

PhD thesis

Ola Hendar

When two language modalities meet:
Speech and sign language, and the impact
on education

Academic advisor: Jesper Dammeyer

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ABSTRACT

This thesis is about young children with hearing loss and their educational outcome. Advances in medicine and technology have made it possible for more children with hearing loss to participate in education with their oral language. Approximately 3 per 1000 children grow up with a hearing loss that has more or less an impact on their language development. Research has shown that even mild forms of hearing loss may cause serious delay to language development. Children who, even with modern technology, do not have access to hearing and speech early in life learn, in most cases, Sign Language. Sign language is a natural language and is recognised and accepted in many countries. Even after advances in technology and language recognition, outcome in education remains a concern. One problem might be that, historically, speech and sign language has had difficulties in appearing unified in rehabilitation and education.

This thesis aims to study outcome in education for children with a hearing loss and to explore early language and its connection to achievement in school. This is done by a population study (survey and register) and a literature search.

The thesis consists of four works covering a survey report (I), an article on methodology (II), a book chapter about a pragmatic language approach (III) and finally, as a consequence of outcome in the survey report (I), a structural literature search on research in pre-lingual aspects of language development was conducted (IV).

This thesis confirms that there remains a variation and gap in education outcome even after 25 years of reforms and technical advances, (Study I & II). The documented effects of early language development, bilingual experience and educational outcome are not fully taken into account in research (Study IV). The thesis points to the need for more research in the pre-lingual period to explore gestures and sign language, their role and support, in preparing children with hearing loss for their functional communication and education, (Study III & IV). My conclusion is that there is a link between early language experiences including gestures, sign language and speech and that, with a more pragmatic language perspective, the educational achievements of such children will change in a positive direction.

Résumé – Dansk

Denne afhandling omhandler børn med høretab og deres skolemæssige resultater. Fremskridt inden for medicin og teknologi har gjort det muligt for flere børn at udvikle brugbart talesprog. Omtrent 3/1000 børn vokse op med et høretab, der mere eller mindre påvirker deres sproglige udvikling. Forskning har vist, at selv mindre høretab kan forårsage en afgørende forsinkelse af den sproglige udvikling. Børn, der, selv med moderne teknologi, ikke har adgang til at høre og tale tidligt i livet lærer i de fleste tilfælde tegnsprog. Tegnsprog er et naturligt sprog og er anerkendt og accepteret i mange lande. Men selv efter at de teknologiske fremskridt er forsinket sprog og skolemæssige præstationer fortsat et problem. Et problem kan være, at historisk set har tale og tegnsprog haft svært ved at forstå samlet i rehabilitering og uddannelse.

Denne afhandling har til formål at studere resultatet i undervisning af børn med høretab og udforske tidlig sprog og dets betydning for senere skolepræstation. Dette er gjort ved hjælp af et population undersøgelse (register og spørreskjema) og et litteraturstudie.

Afhandlingen består af 4 værker, i form af en rapport (I), en artikel om metodologi (II), et bogkapitel om et pragmatisk sprog syn (III) og en systematisk litteratursøgning på forskning i før-sproglige aspekter af densproglige udvikling (IV).

Denne afhandling bekræfter en spredning i uddannelsesresultater, selv efter 25 års reformer og tekniske fremskridt, (Study I & II). Den dokumenterede effekt af tidlig sproglig udvikling, tosproglig tilgang og uddannelsesmæssige resultater er ikke tagets fuld ud med videre i forskningen, (Study IV). Afhandlingen peger på behovet for mere forskning i den før-sproglige periode mht udforskningen af gestus og tegnsprog, deres rolle og støtte til barnets funktionelle kommunikation og senere uddannelse, (Study III). Min konklusion bliver, at med pragmatisk sprog-synspunkt, vil uddannelsepræstationerne ændre sig i en positiv retning.

Résumé – Svenska

Denna avhandling handlar om barn med hörselnedsättning, språk och utbildningsresultat. Framsteg inom medicin och teknik har gjort det möjligt för fler barn att delta i utbildningen med talspråk och hörsel. Omkring 3/1000 barn växer upp med en hörselnedsättning som har mer eller mindre en inverkan på deras språkutveckling. Forskning har visat att även lätta former av hörselnedsättning kan orsaka allvarligt försening av språkutvecklingen. Barn som inte har tillgång till hörsel och tal tidigt i livet, även med modern teknik, lär sig i de flesta fall teckenspråk.

Teckenspråk är ett naturligt språk och är erkänt och accepterat i många länder. Även med medicin-tekniska framsteg och erkännande av teckenspråk i samhället är utbildningsresultaten låga och fortsatt ett problem för elever med hörselnedsättning. En sida av detta

problem kan vara att tal och teckenspråk, historiskt, har haft svårt att förenas i rehabilitering och utbildning.

Denna avhandling syftar till att studera utfallet i utbildning för barn med hörselnedsättning och utforska tidig språkutveckling och dess koppling till resultat i skolan. Detta görs genom att en population undersökning med register och enkäter samt en litteratursökning.

Avhandlingen består av fyra publikationer som omfattar en fältstudierapport (I), en artikel om metodik (II), ett bokkapitel om pragmatisk språkstrategi (III) och en strukturell litteratursökning på forskning i för-språkiga aspekter av barns språkutveckling (IV).

Denna avhandling bekräftar en fortsatt variation och avstånd i utbildnings resultatet även efter 25 år av reformer och tekniska framsteg, (Studie I & II). Den dokumenterade betydelsen av tidig språkutveckling, tvåspråkighet och resultat i skolan är inte i tillräcklig grad fokus i forskning gällande barn med hörselnedsättning, (Studie IV). Avhandlingen pekar på behovet av mer forskning på för-språkiga aspekter såsom t.ex. gester och teckenspråk, deras roll och stöd, i den tidiga delen av barns språkutveckling. Detta för att bättre förbereda barnen för deras funktionella kommunikation och utbildning, (Studie III & IV). Min slutsats är att det finns en koppling mellan tidiga språkerfarenheter, inklusive gester, teckenspråk och tal, och att denna koppling med ett mer pragmatisk språkperspektiv, kan förändra utbildningsresultat i positiv riktning

Résumé – Norsk

Denne oppgaven handler om små barn med hørselstap og deres læringsutbytte. Fremskritt innen medisin og teknologi har gjort det mulig for flere barn å delta i utdanning med sitt muntlige språk og hørsel. Omkring 3/1000 barn vokste opp med et hørselstap som har mer eller mindre en innvirkning på deres språkutvikling. Forskning har vist at selv milde former for hørselstap kan forårsake alvorlig forsinkelse av språkutvikling. Barn som, selv med moderne teknologi, ikke har tilgang til å høre og tale tidlig i livet lære i de fleste tilfeller tegnspråk. Tegnspråk er et naturlig språk og er anerkjent og akseptert i mange land. Selv etter fremskritt innen teknologi og språk anerkjennelse forblir utfallet i utdanning en bekymring. Et problem kan være at historisk tale og tegnspråk har hatt vanskeligheter med å eksistere forenet i rehabilitering og utdanning.

Denne oppgaven tar sikte på å studere læringsutbyttet i utdanning for barn med nedsatt hørsel og utforske tidlig språk og dens forbindelse til prestasjoner i skolen. Dette gjøres ved en populasjonsundersøkelse og litteratursøk.

Avhandlingen består av fire verk som dekker en nasjonsrapport (I), en artikkel om metodikk (II), et bokkapittel om en pragmatisk språktilnærming (III) og en strukturell litteratursøk på forskning i pre-språklige sider ved språkutvikling (IV).

Denne avhandlingen bekrefte en variasjon og forskjeller i læringsutbytte, selv etter 25 år med reformer og tekniske fremskritt, (Study I & II). Den dokumenterte effekten av tidlig språkutvikling, tospråklig erfaring og pedagogisk utbytte er ikke fullt ut tatt hensyn til i forskning, (studie IV). Avhandlingen peker på behovet for mer forskning i den pre-språklige periode for å utforske gester og tegnspråk, deres rolle og støtte, i å forberede barna for deres funksjonelle kommunikasjon og utdanning, (studie III og IV). Min konklusjon er at det er en sammenheng mellom tidlige språklige erfaringer inkludert gester, tegnspråk og tale, og at med en mer pragmatisk språkperspektiv, vil skoleprestasjonene endres i positiv retning.

PUBLICATIONS

1. Hendar, O. (2012). *Elever med hørselshemming i skolen. En kartleggingsundersøkelse om læringsutbytte. [Pupils with hearing impairment in school: A study on learning outcomes]. Skådalen Publication Series No 32.* Norway: Skådalen Resource Center.
2. Hendar, O., & O'Neill, R. (Submitted). Monitoring the achievement of deaf pupils in Sweden and Scotland: approaches and outcome.
3. Swanwick, R., Hendar, O., Dammeyer, J., Kristoffersen, A. -E., 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. *Bilingualism and bilingual deaf education.* New York: Oxford University Press.
4. Hendar, O., & Dammeyer, J. (2015). A literature analysis of themes in paediatric cochlear implant research. *Journal of Communication Disorders, Deaf Studies & Hearing Aids*, 3(2), 1-6.

There are four submitted works in this thesis. The first is a report of a field study published in Norway, (Hendar 2012). The second (Hendar & O'Neill, submitted) is an article written together with a colleague at University of Edinburgh. The third (Swanwick, Hendar, Dammeyer, Kristoffersen, Salter & Simonsen, 2014), is a summary of what we know about bilingual education in Northern Europe and a proposal for a more pragmatic perspective in education. The last article (Hendar & Dammeyer, 2015) is a literature analysis on early linguistic aspects of language development in children with a hearing impairment.

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After twenty-five years of experience as a professional psychologist I intend with this thesis to fulfil a personal contribution to the understanding of the complicated but important phenomenon of deaf education. This thesis is about deaf children's preparation for life and the impact that delayed language development has on education.

It would never have come this far without support from many close friends, colleagues and family.

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CONCEPTS

This thesis covers a broad spectrum of research. My intention is to find a pragmatic way forward. By doing that I will here describe how I use concepts that in other perspectives might be interpreted differently.

Deaf, Deafness, Hearing loss, Hearing impairment. In this thesis, the use of audiological terms in describing the target group refers to any level of hearing loss significant enough to have an impact on language development. This include mild, moderate, severe and profound deafness. ‘Deaf’ in this thesis is also used to refer to a language minority group.

Language, Speech and Sign language. In this thesis the use of language isolated refers in general to a higher cognitive function where speech and sign language are equal. Different varieties of speech and sign language are also a part of an identity and cultural aspect of life. Although I do not explicitly address these issues in this thesis, I am aware of them.

Signed exact English, sign-support to speech and other blended forms of languages. I see speech and sign language as two independent languages. Blended forms can be used in a unique configuration of two languages. I will devote a special part of this thesis to blended forms. If blended forms are used on equal terms there is, from my perspective, no problem, that is something we do every day. If, however, blended forms are forced into use without any deeper skill and knowledge of the two languages it can only work as a lesser good alternative.

Inclusion. Inclusion in this thesis is used in terms of the UN Convention for Persons with a Disability. This describes how education should strive for that “community services and facilities for the general population are available on an equal basis to persons with disabilities and are responsive to their needs”, (UN 2007). As I interpret it, this means that education must be prepared (and available) for all needs, which gives schools a responsibility to be active and responsive to fulfilling the intentions of the Convention. There are extensions to this for children needing a bilingual education. For them special schools can be an alternative.

FOREWORD

Without the development of a functional language, there is a risk of negative impact on outcome in education, as well as having consequences for quality of life. It is therefore one of my interests to help strengthen language development in children with hearing loss to ensure that they can finish school with grades that reflect their abilities and not their hearing loss. The aim of this thesis is to expand knowledge and understanding and, hopefully, to contribute to increasing interest in this field.

My own interest goes back to the end of the 1980s, when I completed an internship at a school for deaf children during my studies in psychology. There, I had to re-evaluate my knowledge of language development, children's progress in education, and sensory disability. Since the internship I have spent most of my career as a psychologist supporting deaf children and their families in different social settings, such as rehabilitation and education. My knowledge of sign language in the 1980s was small. Because I experienced for myself what an additional language modality can do to open up one's eyes in a surprisingly more positive way than Sapir and Whorf ever could have imagined, I have never regretted my third language resource.

During a period of 25–30 years I have seen progress and advances in technology, medicine, education and sign language recognition and acceptance in education. Today's use of digital hearing aids and cochlear implants, together with early childhood diagnosis is amazing and promising because it opens up for speech and hearing. Changes in education towards inclusive education have strengthened equal education. Language recognition and acceptance are positive because they reposition sign language as an independent language instead of as being connected to a disability. From that perspective everything seems optimistic. However, the experience I have from education also reveals something different, namely that children with hearing loss have difficulties reaching educational goals, regardless of their level of hearing loss. And my experience is also that Sign Language and technology have had difficulties appearing simultaneously in rehabilitation and education. I find it important to explore these matters because I think two languages can be a good start in life for children with a hearing loss and that outcome in education can be changed with an early access to a functional language (Speech and/or Sign language). As a researcher, however, I have to balance a concern for the combination of hearing loss and achievement with full respect for the inherent dignity, freedom and independence of persons for whom Speech and Sign Language are a natural part of life. We do not decide what language our parents are speaking but we can all be part of expanding language experience for children.

PART I: INTRODUCTION

The title of this thesis refers to the UN Convention on the Rights of Persons with Disabilities (UN, 2007). The convention states that member countries should take measures to ensure education for children with disabilities, ensure education of persons who are blind, deaf or deaf-blind and ensure that education is delivered in the most appropriate languages and modes of communication, in environments which maximize academic and social development. The convention also states that member countries should recognize, promote and facilitate the learning of sign language. The title describe that this thesis intend to proceed scientifically from deafness as a disability to deafness in education in terms of language and communication.

