. Clark (Ed.), *Proceedings of the twenty-ninth annual child language research forum (*pp*. 63-72).* Stanford, CA: CSLI Publications.
Meier, R. P., & Newport, E. L. (1990). Out of the hands of babes: On a possible sign advantage in language acquisition. *Language, 66*, 1-23.
Meier, R. P., & Willerman, R. (1995). Prelinguistic gesture in deaf and hearing infants. In K. Emmorey & J. Snitzer Reilly (Eds.), *Language, gesture, and space* (pp. 391-409). Hillsdale, NJ: Lawrence Erlbaum Associates.
Meisel, J. M. (Ed.). (1990). *Two first languages – early grammatical development in bilingual children.* Dordrecht: Foris.
Meisel, J. (1994). *Bilingual first language acquisition. French and German grammatical development*. Amsterdam: John Benjamins Publishing Company.
Meschyan, G., & Hernandez, A. E. (2006). Impact of language proficiency and orthographic transparency on bilingual word reading: an fMRI investigation. *Neuroimage, 29*(4), 1135-40.
Miller, J. L., & Eimas, P. D. (1996). Internal structure of voicing categories in early infancy. *Perception & Psychophysics, 58*(8), 1157–1167.
Moeller, M. P. (2000). Early intervention and language development in children who are deaf and hard of hearing. *Pediatrics, 106*(3), 1-9.
Moeller, M. P., Carr, G., Seaver, L., Stredler-Brown, A., & Holzinger, D. (2013). Best practices in family-centered early intervention for children who are deaf or hard of hearing: An international consensus statement. *Journal of Deaf Studies and Deaf Education 18*(4), 429-445.
Moeller, M. P., & Schick, B. (2006). Relations between maternal input and theory of mind understanding in deaf children. *Child Development, 77,* 751–766.
Mohay H. (1988). *The effects of hearing status on the methods of attention getting used by mothers and infants*. Paper presented at the 24th International Congress of Psychology: Sydney, Australia.
Mohay, H., Milton, L., Hindmarsh, G., & Ganley, K. (1998). Deaf models as communication models for hearing families with deaf children. In A. Weisel (Ed.), *Issues unresolved: New perspectives on language and deaf education* (pp. 76– 87). Washington, DC: Gallaudet University Press.

Moore, C., & Dunham, P. J. (1995). *Joint attention: Its origins and role in development.* Hillsdale, NJ: Erlbaum.

Morgan, G., Barrett-Jones, S., & Stoneham, H. (2007). The first signs of language: Phonological development in British Sign Language. *Applied Psycholinguistics, 28,* 3–22.

Morgan, G., & Woll, B. (2002). *New directions in sign language acquisition*. Amsterdam: John Benjamins Publishing Company.

Morgan, G., & Woll, B. (2009). Applied linguistic studies of sign language. In L. Wei & V. Cook (Eds.), *Contemporary applied linguistics, Vol. 1 Language teaching and learning. Vol. 2, Linguistics for the real world.* London: Continuum.

Most, T. (2007). Speech intelligibility, loneliness, and sense of coherence among deaf and hard-of-hearing children in individual inclusion and group inclusion. *Journal of Deaf Studies and Deaf Education, 12*, 495–503.

Most, T., Shina-August, E., & Meilijson, S. (2010). Pragmatic abilities of children with hearing loss using cochlear implants or hearing aids compared to hearing children. *Journal of Deaf Studies and Deaf Education, 15*(4), 423-437.

Munson, B., Edwards, J. & Beckman, M. E. (2005). Phonological knowledge in typical and atypical speech-sound development. *Topics in language disorders*, *25*(3), 190-206.

Namy, L. L., Acredolo, L. P., & Goodwyn, S. W. (2000). Verbal labels and gestural routines in parental communication with young children. *Journal of Nonverbal Behavior, 24,* 63–79.

Napier, J., Leigh, G. & Nann, S. (2007) Teaching sign language to hearing parents of deaf children: An action research process. *Deafness and Education International, 9*(2), 83–100.

Nelfelt, K., & Nordqvist Palviainen, Å (2004). *'It sounds': From visual to auditory communication in young deaf children with cochlear implants.* Final report of the project: Language development in children with CI - linguistic implications of new medical technologies. Gothenburg papers in theoretical linguistics S31. Sweden: Gothenburg University, Department of Linguistics.

Neville, H. J., Coffey, S. A., Lawson, D. S., Fischer, A., Emmorey, K. & Bellugi, U. (1997). Neural systems mediating American Sign Language: Effects of sensory experience and age of acquisition. *Brain and Language*, *57*(3), 285–308.

Newport, E. L., & Meier, R. (1985). *The acquisition of American Sign Language.* In D. Slobin (Ed.), *The crosslinguistic study of language acquisition*, (Vol. 1, pp. 881-938). Hillsdale, NJ. Lawrence Erlbaum & Associates.

Nicholas, J. G., & Geers, A. E. (1997). Communication of oral deaf and normally hearing children at 36 months of age. *Journal of Speech, Language, and Hearing Research, 40,* 1314-1327.

Nicholas, J. G., & Geers, A. E. (2006). Effects of early auditory experience on the spoken language of deaf children at 3 years of age. *Ear and Hearing, 27*, 286–298.

Nicholas, J. G., & Geers, A. (2007). Will they catch up? The role of age at cochlear implantation in the spoken language development of children with severe to profound hearing loss. *Journal of Speech Language & Hearing Research*, *50*, 1048–1062.

Nicoladis, E., & Genesee, F. (1997). Language development in preschool bilingual children. *Journal of Speech-Language Pathology and Audiology, 21*, 258-270.

Nicoladis, E., & G. Secco (2000). The role of a child's productive vocabulary in the language choice of a bilingual family. *First Language 20,* 1-27.

Nikolopoulos, T. P., Archbold, S. M., Wever, C. C., & Lloyd, H. (2008). Speech production in deaf implanted children with additional disabilities and comparison with age-equivalent implanted children without such disorders. *International Journal of Pediatric Otorhinolaryngology, 72*, 1823–1828.

Ninio, A., & Snow, C. (1999). *The development of pragmatics: Learning to use language appropriately.* Invited chapter, in T. K. Bhatia & W. C. Ritchie (Eds.), *Handbook of language acquisition* (pp. 347-383). New York: Academic Press.

Norton, E., Baker, S., Petitto, L. A. (2003). *Bilingual infants' perception of handshapes in American Sign Language.* Poster presented at the University of Pennsylvania Institute for Research in Cognitive Science Summer Workshop. Philadelphia, PA.

Nott, P., Brown, P. M., Cowan, R., & Wigglesworth, G. (2003). Assessment of language skills in young children with profound hearing loss under two years of age. *Journal of Deaf Studies and Deaf Education, 8(*4), 401-421.

Nover, S., Christensen, K., Cheng, L. (1998). Development of ASL and English competence for learners who are deaf. *Topics in Language Disorders, 18*(4), 61.

Nussbaum, D., Waddy-Smith, B., & Doyle, J. (2012). Students who are deaf and hard of hearing and use sign language: Considerations and strategies for developing spoken language and literacy skills. *Seminars in Speech and Language, 33,* 310–321.

Odom, S. L., Brantlinger, E., Gersten, R., Horner, R. H., Thompson, B., & Harris, K. R. (2005). Research in special education: Scientific methods and evidence-based practices. *Exceptional Children*, *71*(2), 137-148.

Okita, O. (2002). *Invisible work: Bilingualism, language choice, and childrearing in Japanese-British intermarried families*. Amsterdam: Benjamins PublishingCo.

