Childhood Bilingualism and Reading Difficulties:
Insights from Cognition and Pedagogy
To Diba, my fantastic daughter, who is indeed the treasure of my life.
Childhood Bilingualism and Reading Difficulties: Insights from Cognition and Pedagogy
Abstract


We are living in a world in which bi/multilingualism has become commonplace within everyday life for a great number of people. Research has shown that bilingualism produces various cognitive consequences. These effects are generally seen as positive and contributing to an enhanced level of cognitive processing. Bilingualism functions selectively to produce outcome performances depending on the areas that are the subject of investigation. Furthermore, the patterns of results may vary if second-language reading occurs in a dyslexic context. Thus, many children may struggle with this situation, suggesting the need for the provision of a special education agenda in schools. The intention of this dissertation is to address the abovementioned topics. In study I, the effect of bilingualism on lexical vs. non-lexical reading tasks is examined. This study finds that the pattern of the effect might vary based on the type of reading task (e.g., semantic or phonological origins for information processing). In studies II and III, the combined effect of bilingualism and reading difficulties on executive functions (working memory, inhibitory control and flexibility) and on long-term memory (episodic and semantic) is examined. These studies find that, in line with primary expectations, bilingualism in typically developed reading is associated with enhanced overall cognitive performance in either executive functioning or episodic and semantic memory. Interestingly, the combination of second-language reading and reading difficulties is associated with lower performance (longer processing time) for executive functioning and long-term memory (specifically episodic memory). It is suggested that this pattern of performance is produced by a general delayed processing profile in the context of bilingualism and reading difficulties. The findings are discussed in light of the notion of inefficient and difficult learning of new input in terms of dyslexic problems. Study IV explores special education teachers’ assumptions with respect to the type of special education services in Swedish schools with a high proportion of (bilingual) pupils with reading difficulties. The findings of this study underscore the importance of the provision of special bi-literacy education for bilingual dyslexic children in schools and the current shortcomings regarding time and knowledge resources in this regard.

Keywords: bilingualism, reading difficulties, children, second language reading, cognition, special education, teachers, pedagogy.

Niloufar Jalali-Moghadam, Department for law, psychology and social work Örebro University, SE-701 82 Örebro, Sweden, e-mail: Niloufar.jalali-moghadam@oru.se
Acknowledgements

The doctoral life span includes a lot of diverse experiences: both happy and challenging. No PhD graduate could deny that the study period is a tough but at the same time a mostly prosperous experience. For me, it is undeniable that throughout the experiences, I have learnt much and matured as a person. This project could not have taken place without the helping hands and meaningful contributions from my network of people in the background and they all deserve to be credited.

Firstly, I would like to express my deep gratitude to my supervisor Associate Professor Reza Kormi-Nouri for his continuous and compassionate support. I have learnt many things from you, Reza. Thank you! Now I am fairly convinced that career life in research is the matter of practicing patience, motivation and systematic work. You were always there to encourage me to go further and to not to give up.

Next, I would like to thank my co-supervisor Dr. Christina Hedman from Stockholm University. During this period, you have given many insightful comments on the studies and this very dissertation. Kicki, your expertise and broad knowledge on the research field as well as your precise way of thinking have indeed helped me improving my research skills. Thank you! Very genuine thanks go to my colleagues: doctoral students, and those who already earned their PhD degrees: present and former CHAMP members. The following people have been an inspirational source and a fun part of this long journey: Dr. Hosein Mosavi-Nasab, Frazaneh Badinlou and Roda Hamsis (my former nice roommates), Matilda Wurm, Sara Edlund, Dr. Ida Flink, Dr. Sofia Bergbom, Dr. Annika Norell-Clarke and her husband Iain Clarke, Serena Bauduco, Malin Anniko, Maria Lind, Christina Sfykrou, Johan Carstens Söderstrand, Mika Traczyk, Dr. Nanette S. Danielsson, Dr. Martien Schrooten and Dr. Shane McDonald. Thank you guys! You are all altruistic, kind and precious persons and friends.

My special thanks and regards go to Dr. Farah Moniri with whom I have many times shared thoughts about both research and personal life. Thank you Farah for being there for me!

Also, I would like to take this opportunity to thank Dr. Parivash Ranjbar and her nice family for practical and emotional support for my family and I through all my doctoral life and beyond that. Thank you Parivash! You are not only a competent researcher but also a great person.

In addition, I would like to thank the research funding foundations (Swedish Research Council, Kempe-Carlgrenska and the Clas Groschinsky Memorial Fund) that provided the financial foundation for this project. Without their funding, this project could not have succeed. A thank you also goes
to all the participants, including children and their families as well as teachers, for their collaboration and valuable support. Their contributions were undoubtfully the most essential part of this project.

A very immense and special thank you goes to my family (my mum, my dad, my beautiful sister Nastaran, her beloved husband and their adorable son Vala) who live in Iran. Although living far away from us, you guys feel closer to me than me! Your high standards for education and career has given me goals to strive for and your encouragement, emotional support, and understanding has helped me to achieve them. Believe me, you mean everything to me!

Finally, I would like to praise and thank the most VIP person ever in my entire life, my daughter Diba. You are such an intelligent, generous, smart, kind, happy and hopeful kid, Diba. Without you and all the inspiration and energy I get from your side, I would never be in the last stage of this journey. Thank you for being in my life aziz e delam!

Niloufar
Örebro 15-10-15
List of studies
This dissertation is based on the following studies which will be addressed in the text respectively.


IV. Jalali-Moghadam, N., & Hedman. CH. Literacy support for bilinguals with dyslexia in Swedish special education: A bilingual lens vs. difference blindness. Manuscript submitted to the Nordic journal of literacy research.

The published studies are reprinted with kind permission from the publishers.
Table of Contents

INTRODUCTION ........................................................................................................ 13
General overview to the content of this volume ............................................ 13
General aim........................................................................................................ 18

RESEARCH ON BILINGUALISM ...................................................................... 19
Challenging areas ................................................................................................. 19
  Definition ........................................................................................................ 19
  Language proficiency ................................................................................. 20
  Socioeconomic status .............................................................................. 21
  Other variables .......................................................................................... 22
Bilingualism research and cognitive psychology ............................................. 22
Theoretical background in relation to bilingualism and cognition ................. 24
Salient researched areas in bilingualism and cognition ................................... 28
  Reading in a second language context ......................................................... 29
  Executive functioning .............................................................................. 30
  Definition ................................................................................................... 30
  Sub-components of executive functions ................................................... 31
  Long-term Memory ..................................................................................... 33
Link between executive function and long-term memory ................................ 34

RESEARCH ON READING ............................................................................ 36
Cognitive portrait of reading ........................................................................... 36
  Dual-route cascaded model of reading ....................................................... 37
Reading difficulties and cognitive outcomes .................................................. 38

THE ANCHOR POINT: BILINGUALISM AND READING DIFFICULTIES .............. 43
Overview of existing cognitive research ......................................................... 43

REFLECTIONS FROM A DIDACTIC VIEW ON PEDAGOGICAL PRACTICES FOR BILINGUAL CHILDREN WITH READING DIFFICULTIES .......................................................... 48

THE PRESENT DISSERTATION ........................................................................... 50
Research questions ........................................................................................... 50

OVERVIEW OF THE STUDIES ....................................................................... 52
Study I ............................................................................................................... 52
  Introduction ................................................................................................. 52
  Aim .............................................................................................................. 52
INTRODUCTION

General overview to the content of this volume

“If we spoke a different language, we would perceive a somewhat different world”.

~ Ludwig Wittgenstein (1889-1951)

Through the widespread global phenomenon of immigration, many children learn a second language. It is often the case that these bilingual children learn a majority language other than their mother tongue. This is a challenge for any bilingual child, but particularly for those bilingual children who have dyslexic problems. The present dissertation is focused on this topic. Clearly, an additional load of dyslexic problems would make reading in a second language even more difficult for children (e.g., Lundberg, 2002; Sparks & Ganschow, 1991). Generally, children’s struggles with literacy development are a source of concern for parents and teachers. These concerns increase if the children who experience these struggles are (bilingual) children within the context of a second language. Some parents believe that bilingual children must work twice as hard as monolingual children. Teachers and educators, in contrast, usually see this as a complex problem with an intricate nature. A potential dilemma for assessment and screening tools that address children at risk for experiencing reading and writing problems is the over- and under-identification of dyslexic problems. The former cause an individual to be labelled dyslexic when there is no actual dyslexia disorder, and the latter cause individuals to not be identified as having dyslexia although they have the disorder (e.g., Hedman, 2012). These complexities are even more difficult to disentangle with regard to a second language, making the understanding of this problem even more complicated. Dyslexic symptoms and related impairment areas impede literacy development in a second-language context (e.g., Crombie, 1997) and make it difficult to distinguish the origins of the problem. This is an important issue. The topic of assessing dyslexia in children (preferably in the early stages) in general and in bilingual children in particular has consistently been a challenging area of debate among researchers.