Language and communicative ability are probably among the most essential aspects of cognitive development (Botting & Resing, 2007). Language is fundamental in school readiness and essential for academic success (Durand, Loe, Yeatman & Feldman, 2013; Morisson & Hindman, 2012; Walker & Greenwood, 1994). In the school context, using language and presenting information in structured ways are required (Schleppegrell, 2001). Language ability is also reported in research to be one of the most important concerns and focuses following early childhood hearing loss (Karchmer & Allen, 1999; Kenndy et al., 2006a; Moeller, 2000).

Early intervention in rehabilitation after hearing loss is intended to compensate the sensory impairment by parental support, hearing aids, cochlear implants and sign language. In education measures have been taken on the prerequisites for learning as accessibility to curriculum through technical advices and bilingual instruction, (se e.g. Knoors & Marschark 2014). However, even with modern rehabilitation and efforts in education, researchers report language delay (Kennedy et al., 2006a) and lower educational outcome (Hendar, 2008; Thouthenhoofd, 2006; Traxler, 2000).

In education large and small consequences of hearing loss become evident when research study academic outcome. Powers (2011) described several factors that could explain the variability in outcome of education: parental education, maternal communication skills, parental involvement in education, quality of parent-child linguistic interaction, age of onset of hearing loss, additional difficulties, ethnicity, language at home, parental expectations and use of technology. Powers (2011) asked “why some deaf students are successful and others are not”. He answered this question by pointing to children’s attributes and the influence of their parents. Language was mentioned as a factor, but as significantly “minor strong”. Lederberg, Schick and Spencer (2013) found, on the other hand, a strong relation between language delay among deaf children and negative life consequences. Dammeyer

(2014) also found in his results a support for Sign language as being a cognitive and linguistic foundation for the development of literacy skills among children with hearing loss.

In a way, this thesis is not comparing several different efforts to support children's learning. It rather focus on a part of them – language and communication

Language, then, can be seen as a resource and prerequisite for efficient cognitive development (where sign language and speech play equal roles). In this thesis I will use languages as a resource in a holistic language model (Grosjean, 1989). Bilingualism, as Grosjean described it, is the unique configuration of two languages rather than the sum of two complete or incomplete monolingual competences; and there is no evidence that children cannot learn languages via different modalities or that sign language should hinder spoken language development (Cramér-Wolrath, 2012; Lederberg et al., 2013).

In this thesis I will first present three areas of focus: hearing loss, language and education. These three areas will further lead to the research aim and question. This thesis will end with results, a discussion and a conclusion.

THREE AREAS OF FOCUS

Research in disability has a long history and is conducted within different disciplines. First, there is an individual and biomedical perspective, seeing disability as different from normality, and which can be compensated for. Disability is seen as an impaired part of the body. An impairment become a disability in contact with society. Disability in society can, from this medical perspective, be compensated for by implementations (Bøttcher & Dammeyer, 2013; Rönnberg, Classon, Danermark & Karlsson, 2012; WHO, 2001). The second perspective is a sociocultural view of disability where disability falls within normal variation. The focus of implementations is on society and its responsibility to accommodate such that persons with disability should never be hindered (Bøttcher & Dammeyer, 2013; Rönnberg et al., 2012).

A balanced approach is needed because persons with disability can experience different problems from their health condition. Disability, in the UN convention, applies to all persons who have long-term physical, mental, intellectual or sensory impairments which, in interaction with various barriers, may hinder their full and effective participation in society on an equal basis with others (UN Convention on the Rights of Persons with Disabilities, 2007).

Disability, as Vygotsky described it, consists of both a biological/natural part and a cultural/social part (Bøttcher & Dammeyer, 2013; Daniels & Hedegaard, 2011). A direct individual connection between an organic deficit and consequences in life is the definition commonly used in a medical context. But this definition does not sufficiently describe children with organic deficits in education, because children with disability in school act in relation to their environment, including social and cultural aspects of life. The consequences and outcome should therefore be seen not solely in terms of a direct connection, as in the medical model. Instead, consequences should also be seen in terms of the social context where the child acts.

Sensory impairment, hearing loss, and disability should be viewed neither as purely medical nor as purely social (WHO, 2011).

The consequences of hearing loss pose a difficulty in the context of education in the early years and throughout education. Interventions that are based only on an impairment and not on social individual needs can hinder independent choice. On the other hand, a strict sociocultural perspective, giving society a responsibility of accommodate environment and preventing difficulties, may support generalized implementations and miss specific needs of individuals. General implementations can therefore generate difficulties since some children's needs are opposed to each other. Creating a balance is a challenge in education.

Both an individual and a sociocultural perspective are considered and used as a framework in this thesis. The individual perspective is valuable for understanding disability (WHO, 2001). The sociocultural perspective is necessary to place language use and education in a framework where, according to Vygotsky (1986), a more dialectical meeting between body and culture can take place. There are consequences after early hearing loss which are described in this thesis from both a sensory impairment and a disability perspective.

Hearing loss

A classification of hearing level based on hearing threshold is done medically in childhood in order to detect hearing loss and suggest language rehabilitation and communication support. Hearing loss can be mild, moderate, severe or profound (WHO, 2015). Hearing loss can be congenital or acquired and can affect one or both ears. Hearing loss is found slightly more often among new-born boys than girls (Van Kerschaver, Boudewyns, Declau, van de Heyning & Wuyts, 2013).

The prevalence of congenital hearing loss varies. A commonly estimated prevalence is 1–3 per 1000 live births (Häkli, Luotonen, Sorri, Majamaa & Bloigu, 2014; Kral & O'Donoghue, 2010; Mehra, Eavey & Keamy, 2009; Nafstad, Samuelsson, Irgens & Bjerkedal, 2002; Vartiainen, Kempainen & Karjalainen, 1997; Watkin & Baldwin, 2012). There is an increase in prevalence from very young to school-age children (Fortnum, Marshall & Summerfield, 2002). In Sweden, based on a total population survey, the prevalence among school-age children with hearing impairment (> 35 dB) was found to be 2.8/1000 (Hendar, 2008).

A majority of children in school with hearing loss have a mild or a moderate level. Häkli et al. (2014) found from a Finnish birth cohort that 84% of children with hearing loss were classified as mild or moderate cases.

The consequences of hearing loss and the necessity of aural rehabilitation are well documented (Laukli, 2007; Lidén, 1985). Research has indicated that hearing is crucial for language and speech development (Pimperton & Kennedy, 2012; Wake & Poulakis, 2004). Hearing loss can negatively affect language development (Blamey, Barry & Jacq, 2001; Campbell, 2008; Karchmer & Allen, 1999; Lederberg et al., 2013; McGowan, Nittrouer & Chenausky, 2008; Vohr, Topol, Watson, St Pierre & Tucker, 2014). Limited access to surrounding communication and restricted language experience are commonly understood as causing language delay (Kuhl, 2004). Children with hearing loss do not, for instance, develop vocabulary at the same rate as normal hearing children (Blamey et al., 2001; McGowan, Nittrouer & Chenausky, 2005; McGowan et al., 2008; Vohr, St Pierre, Topol, Jodoin-Krauzyk, Bloome & Tucker, 2010; Vohr et al., 2014). This delay in language acquisition after hearing loss can have further impact cognition, communication and

learning (Arlinger, 2003), educational outcome (Hendar, 2008; Powers, 1999; Thoutenhoofd, 2006; Traxler, 2000) and psychosocial functioning (Dammeyer, 2010).

Dammeyer (2010) evaluated the prevalence of psychosocial difficulties among 334 children with hearing loss. He found a higher risk for psychosocial difficulties among children with hearing loss compared to those with typical hearing. He also found that as long the level of language was good, there was no difference between children with oral or sign language competences. This study stressed the importance of good communication, regardless of language modality or degree of hearing loss.

Children with mild or unilateral hearing loss also seem to face communication and educational challenges (Bess, Dodd-Murphy & Parker, 1998; Bess & Thorpe, 1986; Teasdale & Sorensen, 2007; Vohr, Topol, Girard, St Pierre, Watson & Tucker, 2012). Bess and Thorpe (1986) found that half of a group of 60 children with unilateral hearing loss experienced some sort of difficulties in school. Vohr et al. (2012) reported that among 6-year-old children the risk of low verbal comprehension and need for more special education support was significantly high for children with unilateral or mild hearing loss.

Rehabilitation of hearing loss

Historically, interventions in rehabilitation of children with hearing loss have generally been directed towards hearing and speaking. Lip-reading and use of technical devices such as hearing aids and sound amplifiers have dominated interventions. Sign language in rehabilitation is introduced if children are unable to achieve proficiency in spoken language (Kral & O'Donoghue, 2010). A consequence of this policy is that children with mild or moderate hearing loss are seldom offered sign language as a resource in their language development. Others have argued for a more pragmatic (language as a resource) position that children with hearing loss instead are in favour of an early contact with and the use of sign language (Danielsson & Hendar, 2009; Preisler, 1999; Preisler & Midbøe, 2011; Swanwick & Tsverik, 2007).

Advances in technology have opened up new possibilities. Hearing aids have become digitized, and cochlear implant surgery has given severely and profoundly deaf children access to hearing. It has been 25 years since 1990, when the Food and Drug Administration in United States approved cochlear implantation (CI) in children between 2 and 17 years of age (Stinson, 1996). The introduction of CI was a breakthrough in rehabilitation and research has shown good outcome with regard to speech production and perception. However, even though CI has proven to be a step forward compared to former technologies and approaches in rehabilitation, there are still challenges (Archbold & O'Donoghue, 2009). The variation in outcome shows that many children continue to struggle with delay in language development (Lyness, Woll, Campbell & Cardin, 2013; Tait, Lutman & Robinson, 2000). Niparko et al. (2010) reported that the difference in spoken language abilities

between children without hearing impairment and children with CI continued three years after implantation. The mechanisms behind this delay and variation remain poorly understood. From a multi-language approach, one challenge is that intervention in rehabilitation sometimes asks parents to make a choice between speech and accessibility to sign language (Simonsen, Kristoffersen, Hyde & Hjulstad, 2009).

Hearing loss and Additional disability

Disability in addition to hearing loss has been mentioned as a reason why some pupils have difficulties reaching all goals in education (Blackorby & Wagner, 1996; Hendar, 2008). Many children with hearing loss are reported to have additional medical disabilities compared to typical hearing children. Fortnum et al. (2002) reported that within a cohort of children with hearing loss, 27.4% had an additional disability. In similar studies, Birman, Elliott and Bibson (2012) reported 33%; and Roush, Holcomb, Roush and Escobar (2004) reported 40%. For normally hearing children in education, around 10% are reported to have a disability (Brault, 2012; Snyder & Dillow, 2013). There are several explanations for a higher prevalence of disability among children with hearing loss. Van Dijk, Nelson, Postma and van Dijk (2010) suggested genetic syndromes, problems that occur before and after birth and problems acquired later in life through infection or traumatic brain injury. In Sweden a correlation between school placement and additional disability has been reported (Hendar, 2008). Among children with severe and profound hearing loss, 40% were found to have an additional disability, and they were more represented in special schools. For children with mild or moderate hearing loss, 25% had an additional disability, and they were more represented in mainstream or resource schools. Shaver, Marschark, Newman and Marder (2014) did not find any link between school placement and additional disability in US schools. Knoors and Marschark (2014) suggested that cross-cultural differences might explain these contradictory results.

Psycholinguistics

This section focuses on the connection between language, cognitive development and later educational outcome from a psycholinguistic perspective. Early language acquisition, as mentioned, has an impact on achievement later in school (Durand et al., 2013; Morisson & Hindman, 2012; Walker & Greenwood, 1994; Wasserman, 2007).

Psycholinguistics in general tries to answer questions about how language works, why it takes different forms and how it is connected to thought (Taxler, 2012). Gaskell (2011) described its main focuses as being the mental lexicon, higher-level comprehension and language development. This description of psycholinguistics will be used as the framework here. To further specify this framework, I will use concepts regarding “language as a function” rather than “language as a structure” (Bischoff & Jany, 2013; Bohannon III &

Bonvillian, 2013; Croft, 1995). The former addresses why language is the way it is and finds answers in language use (Bischoff & Jany, 2013). Structural linguistics, by contrast, is more focused on given phonemes, morphemes, grammar and vocabulary. Thus Chomsky, with his theory of a universal grammar, represents a structuralist view (Bohannon III & Bonvillian, 2013) whereas Functionalism, on the other hand, addresses language behaviour in different social contexts (Bischoff & Jany, 2013; Tomasello, 2003, 2009).

Language is not only a domain of human knowledge; it is also the process by which experience becomes knowledge (Halliday, 1993). There is an academic debate on how much of language development can be accounted for by genetics (nature) and environment (nurture) respectively. Hayiou-Thomas, Harlaar, Dale and Plomin (2010) found that both genetic and environmental factors contribute to the relationship between early language skill and reading. Their findings are in line with my opinion. Another classical question, which has been discussed since the time of the ancient Egyptians (Wasserman, 2007), is the relation between language and thought. Though the present thesis focuses on issues of educational outcome, there is a need to present two different approaches to the relation of language and thought. Children beginning school normally know some language grammatical structure and have a growing vocabulary. They are, in other words, usually well prepared for learning. Although this is not the case for all children with hearing loss, I will here describe two psycholinguistic theories on the relationship between language and thought. The first one is the classical Sapir-Whorf hypothesis, and the other, language in the Theory of Mind.