Okumura, T., Takahashi, H., Honjo, I., Takagi, A., & Mitamura, K. (1995). Sensorineural hearing loss in patients with large vestibular aqueduct. *Laryngoscope, 105,* 289-294.

Oller, D. K., Eilers, R. E., Urbano, R., & Cobo-Lewis, A. B. (1997). Development of precursors to speech in infants exposed to two languages. *Journal of Child Language, 24*, 407- 425.

Olson, J., & Masur, E. F. (2013). Mothers respond differently to infants' gestural versus nongestural communicative bids. *First Language*, *33*, 372–387.

O'Neill, D. (2007). The language use inventory for young children: A parent-report measure of pragmatic language development for 18- to 47-month old children. *Journal of Speech, Language, and Hearing Research, 50*(1), 214-228. doi:10.1044/1092-4388(2007/017

Orlansky, M., & Bonvillian, J. (1984). The role of iconicity in early sign language acquisition*. Journal of Speech and Hearing Disorders*, 49, 287-292.

Ormel, E., & Giezen, M. (2014). Bimodal bilingual cross-language interaction: Pieces of the puzzle. In M. Marschark, G. Tang, & H. Knoors (Eds.), *Bilingualism and bilingual deaf education* (pp. 74-101). Oxford/New York: Oxford University Press.

Paavola, L., Kemppinen, K., Kumpulainen, K., Moilanen, I., & Ebeling, H. (2006). Maternal sensitivity, infant co-operation and early linguistic development:

Some predictive relations. *European Journal of Developmental Psychology*, *3*, 13–30.

Paavola, L., Kunnari, S., Moilanen, I. (2005). Maternal responsiveness and infant intentional communication: implications for the early communicative and linguistic development. *Child Care, Health and Development*, 6, 727-736.

Padden, C. (1991). The acquisition of fingerspelling by deaf children. In P. Siple & S. Fischer (Eds.), *Theoretical issues in sign language research: Psychology* (Vol. 2, pp. 191-210). Chicago: University of Chicago Press.

Padden, C., & C. Ramsey. (2000). American Sign Language and reading ability in deaf children. In C. Chamberlain, J. Morford, & R. Mayberry (Eds.), *Language acquisition by eye (*pp. 165-189). Hillsboro, NJ: Lawrence Erlbaum.

Padilla, A. M., & Lindholm, K. (1984). Child bilingualism: The same old issues revisited. In J. L. Martinez & R. Mendoza (Eds.), *Chicano Psychology* (2nd ed., pp. 369-408). New York: Academic Press.

Paradis, J., Emmerzael, K., & Duncan, T. S. (2010). Assessment of English language learners: Using parent report on first language development. *Journal of Communication Disorders,* 43, 474- 497.

Paradis, J., & Genesee, F. (1996). Syntactic acquisition in bilingual children: Autonomous or interdependent? *Studies in Second Language Acquisition, 18*, 1-25.

Paradis, J., Nicoladis, E., & Genesee, F. (2000). Early emergence of structural constraints on code-mixing: Evidence from French-English bilingual children. *Bilingualism: Language and Cognition*, *3,* 245-261.

Paul, R. (2001). *Language disorders from infancy through adolescence* (2nd ed.). St. Louis, MO: Mosby, Inc.

Paul, R., & Elwood, R. (1991). Maternal linguistic input to toddlers with slow expressive language development. *Journal of Speech and Hearing Research, 34,* 982-988.

Peal, E., & Lambert, W. E. (1962). The relation of bilingualism to intelligence. *Psychological Monograph, 76*(546), 1-23.

Pearson, B. Z., Fernández, S. C., Lewedag, V., & Oller, D. K. (1997). The relation of input factors to lexical learning by bilingual infants (ages 10 to 30 months). *Applied Psycholinguistics, 18*, 41-58.

Petitta, G., Di Renzo, A., Chiari, I., & Rossini, P. (2013). Sign language representation: New approaches to the study of Italian Sign Language (LIS). In L. Meurant, A. Sinte, M. Van Herreweghe, & M. Vermeerbergen (Eds.), *Sign language research, uses and practices: Crossing views on theoretical and applied sign language linguistics* (pp.137-158). Berlin, New York: Mouton De Gruyter-Ishara Press.

Petitto, L. A. (1987a). On the autonomy of language and gesture: Evidence from the acquisition of personal pronouns in American Sign Language. *Cognition, 27*(1), 1-52.

Petitto, L. A. (1987b). *Theoretical and methodological issues in the study of sign language babbling: Preliminary evidence from American Sign Language (ASL) and Langue des Signes Québécoise (LSQ).* Paper presented at the Fourth International Symposium on Sign Language Research. Lappeenranta, Finland.

Petitto, L. A. (1994). *Are signed languages "real" languages? Evidence from American Sign Language and Langue des Signes Québécoise.* Reprinted from Department of Psychology, McGill University, Montreal, Canada.

Petitto, L. A. (1999). The acquisition of natural signed languages: Lessons in the nature of human language and its biological foundations. In C. Chamberlain, J. P. Morford, & R. I. Mayberry (Eds.), *Language acquisition by eye* (pp. 41-50*)*. Mahwah, NJ: Lawrence Erlbaum Associates.

Petitto, L. A. (2000). On the biological foundations of human language. In K. Emmorey & H. Lane (Eds.), *The signs of language revisited: An anthology in honor of Ursula Bellugi and Edward Klima* (pp. 449-474*)*. Mahwah, NJ: Lawrence Erlbaum Associates.

Petitto, L. A., & Dunbar, K. (2004). New findings for educational neuroscience on bilingual brains, scientific brains and the educated mind. In K. Fischer & T. Katzir (Eds.), *Building usable knowledge in mind, brain and education* (p.84-101*)*. Cambridge: Cambridge University Press.

Petitto, L. A., & Holowka, S. (2002). Evaluating attributions of delay and confusion in young bilinguals: Special insights from infants acquiring a signed and a spoken language*. Sign Language Studies, 3*(1), 4–33.

Petitto, L. A., Katerelos, M., Levy, B. G., Gauna, K., Tetrealt, K. & Ferraroi, V. (2001). Bilingual signed and spoken language acquisition from birth: Implications for the mechanisms underlying early bilingual language acquisition. *Journal of Child Language, 28,* 453–96.

Petitto, L. A., & Kovelman, I. (2003). The bilingual paradox: How signing-speaking bilingual children help us resolve bilingual issues and teach us about the brain's mechanisms underlying all language acquisition. *Learning Languages, 8*, 5-18.

Petitto, L. A., Kovelman, I., & Harasymowycz, U. (2003). Bilingual language development: Does learning the new damage the old? *Abstracts of the Society for Research in Child Development,* Tampa, FL.

Petitto, L. A., & Marentette, P. F. (1991). Babbling in the manual mode: Evidence for the ontogeny of language. *Science, 251*, 1493-1496.

Pichler, D. C. (2002). Word order variation and acquisition in American Sign Language. *Sign Language & Linguistics, 5(1)*, 89-97.

Pickersgill, M., & Gregory, S. (1998). *Sign bilingualism. A model.* St. Albans, UK: Laser Publication.

Pinker, S. (1984). *Language learnability and language development.* Cambridge: Harvard University Press.

Pinker, S. (1995). Why the child holded the baby rabbits: A case study in language acquisition. In L. Gleitman & M. Liberman (Eds.), *Invitation to cognitive Science: Language (*2nd ed., Vol. 1, pp. 93-120). Cambridge, MA: MIT Press.

Pisoni, D. B. (2007). *Efficacy vs. effectiveness: Cochlear implants work but they don't restore normal hearing or support robust speech perception.* Paper presented at International Conference: Cognitive Underpinnings of Learning by Deaf and Hard-of-Hearing Students. Rochester, NY: NTID.