Scientific research on both the broad topic of child bi-/multilingualism and reading has been developed through diverse perspectives, among which
the most common are psycholinguistic and cognitive theories. These perspectives are interconnected and integrated into each other at many levels because higher cognitive functions are inevitably mediated through language and linguistic skills. Although connected, these perspectives generally address different domains and therefore use distinct theoretical bases for their arguments. Whereas psycholinguistic theories establish a junction between the knowledge of psychology and linguistics and thus address the finer mechanisms and underpinnings of linguistic and literacy skills, cognitive psychology is more oriented toward studying mental processes (e.g., attention, perception, executive functioning, problem solving, flexibility, memory, and thinking) and examines specific connections between psychology and higher-order functions of cognition. This dissertation is primarily oriented toward the field of cognitive psychology. However, additional themes, such as pedagogical perspectives, are included. Research in bilingualism and in the field of cognitive psychology has mostly adopted a cross-linguistic design (e.g., Bassetti & Cook, 2011). Like other genres of studies, previous studies on this topic use varied measures and cognitive tasks to test their hypotheses and theories. Many cognitive tasks that are linked to specific classes of cognitive abilities have been developed. Each cognitive test is designed to measure a specific cognitive ability, which relies on a certain category of cognitive skills.

Reading, for instance, is near the top of the hill of cognitive complexities. It involves different levels of cognition, both phonological and semantic (e.g., Ziegler, Castel, Pech-Georgel, George, Alario & Perry, 2008). It is not clear whether bilingualism would have a differential effect in terms of different types of reading tasks with phonological or semantic origins. Some research findings have proposed that bilinguals are superior in phonological processing skills compared with monolinguals (e.g., Eviatar & Ibrahim, 2000) and that exposure to a second language enhances young bilingual children’s performance of phonological awareness tasks (e.g., Bruck & Genesee, 1995; Campbell & Sais, 1995). This superiority was demonstrated in pair-language combinations with a second language of a somewhat simpler phonological structure than the first one (e.g., it was more profound for English-Greek bilingual children than for Greek-English bilinguals e.g., Loizou & Stuart, 2003).

Additionally, the role of inter-language differences in performance (the effects of the linguistic features of every language) on phonological awareness tasks has been highlighted by a number of studies (e.g., testing Punjabi-English bilingual children in both languages by Stuart-Smith & Martin,
Furthermore, bilinguals have been shown to perform comparably well or slightly lower with regard to semantic (analysis of knowledge) skills; it is suggested that bilinguals have a smaller vocabulary in their second language in comparison with monolinguals (e.g., Abudarham, 1997). However, this deficit is temporary and mostly evident during early ages, and it disappears throughout the grades during elementary school (e.g., Genesee & Nicoladis, 1995).

In this context, reading tasks may vary. Whereas many frequently used reading tasks (e.g., word reading and letter/word chains) have been suggested to rely on to semantic representations and thus to indexing word-encoding skills (e.g., Verhoeven & Leeuwe, 2012), other tasks (e.g., deletion of phonemes, rhyming or non-/pseudo-word reading) mostly address stored phonological representations (e.g., Delazer & Girelli, 1997). If we consider that there are two distinct cognitive resources/origins for reading tasks (phonological or semantic sources), a question arises: whether the hypothesized dissociative (bilingualism) outcomes that might appear by using certain cognitive tasks that originate from different cognitive resources will emerge in terms of reading tasks as well.

In the context of cognitive research and the field of bilingualism and reading difficulties (RD)¹, certain patterns of (increased, decreased or sometimes comparable) outcome performances are clearly observed in diverse conditions and experiments. On the one hand, there is an overall consensus about the positive effect of bilingualism in terms of general cognitive abilities and higher-order cognitive functioning (e.g., particularly by executive functioning and partially by other areas, such as memory), although (by applying different methodologies and research scopes) some observations suggest comparable performances and slight disadvantages in a number of skills (e.g., lexical processing and language production) in comparison to monolingualism. On the other hand, and in relation to RD (or what are commonly considered dyslexic problems), research suggests impairments in terms of different cognitive domains, such as executive functioning skills (e.g., Peng, Sha & Beilei, 2013) or memory (e.g., Menghini, Carlesimo, Marotta, Finzi & Vicari, 2010). There is a paradox in which it is unclear whether bilingual children with RD would face more difficulty performing

¹ Throughout this dissertation, the term reading difficulties (RD) is defined to address a general and widespread range of possible difficulties.
cognitive tasks that tap into different domains of cognition relative to monolingual children with RD or whether their ability to master a second language would contribute to better performance.

This dissertation partially focuses on examining the cognitive function of reading itself with regard to different types of reading tasks and in relation to bilingualism. Research on this issue will contribute to providing a theoretical base for further investigations. Moreover, this work is designed to study the potentially differential effect of bilingualism and RD as one united condition. Attempting to unravel the impact of bilingualism and RD together is a relatively new area of research that will be feasible through a four-way comparison of bilingual and monolingual groups of children who have developed typical reading skills as well as bilingual and monolingual children with RD. Using this strategy, it will also be possible to investigate the individual impact of either bilingualism or RD. In addition to research from a cognitive perspective, some investigations have been conducted in light of a pedagogical perspective on bilingualism research that addresses the special education services that (bilingual) children with RD require and receive. This is an important orientation because cognitive barriers (such as RD) can make children vulnerable to scholastic underachievement and to experiencing more failures in their academic progress; because cognitive abilities are essential in terms of academic development. Overcoming these difficulties to achieving positive academic outcomes is among the primary goals of the special education provision curriculum in schools.

The above-mentioned controversial research areas are particularly interesting for investigating multilingual societies. Romaine (1995) introduced several patterns of bilingualism including a type of bilingualism in which a non-dominant (home) language dynamically exists but is not supported by the community (majority) language system. Many societies live with multiple languages. For example, Iran (a vast multicultural country in Western Asia with diverse ethnic groups) has a total of 87 languages, of which Farsi (Persian)1 is the main (formal) language used in terms of education. Iranians living in different provinces and geographical parts of the country may have very dissimilar cultural habits and languages. Whereas, for example, people in southern Iran speak Arabic and Farsi, those from the western parts of the country have Turkish as their first language and Farsi as their second. Therefore, a large number of bilinguals develop a first language (that is not

---

1 Farsi and Persian are used interchangeably through this work.
supported by the community) with Farsi as their second (the dominant and formal language). At the same time, Farsi is the exclusive language of many (monolingual) people, such as those who live in the capital, Tehran. In addition to these diverse languages within a shared context, there are other types of bilingualism generated by the advances of globalization. Many Western countries’ borders have been open for a long time for immigrants who naturally bring their native (minority) language and culture and, due to the demands of the host community, learn a new (majority) language.

Several Western European countries traditionally welcome immigrant people. Sweden is one country that has a high proportion of immigrants and thus a high population of bilingual children. According to Statistics Sweden (SCB, 2014) for the year 2013, 15.9% of the population were born in a non-Swedish country and immigrated to Sweden. An increasing number of immigrants to Sweden are Iranians, whose population in Sweden, based on 2014 statistics, increased to 1744 people. Iranian immigrant children living in Sweden may have Farsi1 as their mother tongue and begin learning Swedish in schools. Obviously these children (like other bilingual groups) develop different types of bilingualism and language proficiency levels depending on factors such as the age at which they entered Sweden, the amount of exposure to Swedish and education2 in Farsi, the frequency and amount of extra support that they receive from their surroundings and their families, their own cognitive capacities and intellectual properties and many other factors. Generally, the bilingual experience for immigrant children creates a special context in which every child may have different cognitive outcomes. Focusing on these two types of (bilingual) populations, one from Iran and the other one from Sweden, this dissertation attempts to gain a better understanding of the nature of dissociative impacts and selective patterns of bilingualism in terms of reading tasks that rely on different cognitive origins.