Sapir-Whorf

The Sapir-Whorf hypothesis (Hussein, 2012) is that language affects the way we think. This “linguistic determinism” has been criticized because there was no scientific evidence for the hypothesis (Pinker, 1994). But a more moderate form of the hypothesis has returned as researchers have found that “...language allows speakers to encode knowledge in a form that is relatively easy to maintain.” (Traxler, 2012). For example, children who speak Chinese learn to count faster than children who speak English. Hunt and Agnoli (1991) explained that counting in Chinese is based on a base-10 system; “ten-one” or “one-one” is eleven, and “ten-two” is twelve. This more concrete way of counting helps Chinese-speaking children learn and remember numbers better than English-speaking children. Another example of the moderate form of the Sapir-Whorf hypothesis is seen in the work of Gordon (2004), who found that the Pirahã language of native Amazonian people does not have precise words corresponding to specific numbers. It lacks words for large numbers. He observed that Pirahã speakers had no difficulties perceiving a few objects, but when the number of objects passed beyond the numbers in their language, they had more difficulties remembering numbers. These two examples show that accessibility to language seems to

be connected to thought and cognitive function. In other words, language shapes thought (Casasanto, 2008).

Theory of Mind

Theory of mind (ToM) is the theory of the ability to understand that other people can have mental states which can be different from one's own. ToM has been studied from different perspectives, and research has suggested that ToM might be dependent on language and social experience (Garfield, Peterson & Perry, 2001). According to this proposed connection between ToM, language and social experience, there has been an interest in studying ToM and hearing loss. Peterson and Siegal (1995) found that deaf children did not develop ToM at the same speed as normally hearing children. This raises the question of how language and ToM are connected. Levrez, Bourdin, Le Driant, Forgeot D'Arc and Vandromme (2012) also found a language difference between deaf and hearing children on ToM tasks. They found that on ToM tasks there was a language factor correlation for deaf children but not for hearing children. Courtain (2000) found that deaf children with deaf parents did better on ToM tasks than deaf children from hearing families. The same results were found by Meristo, Falkman, Hjelmqvist, Tedoldi, Surian and Siegal (2007) and Schick, De Villiers, De Villiers and Hoffmeister (2007). Tomasuolo, Valeri, Di Renzo, Pasqualetti and Volterra (2013) found that deaf children in bilingual environments scored better on ToM tasks than deaf children in schools with a teaching assistant (TA) as their only sign language link. School Sign Language environment has also been found to be a factor in explaining better outcome on ToM (Meristo et al., 2007). In another study pointing to the necessity of language access for developing ToM, Morgan and Kegl (2006) investigated a group of deaf children in Nicaragua with late contact with Nicaraguan sign language. They found that children with first language contact after 10 years of age showed signs of long-lasting deficits in ToM.

The connection between language and ToM tasks among children with hearing loss has thus been shown in research, but might not yet be fully understood. For example, technical devices such as CI also have been found to have a positive effect on ToM performance (Sundqvist, Lyxell, Heimann & Jönsson, 2014).

A possible hypothesis suggested for these observations is that hearing mothers without earlier experiences of deaf children (or children with CI or children with partial hearing) use significantly less language related to cognitive mental states, instead adapting their language to the child's perceived level of understanding (Morgan, Meristo, Mann, Hjelmqvist, Surian & Siegal, 2013).

Parental communication style may have greater explanatory power than we earlier thought, as suggested by Morgan et al. (2013). It has yet to be addressed in research whether parents perhaps adapt their communication style to a real or perceived level of cognitive

deficit. And if parents might do adapt their communication, on what grounds do they structure their communicative style? But even though the specific cause and connection of language and ToM tasks remain unclear, research thus far suggests that early language acquisition and language environment seem to be important for young children's cognitive development.

Early language development

One discussion point in research on language development is how much innate processes account for the development of language (Gross, 2014). There seems to be an overall agreement that genes, environment and social interaction have a role to play in language development (Harley, 2014). Researchers disagree, however, on the importance and the amount of the involvement of each. This is of interest when studying early language development for children with hearing loss because aspects other than natural language development are involved, namely aspects such as technical support, parental language education and additional disabilities compared to typical hearing children. The main question is whether early rehabilitation and deaf education should focus solely on hearing and oral language or whether sign language should be offered to support multimodal language development (see the discussion in Grima, 2006; Kennedy et al., 2006a; Kennedy, Watkin & Worsfold, 2006b).

An interactionist perspective

Language development is, for most children, a trajectory from vegetative sounds, cooing, laughter, vocal play, babbling, gestures, single-word utterances and two-word utterances to full fluent language (Gleason & Ratner, 2013; Oller, Oller & Oller, 2014;). Deaf children in signing environments have the same milestones as hearing children (Bonvillian, Orlansky & Novack, 1983; Morgan, 2006).

Loew and Kegl, cited in Baker, van der Bogarede and Woll (2007), described steps in deaf children's sign language development in terms of babbling, pointing, pointing at reference vocabulary, using external references, using morphology and using syntax before age of 2 year.

Since Lennerberg's (1967) classical work on critical periods in language development, there has been an inspiring discussion of what effect early language acquisition has on further cognitive development. In studies of early language and hearing loss, there is concern both for the advances of early language acquisition and for the risk of poverty of stimulation (Francis, 2008). Moeller, Tomblin, Yoshinaga-Itano, Connor and Jerger (2007) called for more consideration of the ways in which language foundations are established. In an attempt to answer this, Brentari and Coppola (2013) suggested a more important role of

gestures, home-sign and sign language when language is created. Research has further suggested the importance of taking gestures and sign language into account in deaf education and early pre-linguistic development (Alibali, Kita & Young, 2000; Goldin-Meadow, 2014; Goldin-Meadow & Alibali, 2013; Kendon, 1997; Preisler, 2005; Suttora & Salerni, 2012).

Language, according to Vygotsky, develops in social interactions in a culture and is the tool for cognitive development (Vygotsky, 1986). This idea is central in this thesis as it connects the importance of early language (speech and/or sign language) acquisition and hearing loss with educational outcome. They need, perhaps more than other children, language functions – social interactions – to develop their cognitive skills.

Yoshinago-Itano, Sedey, Coulter and Mehl (1998) found that early identification of hearing loss had a positive impact on language development if there was no additional disability. This advantage was found across all communication modalities. An early language acquisition perspective was in focus when Kuhl (2010) concluded that early social interaction plays a role together with neurological underlying mechanisms. For sign language, Cormier, Schembri, Vinson and Orfanidou (2012) found a difference in sensitivity to grammatical judgement when studying early and late language acquisition of British sign language. Gravel and O’Gara (2003), found regardless of communication mode, it to be important that young children who are deaf or hard of hearing and their families are language proficient and are fluent communicators.

For children with hearing loss, this early language trajectory is not easy. For example, early detection and early rehabilitation focusing on oral language with hearing fluent communicators (without sign language) was not enough for a group of 180 deaf children studied by Cejas, Barker, Quittner & Niparko (2014). They reported a large delay in the attainment of symbol-infused joint engagement at an age of 2.3 years. The cohort comprised children prior to CI with parents committed to educating them in spoken English (children with cognitive impairment was excluded in their study). These research findings indicate there are unanswered questions about how social interaction supports children with hearing loss in their language development.

Gestures

Young language learners, both deaf and hearing, use gestures in their first pre-lingual steps. These steps continue into sign language if children cannot hear and into speech if they can (Goldin-Meadow & Morford, 1990). Gestures continue to be an important part of communication for everyone, even after childhood (Arbib, 2009). Kuhn, Willoughby, Wilbourn, Vernon-Feagans and Blair (2014) found in their longitudinal study of 1117 normal hearing children that communicative gestures at the age of 15 months predicted language development at two and three years, and they in turn predicted executive function at age four measured by working memory, inhibitory control and attention shifting. Even after controlling

for socio-economic impact on vocabulary, a significant correlation between gesture use and language development was found among all children.

Researchers have pointed to the unity of speech and gestures (McNeill, 1992) and the unity of gestures and sign language (Kendon, 2008; Liddell, 2003). There is research suggesting that people use more gestures during non-linguistic vocalization (Fay, Arbib & Garrod, 2013; Fay, Lister, Ellison & Goldin-Meadow, 2014) and when learning a new language (Gullberg, 1998). Tait et al. (2000) demonstrated a positive connection between the use of preverbal behaviour, in terms of vocalization and gestures, and outcome of CI. An important question arising from their findings is whether it is the cochlear implant that increases performance on ToM tasks, as reported earlier (Sunqvist et al., 2014) or whether gestures, as a natural interactive part of pre-lingual activities, make it easier for children to achieve a better outcome of cochlear implant and ToM.

To summarize, early language acquisition is important, and research has shown a connection between pre-linguistic interaction (with gestures and signs) and further language development of speech and sign language. There seem to be no implications for language modality as long as language (in the form of speech or sign language) develops early. Instead, there is research pointing in the opposite direction, namely at the value and necessity of gestures in early communication.

Sign language

Sign language is a natural language with linguistic properties, such as grammar, morphology, phonology and syntax, like any other language (Stokoe, 1980). Research in sign language and the development of language rights in society has strengthened the position of sign language. Many countries around the world have recognized and accepted sign language (Weatley & Pabsch, 2012). My own opinion on sign language is expressed in Danielsson and Hendar (2009), where we urge that more families of children with all levels of hearing loss should be offered the opportunity to learn sign language as a resource.

Newport and Supalla (2000) described the development of the status of sign language as a transformation from the pre-sign language era of the 1960s, when language was thought to have a unique relation to the vocal mode. Speech was special, signs were not; linguistic theories could be applied only to spoken languages, and specialized neurological mechanisms and models were only for speech. This monolingual focus gradually relaxed. By the end of the 1990s, research was able to show that language is indeed special but that there are no differences in principles between speech and sign language (Newport & Supalla, 2000).

In sign language research, several focus areas, both structural and functional, have been addressed. Some of them are of more interest as they are connected to areas addressed in this thesis. For example, there has been focus on language development (Ahlgren, 1980;

Bergman, 2012; Woolfe, Herman, Roy & Woll, 2010), bimodal bilingualism (Emmorey, Petrich & Gollan 2013; Menéndez, 2010), language learning (Thompson, Vinson, Woll & Vigliocco, 2012), iconicity as a bridge between language and experience (Thompson et al., 2012; Thompson, Vinson & Vigliocco, 2010), consequence of language deprivation (Skotara, Salden, Kügow, Hänel-Faulhaber & Röder, 2012), reading comprehension (Traxler, Corina, Morford, Hafer & Hoversten, 2014) and lexical frequency (Johnston, 2012).

The thesis highlights the difficulties children with hearing loss face when they cannot gain full access to communication and are not given visual language and technical support. Children who are not given a functional language, either oral or signing will suffer in their cognitive development in a way that leads to both language and cognitive delays (Li, Xia, Zhao & Qi, 2014).

Rinaldi, Caselli, Di Renzo, Gulli and Volterra (2014) found, for example, that children exposed to sign language from birth had semantic comprehension development similar to that of normal hearing children, but production was slightly delayed. This was discussed according to language access in terms of minority language, language models, amount of linguistic access and test translation bias. They concluded that the gap in production between hearing and deaf children could be explained by the amount of linguistic input (Rinaldi et al., 2014).

The challenge for children and their access to signs and sign language is that children with mild to profound hearing loss are in most cases born randomly into families with no or little experience of sign language.

For deaf people with severe and profound hearing loss, sign language is their prime language and identity. For persons with partial hearing, sign language can be a second language and a language resource.

This has challenged society with the question of how to offer sign language to families without earlier experience and to children with different levels of hearing loss. In Norway (“See my language”) and Sweden (“TUFF”, Sign language for parents), as examples, there are early parental communication classes for families with children having severe or profound hearing loss (Mosand, 1996; SOU, 1996). These classes are popular though they encourage communication (Rambøll, 2011). Teaching normally hearing children sign language has also been seen in families to encourage children’s communicative development (Barnes, 2010).

Blended and bilingual forms of speech and sign language

One example of an attempt in rehabilitation to address the speech and sign language question is to focus on blended forms of signed and spoken languages, this being called a ‘total approach’, simultaneous communication or total communication (TC), (Knoors &

Marschark, 2014; Schlesinger, 1972), as a better alternative than a one-language approach. Theoretically, TC is a mix of two language modalities, oral and visual, based on spoken language grammar. Sign language in TC follows the spoken language grammar. But natural sign language grammar is different from spoken language grammar; therefore, my understanding is that a blended form based on the grammar of one modality can work only as a language support rather than as an independent language.

Another option is to see two or more languages as a bilingual possibility. According to Grosjean and Li (2013), interest in bilingualism has grown the last 25 years. Their perspective is that bilingualism is a use and function phenomenon. Language is used in many different domains in life, such as at home, with friends, at work and in spare-time activities, and “different aspects of life often require different languages” (Grosjean & Li, 2013). In general, research on bilingualism has moved from a position of warning against a bilingual approach to suggesting that bilingual children have a metalinguistic cognitive advantage over monolingual children (Grosjean & Li, 2013) and that bilingualism has a positive neurological effect on cerebral development (Li, Legault & Litcofsky, 2014).

Research on sign language use, either fully or as part of bilingual education, has concluded, with Grosjean and Li (2013), that there is an advantage to a (sign and oral) bilingual approach (Cramer-Wolrath, 2012; Heiling, 1993; Kristoffersen, 2014; Mayberry & Eichen, 1991; Newport & Supalla, 2000; Strong & Prinz, 1997).

A blended form, i.e., shared and mixed, can also be seen as a ‘pidgin’ language phenomenon (Brentari & Coppola, 2013; Holm, 2010). Pidgin forms, as referred to in this thesis, emerge naturally when two languages meet, preferably on equal terms, to fulfil a communicative function (Cokely, 1983). Even though TC theoretically seems to be a solid (pidgin) communication support, children experience different varieties of how TC is conducted as they grow up. These variations of TC might cause a problem in school.