Pisoni, D. B., & Cleary, M. (2004). Learning, memory, and cognitive processes in deaf children following cochlear implantation. In F. G. Zeng, A. N. Popper, & R. R. Fay (Eds.), *Springer handbook of auditory research: Auditory prosthesis*, SHAR Volume X (pp. 377–426). New York: Springer.

Pisoni, D. B., Conway, C. M., Kronenberger, D. L., Horn, J. K., & Henning, S. C. (2008). Efficacy and effectiveness of cochlear implants in deaf children. In M.

Marschark & P. C. Hauser (Eds.), *Deaf cognition: Foundations and outcomes* (pp. 52–101). New York, NY: Oxford University Press.

Pizzuto, E. (2002). The development of Italian Sign Language (LIS) in deaf pre-schoolers. In G. Morgan & B. Woll (Eds.), *Directions in sign language acquisition* (pp.77-114). Amsterdam, Philadelphia: John Benjamins Publishing.

Place, S., & Hoff, E. (2011). Properties of dual language exposure that influence two-year-olds' bilingual proficiency. *Child Development, 82(6),* 1834–1849.

Plaza-Pust, C. (2014). Language development and language interaction in sign bilingual language acquisition. In M. Marschark, G. Tang, & H. Knoors (Eds.), *Bilingualism and bilingual deaf education* (pp. 23-53). Oxford/New York: Oxford University Press.

Poulin-Dubois, D., & Goodz, N. (2001). Language differentiation in bilingual infants: Evidence from babbling. In J. Cenoz & F. Genesee (Eds.), *Trends in bilingual acquisition* (pp. 95-106). Amsterdam: John Benjamins.

Power, D., & Carty, B. (1999). *Auslan proficiency rating scale*. Centre for Deafness and Communication Studies, Griffith University, QLD. Unpublished.

Power, D., & Hyde, M. (1997). Multisensory and unisensory approaches to communication with deaf children. *European Journal of Psychology of Education, 12*, 449–464.

Power, D., Wood, D., Wood, H., & MacDougall, J. (1990). Maternal control over conversations with hearing and deaf infants and young children. *First Language, 10,* 19–25.

Powers, S. (2002). From concepts to practice in deaf education: A United Kingdom perspective on inclusion. *Journal of Deaf Studies and Deaf Education*, *7*(3), 230-243.

Powers, S. (2003). Influences of student and family factors on academic outcomes of mainstream secondary school deaf students. *Journal of Deaf Studies and Deaf Education, 8(1),* 57-78.

Preisler, G. (2007). The psychosocial development of deaf children with cochlear implants. In L. Komesaroff (Ed.), *Surgical consent: Bioethics and cochlear implantation* (pp. 120–136). Washington, DC: Gallaudet University Press.

Preisler, G., Tvingstedt, A-L., Ahlström, M. A. (2002). Psychosocial follow-up study of deaf preschool children using cochlear implants. *Child: Care, Health & Development, 28,* 403-418.

Preisler, G., Tvingstedt A-L., & Ahlström, M. (2005). Interviews with deaf children about their experience using cochlear implants. *American Annals of the Deaf, 150*(3), 260–267.

Prezbindowski, A., Adamson, L., & Lederberg, A. (1998). Joint attention in deaf and hearing 22 month old children and their hearing mothers. *Journal of Applied Developmental Psychology, 19*, 377-387.

Pruss-Ramagosa, E. (2001). *EI is not HUEVO: Bilingualism in two sign languages.* University of Hamburg Manuscript.

Quay, S. (1995). The bilingual lexicon: Implications for studies of language choice. *Journal of Child Language,* 22, 369–387.

Quinto-Pozos, D. (2011). Teaching American Sign Language to hearing adult learners. *Annual Review of Applied Linguistics,* 31,137-158.

Quittner, A. L., Barker, D. H., Cruz, I., Snell, C., Grimley, M. E., & Botteri, M. (2010). Parenting stress among parents of deaf and hearing children: Associations with language delays and behavior problems. *Parenting: Science and Practice, 10, 136-155.*

Quittner, A. L., Glueckauf, R. L., Jackson, D. N. (1990). Chronic parenting stress: Moderating versus mediating effects of social support. *Journal of Personality and Social Psychology, 59,* 1266–1278.

Redlinger, W. E., & Park, T. (1980). Language mixing in young bilinguals. *Journal of Child Language 7,* 337–352.

Reilly, J. S., McIntire, M. L., & Bellugi, U. (1991). Baby face: A new perspective on universals in language acquisition. In P. Siple & S. D. Fischer (Eds.), *Theoretical issues in sign language* r*esearch: Psychology* (Vol. 2, pp. 9–23). Chicago: University of Chicago Press.

Reynell, J. (1977). *Reynell developmental language scales (Revised)* Windsor: NFER.

Rhoades, E. A. (2003). Lexical-semantic and morphosyntactic language assessment in auditory-verbal intervention: A position paper*. The Volta Review, 103*(3), 169-184.

Rinaldi, P., Caselli, C. (2009). Lexical and grammatical abilities in deaf Italian preschoolers: The role of duration of formal language experience. *Journal of Deaf Studies and Deaf Education 14*(1), 63-75.

Rinaldi, P., Caselli, C., Onofrio, D., & Volterra, V. (2014). Language acquisition by bilingual deaf preschoolers: Theoretical, methodological Issues and empirical data. In M. Marschark, G. Tang, & H. Knoors (Eds.), *Bilingualism and bilingual deaf education* (pp. 54-73). Oxford/New York: Oxford University Press.

Rizzi, L. (1989). On the format of parameters. *The Behavioural and Brain Sciences, 12*(2), 355–356.

Robbins, A. M., Svirsky, M. A., & Miyamoto, R. T. (2000). Aspects of linguistic development affected by cochlear implants. In S. B. Waltzman & N. Cohen (Eds.), *Cochlear implants* (pp. 284-287). New York: Thieme Publications.

Robinshaw, H. M. (1996). Early intervention for hearing impairment: Identifying and measuring individual differences in the timing of communication and language development. *Early Childhood Development and Care, 19,* 73-100.

Romaine, S. (1995). *Bilingualism.* Oxford: Basil Blackwell.

Ronnberg, L., Soderfeldt, B., & Risberg, J. (2000). The cognitive neuroscience of signed language*. Acta Psychologica, 105*(2-3), 237 -254.

Rowe, M. L. (2008). Child-directed speech: Relation to socioeconomic status, knowledge of child development and child vocabulary skill. *Journal of Child Language, 35,* 185–205.

Rush, D. D., & Shelden, M. (2011). *The early childhood coaching handbook*. Baltimore MD: Paul H. Brookes Publishing Company.

Russ, S. A., Dougherty, D., & Jagadish, P. (2010). Accelerating evidence into practice for the benefit of children with early hearing loss. *Pediatrics, 126*, S7-S18.

Russ, S., Poulakis, Z., Barker, M., Wake, M., Rickards, F., Saunders, K., & Oberklaid, F. (2002). Epidemiology of congenital hearing loss in Victoria, Australia. *International Journal of Audiology, 42(7)*, 385–390.

Sarant, J. Z., Holt, C. M., Dowell, R. C., Rickards, F., & Blamey, P. (2009). Spoken language development in oral preschool children with permanent childhood deafness. *Journal of Deaf Studies and Deaf Education, 14*, 205–217.

Saunders, G. (1988). *From birth to teens*. Clevedon: Multilingual Matters.

Schembri, A. (1996). *The structure and formation of signs in Auslan (Australian Sign Language).* Sydney: North Rocks Press.