1 Farsi is the official language of Iran, however, there are other languages spoken and developed in diverse areas of the country (e.g., Turkish, Kurdish, Armenian, Arabic, Baluchi, ...). The educational system of Iran offers education exclusively in Farsi to students as the main language for education in schools.

2 In Sweden, immigrant children (by means of a voluntary educational service) have the opportunity to practice and learn their mother tongue which is usually set up to be offered for almost once a week and is presented by the mother tongue teachers (who have the native language) in schools.
Furthermore, it was of interest to study the cognitive performance of Iranian-Swedish bilingual children living in Sweden while paying particular attention to the bilingual group with RD through a cross-sectional design and in comparison with three groups of bilingual and monolingual children.

The current body of research on bilingualism and RD, at least with respect to explorations of cognitive and linguistic factors, is tenuous and is a subject that requires further development.

**General aim**

The overall aim of this dissertation is to explore the effect of bilingualism on reading, on the one hand, and to examine executive function and long-term memory performance in the context of bilingualism (second-language use) and RD, on the other hand. The justification for this idea relies on the notion of a general enhancing effect of bilingualism on executive functioning vs. the belief that impairments in executive functioning may be a significant cause of RD. In addition to investigating children’s cognitive performance (at the group level), another aim is to explore teachers’ cognition and pedagogical practices in schools with many bilingual students (many of whom may have dyslexia) to examine how the current special education system is accomplishing the national policy and legislation addressing special education for bilingual students with problems related to dyslexia. The population for this latter research included teachers who work in schools with a high proportion of bilingual children (and those at risk for experiencing RD). Bilingual children were chosen from two settings with both similar and dissimilar cultural backgrounds. The first setting encompassed two large groups of Turkish-Persian and Kurdish-Persian bilingual children within the same country (Iran) with a relatively integrated and similar cultural background, whereas the second setting included bilingual children living in a host country (Sweden) with a dissimilar cultural/linguistic background.
RESEARCH ON BILINGUALISM

Bi-/multilingualism is a global experience that is accessible to everyone. Bilingualism can be found in every society and in different age ranges and stages of life, so it is globally apparent. The opinion of bilingualism among people outside of the academic context is generally favourable. The current scientific view within academia also supports bilingualism. In fact, this is a complex area of research that is intertwined with myriad (linguistic, cognitive, neuropsychological, familial, cultural, societal) dimensions that influence the state of the art in this field. Research on this topic requires preliminary study that takes into account the key factors and those that must be controlled. In the following section, a brief summary of these controversial factors is presented.

Challenging areas

One of the arguments in this field is related to the question of how to define bilingualism and bilinguals. It is an unpleasant fact that contingencies and illusory issues in relation to determining definitional criteria make it difficult to produce accurate empirical designs for study. In addition to the difficulty of definition, another challenge is to determine the level of language proficiency of bilinguals. Both of these issues support the idea of classifying bilinguals according to their type of bilingualism. Furthermore, socioeconomic status (SES) should be considered because it has been shown to affect outcome performance.

Definition

Identifying a pragmatic, satisfactory and concrete definition of bilingualism and determining who is counted as bilingual are intricate tasks. There are multiple definitions; thus, an exact and objective method to measure bilingualism is lacking (Carlson & Meltzoff, 2008). Over time, various conflicting definitions have been produced, from considering the bilingual person as someone who must be perfectly fluent in both languages (Bloomfield, 1933) to labelling a person as bilingual who has a minimum level of competence in one of the languages (Macnamara, 1967). Moderate definitions have also been developed that suggest that a bilingual person is expected to function in both languages based on the given demands in daily life (e.g., Fredrickson & Cline, 2002; Grosjean, 1989; Skutnabb-Kangas, 1995). In this context, Kormos (2013) stated, “In foreign language contexts, a bilin-
gual person is someone who can use another language to meet their communication needs in situations where knowledge of another language is required” (p. 76). Based on this understanding, both languages are not necessarily used intensively every day. Kormi-Nouri and associates (Kormi-Nouri, Moniri & Nilsson, 2003; Kormi-Nouri, Shojaei, Moniri, Gholami, Moradi, Akbari-Zardkhaneh & Nilsson, 2008; Kormi-Nouri, Moradi, Moradi, Akbari-Zardkhaneh & Zahedian, 2012) also defined bilinguals as people who use one language (the first language) at home and another (the second language) at school in their everyday life. Definitions similar to the latter one have attracted interest in the context of the current research. Consistent with such definitions, two relevant factors in defining bilinguals are language use and fluency (Grosjean & Li, 2013). As Altarriba and Heredia (2008) suggested, many factors, including linguistic, bio-psychological, cognitive, educational and socio-cultural factors, are involved in the study of bilingualism that make the definition of bilingualism more complex.

This dissertation adopts the definition of bilingualism proposed by Grosjean (1989) and used by Kormi-Nouri et al. (2003, 2008 & 2012) as the “regular use of two (or more) languages (or dialects) in everyday life (usually one at home and one at school)”.

**Language proficiency**

In contrast to common belief, bilingual individuals’ levels of language proficiency in their two languages are not necessarily equivalent. As a definition, “language proficiency is the ability to function in a situation that is defined by specific cognitive and linguistic demands” (Bialystok, 2001, p. 18). It is important to assess all four modalities of language, including reading, writing, speaking and listening (belonging to literacy and oral skills; Baker, 2011), when measuring language proficiency (Wei, 2000). Although this strategy is practical, it is complicated by the fact that proficiency levels in these four modalities might not be always as the same (e.g., a person may have better writing or comprehension skills than speaking skills) (Grosjean & Li, 2013). Debate on the level of language proficiency has produced a sphere in which to discuss classifications of the types of bilingualism (e.g., sequential or successive bilingualism; Butler & Hakuta, 2004). The context in which bilingualism develops and the amount of exposure to the second language are important factors in determining the general pattern of bilingualism (e.g., Thordardottir, 2011). It has also been suggested that language proficiency can be predicted by the intensity of exposure to the second lan-
language (i.e., more frequent exposure leads to higher proficiency) (e.g., Chondrogianni & Marinis, 2011). In the current dissertation, to control for language proficiency, the five primary school grades (study I) and self-rating scales (study II & III) were taken into granted. The different school grades from one to five can be regarded as an indication of different levels of language proficiency. In the self-ratings, children rated their proficiency levels in the four areas of speaking, writing, listening and reading in both languages.

**Socioeconomic status**

Social variables have long been considered important (e.g., Grosjean, 1982). It is suggested that belonging to a lower social class is linked to poorer vocabulary size in children (e.g., Morisset, Barnard, Greenberg, Booth & Spieker, 1990). This is important because vocabulary development is one way of assessing language proficiency (Bialystok, 2001). In general terms, lower SES is associated with poorer academic achievement and the underdevelopment of literacy skills (e.g., Sirin, 2005), whereas more privilege in SES is believed to correlate with executive functioning and control abilities (e.g., Lawson, Duda, Avants, Wu & Farah, 2013; Rhoades, Greenberg, Lanza & Blair, 2011). There is also some research evidence supporting the notion that SES affects second-language acquisition and proficiency by moderating executive functioning performance (e.g., Hedden, Ketay, Aron, Markus & Gabrieli, 2008). Bilingual children who belong to medium- and high-level SES were reported to outperform children of low SES in memory, attentional control and executive functioning (e.g., Noble, Norman & Farah, 2005). However, Bialystok and Viswanathan (2009) suggested that bilingual advantage could not be explained by SES and was more affected by greater differences in culture between bilingual groups of different countries. In addition, a negative link was found between poverty and parental educational level with the oral and academic use of language (e.g., Hakuta, Butler & Witt, 2000). Parental education was also proposed to positively influence vocabulary size and second-language proficiency (e.g., Golberg, Paradis, & Crago, 2008) as well as working memory and control abilities (e.g., Ardila & Rosselli, 1994). To control for SES, several factors were considered by the studies included in this dissertation. For study I, groups of bilingual as well as monolingual children were selected in three different geographical districts and different types of schools (private, semi-public and public) systematically and across all three cities. Taking the type of school into account when studying bilingualism in a country such as Iran is
important, because in Iran, children who study in private schools mainly belong to an economically and socially privileged class. In contrast, public schools mainly contain less economically/socially privileged children whose families have lower monthly income on average. Children who come from a middle social class are more frequently found in the semi-public types of schools. For studies II and III, because the population was from Sweden, which has a different social system comparing Iran, and because there are no large social class differences in Sweden in comparison with Iran, a SES index was created based on the educational level and occupations of the parents. The bilingual sample was collected randomly through a wide range of Swedish municipalities and in schools throughout the country.