If children experience different levels of blended forms, depending on needs and language knowledge in families, it becomes a challenge in education. Teachers have to be prepared (i.e., know enough signs and sign language to have adequate resources to blend with) for every narrative matter. This is a challenge as only fluent sign language teachers can meet every need in blended TC situations. And an even greater challenge arises if children with hearing loss experience different TC before school, as they will have difficulty participating with each other. Different TC experiences and communicative needs are not easily matched. In most situations children learn from each other. But it is an advantage if they know more than basic Signs level in TC. The optimal preparation for teachers before entering TC situations must be to know two languages. The way children discover their language and languages can then be individual.

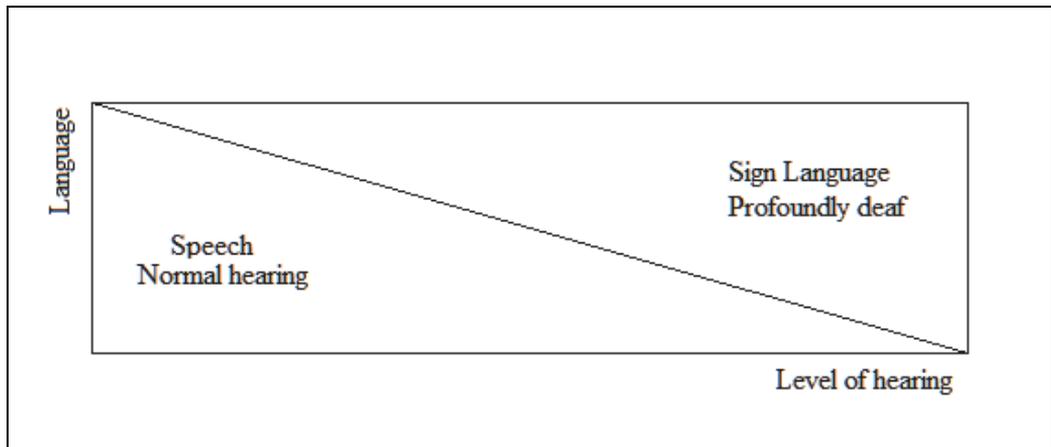
There are people, namely sign language signs and grammar users, who if needed use (blend) oral words parallel to signs by using their voice when signing. This sign-speech blended form is most common when deaf persons communicate with hearing persons with

low or moderate experience of sign language. The outcome and efficiency vary depending on the language experience of participants in the conversation.

Traditionally, bilingualism in profoundly deaf children referred to having a sign language and a written language (Svartholm, 1993). Today, with advanced technology, children's hearing loss, needs and experience with sign language vary (Knoors & Marschark, 2012). They have skills in spoken, signed and written languages. But research does not show consensus in these matters. Geers, Strube, Tobey, Pisoni and Moog (2011) concluded that the use of sign language negatively influenced verbal rehearsal speed. In the same article, however, they discuss the possible explanation that some children might have difficulties with processing speed and therefore use sign language to compensate. Their discussion is important. Sign language might not be a predictor of language development in this case; instead, it seems to be an outcome if language development does not follow typical hearing milestones.

To clarify the complexity of the relation between speech and sign language as two independent languages and the existence of blended forms, in this thesis I will use a continuum language model. This model is a modification of Kendon's continuum (McNeill, 1992; de Bot, 1997). His model described the continuum from speech and gestures to sign language. Kendon's continuum can be understood as a formal structural model. The modification I suggest (Figure 1) is to visualize language function and use. It involves also communications for children with hearing loss suggested by (Gravel & O'Gara, 2003). Kendon's model described how gestures and spoken languages are connected. In my model, spoken language, with the involvement of natural gestures, is used when everyone can hear or when the level of hearing loss is low. Sign language is used when one or several participants are severely or profoundly deaf. Every situation in between, in my model, supports a spontaneous language meeting of two independent languages or blended forms. The area in between consists of users with knowledge of sign language, varied levels of hearing loss and different contexts. Contexts, domains and purpose can quickly make us move from one end to the other without loss of speed in our understanding.

Figure 1. A theoretical meeting between speech and sign language



It is a “holistic” (Grosjean, 1989) model in the sense that it take into account values of two languages rather than one only. Grosjean (1989) explained holistic as understanding bilingualism as a specific language creation between two languages instead of as the sum of two monolingual competences; bilingualism is more than the sum.

When Languages meet

Thus far I have looked at the necessity for children with hearing loss to have early access to a language. As described previously, there is a tension between sign language and speech in rehabilitation and education, a tension which can result in language delay and further increased risk of negative impact on education. Some researchers have a structural view of language that vocal, i.e., oral, language is the only acceptable modality. In their perspective, sign language hinders speech development and should be questioned in both rehabilitation and education (Borchgrevink, 2012; Lynas, 2005; Percy-Smith, Cayé-Thomasen, Breinegaard & Jensen, 2010). Out of their concern regarding multimodality use and what I earlier described as the advantages of early access, similarities between modalities and the use of gestures in typical hearing speech, there is a need for a more pragmatic view based of a functional approach. Therefore, I will here describe an attitude framework that surrounds the meeting between speech and sign language.

There are many languages in the world. Sign language, as one language, is a minority language (Charrow & Wilbur, 1975) and it faces several challenges when in contact with hearing society. Many languages meet naturally and frequently due to tourism, global business, travel and use of the Internet. A growing interest in research into these matters has been seen since the 1950s (Hickey, 2010). Research has described positive aspects, difficulties and tensions when languages meet in terms of, for example, borrowing words from

different languages (Winford, 2010), the tragedy of language extinction (Moseley, 2012; UNESCO, 2003; Vonen, 2006; Wendel & Heinrich, 2012) and difficulties for Minority language speakers in education (Wise, 2007).

Thomason defines language contact as occurring when people use more than one language and “some communication between speakers of different languages is necessary” (2004). The communicative aspect of language contact is of great interest because it can address both the function of language and the persons involved.

There are other examples where language contact has resulted in conflicts. Many borders between countries in Africa were drawn for geographical, economical, religious or political reasons without respect for culture and language use, resulting in ongoing conflicts within and between countries (Koffi, 2012). Many minority languages in the European Union are under special protection, and member states are obliged to enhance these languages’ existence, (Council of Europe, 1992). In connection with this, it is worth mentioning that sign language is not included in this charter.

In an attempt to normalize the recognition and acceptance of sign language as a natural language, many researchers have pointed to, and emphasized that sign language and spoken languages share aspects in early language development (Capirci & Volterra, 2008), share neurological aspects (MacSweeney, Capek, Campbell & Woll, 2008) and share language functions (Woolfe et al., 2010). Knoors and Marschark (2012) concluded in a discussion of language planning that even if advances in hearing technology have been developed, “sign language stimulates the development of deaf children in a number of ways, and there is no evidence of any negative effects”.

Language contact with an impact on deaf education has been addressed in research, for example, in minority languages (Charrow & Wilbur, 1975; Darquennes, 2010), language endangerment (Skutnabb-Kangas, 2012), identity (Fought, 2010), language planning (Jones, 2011; Knoors & Marschark, 2012; Mühlhäusler, 2000), language policy (Hult & Compton, 2012; Spolsky, 2004), pidgins and creoles (Holm, 2010), bilingual education (Munoz-Baell, Alvarez-Dardet, Ruiz-Cantero, Ferreiro-Lago & Aroca-Fernandez, 2011; Serratrice, 2012; Swanwick & Tsvetik, 2007; Svartholm, 2010; Wright, 2012), literacy practice (Kristoffersen & Simonsen, 2012), blended language attitude (Holten & Lønning, 2011) and second-language acquisition (Cormier et al., 2012).

From a strictly theoretical perspective, languages and modalities never meet, but their users do (Nelde, 2000). According to Nelde, the source of difficulties and conflicts between languages can be found in language users and their attitude towards their own and other languages. When language choice is based on a need for communication between people, conflicts seldom appear.

When aspects other than communicative needs are involved in the choice of preferred language, such as culture and attitude, conflicts seems to occur more frequently (de Bot, 2004). Therefore, to summarize, language tension and conflict in deaf rehabilitation cannot

be seen as an isolated phenomenon solely within rehabilitation and education. Instead, it can be seen as a general language-meeting phenomenon.

Education for children with hearing loss

In this section I describe the education situation of children with hearing loss and the challenges they face. Education is of great importance for young people and their entrance into adult life. There is, according to reports from the OECD, a growing interest in education and what education can do for people and nations (e.g., OECD, 2010). There is a common belief that education creates change. It can increase social mobility and play a role in improving health and social cohesion (Causa & Johansson, 2010; Lindley & Machin, 2012; OECD, 2010, 2012). This might not, however, be true for all children with hearing loss (Helvik, Krokstad & Tambs, 2013; Stam, Kostense, Festen & Kramer, 2013; Woodcock & Pole, 2008).

Children with hearing loss need in most cases support to overcome lack of auditory input. When the auditory input hinders learning it becomes a special educational need. The educational need is identified that children have difficulties to hear and locating speech (especially when more than one is speaking and there is background noise), need to ask for repetition of things said, tendency to be tired and irritable in situations of listening, difficulties in joining into groups discussions and activities, and speech, language and literacy difficulties (National Deaf Children's Society, 2012). These are met by a variety of interventions. Teachers can meet these needs by paying attention to children language level and skills, and create good communication environment. The support in classroom beyond technical hearing devices and sign language can also be use of smaller groups, use of visual pictures to support oral instruction, light conditions and acoustic adaption (Guardino, 2012; Gustafsson, 2009; Knoors & Marschark, 2014). This makes it complex to sort out and conduct analysis of how hearing loss, disability or language delay have a unique or correlated impact on the outcome. I have chosen to use historically published concern of children with hearing loss, together with data on disability and language disadvantage groups, with an intention to scientifically travel from a concept of sensory impairment and end up in the importance of early communication.

The focus on education and disability in general has changed since the 1970s, from education and school placement for children with a disability based primarily on a diagnosis to a perspective based on support and needs and placement in ordinary classes. The inclusive philosophy has opened up education for pupils with disability to participate in all activities in school. The UN Convention on the Rights of Persons with Disabilities recommends the ideas of inclusion. For children with hearing loss the convention also recognizes exceptions such as facilitating the learning of sign language (Article 24 3.b) and an educational environment for some children to maximize academic and social development (Article 24

3.c). Disability in education should therefore be met with accessibility based on the needs of the individual, both physical and linguistic. The charter with these ideas has been signed by countries around the world.

Most countries stress that children in need of support due to disadvantages should receive support within an inclusive framework. A majority of pupils with disability are following an inclusive policy. This can be interpreted as good according to intention in education policy, but inclusion is discussed in research on its empirical foundations, (Dyson, 2014; Göransson & Nilholm, 2014). The support many schools offer is based mainly on what is needed to reach academic goals rather than disability per se. It is unclear whether children with hearing loss find a language environment that maximizes their academic and social development.

Education for children with hearing loss, or deaf education, can, from my point of view and irrespective of location in the world, be described as education in which the curriculum is adapted when needed linguistically and communicatively. Support is focusing on providing access to the curriculum, instruction and adaptation strategies focus on knowledge and there is a teaching understanding, language valuing and respect for the needs of children with hearing loss. Education, from this view, improves children's ability to make choices for their future based on their motivation and skills.

Over the years we have seen many school alternatives for children with hearing loss. Three general options are often seen. Hendar (2008) and Shaver et al. (2014) described the characteristics of these options and students in different school settings. One alternative is regular neighbourhood schools which do not have any experience with hearing loss. Schools in this category support children in the classroom. A second alternative is special schools where teachers have experience of educating deaf children. They often use sign language as a part of the language of instruction. If the school has enough signing teachers, one can describe them as bimodal bilingual schools with a sign language environment. A third alternative can be described as a mix of support between the first two ones.

The educational situation for deaf pupils has changed over the last 20 years. More advanced hearing aids and cochlear implants have made it possible for deaf children to participate in oral communication during their time at school (Knoors & Marschark, 2014). Furthermore, in many countries, there have been efforts to adapt schools for the target group in terms of curricula, language and policy documents. During the same period more countries have also recognized the legal status and acceptance of sign language as a language (Wheatley & Pabsch, 2012).

In general education there has been a change in expectations over the last 30 years. Many countries now focus more on knowledge and outcome than on social aspects (Grek, 2009). This development is positive for the target group in this thesis, as more students with hearing loss will reach an upper secondary examination even though they have not yet closed the gap compared to hearing children (Rydberg et al., 2009).

Deaf education, as a broad description and understanding, increases the possibility that children with hearing loss can be equally educated. Policy documents in many countries state that deaf children should reach the same level as everyone else. Deaf education can be seen as an intervention to counter the consequences of hearing loss in terms of communication and learning. These prerequisites and goals are good but the intentions and outcome are not systematically evaluated.

Educational outcome

The educational outcome for children with hearing loss is of concern. To better understand the context of achievement of children with hearing loss, I will here describe a framework of educational outcome: first, a general introduction to grading; second, a closer look at outcome for children with disability in general, and then a description of outcome for children with different types of disability such as preterm birth, ADHD and language challenges such as language disorders and ethnicity language experiences. This framework will demonstrate the impact disability and language have on educational outcome.