Schembri, A., & Johnston, T. (2007). Sociolinguistic variation in the use of fingerspelling in Australian Sign Language (Auslan): A pilot study. *Sign Language Studies* 7(3), 319-347.

Schembri, A., Wigglesworth, G., Johnston, T., Leigh, G., Adam, R., & Barker, R. (2002). Issues in development of the test battery for Australian Sign Language morphology and syntax. *Journal of Deaf Studies and Deaf Education, 7(*1), 18-40.

Schick, B. (2006). Acquiring a visually motivated language: Evidence from diverse learners. In B. Schick, M. Marschark, & P. E. Spencer (Eds.), Advances in the sign language development of deaf children (pp. 102–134). Oxford University Press.

Schick, B. (2007). *A model of learning within an interpreted K-12 educational setting.* Paper presented at International Conference: Cognitive Underpinnings of Learning by Deaf and Hard-of-Hearing Students. Rochester, NY: NTID.

Schick, B., Marschark, M., & Spencer, P. E. (2005). *Advances in sign language development of deaf and hard of hearing children.* Oxford: Oxford University Press.

Schick, B., Marschark, M., & Spencer, P. E. (Eds.). (2006). *Advances in sign language development in deaf children.* Oxford: Oxford University Press.

Schlyter, S. (1993). The weaker language in bilingual Swedish-French children. In K. Hyltenstam & Å. Viberg (Eds.), *Progression and regression in language.* Cambridge: Cambridge University Press.

Scollie, S. D., Ching, T. Y. C., Seewald, R., & Dillon, H. (2010). Evaluation of the NAL-NL1 and the DSL v.4.1 prescriptions for children: Preference in real-world use. *International Journal of Audiology*, *49,* S49-S63.

Sedey, A. L. (1996). *Speech intelligibility checklist*. Boulder, CO: University of Colorado.

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference.* Boston, MA: Houghton Mifflin.

Shonkoff, J. P., & Phillips, D. A. (Eds.). (2000). *From neurons to neighbourhoods: The science of early childhood development.* Committee on integrating the science of early childhood development, National Research Council and Institute of Medicine. Washington, DC: National Academy Press.

Shulman, S., Besculides, M., Saltzman, A., Ireys, H., White, K. R., & Forsman, I. (2010). Evaluation of the universal newborn hearing screening and intervention program. *Pediatrics, 126*, S19.

Siegel, D. J. (1999). *The developing mind: Towards a neurobiology of interpersonal experience.* New York: The Guildford Press.

Siegel, D. J., & Hartzell, M. M. (2003). *Parenting from the inside-out: How a deeper self-understanding can help you raise children who thrive.* New York: Tarcher-Penguin.

Singleton, J. L., Supalla, S., Litchfield, S., & Schley, S. (1998). From sign to word: Considering modality constraints in ASL/English bilingual education. *Topics in Language Disorders, 18(*4), 47-60.

Singleton, J. L., & Tittle, M. D. (2000). Deaf parents and their hearing children. *Journal of Deaf Studies and Deaf Education*, *5*(3), 221–236.

Sininger, Y. S., Martinez, A., Eisenberg, L., Christensen, E., Grimes, A., & Hu, J. (2009). Newborn hearing screening speeds diagnosis and access to intervention by 20–25 months. *Journal of the American Academy of Audiology, 20*(1), 49–57.

Skinner, E. A. (1986). The origins of young children's perceived control: Mother contingent and sensitive behavior. *International Journal of Behavioral Development, 9*, 359–382.

Skutnabb-Kangas, T. (2007). *Bilingualism or not: The education of minorities.* New Delhi: Orient Longman.

Slobin, D. I. (1973). Cognitive prerequisites for the development of grammar. In C. A. Ferguson & D. I. Slobin, (Eds.), *Studies of child language development* (pp. 175-208). New York: Holt, Rinehart & Winston.

Slobin, D. I., Hoiting, N., Kuntze, M., Lindert, R., Weinberg, A., Pyers, J…. Thumann, H. (2003). A Cognitive/functional perspective on the acquisition of "classifiers". In K. Emmorey (Ed.), *Perspectives on classifier constructions in sign languages* (pp. 271-296). Mahwah, NJ: Lawrence Erlbaum Associates.

Smith, C., Adamson, L., & Bakeman, R. (1988). Interactional predictors of early language. *First Language, 8,* 143–156.

Snitzer Reilly, J., & Bellugi, U. (1996). Competition on the face: Affect and language in ASL motherese. *Journal of Child Language, 23,* 219-239.

Snow, C. E. (1977). The development of conversation between mothers and babies. *Journal of Child Language, 4*, 1-22.

Snow, C. E. (1979). The role of social interaction in language acquisition. In W. A. Collins (Ed.), *Minnesota symposia on child psychology* (Vol. 12, pp.157-182). Hillsdale NJ: Erlbaum.

Snow, C. E. (1986). Conversations with children. In P. Fletcher & M. Garman (Eds.), *Language acquisition* (pp. 69–89). Cambridge: Cambridge University Press.

Snow, C. E. (1989). Understanding social interactions and language acquisition: Sentences are not enough. In M. Bornstein & J. Bruner (Eds.), *Interactions in human development* (pp. 83-103). Hillsdale, NJ: Erlbaum.

Snow, C. E. (1995). Issues in the study of input: Fine-tuning, universality, individual and developmental differences, and necessary causes. In P. Fletcher & B. MacWhinney (Eds.), *The handbook of child language* (pp. 180-193). Oxford, UK: Blackwell.

Snow, C. E., & Hoefnagel-Höhle, M. (1977). Age differences in the pronunciation of foreign sounds. *Language and Speech, 20*, 357-365.

Spencer, P. E. (1993). Communication behaviours of infants with hearing loss and their hearing mothers. *Journal of Speech and Hearing Research, 36*, 311-321.

Spencer, P. E. (2000). Looking without listening: Is audition a prerequisite for normal development of visual attention during infancy? *Journal of Deaf Studies and Deaf Education, 5(*4), 291-302.

Spencer, P. E. (2001). *A good start: Suggestions for visual conversations with deaf and hard of hearing babies and toddlers*. Washington DC: Laurent Clerc National Deaf Education Centre, Gallaudet University.

Spencer, P. E. (2004). Individual differences in language performance after cochlear implantation at one to three years of age: child, family, and linguistic factors. *Journal of Deaf Studies and Deaf Education, 9*, 395–412.

Spencer, P. E., Bodner-Johnson, B. A., & Gutfreund, M. K. (1992). Interacting with infants with a hearing loss: What can we learn from mothers who are deaf? *Journal of Early Intervention*, *16*(1), 64-78.

Spencer, P. E., & Harris, M. (2006). Patterns and effects of language input to deaf infants and toddlers from deaf and hearing mothers. In B. Schick, M. Marschark, & P. E. Spencer (Eds.), *Advances in the sign language development of deaf children* (pp. 71-101). Oxford: Oxford University Press.

Spencer, P. E., & Marschark, M. (2010). *Evidence-based practice in educating deaf and hard-of-hearing students.* New York: Oxford University Press.

Spencer, P., & Waxman, S. (1995). *Joint attention and maternal attention strategies: 9, 12, & 18 months. Maternal responsiveness and child competency in deaf and hearing children.* Final Report, Grant H023C10077, OSERS, US. Department of Education.

Sperling, G. (1978). Future prospects in language and communication for the congenitally deaf. In L. S. Liben (Ed.), *Deaf children: Developmental perspectives.* New York: Academic Press.

Stewart, L. G. (1992). Debunking the bilingual/bicultural snow job in the American deaf community In M. Garretson (Ed.), *A Deaf American monograph, 42,* 129-142.