Other variables
Revisiting the multidimensional and complex picture of bilingualism research, other variables are important to consider. For example, a handful of studies have suggested that similarity between languages can be regarded as advantageous for bilinguals when performing cognitive tasks (as explored specifically in terms of reading or memory tests) in their second language (e.g., Bialystok, Majumder & Martin, 2003; Ringbom, 1992). However, Kormi-Nouri et al. (2008) suggested that less similarity between languages can be associated with a higher level of cross-language interactivity and therefore a bilingual advantage. In addition, second-language acquisition has been suggested to be influenced by the level of proximity between the first and second languages (Lakshmanan, 2009). Some studies posit the role of children’s aptitude in acquiring a second language (e.g., Ranta, 2002) or their age as a predictor of cognitive development (e.g., Chondrogianni & Marinis, 2011). Among these additional variables, the possible role of the similarity/dissimilarity of languages as well as school grades were taken into account in studies I to III. Understanding of this range of important factors is crucial prior to conducting research in the field of bilingualism.

Bilingualism research and cognitive psychology
Trends, general assumptions and perspectives of cognitive psychology research in the field of bilingualism have changed considerably over time. The dominant perspective on bilingualism has shifted conceptually from a pessimistic orientation to a reasonably optimistic one. Although the traditional view preferred to highlight the negative influences of bilingualism on cognitive outcomes and development (e.g., Long & Harding-Esch, 1977), the current view of bilingualism is that it is associated with an increase in certain
cognitive domains (i.e., executive functioning or, in a narrower and more specific frame, inhibitory control) (e.g., Bialystok, Craik, Klein & Viswanathan, 2004; Colzato, Bajo, van den Wildenberg, Paolieri, Nieuwenhuis, La Heij & Hommel, 2008). From a generic and popular perspective, this is considered the bilingual advantage effect. Despite this image in favour of bilingualism, there is research evidence that indicates some less positive reports, especially in terms of lexical processing and processing time (e.g., Gollan, Montoya, Fennema-Notestine & Morris, 2005; Ivanova & Costa, 2008). For example, in some experimental paradigms such as picture naming (e.g., Gollan, Fennema-Notestine, Montoya & Jernigan, 2007) or verbal fluency (e.g., Strauss, Sherman & Spreen, 2006), bilinguals and monolinguals have been shown to have significant between-group differences. Gollan, Montoya, Cera and Sandoval (2008) concluded that bilinguals’ representational knowledge resources are not comparable (and are less rich in each language) in comparison to monolinguals. This idea supports the hypothesis of within-network “weaker links” for bilinguals based on the understanding that they use each of their languages less often. Although bilingual language processing is not generally believed to be deficient, some studies have suggested that bilinguals’ lexical retrieval (even in their first language) is inferior to that of monolinguals in terms of both speed and number of produced items. These differences have been attributed partially to the notion of bilinguals’ smaller vocabulary size (especially with respect to fluency/semantic categorization tasks) and partially to the idea of competition and interference between languages (e.g., Sandoval, Gollan, Ferreira, & Salmon, 2010) for activation because this management requires time. Notably, it is important to consider age differences when studying lexical retrievals such as picture naming because older bilinguals are more likely to experience first-language attrition compared with younger individuals. For example, Goral, Libbon, Olber, Jarema and Ohayon (2008) suggested that older Hebrew-English bilinguals had slower retrieval time because their first language was prone to attrition (see, however, the critique of these types of comparisons in Grosjean, 1998).

Early studies on bilingualism were parochially sanguine about childhood bilingualism and were keen to describe bilingualism as a cause of language deficits and lower intelligence (e.g., Macnamara, 1966), poorer vocabulary repertoire (e.g., Grabo, 1931) and articulation impairments (e.g., Carrow, 1957). Their designs involved multiple language pairs and varied conditions (children mostly had a lower level of SES) with respect to childhood bilingualism and so included few methodological details. Recent research has
become increasingly more careful to minimize such methodological flaws. The turning point from negative to positive standpoints was triggered by Peal and Lambert’s study (1962) in which bilinguals matched by gender, age and SES were argued to be more efficient in cognitive flexibility. Cognitive research in its current holistic mode argues first and foremost in favour of bilingualism through an overarching belief about the bilingual advantage effect, which, as mentioned above, is generated by numerous findings in various cognitive areas. The advantage effect reflects a superiority effect of being bilingual in terms of executive and inhibitory skills. Although this dominant view gives credit to most findings within the field of cognitive psychology, there have been less positive reports that have not found the well-known bilingual advantage effect. This bilingual disadvantage has particularly appeared in estimates of language processing, lexical retrieval and receptive vocabulary repertoire in comparison with monolinguals (e.g., Bialystok, Luk, Peets & Yang, 2010; Gollan et al. 2005; Roberts, Garcia, Desrochers & Hernandez, 2002).

In addition to behavioural studies, cognitive neuroscientists have studied the neural bases of bilingualism at the brain level. For instance, it was suggested that bilingual advantage in inhibitory control originates from either bilinguals’ master experience in employing the network that specifically addresses the control system or from constant adjustments and dynamic changes that occur within this system to resolve conflict (e.g., Abutalebi & Green, 2007), although both bilinguals and monolinguals recruit the same neural and cortical regions.

**Theoretical background in relation to bilingualism and cognition**

To understand the cognitive impact of bilingualism, it is necessary to obtain an insight into the cognitive processes and underlying mechanisms that cause different cognitive outcomes. Typically, two lines of cognitive processes are introduced upon which linguistic skills can be situated and explained, namely, control of attention and analysis of representational structure (Bialystok & Ryan, 1985). Based on this framework, different language use tasks, such as oral (e.g., conversation), literate (e.g., writing, reading, skimming) and metalinguistic (e.g., judgements about anomaly or correctness of sentences), demand different levels of either control or analysis processes (Bialystok, 2001). For example, reading involves a deep demand for higher levels of control and analysis than skimming; although the former relies on high control, it requires a lesser amount of analysis. On the one hand, mental representations are built on the analysis of representational
knowledge. Through cognitive development, such representations become clearer and re-constructed continuously. Such modifications contribute to the further development of novel relations among implicitly related and explicitly unrelated facts and concepts and, consequently, cognitive development. On the other hand, there are control mechanisms, such as inhibitory and attentional processes, which allow for the regulation and approach of mental representations.

As briefly mentioned above, different types of tasks rely on dissimilar areas of analysis of representational knowledge and control processes, such as domains of language proficiency. The more proficient a child becomes in a language, the more competent he/she becomes in the metalinguistic use of language. Therefore, every task that draws upon these cognitive processes (i.e., executive control and language knowledge) to varying degrees should be a metalinguistic task (e.g., Friesen & Bialystok, 2012). Metalinguistic skills and language proficiency develop differently for first- and second-language learners since for bilinguals, “second-language acquisition is facilitated because a language template is available” (Bialystok, 2001, p. 127). In this account, bilingualism is thought to affect control skills and language arbitrariness (e.g., Bialystok, 1991) and not to inevitably affect the development of knowledge representations per se. With regard to the possible differences among bilingual and monolingual individuals in handling cognitive tasks, there has been a tendency among researchers to take the nature of the cognitive task for granted. Based on this conceptual viewpoint, a certain amount of cognitive burden would be imposed on the subject to accomplish a specific task. In this account, it is the nature of the cognitive task that finally determines success or failure in task accomplishment. This reasoning, which was initially developed by Bialystok and her colleagues, seems to rely on gumption and precision. These authors claimed that the difficulty levels of tests or, in some sense, the amount of their reliance on

---

1 Metalinguistic use of language (Bialystok, 2001) is defined into three overall contexts of knowledge (about language in general terms), ability (to use the knowledge) and awareness (conscious attention actively given to the language knowledge).