Grading

Grades are an evaluation used for different purposes in education. Grading is a system for teachers to evaluate pupils' progress in knowledge according to the goals in the curriculum. Grading in education fulfils several purposes. Grades, as described by Santrock (2006), can be used as an administrative tool in deciding whether a student will be promoted to the next level, or as part of a job application. Grades can give mid-year feedback to students, reflecting the quality of their efforts in schoolwork. Grades can also be used to receive additional support. They can, at a lower level of education, used as a formal evaluation, be a motivational part. Grading and large-scale data collection have become a tool for school development (Grek, Lawn, Lingard, Ozga, Rinne, Segerholm & Simola, 2009). This seems to be more frequent in countries where school inspectorates (e.g. Ofsted in the United Kingdom) collect data and write reports and concerns about schools with low outcome. When grades are low, many schools initiate organizational development in order to raise results (Rosenkvist, 2010).

Disability and educational outcome

Disability is reported to affect educational outcome (Reynolds & Wolfe, 1999; Shandra & Hogan, 2009; Wei, Blackorby & Schiller, 2011; Wei, Lenz & Blackorby, 2012), but the picture is not clear. There are many children with disability in school that complete their education on time and with good outcome, but the risk within the target group is high and variable. Therefore, I will here describe some examples indicating the risks and reasons

why it is of importance that evaluation of schools also covers outcome for children with disadvantages in education.

Blackorby and Wagner (1996) reported from a national longitudinal study of special education that in a life-time perspective, youths with disability lag behind their peers in education, employment, wages and residential independence. Cawthon (2004) reported that compared at a fourth-grade level, more than half of the states in the United States reported a 25% to 50% achievement gap for children with disability compared to those without. Brault (2012) reported that half of pupils with disability reported difficulties in doing regular schoolwork. As an example, the state of Arizona reported in 2013 that 74% of children with disability in eighth grade fell below basic levels in mathematics and 72% in reading compared to national expected levels (for children without disability) of 27% in mathematics and 23% in reading (Department of Education, 2013). Snyder and Dillow (2012) reported from the National Centre for Educational Statistics that a lower number of pupils with disability exit school with a diploma.

Among other children with disabilities like born preterm with neurological impairment and Attention deficit hyperactivity disorder (ADHD) academic difficulties also are common (Aylward 2005, 2014; Bussing, Porter, Zima, Mason, Garvan & Reid, 2012; Ek, Westerlund, Holmberg & Fernell, 2011; Marlow, Wolke, Bracewell & Samara, 2005; Whitfield, Grunau & Holsti, 1997).

Hearing loss and educational outcome

It is well documented that hearing loss has an impact on children falling behind in terms of educational outcome (Hendar, 2008; Lederberg et al., 2013; Punch & Hyde, 2010; Thoutenhoofd, 2006; Traxler, 2000). This, in fact, may affect their transition to higher education and the labour market, socio-economic situation and quality of life (Epinion, 2006; Rydberg et al., 2009; Winn, 2007). Even though there have been several efforts to change this situation, research continues to show an attainment gap.

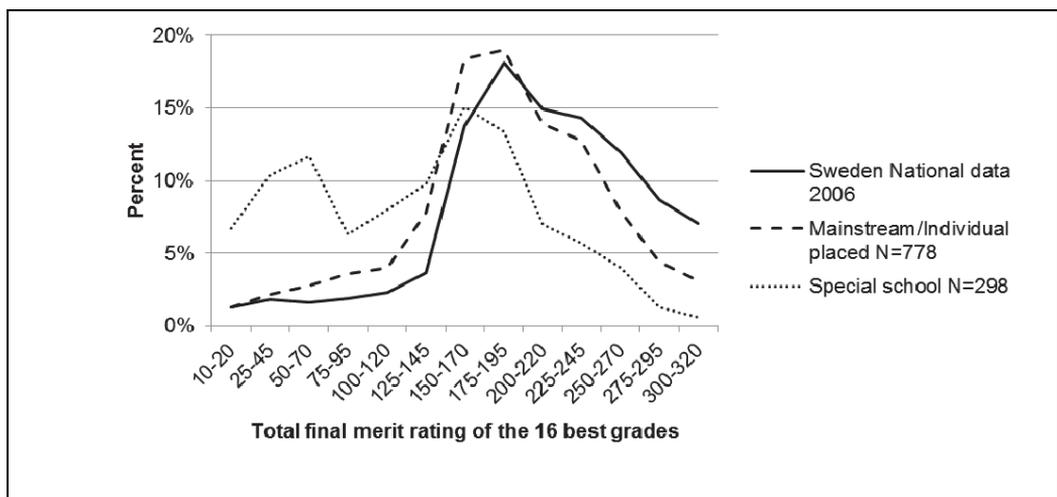
There is a scientific discussion on different quantitative methods in attempts to collect and describe aspects of education. There are for example an experimental- or descriptive methodology discussion as well as a discussion about use of large scale- or single case design. These discussions strive to one or several recommendations. There is no answer on which method that is best. Different approaches to access data is possible. Within the scientific field this thesis is written I have chosen a large-scale descriptive methodology based on work by Allen, (Allen, 1994) and Gorard, (Gorard, 2003). An advantage with my design is that errors based on variation on outcome in heterogeneous groups can be controlled for. The main disadvantage is that they are expensive in terms of time and costs to get access to data and that individual characteristics will be missed in group statistics. Descriptive statistics is like a “photo” on what was seen in education and give options to evaluate different

measures taken for compensating hearing loss and evaluate if they have reached their goals. Experimental design on the other hand can point in what direction we should look at to become even better in our efforts to support children with hearing loss. But experimental design in deaf education often fail though prerequisites in the model of comparison of similar groups is seldom reached. Therefore descriptive large-scale design is chosen.

In 2008 a large-scale study on educational outcome for children with a hearing loss was reported in Sweden (Hendar, 2008). The aim of the Swedish study was to report and analyse any differences in goal fulfilment between pupils at special schools (schools for children with severe and profound hearing loss and with bilingual tuition) and children with hearing loss at resource and mainstream schools. The Swedish project was undertaken on behalf of the Ministry of Education as a project at the Agency of Special Schools. (Special school in Sweden is an alternative for children if they cannot fulfil their education in ordinary class due to their hearing loss). Swedish special schools for children with severe to profound hearing loss conduct bilingual education. The study also reported information from a survey of parents and teachers on hearing loss and education.

The overall conclusion was that children with hearing loss, irrespective of level of hearing or language modality, have difficulties reaching all goals in school.

Figure 2 Amount (percent) children with different final grade points at age 16 within three school placements.



In Figure 2, the comparison between children's school outcome shows that both special schools and mainstream schools have a larger proportion of children with very low goal fulfilment (sum of 16 final-grade points) and a smaller proportion of children with high goal fulfilment. Figure 2 suggests what we know from the study of the differences between

school alternatives, namely that children with severe and profound hearing loss have more difficulties than children with mild or moderate hearing loss.

Language difficulties and educational outcome

Language disorders are of interest because they lead to similar language development delays as does hearing loss. Children with specific language impairment (SLI) comprise a heterogeneous group; they are defined as having an impaired language ability without oral structural anomalies, fall outside autism spectrum, no learning disability, no hearing loss or no neurological impairment (Leonard, 2014). Different aspects of language can be impaired, such as expressive or receptive functions. The variations in severity and cause are as broad as among children with hearing loss. The prevalence at age 6 is about 7% (Tomblin, Records, Buckwalter, Xuyang, Smith & O'Brien, 1997). There are also reasons to believe that the prevalence of SLI at high-school age remains at 7% (Reed, 2014). There is a connection between early language delay and academic performance. Aram, Ekelman and Nation (1984) followed children with language impairment (identified from 3.5 to 6.11 years of age) and found that more than 50% were below the 25th percentile in reading at the age of 13:3–16:10. Similar outcomes have also been reported by others (Conti-Ramsden, Durkin, Simkin & Knox, 2009; Hayiou-Thomas et al., 2010; Stothard, Snowling, Bishop, Chipchase & Kaplan, 1998).

Research has shown that children with another native language than that spoken in the region in which they live, e.g., immigrant languages, also face difficulties in reaching the upper levels of education (Heath & Kilpi-Jakonen, 2012; Thomas & Collier, 1997; Ut-danningsdirektoratet, 2012). Thomas and Collier (1997), in their cross-sectional and longitudinal study, analysed over 700,000 cases and found that English second-language learners achieved below or far below typical children in school. By contrast, learners receiving one of several forms of enriched bilingual education ended school with average or above average scores. Heath and Kilpi-Jakonen (2012) found that time of arrival and standards of education in the country of origin have an impact on school outcome. The later the arrival time and lower the standards, the larger the school outcome gap will be.

Summary of introduction

In the introduction I have described the vulnerability of having a hearing loss according to auditory lack and language development. I have further pointed out the importance of language acquisition for cognitive development in the section of Psycholinguistics. Finally I have described a greater risk for some children in school of not reaching all achievement goals if they have a language delay or a disability. These results correspond to outcome studies of children with hearing loss. In the section of disability I argued that hearing loss must be seen as both in terms of individually needs caused by the hearing loss and different

support needs in communication to meet consequences in the context. Therefore, I will expand the focus on hearing loss as a sensory impairment to also include a closer look at language acquisition

AIM

In the introduction I pointed out a possible connection between hearing loss, early language development and educational outcome. Research within hearing loss indicates a variation of outcome even with modern technologies, and research on other groups with language disadvantages also reports difficulties in education. Research suggests that education outcome for children with hearing loss is dependent on hearing loss level, language acquisition and additional disability.

Efforts in rehabilitation to compensate for hearing loss are often based on technical and advanced hearing aids. But these efforts do not seem to fully compensate for hearing loss. It is of importance, however, to remember that one of the overall aims of education is knowledge, and knowledge is dependent on language learning (Halliday, 1993). Besides transferring knowledge, education also increases participation and other skills, especially for children with different disadvantages in terms of language, poverty and special needs (Gorard & Smith, 2010).

This means that there is a large number of children that may be at risk of not developing their full capacity for language comprehension and language expression in the way that other children do. As a consequence they are at risk of falling behind, not only in communication but also in social situations and learning at school. A historically long period of debate of best language practices in deaf education has not changed the fact of a higher risk for language delay and further consequences. Furthermore, the question is whether earlier general findings can be confirmed and whether, after 25 years of technical advances and educational reforms, there remains a connection between language development and educational outcome.

RESEARCH QUESTION

Out of the introduction, on historical educational outcome for pupils with hearing loss, advances in technology in rehabilitation and educational reforms in the last 25 years, the aims and questions addressed in this thesis will use language meeting as a frame between two languages in education.

Questions

- To explore educational outcome and predictors as described on page 19 with special focus on gender, hearing loss level, parental education, additional disability, ethnicity and language. Is there a variation in educational outcome and is there a gap?
- To explore the connection between early language acquisition and educational outcome. Is there a connection between early language experiences and education following consequences of hearing loss and language development?
From the historical discussion of the status of sign language in rehabilitation and education I will explore the use of sign language described by parents. How does the language map look like nowadays?

PART II – METHODOLOGY

A method is a tool to translate experiences into knowledge. In this thesis I follow the APA Board's proposed recommendations for structure (Wilkinson, 1999). This thesis is a descriptive and quantitative project. It uses a non-experimental design to explore a phenomenon and interpret patterns and findings of experiences in the field. In other words, it is a method conducted by surveys and literature which leads to a new level of understanding. This thesis translates large-scale data of young children's experience of education into knowledge. I will therefore describe the method used, participants and measures for each submitted work.

Study I: (Hendar, 2012)

This study reports on data collection regarding educational outcome and academic progress for children with hearing loss in Norway. It was a large-scale study collecting data from national databases and survey answers from parents and teachers. Together with teachers' descriptions of academic progress, this study had a unique opportunity to describe educational outcome. The study was conducted as an assignment from The Agency of Education to Skådalen resource centre.

Method

To achieve the aim of exploring educational outcome and language use, a quantitative register study and survey was conducted. International reviews of the education of normal hearing children entirely exclude pupils with hearing disability (Schuelka, 2013). From that perspective, large-scale methodology addressing deaf education and the target group is an advantage. Large-scale methodology, as Allen (1994) suggested, has led to more projects and research in deaf education (see, for example, Convertino, Marschark, Sapere, Sarche & Zupan, 2009; Dammeyer, 2010; Luckner & Bowen, 2010; Qi & Mitchell, 2012).

The method used in this study was modified from a version used in Sweden (Hendar, 2008). The model in Sweden was a combination of a model described by Allen (1994) and Stacey, Fortnum, Barton and Summerfield (2006) and a model of a large-scale register on hearing loss described by Konradsson and Jarvholm (2004). It corresponds to the theory that large-scale studies can describe, and have an impact on, educational effectiveness and school development recently published (von Davier, 2013). The method was carried out by combining health care security identification of participants with diagnoses of hearing loss and national attainment data on educational outcome. The model was first used in Sweden

as reported in Hendar (2008). Approval before conducting the project according to rules in Norway was obtained from The Norwegian Directorate of Health (Helsedirektoratet), The Norwegian Data Protection Authority (Datatilsynet) and Statistics of Norway (Statistisk Sentralbyrå). Data analysis was interpreted in a hearing loss, language and educational context motivated by earlier studies (Brennan, 2003; Powers, 1999; Thoutenhoofd, 2006).

The survey questionnaire used was modified from the study conducted in Sweden (Hendar, 2008) and was expanded with questions from Agency of Education in Norway, and modified based on what teachers from education and rehabilitation in Sweden and Norway have in general experienced in the education of students with hearing loss. In Norway, Skådalen resource centre and Research team (FoU) supported the project with their valuable experience and qualitative suggestions for questions in the survey. A language functional approach was used to cover language modality use in different contexts. The model also covered a description of schools' and children's use of technical devices.