Stien, P. T., & Kendall, J. (2004). *Psychological trauma and the developing brain: Neurologically based interventions for troubled children.* Binghampton, NY: The Haworth Press.

Stokoe, W. (1960). *Sign language structure: An outline of the visual communication systems of the American Deaf.* Studies in Linguistics, Occasional Papers 8. Buffalo: University of Buffalo.

Stokoe, W., Casterline, D., & Croneberg, C. (1965). *A dictionary of American Sign Language on linguistic principles*. Washington, DC: Gallaudet College Press.

Stokoe, W. C. & Marschark, M. (1999). Signs, gestures, and signs. In L. Messing & R. Campbell (Eds.), *Gesture, speech, and sign* (pp. 161-182). Oxford: Oxford University Press.

Stredler-Brown, A. (2005). Family-centred intervention: Proven strategies to assure positive outcomes. In R. Seewald & J. Bamford (Eds.), *A sound foundation through early amplification 2004, proceedings of the Third International Conference* (pp. 185–196). Great Britain: Cambrian Printers Ltd.

Stredler-Brown, A. (2010). Communication choices and outcomes during the early years: An assessment and evidence-based approach. In M. Marschark & P. Spencer (Eds.), *The Oxford handbook of deaf studies, language, and education* (Vol. 2, pp. 292–315). New York: Oxford University Press.

Stredler-Brown, A., Johnson, D. C. (2001). *Functional auditory performance indicators: An integrated approach to auditory development*. Retrieved from http://www.cde.state.co.us/cdesped/SpecificDisabilltyHearing.htm.

Stredler-Brown, A., & Yoshinaga-Itano, C. (1994). F.A.M.I.L.Y assessment: a multidisciplinary evaluation tool. In J. Roush & N. Matkin (Eds.), *Infants and toddlers with hearing loss (*pp. 133-161). Baltimore, MD: York Press.

Strong, M. (1997). A review of bilingual-bicultural programs for deaf children in North America. *American Annals of the Deaf, 140,* 84-89.

Sutton-Spence, R., & Woll, B. (1999). *The linguistics of British Sign Language: An introduction.* Cambridge: Cambridge University Press.

Svartholm, K. (1993). Bilingual education for the deaf in Sweden. *Sign Language Studies, 81,* 291-332.

Swain, M. (1983). Bilingualism without tears. In M. Clarke & J. Handscombe (Eds.), *On TESOL '82: Pacific perspectives on language learning and teaching* (pp. 35–46). Washington, DC: TESOL.

Swanwick, R. (2010) Policy and practice in sign bilingual education: development, challenges and directions, International Journal of Bilingual Education and Bilingualism, 13:2, 147-158.

Swanwick, R., & Gregory, S. (2007). *Sign bilingual education: Policy and practice*. Coleford: McLean Publishing.

Swanwick, R., Hendar, O., Dammeyer, J., Kristoffersen, A., Salter, J., & Simonsen, E. (2014). Shifting contexts and practices in sign bilingual education in northern Europe: Implications for professional development and training. In M. Marschark, G. Tang, & H. Knoors (Eds.), *Bilingualism and bilingual deaf education* (pp. 292-310). Oxford/New York: Oxford University Press.

Swanwick, R., & Tsverik, I. (2007). The role of sign language for deaf children with cochlear implants: good practice in sign bilingual settings*. Deafness and Education International, 9*(4), 14-231.

Swisher, M. V., & Thompson, M. (1985). Mothers learning simultaneous communication: The dimensions of the task. *American Annals of the Deaf, 130*, 212-218.

Taeschner, T. (1983). *The sun is feminine: A study on language acquisition in bilingual children.* Berlin: Springer.

Tamis-LeMonda, C., Bornstein, M., & Baumwell, L. (2001). Maternal responsiveness and children's achievement of language milestones. *Child Development, 72,* 748-767.

Tamis-LeMonda, C. S., Uzgiris, I. C., & Bornstein, M. H. (2002). Play in parent-child interactions. In M. H. Bornstein (Ed.), *Handbook of parenting: Practical issues in parenting (*2nd ed., pp. 221-241). Mahwah, NJ: Lawrence Erlbaum Associates.

Tevenal, S., & Villanueva, M. (2009). Are you getting the message?: The effects of SimCom on the message received by deaf, hard of hearing, and hearing students. *Sign Language Studies, 9*(3), 266-286.

Tharpe, A. M., Ashmead, D. H., & Rothpletz, A. M. (2002). Visual attention in children with normal hearing, children with hearing aids, and children with cochlear implants. *Journal of Speech, Language, and Hearing Research, 45*, 403-413.

Thompson, G. G. (1952). *Child psychology*. Boston, MA: Houghton Mifflin.

Thoryk, R. (2010). A call for improvement: The need for research-based materials in American Sign Language education. *Sign Language Studies, 11*, 1.

Tomasello, M. (1998). *The new psychology of language, (Vol.1): Cognitive and functional approaches to language structure.* Mahwah, NJ: Lawrence Erlbaum.

Tomasello, M. (2003). *Constructing a language: A usage-based theory of language acquisition.* Cambridge, MA*:* Harvard University Press.

Tomasello, M. (2006). Acquiring linguistic constructions. In D. Kuhn & R. Siegler (Eds.), *Handbook of child psychology* (pp.225-298)*.* New York: Wiley.

Tomasello, M., & Farrar, J. M. (1986). Joint attention and early language*. Child Development*, *457*, 1454-1463.

Tomasello, M., & Todd, J. (1983). Joint Attention and lexical acquisition style*. First Language, 4,* 197-212.

Tomblin, J. B., Spencer, L., Flock, S., Tyler, R., & Gantz, B. (1999). A comparison of language achievement in children with cochlear implants and children using hearing aids. *Journal of Speech, Language, and Hearing Research, 42*, 497–511.

Toscano, R. M., McKee, B. G., & Lepoutre, D. (2002). Success with academic English: Reflections of deaf college students*. American Annals of the Deaf, 147*, 5-23.

Traci, M., & Koester, L. S. (2003). Parent-infant interactions: A transactional approach to understanding the development of deaf infants. In M. Marschark & P. E. Spencer (Eds.), *Oxford handbook of deaf studies, language and education*. Oxford, UK: Oxford University Press.

Traxler, C. B. (2000). Measuring up to performance standards in reading and mathematics: Achievement of selected deaf and hard-of-hearing students in the national norming of the 9th Edition Stanford Achievement Test. *Journal of Deaf Studies and Deaf Education, 5, 337-348.*

Tye-Murray, N. (2003). Conversational fluency of children who use cochlear implants. *Ear & Hearing, 24*(Suppl. 1), 82S–89S.

Uhlén, I., Bergman, B., Hägg, Å., & Eriksson, C. (2005). Bilingualism in early parallel speech and sign language development in children with a hearing disability or deafness. *Logopednytt, 6,* 12-16.

VanDam, M., Ambrose, S. E., & Moeller, M. P. (2012). Quantity of parental language in the home environments of hard-of-hearing 2-year-olds. *Journal of Deaf Studies and Deaf Education, 17(*4), 402-420.

Van den Bogaerde, B. (2000). *Input and interaction in deaf families*. Doctoral dissertation. University of Amsterdam. Utrecht: LOT. ISBN 90-76864-01-2

Van den Bogaerde, B., & Baker, A. (2002). Are young deaf children bilingual? In G. Morgan & B. Woll (Eds.), *Directions in sign language acquisition: Trends in language acquisition research (*pp. 183–206). Amsterdam & Philadelphia: John Benjamins.

Van den Bogaerde, B., & Baker, A. E. (2005). Code mixing in mother-child interaction in deaf families. *Sign Language & Linguistics 8(*1-2), 151–174.