2 Arbitrary vs. non-arbitrary refers to understanding the fact that word forms are not necessarily predicted by words’ meanings.
different domains of cognition affect outcome performances. Whereas bilinguals are more frequently observed to be advanced in metalinguistic concepts and successful in accomplishing tasks relying on attentional/inhibitory control (considered more difficult or cognitively appealing tasks) than monolingual children are, they remain at the same level as monolingual children in performance on tasks based on analysis of representational structure (i.e., less difficult tasks) (e.g., Bialystok & Majumder, 1998 [problem solving]; Bialystok, 1986, 1988 [problems with metalinguistic judgments]; & Bialystok & Codd, 1997 [concepts of numbers]) (see Figure 1). Since then, many studies have formulated discussions to explore performance on tasks that tax different cognitive skills on this conceptual framework (e.g., Adesope, Lavin, Thompson & Ungerleider, 2010; Cromdal, 1999 [metalinguistic skills such as symbol substitution, grammaticality judgment, and grammaticality correction], Kormi-Nouri, et al. 2012 [semantic memory: category and letter fluency tasks]).
Differences in specific cognitive processes

At a less general level*  
Bilingual disadvantage effect

At a general level  
Bilingual advantage effect

Analysis of Representations  
(Second language) lexical processing, Speech Production

Control of Attention  
(Metalinguistic skills, inhibitory control & conflict resolution)

Figure 1. Differences between bilinguals vs. monolinguals in cognitive processing

*Noteworthy, in discussing the bilingual reduced advantage effect in terms of analysis of knowledge and lexical processing, numbers of factors are important to take into consideration including the opportunities due to second language exposure, education, terms of use, as well as language aptitude. On this account, different groups of bilinguals belonging to different educational and linguistic backgrounds might differentially perform on lexical processing measures of either first or second language. The background idea to highlight this notion is to stress that such a disadvantageous profile is not universal and also to advocate the general enhanced effect of bilingualism for cognitive processing.

As shown in Figure 1, bilinguals benefit from possessing a powerful inhibitory control mechanism that makes them superior in mastering conflicts (Bialystok, 2001). The fronting perspective to superior inhibitory control (known as the second-language lexical disadvantage hypothesis) proposes delayed lexical processing because bilinguals have reduced language proficiency in their second language and in comparison to monolinguals (e.g., Runnqvist, Strijkers, Sadat & Costa, 2011). Such difficulties have specifically been found for word productions in terms of frequency (e.g., Gollan et al. 2002), the time needed for picture naming and comprehension tasks (e.g., Ivanova & Costa, 2008) and tip-of-the-tongue (TOT) states (Gollan
These delay profiles have been discussed based on the idea of reduced frequency of first and second languages for bilinguals in comparison with monolinguals (e.g., Gollan et al. 2005).

Furthermore, bi-literacy has been suggested to have differential effects in terms of deep (e.g., English) vs. shallow (e.g., Urdu) orthographies\(^1\) and literacy acquisition (Mumtaz & Humphreys, 2001). As Bassetti and Cook (2011) noted, bilingualism seems to have two classes of cognitive outcomes: one that is situated at a macro-level, such as the overall advanced effect of bilingualism in terms of inhibition and metalinguistic skills, and another that is established at a micro-level, which is mostly in relation to the finer characteristics of (within and between) differences of languages and the ways by which different languages encode various inputs. Notably, however, not all of these types of studies have conducted careful analyses of the various prerequisites for bilingual (lexical) development and/or the individual differences among bilingual speakers (e.g., Grosjean, 1998). For example, lexical and literacy development in bilingual individuals’ first and second languages is highly dependent on effective instruction (e.g., August & Shanahan, 2008). Also, the conditions for language (vocabulary) development in a first minority language within a majority language context are different compared to the conditions for language (vocabulary) development in a majority language. Language usage patterns may also vary extensively between bilingual individuals as well as with the extent of exposure to the first- and second-language vocabulary (Grosjean, 1998). The TOT phenomenon, for example, have been found to arise more commonly for low-frequency words (Harley & Brown, 1998), and knowledge of these types of words (which elicit TOT delays) may vary with educational level (e.g., Dahlgren, 1998).

**Salient researched areas in bilingualism and cognition**

In what follows, some of the most common research areas in bilingualism which have been investigated in terms of cognition are briefly reviewed.

---

\(^1\) A shallow orthography follows the letter-sound correspondence rules in a more extent than a deep orthography (e.g., Katz & Frost, 1992). While reading in a shallow orthography relies more on phonological processing, reading in a deep one is based on visual processing skills more extensively.
Reading in a second language context

One of the central areas for studying reading in the context of a second language is language transfer among second-language learners. Research suggests that language capacities such as phonology, metalinguistic awareness or morpho-syntax can be transferred from the first language to a second language (e.g., Gundel & Tarone, 1983; Koda, 2000). There are two contrasting perspectives regarding reading transfer into a second language that argue for either orthographic characteristics or cognitive/linguistic skills underlying reading practice and language proficiency. Based on the script-dependent hypothesis, it is more probable to experience RD in shallow than deep orthographies (e.g., Katz & Frost, 1992). Thus, children with RD in one language (with a deep orthography) will not necessarily experience problems in the other language (with a shallow orthography and more correspondent grapheme-to-phoneme system). In contrast, based on the central processing hypothesis, deficient cognitive and linguistic skills in the first language will inevitably, and regardless of the script and orthographic depth of the languages, prevent the development of basic reading skills in the second language (e.g., Bialystok & Ryan, 1985). In fact, very few studies have examined the relationship between RD in the first and second language in bilinguals (e.g., Petrie & Geva, 1991). These few studies, however, provided support for the central processing hypothesis for bilingual readers. According to Luk (2003), phonological awareness skills generally develop in parallel; in contrast, reading skills are more script/language dependent. Many factors have been suggested to play important roles in the development of proficiency in second-language reading. Miller-Guron (2000) proposed that both first-language background factors (e.g., mental representations, word reading and text processing methods) and second-language factors (e.g., motivation, exposure to culture, text and instruction) affect core reading skills/requirements. Through multiple interactions and the influences of such linguistic and non-linguistic factors, reading in a second-language context can be implemented. With regard to bilingualism and reading, although the picture is not vividly clear (Bialystok, 2001), it is well documented that the phonological awareness skills of first and second languages are highly correlated (e.g., Dickinson, McCabe, Clark-Chiarelli & Wolf, 2004; Durgunoğlu, 1998) and that bilinguals outperform monolinguals with regard to phonological processing and morpheme-deletion skills, especially during the first years of primary school (e.g., Bialystok, 1988; Campbell & Sais, 1995). Such an effect was also shown in less balanced
bilinguals who had a lower amount of exposure to a second language (Yel-
land, Pollard, & Mercuri, 1993). However, this finding was not replicated
by other studies, and this advantage has sometimes failed to appear (e.g.,
Demont, 2001; comparing two groups in performance on phoneme deletion
task). There is no consensus on the absolute superiority of sound awareness
among bilinguals over monolinguals. However, it has been suggested that
because tasks measuring children’s levels of phonological awareness do not
demand a high level of processing and inasmuch as bilinguals’ two lan-
guages share relations and similarities in terms of transparency, such an ad-
vantage profile in sound awareness skills can be predicted (Bialystok, 2001).
In this line, Bruck and Genesee (1995) posed that the way that bilingualism
affects the development of phonological awareness is more selective than
universal, testifying to the notion that outcome performances vary depend-
ing on the different conditions and foundations of various types of bilin-
gualism. In the context of semantic representations, bilinguals have been
shown to underperform their monolingual counterparts in terms of the ex-
tent to which semantic knowledge is available to access and the level of
reading comprehension (e.g., Cremer & Schoonen, 2013). Bilinguals’
smaller vocabulary and semantic categorizations in comparison to mono-
inguals are particularly observed when they are measured in one and not
both languages (e.g., Kormi-Nouri et al. 2008; Thordardottir, Rothenberg,
Rivard & Naves, 2006). Differences are not only due to vocabulary size but
are also related to semantic knowledge of words’ meanings, which causes
difficulties with reading comprehension (Cromley & Azevedo, 2007). How-
ever, understanding of this issue remains vague. As Koda (2005) stated, re-
lationships among comprehension and vocabulary knowledge in second-
language readers are complex and not easily achieved.

Executive functioning
Executive functioning is one of the most frequently researched areas in
terms of bilingualism. The present general overview supports the idea of
bilinguals’ superiority in several of these skills. However, a number of stud-
ies (exploring sub-components other than inhibition, such as working
memory) have been less conclusive (e.g., Bialystok, Craik, & Luk, 2008).