Participants

In this section I will describe the participants and the target group in Norway and compare these data with the Swedish study (Hendar, 2008). In Norway the task was to describe the target group in education (Hendar, 2012). In both Sweden and Norway the target group was defined as any children with hearing loss that were advised to use a hearing aid, cochlear implant and/or sign language. In both countries the target group was defined as a cohort representing all children born in a successive period of 15 years. The younger group, born in the first 10 years, was defined as the 'parent and teacher' group. The older group, born in last 5 years, was defined as the 'attainment' group.

Table 1. Participation in Norway compared to Sweden.

| | Sweden (Hendar, 2008) | Norway (Hendar, 2012) |
|---|--------------------------|--------------------------|
| Total number of participants identified by health patient system born during the 15-year period | 3985 | 1564 |
| <i>Number of children in the attainment group</i> | <i>1313</i> | <i>560</i> |
| <i>Number of children in the parent and teacher group</i> | <i>2672</i> | <i>1004</i> |
| Attainment | | |
| <i>Number of attainments in national databases</i> | <i>801</i> | <i>454</i> |
| <i>Attainment from special schools and resource schools</i> | <i>506</i> | <i>137</i> |
| Total attainment | 1307 | 591 |
| Parental and teacher survey | | |
| Parents participating | 1841 | 586 |
| Teachers participating | 1341 | 345 |

For a more detailed technical description, see Hendar (2008, 2012).

There was a slight overrepresentation of girls in the older group and boys in the younger group. Around 10% were born outside Norway, which was an expected level in the Nordic countries at the time. There were no differences in educational level of the parents. In the parental survey, slightly fewer parents with lower education and more with higher education participated. This was expected based on what is known about which parents answer surveys.

Data organization and analysis

Data collected from the parents and teachers in the survey was organized in variables corresponding to three different levels.

- The first level of data contains information collected directly from statistics agencies with a direct connection to each individual. Examples of variables are parental education level, children's educational outcome, ethnic background and gender.
- The second level of data contains survey answers directly from parents or teachers. Examples of such data are parental descriptions of hearing loss level, school placement, school satisfaction and children's additional disability.

- The third level of data is drawn from constructed based on answers from two or three questions in the survey. An example is age of language acquisition. These variables were constructed from parents' answers about child language learning of language modality and the age of acquisition.

The choice of an age limit on early and late acquisition was made based on Mayberry, Lock and Kazmi (2002). Parental education is reported as a factor with an important impact on children's achievement in school (Davis-Kean, 2005). The data were analysed using Chi-Square and one-way ANOVA. Statistical significance was defined as $p < 0.05$.

Study II: (Hendar & O'Neill, submitted)

The aim of the article was to discuss the methods used and highlight similar results from two countries, namely that children with hearing loss face challenges in education. The approach in the article was a collaborative project with the intention to compare methods used and outcome in two countries, Sweden and Scotland. Sweden was chosen in this project because the model used in Norway was originally developed in Sweden. The University of Edinburgh and the Swedish Agency of Special Schools also cooperated in translating the Swedish report (Hendar, 2009).

The findings were partially reported in 2013 at the European Conference on Educational Research in Istanbul, Turkey.

The article showed similar background experience in deaf education and how an increasing interest in goal fulfilment data has been formulated in Sweden, Scotland and Norway. A focus of, and concern in, the article was international surveys, such as PISA, which do not include children with hearing loss.

Method

In this work we conducted a comparative interpretation of method and outcome from two large-scale studies. The method used in each country were analysed by number of participants and method to collect data. In Sweden a register-based method was used, while in Scotland a teacher and parent survey was the main source of information. The interpretation of data was done based on similar outcomes.

Participants

The Swedish study retrieved identity information from audiology clinics for children with at least mild deafness without any more specific information regarding hearing loss level, aid or additional disability. The Scottish study included any deaf child who received at least two visits from a teacher of deaf children each year. In Scotland the data were collected from teachers and parents, not audiology clinics.

Table 2. Participants from each country.

| | Scotland | Sweden | | Attainment |
|-------------|----------------------------------|---------|----------|--------------------|
| | Attainment group, 16 years | Parents | Teachers | group, 16 years |
| Total | 1607 | 2670 | 1770 | 1306 |
| Excluded* | -1067 | -829 | -429 | -31 |
| Final total | 540 | 1841 | 1341 | 1275 |

* Cases excluded in Scotland were those where there was an incomplete match between the database and state agencies about year group. In Sweden, the excluded cases were non-respondents.

Parents and teachers in Sweden represented a cohort of pupils aged 8–16. Achievement data came from a cohort of young people aged 17–21. In Scotland, data on school-age pupils between the ages of 5 and 15 were collected for six years. And data in the article cover those children in 2011 who completed at least their fourth year at secondary school (S4), which corresponds to 16 years of age. Using this model we could compare outcome.

Data organization and analysis

The data was organized into some sections of focus after collection. These were decided based on the earlier reported achievement gap and the risk of challenges in further transition and future education. Therefore we analysed (1) qualification for higher education, (2) attainment outcome – a distribution of high-low results, (3) a specific attainment outcome – bimodal distribution and (4) a specific attainment outcome – additional disability.

Study III: (Swanwick, Hendar, Dammeyer, Kristoffersen, Salter & Simonsen, 2014)

This chapter was written by six colleagues from four countries, Sweden, Norway, Denmark and the United Kingdom, representing both universities and agencies. The pre-work and initial outline were discussed at the International Conference on Deaf Education in Vancouver in 2010, where the Swedish report (Hendar, 2008) was presented. All contributors shared an interest in communicating about language aspects of education for children with hearing loss. Swanwick in Leeds took the lead in the writing process and wrote the draft version. The final version, (Study III), reviews concepts and approaches in bilingual education for deaf children from a Northern European perspective.

Method

A review of concepts in the education of children with hearing loss and their language use was conducted. Data were collected from published research and official government documents from all four countries. Data on deafness, language and bilingual learning was collected and analysed. A cross-country comparison and qualitative analysis on a pragmatic language approach was done based on the reported needs for a new approach to language use.

Data organization and analysis

The data were collected and structured in five groups: deafness, language, technology, bilingual learning and teacher education. The choice of concepts and the structure were selected based on both the experience of the cooperating group and the literature. Analyses were conducted mainly from reported research in Northern Europe.

Study IV: (Hendar & Dammeyer, 2015)

To answer the question whether research in children with hearing loss takes into account pre-lingual aspects of development, a systematic review of published articles in Scopus was conducted.

Method

We conducted a literature search in Scopus on research published in 1990–2013 on language development with respect to selected search terms reflecting different language acquisition themes. Articles published between 1990 and 2013 were collected and counted based on the search terms: language development, child, hearing impairment and cochlear implant. The search results were analysed with descriptive measures as percentages and a statistical analysis based on a between-group differences model. Differences were analysed using Chi-Square. Any differences at $p < 0.05$ were reported.

Data organization and analysis

Within the search terms “child language development”, “hearing impairment” and “cochlear implant”, we checked whether 12 early-linguistic terms were used in the title, abstract or keywords: namely, imitation, babbling, social interaction, joint attention, gesture, speech, sign language, vocabulary, semantic, Syntactic, grammar and pragmatic.

RESULTS

This section reports results from the publications. The method, data and outcome from the survey in Norway are presented in Publications 1, 2 and 3. This part consists of four sections, first on the collection of data regarding measures used, then academic achievement (Publication 1 & 2), then on sign language (Publication 1 & 3) and finally, the results of the literature search on early linguistics steps (Publication 4).

Results on collecting data regarding measures used in Publication 1

Six background characteristics variables were used in the study. Three of them were based on national official statistics, Gender, Ethnicity and Parental education. Two were added as they were used in Sweden (Hendar 2008) to describe deaf education, Hearing loss level and Additional disability. The sixth and last one was added in the Norwegian study to explore findings in (Mayberry & Lock, 2003) that early language acquisition have an impact on later language skill. This was also in line with what was earlier mentioned in the introduction that many children with language delay are at risk for lower achievements in school. Variables were collected from different sources. Gender, ethnicity and parental education were collected from official statistics in Norway. Hearing loss level, additional disability and early language experience were collected from the parental survey. Ethnicity is covered and presented under gender.

Gender and Ethnicity

There was a difference in outcome based on gender between the older group, born in 1989–1993, and the younger group, born in 1994–2002. In the older group the number of girls was slightly higher. The differences between boys and girls within each variable in Table 3 was tested with Chi-Square. No significant differences were found, $p > 0.05$ in all cases.

Table 3. Proportion (%) of boys and girls from the survey in Norway.

| | Amount of children born in 1989–1993 | Amount of children born in 1994–2002 (Parent survey) | Amount of children born in Norway | Amount children with severe and profound hearing loss | Amount of children with no additional disability |
|------------|--------------------------------------|--|-----------------------------------|---|--|
| Boys/Girls | 47/53 | 54/46 | 90.8/87.7 | 16.6/20.2 | 47.7/54.4 |

These results show that there were more boys in the younger group compared to the older group. Among children born in Norway there were more boys than girls. There were more girls than boys with severe and profound hearing loss. Finally, it was more common among girls to have an additional disability. However, the difference between boys and girls on hearing loss level and additional disability was not statistically significant ($p > .05$).

Parental education

Using data from Statistics Norway, parents were grouped based on highest educational level of mother or father. The attainment group (born in 1989–1993) followed the expected levels from Statistics Norway. A significant difference (Chi-Square 5x2 table, $p < 0.01$) was found between the two groups. The parent and teacher survey covers more families with higher education than parents in the attainment group. This was to be expected because a common finding in questionnaire surveys is that willingness to participate is greater in groups with higher levels of education.

Table 4. Distribution (%) of parents' highest educational level in Norway.

| | Attainment group | Parent & Teacher group |
|----------------------------|------------------|------------------------|
| Highest Educational level: | | |
| Secondary | 9.8% | 8.4% |
| Upper secondary | 45.0% | 37.0% |
| Tertiary ≤ 4 years | 30.5% | 36.7% |
| Tertiary > 4 years | 10.2% | 15.0% |
| Unknown | 4.5% | 2.9% |

Hearing loss

By asking parents to choose their children's hearing status from four given levels, we divided the children into four groups of mild, moderate, severe and profound deafness. The given levels were a modification of a WHO questionnaire (Hendar, 2008). Teachers were asked the same question. A correlation between parents' and teachers' answers was found, Pearson $r = 0.52$, $p < 0.01$. In the table below Severe and profound hearing loss have been presented together. In the analysis later, Table 8, these three groups have been further reduced to two groups. Mild/Moderate and Severe/Profound.

Table 5. Parents' report of hearing loss.

| | Boys | Girls |
|---------------------------------|------|-------|
| Mild hearing loss | 103 | 91 |
| Moderate hearing loss | 149 | 106 |
| Severe or profound hearing loss | 50 | 50 |

Additional disability

Parents answered whether their child had any disability, in addition to their hearing loss, that they believed had an impact on educational outcome. Examples of disability were given: visual impairment, motor skill disability, cerebral palsy, autism, ADHD, specific speech or language disability, dyslexia, severe or profound learning disability, multiple disadvantages or other medical impairments. There were three alternative responses: no; yes, one additional disability; and yes, more than one additional disability; see Table 6. The study showed that 50% of children in Norway whose parents participated in the survey had one or several additional disabilities. When dividing each group into new groups based on hearing loss level, a significant differences was found, (Chi-Square = 13.2 (4), $p < 0.05$) see Table 6. Children with severe or profound hearing loss had additional disabilities significantly more often than children with mild or profound hearing loss. But the prevalence of additional disability was shown to be high in all groups of children with hearing loss.

Table 6. Parents' report of additional disability.

| | Number of children | Percentage with severe and profound hearing loss |
|--|--------------------|--|
| No additional disability | 289 | 13.8% |
| Yes, one additional disability | 129 | 17.2% |
| Yes, more than one additional disability | 151 | 27.8% |

Early language acquisition

After analysing modality and age acquisition in the parent survey, I found four groups: early start (before two years) with spoken language only, early start with sign language or sign and spoken language in combination, late start (after two years of age) with spoken language only, and late start with sign language or sign and spoken language in combination. Six social variables were used to describe the four communication groups; see Table 3. There was no difference between the four groups of early language experience according to age. They were all born between 1994 and 2002. Nor was there a difference in gender between the groups. But there was a significant difference between the groups on parental education ($p < 0.05$), additional disability ($p < 0.01$), ethnicity, school placement, cochlear implant and hearing loss ($p < 0.001$).

Table 7. Description of four groups of early language experience. Percentage children in each group and variable.

| | I N = 210 | II N = 116 | III N = 85 | IV N = 63 |
|--|--------------|---------------|---------------|--------------|
| Gender, Percent boys | 51.4 | 54.3 | 63.5 | 49.2 |
| Ethnicity, Percent born in Norway | 94.3 | 95.7 | 85.9 | 77.8 |
| Parental education, Percent with upper secondary as highest education | 42.5 | 50.9 | 50.0 | 56.1 |
| School placement, Percent mainstream | 99.5 | 65.4 | 100 | 60 |
| Cochlear implant, Percent using bilateral or unilateral cochlear implant | 2.9 | 65.5 | 5.9 | 38.1 |
| Hearing loss, Percent with mild or moderate hearing loss | 96.5 | 71.4 | 91.3 | 60.3 |
| Additional disability, Percent with one or more additional disabilities | 38.7 | 48.2 | 50.0 | 60.3 |

I: Before age of 2, spoken language only (no later use of sign language reported)

II: Before age of 2, sign language or sign and spoken language together

III: After age of 2, spoken language only (no later use of sign language reported)

IV: After age of 2, sign language or sign and spoken language together

This table shows that there are significant differences between the groups which must be taken into account when interpreting results. The four groups were used to describe and understand outcome of final grades at 16 years of age and results on national tests in reading and math.