Vigil, D. C., & Hwa-Froelich, D. A. (2004). Interaction styles in minority caregivers: Implications for intervention. *Communication Disorders Quarterly, 25*, 119–126.

Vihman, M. M. (1985). Language differentiation by the bilingual infant. *Journal of Child Language 12*, 297-324.

Vihman, M. M., & McLaughlin, B. (1982). Bilingualism and second language acquisition in preschool children. In C. Brainerd (Ed.), *Progress in cognitive development: verbal processes in children* (pp.35-58). New York: Springer.

Vihman, M. M., Thierry, G., Lum, J. A., Keren-Portnoy, T., & Martin, P. (2007). Onset of word form recognition in English, Welsh, and English–Welsh bilingual infants. *Applied Psycholinguistics, 28*, 475–493.

Vohr, B., Jodin-Krauzyk, J., Tucker, R., Johnson, M. J., Topal, D., & Ahlgren, D. (2008). Early language outcomes of early-identified infants with permanent hearing loss at 12 to 16 months of age. *Pediatrics, 122,* 535–544.

Volterra, V., & Caselli, M. C. (1986). First stage of language acquisition through two modalities in deaf and hearing children. *Italian Journal of Neurological Sciences, 5,* 109-15.

Volterra, V., & Erting, C. J. (1990). *From gesture to language in hearing and deaf children.* Berlin: Springer-Verlag.

Volterra, V., & Erting, C. (Eds.). (1994). *From gesture to language in hearing and deaf children.* Washington, DC: Gallaudet University Press.

Volterra, V. & Iverson, J. (1995). When do modality factors affect the course of language acquisition? In K. Emmorey & J. Snitzer Reilly (Eds.), *Language, gesture, and space* (pp. 371-390). Hillsdale, NJ: Lawrence Erlbaum Associates.

Volterra, V., & Taeschner, T. (1978). The acquisition and development of language by bilingual children. *Journal of Child Language, 5,* 311-326.

Vonen, A. M. (2007). Bilingualism: A future asset in the education of socially deaf children. In M. Hyde & G. Hoie (Eds.), *Constructing educational discourses on deafness* (pp. 108–118). Oslo, Norway: Norwegian Government Printers, Skadalen Resource Center.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Translated and edited by M. Cole, J. John-Steiner, S. Scribner, & E. Souberman. Cambridge, MA: Harvard University Press.

Vygotsky, L. S. (1986). *Thought and language* (translated by A. Kozulin) Cambridge, MA: MIT Press.

Wake, M. A. (2002). Newborn hearing screening: Decision time for Australia. *Medical Journal of Australia, 177*(4), 172-173.

Wake, M., Hughes, E. K., Poulakis, Z., Collins, C., & Rickards, F. W. (2004). Outcomes of children with mild-profound congenital hearing loss at 7 to 8 years: A population study. *Ear and Hearing, 25*, 1-8.

Wake, M., Poulakis, Z., Hughes, E. K., Carey-Sargeant, C., & Rickards, F. W. (2005). Hearing impairment: A population study of age at diagnosis, severity, and language outcomes at 7–8 years. *Archives of Disease in Childhood, 90*, 238–244.

Warren, S. F., & Brady, N. C. (2007). The role of maternal responsivity in the development of children with intellectual disabilities. *Mental Retardation and Developmental Disabilities Research Reviews, 13,* 330-338.

Wartenburger, I., Heekeren, H. R., Abutalebi, J., Cappa, S. F., Villringer, A., & Perani, D. (2003). Early setting of grammatical processing in the bilingual brain. *Neuron*, *37*(1), 159-170.

Watson, J. S. (1985). Contingency perception in early social development. In T. Field & N. Fox (Eds.), *Social perception in infants.* Norwood, NJ: Ablex.

Watson, L. M., Hardie, T., Archbold, S. M., & Wheeler, A. (2008). Parents' views on changing communication after cochlear implantation. *Journal of Deaf Studies and Deaf Education, 13(*1), 104-116.

Wauters, L. N., & Knoors, H. (2008). Social integration of deaf children in inclusive settings. *Journal of Deaf Studies and Deaf Education*, *13*(1), 21-36.

Waxman, S. R. (2006). Finding the points of contact: Language acquisition in children raised in monolingual, bilingual and multilingual environments. In W. Li (Series

Ed.) & P. McCardle & E. Hoff (Vol. Eds.), *Child language & child development: Childhood bilingualism - Research on infancy through school age*. Clevedon, UK: Multilingual Matters.

Weber-Fox, C. M., & Neville, H. J. (1999). Functional neural subsystems are differentially affected by delays in second language immersion: ERP and behavioral evidence in bilinguals. In D. Birdsong (Ed.), *Second language acquisition and the critical period hypothesis* (pp. 23-38*)*. Mahwah, NJ: Lawrence Erlbaum Publishers.

Wedell-Monnig, J., & Lumley, J. M. (1980). Child deafness and mother-child interaction. *Child Development*, *51*(3), 766-74.

Weizman, Z., & Snow, C. (2001). Lexical input as related to children's vocabulary acquisition: Effects of sophisticated exposure and support for meaning. *Developmental Psychology*, *37*, 265–279.

Werker, J. F., & Byers-Heinlein, K. (2008). Bilingualism in infancy: First steps in perception and comprehension. *Trends in Cognitive Sciences 12*, 144–51.

Wexler, K. (1998). Very early parameter setting and the unique checking constraint: A new explanation of the optional infinitive stage. *Lingua, 106*, 23-79.

Wheeler, A., Archbold, S. M., Hardie, T., & Watson, L. M. (2009). Children with cochlear implants: The communication journey. *Cochlear Implants International, 10*(1), 41–62.

White, S. J., & White, R. E. C. (1987). The effects of hearing status of the family and age of intervention on receptive and expressive oral language skills in hearing-impaired infants. *Monographs of the American Speech, Language and Hearing Association, 26,* 9–24.

Wilbur, R. (1987). *American Sign Language: Linguistics and applied dimensions.* Boston: College Hill Press.

Wilbur, R. (1993). Syllables and segments: Hold the movement and move the holds! In G. Coulter (Ed.), *Current issues in ASL phonology: Phonetics and phonology* (Vol.3*,* pp. 135-68)*.* San Diego: Academic Press.

Wilbur, R. B. (2000). The use of ASL to support the development of English and literacy. *Journal of Deaf Studies and Deaf Education, 5*(1), 81-104.

Wilkes, E. M. (1999). *Cottage acquisition scales for listening, language & speech.* Texas: Sunshine Cottage School for Deaf Children.

Wills, A. J. (2005). *New directions in human associative learning*. Mahwah, NJ: Erlbaum.

Wolery, M., Dunlap, G., & Ledford, J. R. (2011). Single-case experimental method: Suggestions for reporting. *Journal of Early Intervention, 33*(2), 103-109.

Woll, B. (1990). Sign language. In N. E. Collinge (Ed.), *An encyclopaedia of language (*pp. 740-783). London: Routledge.

Woll, B. (1998). The development of signed and spoken language. In S. Gregory, P. Knight, W. McCracken, S. Powers, & L. Watson (Eds.), *Issues in deaf education* (pp. 58-65)*.* London: Fulton.

Woolfe, T., Herman, R., Roy, P., & Woll, B. (2010). Early vocabulary development in deaf native signers: A British Sign Language adaptation of the communicative development inventories. *Journal of Child Psychology and Psychiatry*, *51*, 322-331.