Definition
Executive functioning is also called supervisory attention (Shallice, 1988) or
cognitive control (Miller & Cohen, 2001). It is a complex concept that con-
sists of multiple components (Miyake & Friedman, 2012) that are crucial
to every cognitively involved practice (Diamond, 2006). Executive functioning specifically comes into (effortful) demand when automatic processing does not suffice to resolve a conflict situation (Espy, McDiarmid, Cwik, Stalets, Hamby & Senn, 2004). Therefore, typical executive functioning tasks demand the refusal to notice non-relevant dimensions of a task stimulus and instead require focus on a certain dimension (see MacLeod, 1991 for review). A few core functions are defined under this construct, including so-called working memory, inhibitory control, and cognitive flexibility (Miyake, Friedman, Emerson, Witzki, Howarter & Wager, 2000), which build the foundations for higher levels of cognition, such as problem solving, divergent thinking and planning skills (e.g., Lunt, Bramham, Morris, Bullock, Selway, Xenitidis & David, 2012). The sub-components of executive functioning (in terms of bilingualism) are briefly reviewed in the following section.

Sub-components of executive functions

a) Working Memory

One of the core sub-components of executive functions is working memory\(^1\), which entails not only retention (short-term memory) but also processing and manipulation of information (Baddeley & Hitch 1994; Zelazo, Muller, Frye & Marcovitch, 2003). Many daily tasks, such as counting, calculations, reasoning, map reading, comprehension, planning and even consciousness (Baddeley, 2007), require relating previously saved information and reconsidering current options for updating that demand the involvement of working memory. Inhibition skills and working memory collaborate and support each other (Diamond, 2013). According to one of the most frequent empirically tested and structure-based theories (Baddeley & Hitch, 1994), the working memory system is conceptualized as having three components that work in collaboration. The most important one is the central executive, which directs and leads the resources of the entire system to mentor whether they perform well jobs. This is why it is regarded

---

\(^1\) Working memory (as a sub-component of executive functions) is a system which according to Baddeley’ model (Baddeley & Hitch, 1994) constitutes several sub-systems among which there is central executive sub-system as the responsible unit for supervising the jobs of the other sub-systems. On this account, working memory is itself classified as a core executive function currently.
as the nucleus of system. The other two components are the phonological loop and the visuospatial sketchpad, which mostly address the storing of information in visual, spatial as well as spoken and written forms. They work under central executive supervision. A fourth component (episodic buffer) was added to the revised system (Baddeley, 2000) and is thought to be responsible for integrating information through a united experience. Working memory performance is usually explored by span tasks as estimates of capacity (e.g., Gass & Lee, 2011). In several studies, bilinguals and monolinguals have been shown to not differ in terms of working memory performance (e.g., Engel de Abreu, 2011). However, specifically with regard to working memory measurements that involve handling non-verbal and inhibition information (Yang & Lust, 2005), bilinguals have shown superior performance.

b) Inhibitory control

Inhibitory control refers to the ability to control/suppress thoughts and behaviours (despite a strong feeling of readiness to render them) and instead to concentrate on the most relevant and suitable response (Diamond, 2013). Evidence for bilinguals’ advantage profiles comes from bilinguals’ superiority in interference inhibition (e.g., Engel de Abreu, Cruz-Santos, Tourinho De Abreu, Carlos, Martin & Bialystok, 2012) and on several tasks (e.g., Simon, Stroop or dimensional change card sorting) that mainly involve inhibitory and attentional control skills (e.g., Carlson & Meltzoff, 2008). Bilinguals have also been suggested to resolve conflicts with a high level of interference more quickly than monolinguals (e.g., Bialystok & Viswathan, 2009).

c) Cognitive flexibility

The third component that is built upon the previous two is cognitive flexibility, which has a later development (e.g., Garon, Bryson & Smith, 2008) and is principally due to the ability to switch roles or perspectives successfully and smoothly. The ability to consider one’s own and others’ viewpoints from different perspectives and beyond egocentrism is an example of cognitive flexibility (e.g., Geurts, Corbett, & Solomon, 2009). This ability
underpins the theory of mind and creativity (Diamond, 2013). Many task-switching paradigms (e.g., Zelazo et al. 2003), such as the dimensional change card sorting test, have been used as measures of cognitive flexibility (e.g., Huizinga & van der Molen, 2007). Again, bilinguals’ enhanced levels of cognitive flexibility and more precise judgments are suggested by research findings (e.g., Prior & Gollan, 2011). Such an advantage might be linked to the extensive practice of two languages during life, which re-organizes and modifies the brain networks that underlie cognitive plasticity (e.g., Sanjuan, 2010).

**Long-term Memory**

Examining the effects of speaking two languages on recalling information has been another area of investigation. In addition to working memory, another type of memory involves the long-term storage of information. According to one evidence-based conceptual theory, people have declarative/explicit vs. procedural/implicit long-term memory (Squire, 1992). Whereas the former type generally refers to knowing and retrieving (explicit) events and conceptual facts, the latter refers to the knowledge of how to do things or unconscious (implicit) knowledge about skills. Declarative memory is further divided into episodic and semantic memory, which are two classes of declarative memory. Whereas episodic memory is defined as recollections of autobiographical events (in most cases, with clear links to place, time and even emotions), semantic memory is concerned with general knowledge and information and therefore with “knowing” than “remembering” (e.g., Tulving, 1972; 1985). Encoding, storage and retrieval are three phases embedded in all memory systems. However, the overlap between encoding and retrieval is important in studying memory performance (Tulving & Thomson, 1973). It has been shown that if there is an extra aid, such as a specific (relevant) cue, retrieval will be accomplished more effectively (e.g., Craik & Tulving, 1975; Watkins & Tulving, 1975) compared with free recall retrievals. This issue was explored by several studies in the domain of verbal and action memory (e.g., Korni-Nouri & Nilsson, 1998 & 1999). Studies measuring episodic memory have consistently suggested that different types of materials (subject-performed tasks: SPT or verbal

---

1 Theory of mind is referred to our ability to consider and interpret the others’ intentions and so to predict their behaviours and perspectives, although they could be different than our own.
tasks: VT) are remembered differently. In most studies, SPT has been retrieved significantly more frequently than VT (e.g., Engelkamp, 1998; Kormi-Nouri, 1995). This superiority is considered as an effect of the enactment and motor component offered by SPT (e.g., Engelkamp & Cohen, 1991 for reviews).

In general, linguistic factors have been suggested to affect memory outcome performance through both within-language variability (Loftus & Palmer, 1974) and between-language differences (Fausey & Boroditsky, 2011). With regard to bilingualism, the linguistic aspects of memory processes and encodings/retrievals can occur in either one or both languages (Schroeder & Marian, 2014) and through multiple cognitive processes underlying encodings and retrievals (Bialystok, Craik, Green & Gollan, 2009). A mixed pattern of results on bilingual memory performance has been obtained by considering the role of cultural background, such as in the Kormi-Nouri et al. (2003) study, which matched groups by socioeconomic status and found an advantage for Swedish-Iranian bilinguals with regard to both episodic and semantic memory. Focusing on Iranian bilingual and monolingual children with similar cultural backgrounds but different languages, Kormi-Nouri et al. (2008) found a positive effect of bilingualism on these two types of memory tasks. In a third study (Kormi-Nouri et al. 2012), there was a bilingual advantage effect for letter fluency but a disadvantage effect for a category fluency task. This dissociation was explained based on the notion of specific cognitive characteristic for each cognitive task. In line with previous research (e.g., Bialystok et al. 2009; Butters, Granholm, Salmon, Grant & Wolfe, 1987), Kormi-Nouri et al. (2012) argued that although letter fluency relies more on executive control skills, category fluency tasks demand semantic processing. There is a similar view that considers different origins with respect to free and cued recollections, in which tests in the former category rely more on the extensive involvement of executive functions and working memory than do tests in the latter category (e.g., Stuss & Knight, 2002). Schroeder and Marian (2012) proposed that a bilingual experience can enhance episodic memory because this type of memory requires monitoring attempts and the recruiting of controlled searching attempts.

**Link between executive function and long-term memory**

Recent research has emphasized the importance of the involvement of executive functioning by working memory assignments; as mentioned earlier, they are interconnected and collaborate. In addition, the central executive
A component of working memory can interface with long-term memory input (Henry, 2012). Baddeley (2007) suggested that working memory slave systems (via episodic buffer) provide many different types of information from both types (episodic and semantic) of long-term memory. Such a link (which makes use of semantic representations to facilitate short-term recollections) was previously supported by studies (e.g., Hulme, Maughan & Brown, 1991). Generally, executive functions have been suggested to assist in the supply of information to and retrieval of information from long-term memory resources (e.g., McCloskey, Perkins & Van Divner, 2009). Therefore, it seems logical to consider that working memory deficits can be associated with the retrieval of a smaller amount of long-term memory information. However, the extent to which long-term memory recollections are dependent on executive functioning skills is not clear and is open to debate and further empirical evidence.
RESEARCH ON READING

The ability to read requires the decoding\(^1\) of text stimuli (strings of alphabetical signs) and the comprehension of the message that these serial strings send to the reader. Good reading in the early years of school is suggested to be a strong predictor of further reading comprehension later in life (e.g., Nakamoto, Lindsey & Manis, 2008). Several essential cognitive processes underlie the integrated understanding of reading. There are many levels of information processing involved in composing an integrated level of meaning from printed text (e.g., Kucer, 2005).