Academic achievement – Publication I & II

In general, publication I, I reported in average, a lower academic outcome for children with a hearing loss, both on national tests in Reading, Math and English and on final exam scores, marks. There are lot of variables used to explain variability in education. There are variables used to explain the outcome, background characteristics and program profile (Kluwin & Morris, 2006). Background characteristics are those that are connected to the child itself like gender, ethnic background and parental educational level, (Agency of Education, 2005). Program profile variables are those variables depended on others decisions, like group size, teacher education, material used and learning expectations. In deaf education there are background characteristics and program profile in addition as hearing loss level, additional disability, language use, school placement, acoustic adaption and use of hearing techniques. I primary focus on individual characteristics in this thesis.

Parent education, ethnicity and gender were found as factors that had an impact on educational outcome; see Table 8. These three are common factors in education even for normally

hearing children. Additionally, in the education of children with hearing loss, I found hearing loss and additional disability to be unique factors that had an impact on the outcome. From Study I in Norway it was reported that school placement did not explain differences in outcome for children with hearing loss.

Having hearing loss increased the risk of not reaching the upper levels of education. The correlation of five social variables and national tests showed a significant connection between two of them in both fifth and eighth grade (parental education level and additional disability). The difference in outcome on national tests according to gender, ethnicity and hearing loss was significant in eighth grade.

As a final variable in Norway, I found a significant link such that early language acquisition may play an important role in children with hearing loss reaching higher levels of education irrespective of language modality.

To check for collinearity between predictors a standard regression analysis was conducted. The analysis has not yet been published. The regression analysis in SPSS showed no collinearity between predictors (Gender, additional disability, ethnicity, parental education, hearing loss and early language experience). The six variable model was able to account for 40% of the variance in Reading comprehension 8th grade (14 year of age). $F(6,100)=11.16$, $p<0.0005$, $R^2=0.401$.

Table 8. Correlation (Pearson) between five variables and outcome on national tests in fifth and eighth grade, reading and math.

| | | Grade 5 | | Grade 8 | |
|---|----------------|---------|-------|---------|-------|
| | | Reading | Math | Reading | Math |
| Gender, (Boys=1, Girls=2) | <i>r</i> | | | .19 | |
| | <i>P value</i> | n.s. | n.s. | .04* | n.s. |
| | N | | | 125 | |
| Ethnicity, (Born outside Norway=1, Born in Norway=2) | <i>r</i> | | | .28 | .20 |
| | <i>P value</i> | n.s. | n.s. | .00** | .03* |
| | N | | | 125 | 123 |
| Parental Edu- cational level (Secondary=1, Upper sec- ondary=2, Tertiary<=4 years=3, Tertiary>4 years=4) | <i>r</i> | .29 | | .33 | .35 |
| | <i>P value</i> | .00** | n.s. | .00** | .00** |
| | N | 121 | | 123 | 121 |
| Hearing loss (Severe and profound=1, Mild and moderate=2) | <i>r</i> | | | .22 | |
| | <i>P value</i> | n.s. | n.s. | .02* | n.s. |
| | N | | | 117 | |
| Additional disability (No add.=1, One add.=2, Two and more add.=3) | <i>r</i> | -.40 | -.41 | -.37 | -.43 |
| | <i>P value</i> | .00** | .00** | .00** | .00** |
| | N | 118 | 126 | 122 | 120 |

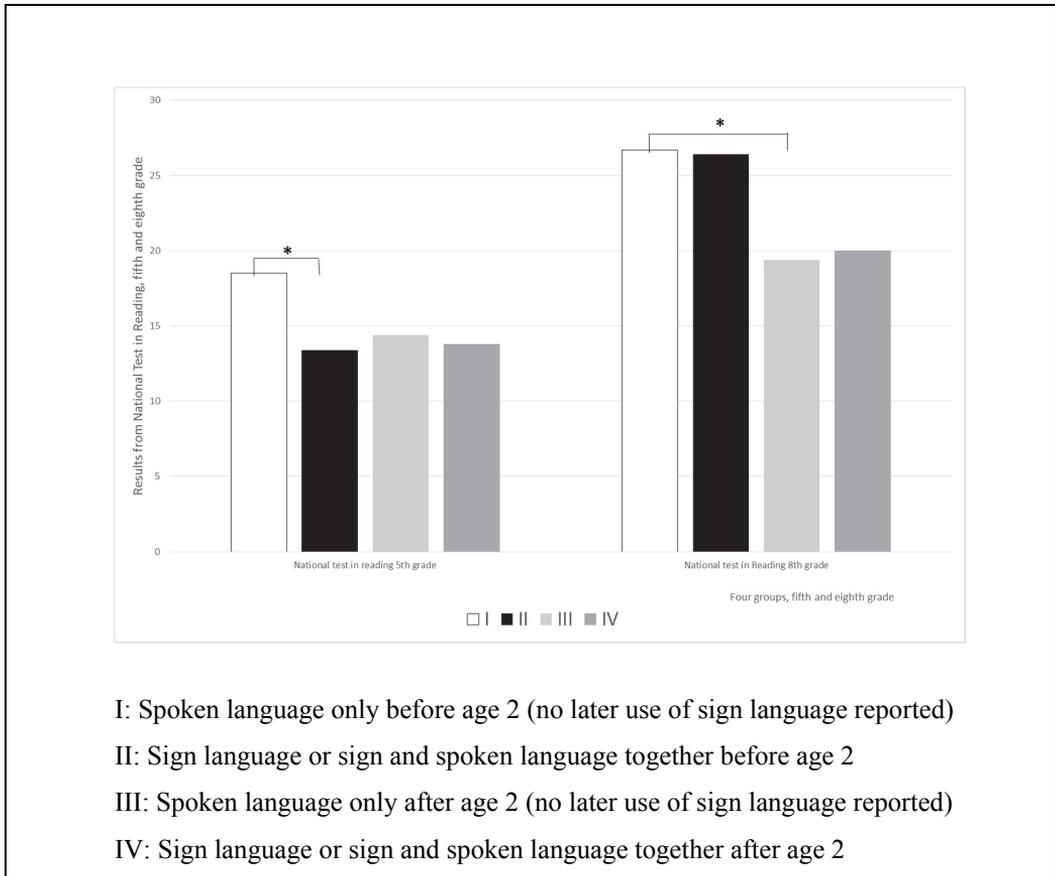
The study found that only about 65% of children with hearing loss participated in national tests. The study also showed that the group of children with missing data probably would have had lower results compared to children who participated. The study asked teachers to describe children's academic progress according to goals in the national curriculum. By using the teachers' answers the study compared children with and without results from national tests. Teachers' descriptions of academic progress showed a significant difference between those who had participated and those who had not participated in national tests. Children without results from national tests were reported by teachers to have reached only half of the goals compared to children who participated in national tests.

Early language acquisition and academic outcome?

In the survey and collection of data on national tests, there was an option to connect parents' description of children's early experience and results on national tests. The figure below shows outcome on national tests in fifth and eighth grade for four groups with different

early language experience. The figure shows that children with experience of early access to spoken language achieved higher results on national tests compared to the three other groups. At eighth grade there is a significant gap between early and late start with spoken languages. Early access to sign language or spoken and sign language in combination increased the results but did not reach significance.

Figure 3. Outcome on national tests in fifth and eighth grade in reading for four groups.



What parents say about sign language – Publication I

A central focus in this thesis is the connection between language and education. And in education of children with hearing loss, the language of instruction is spoken language, sign language and/or blended forms. Based on reported intentions in rehabilitation, I expected that speech is well represented in children's early lives. Therefore, it was of interest to investigate how frequently sign language is used and, if parents report use of sign language, whether there are environments as described in the convention.

In Norway 25% of parents reported that children use sign language or both speech and sign language in school. Sixteen percent of parents reported they wanted more sign language in education (one-third of these had only speech in school today). By comparison, 9% reported they wanted more speech for their children in education (one-sixth of these used only

sign language today). The number in Norway (16%) is similar to the 17% reported in Sweden (Hendar, 2008). Parents' wanting more sign language or speech was not connected exclusively to profound deafness or to bilingual schools. Instead, these wishes were expressed irrespective of school setting and level of hearing loss. According to parents, sign language is not limited to a minority group with profound deafness or to special schools. The table below shows what percentage of parents want more sign language in school for their children in different school settings and with different levels of hearing loss. A difference between Sweden and Norway is that in Sweden special schools are officially bilingual.

Table 9. Proportion (%) of parents who want more sign language in tuition in Norway compared with Sweden according to hearing loss level.

| | | Mild | Moderate | Severe/Profound |
|------------------|---------------|------|----------|-----------------|
| Mainstream | <i>Sweden</i> | 6% | 17% | 33% |
| | <i>Norway</i> | 6% | 15% | 36% |
| Resource schools | <i>Sweden</i> | 15% | 32% | 38% |
| | <i>Norway</i> | — | 22% | 31% |
| Special schools | <i>Sweden</i> | — | 18% | 28% |
| | <i>Norway</i> | | | |

Data from Sweden comes from Hendar, (2008). In Norway, there are resource schools but no special schools.

To explore how schools meet parents' request for more sign language in tuition, I asked teachers to describe whether the school could be described as having a bilingual environment. Only 7% of teachers of children with hearing loss in mainstream schools reported that their schools had a bilingual environment.

Outcome of Publication III

The third publication, a book chapter, has a different form than the three others. It was a desire of all participants to contribute in a cross-disciplinary (psychology and pedagogy) collaboration. All participants contributed with both experiences from a researcher perspective and with helpful description and analysing of actual national school steering documents. The group that cooperated in this chapter contributed both similar and different historical backgrounds and recent findings. Within this genre of research presentation and representation, the group was able to construct ideas for a possible way forwards according to language use in education of children with hearing loss. Therefore, in this thesis, I would like to highlight some findings that correspond with my own results. In general, children with hearing loss are becoming more bilingual in that technology creates more language possibilities. Children are able to move across language borders and boundaries if we give

them opportunities. Language policies in education and rehabilitation seems not to move fluently enough according to what children actually is capable of, irrespective of modality. For example, many deaf children have a need for both sign and spoken languages in their everyday lives. These needs change for different purposes. The chapter suggested that this situation where children move between two or more languages be called “translanguaging”. The chapter suggested a more pragmatic approach to children’s need to move between and switch languages.

Outcome of literature search, Publication IV

To answer the third question, a literature search was conducted. In total, 12,020 hits were found in the Scopus literature database corresponding to the search terms. The majority, 10,752, were about children without hearing impairment, 567 were about children with hearing impairment without a cochlear implant and 701 were about children with cochlear implants.

The search found fewer studies on preverbal language themes in cochlear implant groups compared to the group with normal hearing. For example, we found only 3% of studies on social interaction in the cochlear implant group compared to 8% in typical hearing.

After analysing with Chi-Square, we found that babbling (for children with CI), gesture (for children with hearing impairment without CI), speech (for children with CI) and sign language (both groups) were more frequent in Scopus compared to normally hearing groups; see Table 10.

Table 10. Statistical comparison of studies covering early language terms that were more frequent in cochlear implant and hearing impairment research compared to studies on children with normal hearing in Scopus 1990–2013.

| Search term | Typical hearing | Hearing impairment | | | Cochlear implant | | |
|---------------|-----------------|--------------------|----------|---------|------------------|----------|---------|
| | N = 10752 | N = 567 | | | N = 701 | | |
| | N | n | χ^2 | p | n | χ^2 | p |
| Babbling | 296 | | | n.s. | 52 | 48.61 | < 0.001 |
| Gesture | 873 | 63 | 6.35 | < 0.05 | | | n.s. |
| Speech | 7464 | | | n.s. | 634 | 140.42 | < 0.001 |
| Sign language | 271 | 136 | 715.9 | < 0.001 | 92 | 241.10 | < 0.001 |

Note. Chi-square 2x2 outcome; n, χ^2 and p, df = 1.

The study also showed that terms such as “pragmatic”, “grammar”, “syntactic”, “semantic”, “vocabulary” (for children with hearing impairment without CI), “gesture”, “joint attention”, “social interaction” (for children with CI), and “imitation” were significantly less represented in this research compared to research on normal hearing; see Table (11).

Table 11. Number of studies covering early language terms that were less frequent in cochlear implant and hearing impairment research compared to research on children with typical hearing in Scopus 1990–2013.

| Search term | Typical hearing | Hearing impairment | | | Cochlear implant | | |
|--------------------|-----------------|--------------------|----------|---------|------------------|----------|---------|
| | N = 10752 | N = 567 | | | N = 701 | | |
| | N | n | χ^2 | p | n | χ^2 | p |
| Imitation | 767 | 21 | 9.78 | < 0.01 | 31 | 7.46 | < 0.01 |
| Social interaction | 896 | | | n.s. | 24 | 21.47 | < 0.001 |
| Joint attention | 624 | 15 | 10.08 | < 0.01 | 12 | 21.01 | < 0.001 |
| Gesture | 873 | | | n.s. | 35 | 8.81 | < 0.01 |
| Vocabulary | 3808 | 139 | 28.18 | < 0.001 | | | n.s. |
| Semantic | 1754 | 42 | 32.00 | < 0.001 | 22 | 87.18 | < 0.001 |
| Syntactic | 1731 | 45 | 27.13 | < 0.001 | 45 | 47.06 | < 0.001 |
| Grammar | 2085 | 50 | 39.34 | < 0.001 | 87 | 20.87 | < 0.001 |
| Pragmatic | 984 | 28 | 11.75 | < 0.001 | 12 | 45.74 | < 0.001 |

Note. Chi-square 2x2 outcome; n, χ^2 and p, df = 1.