World Federation of the Deaf (WFD) & International Federation of the Hard of Hearing (IFHOH) (2013). *Co-operation Agreement between World Federation of the Deaf*

and the International Federation of Hard of Hearing People. Retrieved from http://www.ifhoh.org/papers/

Yip, V., & Matthews, S. (2006).Assessing language dominance in bilingual acquisition: a case for mean length utterance differentials. *Language Assessment Quarterly, 3*(2), 97–116.

Yoder, P. J., & Kaiser, A. P. (1989). Alternative explanations for the relationship between maternal verbal interaction style and child language development. *Journal of Child Language, 16,* 141-160.

Yoshinaga-Itano, C. (2000). Development of audition and speech: Implications for early intervention with infants who are deaf or hard of hearing*. Volta Review, 100*, 213-234.

Yoshinaga-Itano, C. (2003). From screening to early identification and intervention: Discovering predictors to successful outcomes for children with significant hearing loss. *Journal of Deaf Studies and Deaf Education, 8,* 11-30.

Yoshinaga-Itano, C. (2006). Early identification, communication modality, and the development of speech and spoken language skills: Patterns and considerations. In P. E. Spencer & M. Marschark (Eds.), *Advances in the spoken language development of deaf and hard-of-hearing children* (pp. 298–327). Oxford, England: Oxford University Press.

Yoshinaga-Itano, C., & Sedey, A. (2000). Early speech development in children who are deaf or hard of hearing: Interrelationships with language and hearing. *The Volta Review*, *100*(5), 181-211.

Yoshinaga-Itano, C., Sedey, A. L., Coulter, D., & Mehl., A. L. (1998). Language of early- and later-identified children with hearing loss. *Pediatrics, 102*, 1161–1171.

Young, A. (1997). Conceptualizing parents' sign language use in bilingual early intervention. *Journal of Deaf Studies and Deaf Education, 2,* 264–276.

Young, A., & Tattersall, H. (2007). Universal newborn hearing screening and early identification of deafness: Parents' responses to knowing early and their expectations of child communication development. *Journal of Deaf Studies and Deaf Education, 12*(2), 209-220.

Appendices

Appendix 4.1.1: Sample letter of invitation for participation in the research project.

[School logo]

AURORA SCHOOL

96 Holland Road
Blackburn South VIC 3130
(PO Box 249, Blackburn South 3130)

Tel: 8878 9878
Fax: 8878 9800

September, 2009

The impact of a bimodal bilingual input on deaf children's communication and language development

Dear Participant,

You are invited to participate in the above research project, which is being conducted by Elizabeth Levesque (PhD student), with Associate Professor Margaret Brown, Faculty of Education and Associate Professor Gillian Wigglesworth, Faculty of Linguistics and Applied Linguistics as supervisors. This project will form part of Elizabeth Levesque's PhD thesis and has been approved by the Human Research Ethics Committee at the University of Melbourne.

The aim of this study is to investigate the ways in which young deaf children communicate with their parents in Auslan and English and how this bilingual approach supports their language development. A secondary aim is to find out more about how hearing parents of deaf children learn Auslan skills, what resources they use and whether their Auslan skills are sufficient to support their children's bilingual language development.

Should you agree to participate, you would be asked to merely interact and communicate bilingually with your child in a natural way, during play and other daily routines. These interactions would be also be part of your regular early intervention sessions with your teacher (Elizabeth Levesque) and would not involve any specific tasks or extra workload. Every two months, communication and language skills will be observed and recorded on checklists and language charts and by a 20 minute videotaped record, using a miniature camera. During

this time, you and your child will not be interrupted or inconvenienced and will interact with each other as you normally do.

In the final report, there will be no references to personal information that might allow someone to identify your child or your family and a high level of care will be taken to ensure that discussions and details are described in non-specific terms. Due to the small sample size, it will not be possible to guarantee full anonymity of participants; however, all reasonable efforts will be made to ensure that there will be no physical, psychological, social, legal or economic risks to you and your family during the course of the study. Once the thesis arising from this research has been completed, a brief summary of the findings will be available to you. It is also possible that the anonymous results will be presented at academic conferences, in professional journals and papers.

The information collected from observations in your home will be kept securely in the University of Melbourne's Faculty of Education for five years from the date of publication, before being destroyed.

Please be advised that your participation in this study is completely voluntary. If you wish to withdraw at any stage, you are free to do so without a problem and without any disruption to the early intervention program provided by Aurora School. If you would like to participate, please indicate that you have read and understood this information by signing the accompanying consent form and returning it to Elizabeth Levesque.

Should you require any further information, or have any concerns, please do not hesitate to contact Associate Professor Margaret Brown (8344 0987), Professor Gillian Wigglesworth (83444720) or Elizabeth Levesque (0400675753). Should you have any concerns about the conduct of the project, you are welcome to contact the Executive Officer, Human Research Ethics, The University of Melbourne, on ph: 8344 2073, or fax: 9347 6739.

Yours sincerely,

……..

Principal,

Aurora School

Appendix 4.1.2: Sample Plain Language Statement.

[University Logo]

PLAIN LANGUAGE STATEMENT

The impact of a bimodal bilingual input on deaf children's communication and language development

You are invited to participate in the above research project, which is being conducted by Elizabeth Levesque (PhD student), with Associate Professor Margaret Brown, Faculty of Education and Professor Gillian Wigglesworth, Faculty of Linguistics and Applied Linguistics as supervisors. This project will form part of Elizabeth Levesque's PhD thesis and has been approved by the Human Research Ethics Committee at the University of Melbourne.

The aim of this study is to investigate the ways in which young deaf children communicate with their parents in Auslan and English and how this bilingual approach supports their language development. A secondary aim is to find out more about how hearing parents of deaf children learn Auslan skills, what resources they use and whether their Auslan skills are sufficient to support their children's bilingual language development.

Should you agree to participate, you would be asked to merely interact and communicate bilingually with your child in a natural way, during play and other daily routines. These interactions would be also be part of your regular early intervention sessions with your teacher (Elizabeth Levesque) and would not involve any specific tasks or extra workload. Every two months, communication and language skills will be observed and recorded on checklists and language charts and by a 20 minute videotaped record, using a miniature camera. During this time, you and your child will not be interrupted or inconvenienced and will interact with each other as you normally do.

In the final report, there will be no references to personal information that might allow someone to identify your child or your family, with the greatest care being taken to ensure that discussions and details are described in non-specific terms. Due to the small sample size, it will not be possible to guarantee full anonymity of participants; however, all reasonable efforts will be made to ensure that there will be no risks or negative impact to you and your family during the course of the study. Once the thesis arising from this research has been completed, a brief summary of the findings will be available to you. It is also possible that the anonymous results will be presented at academic conferences, in professional journals and papers. The information collected from observations in your home

will be kept securely in the University of Melbourne's Faculty of Education for five years from the date of publication, before being destroyed.

Please be advised that your participation in this study is completely voluntary. If you wish to withdraw at any stage, you are free to do so without a problem and without any disruption to your early intervention program. If you would like to participate, please indicate that you have read and understood this information by signing the accompanying consent form and returning it to Elizabeth Levesque.

Should you require any further information, or have any concerns, please do not hesitate to contact Associate Professor Margaret Brown (8344 0987), Professor Gillian Wigglesworth (83444720) or Elizabeth Levesque (0400675753). Should you have any concerns about the conduct of the project, you are welcome to contact the Executive Officer, Human Research Ethics, The University of Melbourne, on phone: 8344 2073, or fax: 9347 6739.

Appendix 4.1.3: Sample consent form for parent participation in the research project.