Cognitive portrait of reading

At a general level, the understanding of reading in cognitive psychology is elaborate and complex. As a purposeful process, reading is achieved through interactions among multiple mechanisms, such as phonological skills (Boada & Pennington, 2006), semantic storage of vocabulary and general lexical knowledge (e.g., Nation & Snowling, 2004), working memory and attentional control (e.g., Menghini, Finzi, Carlesimo & Vicari, 2011) and orthographic skills (e.g., O’Brien, Wolf, Miller, Lovett & Morris, 2011). Universally, mastering reading requires the involvement of both basic syntactic and higher-level strategies for processing (Beech & Keys, 1997). Based on this complexity, researchers have often discussed reading by framing a specific model (e.g., Rayner & Reichle, 2010). Through frequent exposure to reading practices, children become fluent readers and can easily predict the patterns of letter-to-sound correspondences of unfamiliar words (Goswami, 1986). The crucial role of phonological awareness (especially in the earlier stages of reading) have garnered enormous attention in the professional and practical literature in recent years, and phonological awareness is believed to be one of the strongest predictors of reading acquisition in children (e.g., Ehri, Nunes, Stahl & Willows, 2001). Additionally, phonological skills have frequently been investigated with respect to RD and specifically dyslexia (e.g., Savage & Frederickson, 2006).

To formulate a theoretical background on the identification processes of reading, several computational theories have been developed, each of which

---

\(^1\) Decoding is the process of breaking down the text print into graphemes and then associating sounds (phonemes) with graphemes. Therefore, decoding skills refer to using and following the grapheme-phoneme correspondences rules.
utilizes a set of underlying assumptions to simulate reading processes. A common feature throughout these models is initially the issue of the correspondences of letters and sounds in word recognition processing (e.g., Ehri & Wilce, 1985). In the following section, one successful reading theory and its fundamental assumptions is reviewed.

**Dual-route cascaded model of reading**

One of the most empirically supported psycho-linguistic models of reading aloud is the dual-route cascaded (DRC) model. This theory is based on the assumption that there are two fundamental cognitive mechanisms or routes involved during reading, a non/sub-lexical route and a lexical route (Coltheart, Rastle, Perry, Langdon & Ziegler, 2001), and that there is a cascading fashion of information processing within these routes by which any activation or practice in earlier units streams down to the subsequent ones. This theory assumes that word recognition is directed through a number of rules, which are necessary in terms of achieving the pronunciations as well as the meanings of the words from their orthographical mappings.

![Figure 2. A simple demonstration of DRC model of reading](image)
A simple demonstration of this model is illustrated in Figure 2. The lexical route makes use of a knowledge base (that is specific to words) to translate pronunciations to meanings (via the collaboration of the knowledge-based semantic system and orthographical and phonological lexicons). This route is able to process familiar (either regular or irregular)\(^1\) words based on the letter-sound correspondence rules. The lexical route uses a whole-word retrieval process (Rapcsak, Henry, Teague, Carnahan & Beesru, 2007). The non-lexical route, in contrast, uses a grapheme-to-phoneme conversion system for non-/pseudo-word pronunciations (by turning orthography into phonology). Therefore, this route works on the basis of sound-spelling relationships, which work in parallel and not entirely independently. It is assumed that written and spoken information is processed by both routes and through massive competition for retrievals at the letter/spelling and phoneme/reading levels. Whereas the lexical route facilitates the reading of words (regular & irregular), for the reading of non-pseudo words, the non-lexical route is essential to spelling non-words and specifies the pronunciation output. This model has been used as a reliable framework for analysing and understanding the (written) language structures of patients with pathological disorders such as dyslexia or alexia.

**Reading difficulties and cognitive outcomes**

Difficulties in reading are common among children, affecting up to 15% of school children (e.g., Vellunito & Fletcher, 2005). Depending on social, economic and cultural factors, these statistical figures might vary (e.g., Snowling, 2000) from one linguistic context to another. In a broader cognitive scope, many studies have presented theories and theoretical frameworks to discuss the common cognitive causal links of reading problems. Research has traditionally shown much interest in adopting a cognitive deficits framework to explain the causes underlying dyslexia (e.g., Lyon, Shaywitz, & Shaywitz, 2003). Initially, visual deficit theories were considered the most popular perspectives. Poorer performances by children with RD in tasks related to visual-verbal learning were shown by some studies (e.g., Lovegrove & Williams, 1993). However, generally, such theories have not received much evidenced-based support for the causes of RD from either task performance (e.g., Fletcher, Shaywitz, Shankweiler, Katz, Liberman, Stuebing,

\(^1\) Regular words (e.g. cat) have more common letter-sound relationships comparing irregular words (e.g. come).
Fletcher, Shaywitz & Shaywitz, 1999) or eye-movement studies (e.g., Stanley, Smith, & Howell, 1983). Nevertheless, in serial work studies, Stein placed special emphasis on investigating visual processing deficits (Stein, 1991, 2001, 2003). Suggesting multiple deficits in RD for different cognitive areas, he described a magno-cellular hypothesis that accounted for various cognitive impairments (visual, auditory or motor) linked to neurological bases. Based on this idea, the thalamo-cortical magno-cellular system is the subject of insufficient development. This system is suggested to direct visual attention and to identify moving stimuli in nearly all sensory and motor systems. Thus, related dysfunctions are thought to create a direct causal link to multiple cognitive deficits (in both auditory and phonological processing). In line with this hypothesis, the theory of auditory deficits in specific RD is a more recent theory that has received much attention. This view was developed by Tallal (1980), who proposed the temporal order perception theory (Tallal, Miller, Jenkins & Merzenich, 1997; Tallal, 1980). According to this theory, what typically underlies phonological deficits is a deficiency in the temporal resolution of auditory stimuli that occurs over time as a deficient perceptual mechanism (e.g., Ahissar Protopapas, Reid & Merzenich, 2000 & Banai & Kraus, 2007). Such deficits are supposed to be primary to deficits in the perception and processing of phonological representations. Although many studies have supported this theory (e.g., Goswami, Wang, Cruz, Fosker, Mead & Huss, 2011; Poelmans, Luts, Vandermoten, Boets, Ghesquière & Wouters, 2012), some studies have failed to provide further documentation to support this theory (e.g., Waber, Weiler, Wolff, Bellinger, Marcus, Ariel, Forbes & Wypij 2001). Tallal’s theory is still the focus of present and upcoming research. However, the findings raised by this theory have been controversial (Harm & Seidenberg, 1999). In addition, it is not clear whether this auditory deficit would predict phonological deficits (e.g., Ramus, Rosen, Dakin, Day, Castellote, White & Frith, 2003). Other research studies have shown interest in examining the neuro-scientific aspects of RD. These studies have discovered some deficiencies in visual processes in the magno-cellular system (e.g., Raymond & Sorensen, 1998; Stein, 2001). This view provides a foundation for Eden and Zeffiro’s study (1998), which concluded that lower-level visual processing as well as linguistic deficits, both of which originate in the malfunction of a neural system, could explain poor reading outcomes. However, research indicates that even by presenting a small variance, visual deficits might contribute to the problem as a biological marker, contributing to differential diagnoses (Vellutino, Fletcher, Snowling & Scanlon, 2004). Furthermore,
Nicolson and Fawcett (1990, 1994, 2005) suggested that poor readers are specifically handicapped by automatization processing, which affects their motor balance (e.g., Yang & Hong-Yan, 2011) and consequently their processing speed and fluency. Nicolson and associates presented some evidence in later years on cerebellar involvement in the cause of problems (Fawcett, Nicolson & Dean, 1996 & Fawcett & Nicolson, 1999) and then established a hypothesis called cerebellar theory (Nicolson, Fawcett & Dean, 2001). Based on this theory, there are (neurological) cerebellar impairments in RD (Ivry & Justus, 2001; Zeffiro & Eden, 2001). In contrast, by paying attention to the role of visuo-spatial attention while reading, Vidyasagar and Pammer (2010) argued that the core deficit is located in visual and not phonological processing. This view contrasts with views that exclusively postulate upon phonological deficits. Previously, some studies featured the role of visual attention in reading processes (e.g., Behrmann, Moscovitch, & Mozer, 1991). This notion provided the foundations for the multi-trace connectionist model of reading proposed by Ans, Carbonnel and Valdois (1998), which considered visual attentional processes a significant unit within the reading system. Based on this framework, Bosse, Tainturier and Valdois (2007) proposed a hypothesis that supported the idea of a visual attention span deficit. They postulated that because phonological deficits are not necessarily observed in many poor readers, specific visual attention deficits can be regarded as an alternative cause of the problem. Generally, the phonological deficit theory contrasts with magno-cellular theory, which considers the phonological deficit the direct cause of specific RD and assumes that phonological representations are not precisely detected or specified in RD (Serniclaes, Heghe, Mousty, Carre & Sprenger-Charolles, 2004). However, research has suggested that the nature of the phonological deficit is still vague and requires further investigations (Snowling, 2000; Ramus & Szenkovits, 2008). In general, early deficits in phonological awareness in addition to auditory and speech perception processing have been suggested to predict RD in later years (Boets, Vandermosten, Poelmans, Luts, Wouters & Ghesquiere, 2011). Of all of the linguistic deficit theories, the phonological deficit theory has received much theoretical and empirical support in comparison with the semantic deficit theory (e.g., Snowling, 2000 & Stanovich, 1988). It is frequently referred to as one of the strongest theories in this line (e.g., Wang, Yang, Tasi & Chan, 2013). Numerous theories have been derived from this viewpoint (e.g., the phonological-core variable-differences model by Stanovich, 1988 & 1991 or the phonological limitation hypothesis by Liberman, 1990). Notably, phonological deficits
have been addressed as “a universal marker of reading difficulties” (Maïonchi-Pino, Taki, Yokoyama, Magnan, Takahashi, Hashizume, Ecalle & Kawashima, 2013, p. 54). Research at a general level suggests that phonological skills most significantly account for (preliminary stages of) reading, whereas for advanced and fluent reading, one must be fairly well practiced in semantic and higher cognitive skills. Additionally, many studies have confirmed that word recognition plays a significant role in developing reading; consequently, any deficiency that hinders recognition processes can be a cause of RD. Some research has been interested in exploring the impact of orthography (e.g., Badian, 2005; the triple deficit theory as accounting for orthographic deficits besides phonological and visual ones) and types of orthographies in learning to read.