Summary of results

In this thesis I confirm earlier studies on academic outcome for children with hearing loss. There is a general educational gap in outcome described by attainments for 16-year-old children. Schools seem to have difficulties compensating for early-year experience of developmental deficits such as hearing loss, additional disability and age of language onset.

In cooperation with colleagues in Northern Europe, I also found a need for a more pragmatic language approach to children and their need for flexibility in communication. Finally, I found a need for more research on early language development and hearing loss.

DISCUSSION

Critique and limits of the method

Publication I & II

The method used to collect data has been successful in two countries (Hendar, 2008, 2012). And the two projects have been used by other researchers and reported in public commission documents. But even though it was successful, it has its limitations. A large-scale approach will give an overview and outline the scope of a phenomenon. But it cannot be used to describe individual experiences. The aim this time was to study the phenomenon from a general perspective. The difficulty in deaf education research is that there is almost no official register covering both hearing loss and educational outcome. Large-scale studies of children with typical hearing have been used and discussed, for example, on its impact on educational policies (Bulle, 2011, van Davies, 2013), use of comparison as governance (Grek et al., 2009), governing by numbers (Grek, 2009; Sellar & Lingard, 2013) and accounting for change in education (Knodel, Martens & Niemann, 2013). But even though there are no clear answers to how large-scale studies are connected to the process of raising quality in education for children with hearing loss, large-scale methods give us a possibility to conduct follow-up studies, which case studies and small group approaches cannot do in the same way.

Another critique of the method is that the surveys did not collect data directly from those whom the education is for – the children themselves. Their perspective on outcome may be different from what teachers and parents reported. Their opinion on kinds of schools and educational options were not in focus this time. Likewise, I did not collect data from rehabilitation and the medical field. The study did not take into account children's individual experiences with rehabilitation methods or different support systems in education. For that, I have not succeeded in giving a full picture of deaf education.

A critique could also be directed at the use of statistics as a tool to confirm low outcome in education. This can be discussed from two perspectives. First, we do not know how to compare outcome in deaf education though groups are heterogeneous and speech and sign language use are not randomized. In my thesis I have used a comparison between children based on hearing status (Study I), school placement (Hendar, 2008) and country (Study II). When in my studies I generally confirm low outcome, it is in a context that children with any disability and children with language delay have difficulties reaching the same level of

education as other children do. For children with hearing loss the outcome is irrespective of level of hearing loss, school placement and country. Secondly, it can be discussed whether the method used can conclusively demonstrate differences. Results show difference compared to expected levels. And the results also point at, that there might be a structural difficulty in education though a large numbers of low scorers do not attend national test. How can we be sure that educational efforts have an impact if there is no national picture of outcome? Therefore this is stated and stressed in study (II) that every child is given the possibility to participate in national tests. The statistical analyses used were in general descriptive and only partially inferential. Instead, I could have used regression or other multivariate analyses. Researchers argue for more use of regression and other multivariate analysis to ensure strength and power of findings.

Rationale of methodology, large-scale study and descriptive statistics, is based on prevalence of the target group and the scientific field I decided to write in. There were several questions to take into consideration when the model and design was decided. There are only two common traditions (but lot of variations) of collecting data when you study disability and other small groups. One can conduct a stratified model towards the target group or one can use large-scale population studies to ensure representation. Hearing loss is described to be a heterogeneous group with several individual profiles which consequences often turn out to be continuous data rather than dichotomous. For example hearing loss. It is measured on a continuous scale. The consequence of hearing loss is auditive lack which for some individuals lead to delayed vocabulary development, late language access, communication difficulties and for some more use of sign language. There is no functional reason to categorize into groups based on hearing level only though language and consequences vary differently depending on hearing loss in a context. That make it even more difficult to use only large-scale population design. There is a risk that small groups and their needs disappear in large populations. I have for that reason chose to use a combination.

To overcome the difficulty with continuous data connected to consequences of hearing loss I have used a combination design. By a strategic identification process at a medical clinic I ensured participation from individuals representing a heterogeneous profile of the group. After collecting data I decided to mainly use descriptive presentation and analyse some aspects with mean differences and correlation.

This was also decided based on a couple of considerations. First it is choice where I acknowledge there might be differences within the group and further make it possible to analyse it. There are research rather focusing on success cases than difficulties and challenges that non-successful cases face. Second, with this methodology I hopefully reach another category of readers. My main target group are readers in education.

The results from my reports in Sweden and Norway have been cited in a Ministry commission in Sweden, a white paper to Parliament in Norway and a Ministry report in New

Zealand, (Ministry of Education in Sweden, 2011; Ministry of Education in Norway, 2011; Ministry of Education special education in New Zealand, 2010).

Even though I did not capture a deeper qualitative aspect of education with my choice of method, I do believe a large-scale approach was adequate for the questions raised in this thesis. Small group studies or other scientific approaches are good in their own way and should also be conducted. But they will not give the same overall picture presented in this thesis.

There may be criticisms of how the method was used to describe communication and early-in-life steps into communication. My thesis is built on parents' reports. It might have been difficult for them to remember the age of the first communicative steps of their children. Likewise, it is an aspect that I asked on language modality in the survey to parents and in the introduction wrote about similarities between modalities, in the sense that every child starts with gestures. If parents reported not using sign language, I do not know if they and their children might have used extended forms of gestures. The bridge from gestures to sign language and speech might be individual. My survey could not answer that. This is a bias. Therefore, in my conclusion, I suggest further research on these matters.

Another comment is that disability, language and education are three broad concepts to explore. Sampling bias must be taken into account when interpreting the data because inclusion and exclusion criteria differ in different scientific contexts. And a validation difficulty is this thesis's lack of outcome data from other countries except Scotland (Study II).

Finally, I will remark on the limitations of the method presented in Publication I and II. They are expensive and time consuming. Even though the data, when obtained, are easy to analyse, it takes a lot of resources to structure and complete projects of this size. It is not always an option within the time limits many projects have today. For quality reasons to interpreting different aspects of education, I believe large-scale methods are necessary to conduct as a complement to other approaches. The advantages of getting an overview of the field and the risk researchers take by not having a complete picture of a population speak towards more use of large-scale surveys.

Publication III

To communicate research experience and findings to colleagues in different professions, there are many avenues and tools. Because of a long period of uncertainty about sign language in deaf education, the invitation to write a book chapter was a good opportunity for the collaborating authors. Six colleagues contributed documents, literature, curriculums, course plans and educational policies from each country. We then met at Edinburgh University to discuss and analyze the presented empirical evidence according to the aim. We also decided the outline of the chapter.

The most complicated aspect of writing a chapter such as in this project is to make sure that each author can contribute in a way that reflects his or her individual and country profile. If not met, this can be a bias and be time-consuming. On the other hand, when four different countries' perspectives can be written down and led to a common conclusion, there is definitely a possibility to compare different countries. A bias in this research genre is that a group might emphasize or neglect empirical evidence in order to reach consensus. A collaborative project on the other hand can lead to more cross-discipline and international grant applications. As in this case, when the experience and outcome of a project is good, it encourages other research groups to copy the method. A limitation, however, is that these academic books are printed, and only researchers, not teachers, normally have access online. Many journals though are becoming open-access. This mean that others than researchers freely can obtain copies. A final remark is that this kind of research and project is seldom conducted in Scandinavian countries.

Publication IV

Literature reviews are a common method to summarize the state of knowledge or to build up a framework of the phenomenon in focus. There are several qualitatively different ways to conduct a literature review. In Publication IV, we were especially interested in investigating whether research on early childhood language development of children with hearing loss and cochlear implant took into account pre-linguistic aspects. The outcome presented earlier showed that the research did not do so to any large extent. In our method we checked whether search terms were represented in the title, abstract or keywords. There is, of course, a risk that aspects of early language development were covered in the article without being mentioned in the parts we looked at. Another bias in this study was that we could not be absolutely sure we did not miss any published work, because they are published elsewhere than in the sources available in Scopus. With this finding there is a possibility that research in the hearing loss field is more focused on a (speech) goal rather than the pre-linguistic process leading to the (speech) goal. Pre-linguistic approach include multimodal communication. Our model have a pragmatic language approach on the pre-lingual period. Children can from early stages in life develop an individual profile of context use with sign language and/or speech. This is a bias though there is not enough research to support this model.

Scopus, PubMed, Web of Knowledge and other databases are all still young tools in research, and they are under construction and developing. A limitation in the method employed in this study is that we used only one database. For that reason we might have missed articles and work from the early years of the 1990's.

The method used can, in a way, describe the first step in exploring why the earlier described growing interest in the connection of early language steps is not fully represented

in research on children with hearing loss and cochlear implant. The next step can be a more experimental and longitudinal approach.

Critique and limits of the outcome

There are research projects addressing the question of why children with hearing loss have difficulties in education. Some of them point to aspects other than those mentioned in this thesis. Examples of other confounders are teachers and heads, acoustics in the classroom and the size of classes. The findings in this thesis are in a way disappointing as efforts in rehabilitation and education still seem to have challenges even after 25 years of advances in technology and educational reforms. It can be interpreted as a negative “Matthew effect” (Pfof, Artelt, Hattie & Dörfler, 2014). This means children with disadvantages have more challenges and do not get the same out of education as children without disadvantages. Others have argued that assessment can lead in the wrong direction. For example, Garberoglio, Cawthon and Bond (2014) discussed whether literacy measures fully capture the literacy practices used among deaf people. They might have another trajectory than that of hearing children. There is research pointing out the disadvantages children with disability have in education. In my decision to describe these matters, I take a risk for highlighting the group in negative terms. But without this highlighting, there is another bigger risk that people will not be aware of the educational gap. That would create an even bigger risk for the target group.

The outcome was that the target group on average has challenges in education and is at a greater risk of not reaching goals compared to children with normal hearing. The model used in this thesis is, for that reason, not primarily a model for individual consideration; it is rather a model to support reforms that focus on educational support and steering documents encouraging accessibility to curriculum in both speech and sign language.

There is another discussion about whether promoting school readiness on an individual level has an impact on academic outcome or whether education instead should focus on more general interventions to create a school for all (Morrison & Hindman, 2012; Pramling & Samuelsson, 2012). Hattie (2012) found that background ability factors correlate with later achievement in school, $r = 0.51$. His finding suggests that interventions during pre-school time should be strengthened. His results correspond to the findings in this thesis that early life experience has an impact on education. Similarly, Vohr, Topol, Watson, St Pierre and Tucker. (2014), found that a rich language environment in the home is associated with better language abilities, which are necessary for academic success.

Isolation and deprivation can hinder any language development and can lead to social and mental health problems (Dammeyer & Hendar, 2013). There seems not to be any evidence that learning a language, whether speech or sign language, is not a resource. A further step beyond conflict also could be to arrange cross-disciplinary research on sign language

in rehabilitation to ensure that children get the best start in life. Language learning is not only a means to improve communication but, more importantly, a key avenue to promoting global understanding (Fisher, 2012). In my perspective language is a tool to combine things in the world with a symbol (speech, sign language, tactual language, BLISS, written words), and combine as many as possible. Hearing children in families using both sign language and speech are learning both modalities (Cramer-Wolrath, 2012). There is no research pointing out disadvantages for children learning both sign language and speech. The research in this thesis suggests that it might be the other way around: namely that signs and gestures not only facilitate language development but are necessary.

The connection between hearing loss, language development and educational outcome suggested in this thesis has been addressed and discussed for many years, but as mentioned before, the discussion has generally concluded in conflict and difficulties for two language modalities to appear jointly in rehabilitation and education. This thesis has tried to focus on language and to encourage pragmatic language use to support children with delayed language development or other language disadvantages in the challenges they have in school. This might open up for another language approach in both rehabilitation and education. Reaching that goal will probably require great efforts from different scientific domains.

CONCLUSION

In this thesis I have addressed three aims: to explore educational outcome and predictors, to explore the connection between early language acquisition and educational outcome, and to explore the use of sign language by parents and educators. The thesis is written within the framework described by the UN Convention on the Rights for Persons with Disability. With my method I retrieved data to explore outcome and predictors. With the survey I had the opportunity to look closer at early language development and its connection to education. The concerns described about using sign language in rehabilitation I have addressed by describing how close gestures in early language use are with further language development and how parents use sign language with many children, more than the small group of children with severe or profound hearing loss.

The title of my PhD project connects hearing loss, language and education. I have shown in this thesis that there is an educational gap in outcome even after 25 years of educational reforms and advances in technology. Based on achievement and what parents describe of sign language use, it can be discussed whether the intention of the UN convention is being met. The educational gap in deaf education has led to a deeper analysis and understanding of language in this study. The outcome of education for children with hearing loss in this study has been connected to parental education, gender, immigrant background, hearing loss, early language experience and additional disability.

Deafness is both a disability and a language minority at the same time. Disability and minority are just two natural aspects of human life and should not have negative impact on life. Many deaf persons describe themselves as a language minority. And at the same time, rehabilitation and technology are increasing quality of life. These two aspects have created a dichotomous situation for many children with hearing loss. Sign language, from a dichotomous perspective, is at risk of being even more restricted. Modern language research and understanding of language development suggest that we should use signs and gestures for more than just a few months in the pre-linguistic period, especially for children with any kind of hearing loss, cognitive disability or speech disorders. In doing so I believe we can shorten the language delay that many children with hearing loss experience today.

To follow countries' work and the implementation of the UN convention, I suggest, based on my results, that large-scale studies be conducted in more countries and that a pragmatic language approach be seen more often in rehabilitation and education.

Therefore, efforts should be made to stabilize the relation between the two language modalities in deaf education and rehabilitation by strengthening an accessibility and participation perspective, in accordance with the intentions in the minority language charter in Europe and sign language in the UN convention (Council of Europe, 1992; UN, 2007).

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When two language modalities meet: Speech and sign language, and the impact on education