[University Logo]

THE UNIVERSITY OF MELBOURNE
MELBOURNE GRADUATE SCHOOL OF EDUCATION

Consent form for persons participating in research projects

PROJECT TITLE: The impact of a bimodal bilingual input on deaf children's communication and language development

Name of participants: XXXXXX

Name of investigator(s): Associate Professor Margaret Brown, Elizabeth Levesque, Professor Gillian Wigglesworth

1. I consent to participate in the project named above, the particulars of which assessments and observations have been explained to me. A written copy of the information has been given to me to keep.

2. I authorise the researcher or assistant to use for this purpose the assessments and observations referred to under (1) above.

3. I acknowledge that:

   a) the possible effects of the assessments and observations have been explained to me to my satisfaction
   b) I have been informed that I am free to withdraw from the project at any time without explanation or prejudice and to withdraw any unprocessed data previously supplied
   c) I have been informed that withdrawal from the study would in no way affect the provision of the early intervention program provided by Aurora School
   d) the project is for the purpose of research
   e) I have been informed that the confidentiality of the information I provide will be safeguarded subject to any legal requirements
   f) I have been informed that with my consent there will be videotaped records made of parent-child interactions and that the videotapes will be stored at University of Melbourne and will be destroyed after five years

g) I have been informed that my family members' names will be referred to by a pseudonym in any publications arising from the research
h) I have been informed that, due to the small sample size, it will not be possible to guarantee full anonymity of participants and that all reasonable efforts will be made to ensure that there will be no risks or negative impact to my family during the course of the study
i) I am acting as an advocate and guardian for my young deaf child and give my consent to participate on his/her behalf
j) I have been informed that a copy of the research findings will be forwarded to me, should I agree to this

Signature _____ Date _____
(Participants/parents)

Appendix 4.8.1: Summaries of utterances from one minute samples of videotaped parent-child interactions.

Peter										
Data points	1	2	3	4	5	6	7	8	9	10
Number of utterances and parent-to-child reciprocal utterances (RU) in 1 minute										
Parent English	18	5	13	7	17	4	2	6	15	19
Child English*	5	15	10	3	6	2	7	5	11	9
Parent English RU	2	3	1	2	2	0	1	3	3	6
Parent Auslan	0	2	2	0	6	2	0	0	0	0
Child Auslan	0	6	0	0	7	0	0	6	0	0
Parent Auslan RU	0	2	0	0	0	0	0	3	0	0
Child pragmatics	19	10	10	15	14	17	11	9	15	11
Parent prag. RU	5	1	1	1	3	3	1	2	2	2

Note: *vocalizations, not words

Andrew										
Data points	1	2	3	4	5	6	7	8	9	10
Number of utterances and parent-to-child reciprocal utterances (RU) in 1 minute										
Parent English	5	11	0	14	30	19	20	24	18	22
Child English	7	15	5	5	10	6	10	15	15	14
Parent Eng. RU	3	4	0	5	9	2	3	9	9	13
Parent Auslan	3	0	11	6	4	0	4	5	3	10
Child Auslan	0	2	0	4	6	0	2	4	16	2
Parent Auslan RU	0	1	0	3	3	0	2	2	2	2
Child pragmatics	2	15	9	16	6	17	13	14	5	10
Parent prag. RU	2	1	5	4	1	7	5	3	2	1

Tiffany										
Data points	1	2	3	4	5	6	7	8	9	10
Number of utterances and parent-to-child reciprocal utterances (RU) in 1 minute										
Parent English	15	14	20	24	26	25	24	25	7	11
Child English*	0	14	19	21	15	14	15	19	0	15
Parent English RU	0	4	4	8	7	2	9	0	0	4
Parent Auslan	2	3	0	0	5	13	0	16*	6	0
Child Auslan	0	0	0	0	1	0	0	14^	0	2
Parent Auslan RU	0	0	0	0	1	0	0	6	0	2
Child pragmatics	8	9	17	17	12	12	30	21	16	10
Parent prag. RU	8	4	5	7	1	6	12	4	6	4

Note: *Repetitive parent input, imitated from Deaf adult; ^ child imitation from adult

Appendix 4.8.1 (Cont.): Summaries of utterances from one minute samples of videotaped parent-child interactions.

Oscar										
Data points	1	2	3	4	5	6	7	8	9	10
Number of utterances and parent-to-child reciprocal utterances (RU) in one minute										
Parent English	^	^	4	5	7	1	23	26	0	29
Child English*	^	^	3	10	0	0	5	12	0	19
Parent English RU	^	^	0	0	0	0	1	2	0	17
Parent Auslan	^	^	7	3	4	10	16	24	14	17
Child Auslan	^	^	0	0	0	2	0	2	9	15
Parent Auslan RU	^	^	0	0	0	0	0	2	4	12
Child pragmatics	^	^	15	19	13	14	21	18	16	27
Parent prag. RU	^	^	0	5	6	0	10	9	5	12

Note: ^= no data collected; *= vocal patterns only

Sam										
Data points	1	2	3	4	5	6	7	8	9	10
Number of utterances and parent-to-child reciprocal utterances (RU) in one minute										
Parent English	9	17	13	22	23	16	15	28	24	26
Child English	3	15	12	12	6	15	12	8	14	1
Parent English RU	2	2	2	5	5	2	6	3	7	1
Parent Auslan	2	0	3	4	0	3	0	4	0	5
Child Auslan	3	0	0	4	0	8	0	3	5	0
Parent Auslan RU	2	0	0	3	0	3	0	2	3	0
Child pragmatics	8	17	15	12	15	7	13	21	18	13
Parent prag. RU	3	3	3	8	10	1	5	10	12	1

Lachlan										
Data points	1	2	3	4	5	6	7	8	9	10
Number of utterances and parent-to-child reciprocal utterances (RU) in one minute										
Parent English	14	17	15	17	17	30	26	19	18	13
Child English	11	4	9	16	12	0	20	13	15	7
Parent English RU	4	4	3	8	3	0	9	6	5	7
Parent Auslan	0	6	0	0	1	0	0	2	0	16
Child Auslan	0	1	0	0	0	0	0	0	7	1
Parent Auslan RU	0	1	0	0	0	0	0	0	5	0
Child pragmatics	5	15	22	8	12	17	12	8	7	8
Parent prag. RU	2	4	7	0	3	8	4	2	3	3

Appendix 4.8.1 (Cont.): Summaries of utterances from one minute samples of videotaped parent-child interactions.

Oliver										
Data points	1	2	3	4	5	6	7	8	9	10
Number of utterances and parent-to-child reciprocal utterances (RU) in one minute										
Parent English	18	26	12	23	19	13	13	15	19	17
Child English	8	16	14	16	15	23	14	10	19	9
Parent English RU	4	9	8	5	9	8	6	10	10	9
Parent Auslan	23	10	0	0	0	0	2	0	0	6
Child Auslan	15	11	10	5	6	10	6	4	0	4
Parent Auslan RU	7	5	5	4	5	4	2	2	0	4
Child pragmatics	9	11	9	13	5	8	11	7	11	4
Parent prag. RU	3	2	3	1	2	2	3	1	3	1

Max										
Data points	1	2	3	4	5	6	7	8	9	10
Number of utterances and parent-to-child reciprocal utterances (RU) in one minute										
Parent English	12	16	26	17	20	18	13	16	27	24
Child English	3	1	5	8	12*	14*	0	15*	19*	5
Parent English RU	1	1	1	2	6	3	0	6	6	3
Parent Auslan	0	0	0	0	1	0	16^	0	0	2
Child Auslan	1	0	0	0	0	0	4	3	1	0
Parent Auslan RU	0	0	0	0	0	0	4	1	0	0
Child pragmatics	18	8	16	9	17	10	24	11	16	15
Parent prag. RU	6	8	7	6	6	3	8	9	2	8

Note: *mostly imitated utterances; ^ parent Auslan imitated from Deaf adult