In an information processing framework, RD is closely associated with difficulties in text comprehension (Kendeou, van den Broek, Helder & Karlsson, 2014). As mentioned, such failures can be conceptualized into the micro-level (basic) processing in relation to phonological skills or into a macro-level (advanced) information processing order with respect to attentional/inhibitory control, inference and executive mechanism deficiencies. There is a general agreement in the literature about executive/inhibitory control and memory deficiencies in terms of RD (e.g., Linderholm & van den Broek, 2002; Peng et al. 2013; Swanson, Kehler & Jerman, 2010; Wang & Gathercole, 2013). This agreement relies on the notion that attention control/inhibitory control mechanisms are undeniably involved in reading and that there is a robust association and causal link between executive control/working memory systems and the emergence of reading skills (e.g., Baddeley, 1996, 2003; Swanson & O’Connor, 2009; Swanson & Sachse-Lee, 2001; Van der Sluis, de Jong & van der Leij, 2007). While reading, an individual must consistently concentrate on the goal (target) data from the text and repress the non-target data (Gernsbacher, 1993) and then relate the previous parts (and their semantic gestalt of information) to the present part and link to additional information. It has been suggested that phonological processing deficits consume executive and inhibitory resources extensively and therefore would lead to a relatively insufficient and poorly integrated semantic sense of information for higher-order processing. Additionally, higher-level processing deficits can cause difficulties in terms of establishing semantic relationships among orthographical units of print and in understanding the concepts embedded in the text or connecting the stored knowledge base with the current semantic theme (Helder, Van Leijenhorst,
Beker & Van den Broek, 2013). In sum, the overall cognitive deficits framework in relation to RD is complex. As Castles, McLean and McArthur (2010, p. 426) noted, “Multiple causes interact in complex ways to impair reading acquisition”.
THE ANCHOR POINT: BILINGUALISM AND READING DIFFICULTIES

As a general tendency among researchers, the biological-medical framework has earned more attention than the socio-cultural framework in research on dyslexic problems in second-language contexts (Kormos, 2013) because language and literacy skills have been primarily considered cognitive processes and have been studied through psycholinguistic models of information processing. Putting further emphasis on the cognitive framework adopted by this work, the link between bilingualism and RD in relation to cognition and in terms of its possible effects on a series of cognitive abilities is relatively vague. The creation of a bridge between these two subject areas is the anchor point of this dissertation. This is a complex area to investigate because reading is among the important areas of language progress. A bilingual experience in the context of RD can create an overloaded situation for the individual, although at a broad level, bilingualism has an enhancing effect on cognitive outcomes. However, the extent to which second-language exposure in terms of RD is associated with persistently better or, conversely, lower cognitive outcome performance is not clear. Notably, it is argued that RD makes the process of learning a new language more difficult and that such problems are associated with a lesser amount of lexicalization of novel input, although both poor and good readers’ previously stored (and not novel) representations are fairly well consolidated in the memory systems (Bogaerts, Szmalec, Page & Duyck, 2014). It was previously acknowledged by some studies (e.g., Baddeley, Gathercole & Papagno, 1998; Lundberg, 2002) that impaired phonological skills and thus a less efficient working memory system contribute to a more difficult situation when learning a second language. Although some studies have explored the cognitive outcomes of bilingual children with problems other than RD, such as language impairments (e.g., Gutie´rrez-Clellen & Simon-Cereijido, 2010; Thordardottir & Brandeker, 2013), there are very few studies that have examined the specific link between bilingualism and RD as a joint effect condition. Therefore, the research in this area is quite limited.

Overview of existing cognitive research

Most bilingual studies of cognitive paradigms have been conducted in the typically developed population (either children or adults). However, there is a small body of studies that has examined various cognitive domains with
respect to reading and language-related skills in bilingual children with RD. As Durkin (2000) suggested, three overlapping themes for investigation have emerged in the context of bilingualism research and dyslexic problems: phonological awareness and reading, levels of phonological processing, and language and reading comprehension. Research in this area commonly explores the junction and interaction of language and the development of phonological skills from the first to the second language of bilinguals. Despite robust data, such studies have mainly focused on exploring the extent and quality of basic phonological processing and have not aimed to directly explore higher-order information processing (e.g., executive functioning, problem solving, and memory). In addition, these studies have rarely included a four-way comparison to study cognitive differences at the group level; instead, they have used dichotomized research designs to contrast bilinguals with monolinguals.

Figure 3 provides a simplistic thematic demonstration on the factors involved in the development of second-language learning skills (in different cognitive, bio-socio-psychological and pedagogical levels developed by multiple and systematic interactions) and the most researched areas in this context (mostly reading-related skills). Subject areas in every level are connected reciprocally with each other, and every level is influenced by the other levels.
Figure 3. Thematic illustration on the levels entangled in second language learning context and the (most researched and less researched areas in relation to second language and RD)

- Language-related & literacy skills
- Less advanced
- More advanced
- Level of processing
- Cognitive level
- Bio/psychological level
- Pedagogical level

- Executive function
  - Working memory
  - Problem solving/cognitive flexibility
- Memory
  - Recognition/recall
- Metacognition
  - Evaluation/monitor
  - Fluid/crystallized intelligence
- Intelligence
  - Biological factors
  - Social factors
  - Teachers' perspectives
  - Teaching approaches
  - Family background/supplemental factors
  - Teaching methods/approaches

- Orthographic/phonological processing
  - Phonological awareness-memory
  - Semantic processing/comprehension
  - Orthographic/phonological processing
- Decoding/recognition
  - Executive function
  - Working memory
  - Problem solving/cognitive flexibility
- Recognition/recall
  - Fluid/crystallized intelligence
  - Evaluation/monitor
  - Teachers' perspectives
  - Teaching approaches
  - Family background/supplemental factors
  - Teaching methods/approaches
Searching for relationships between RD in English and Portuguese, da Fontoua and Siegel (1995) examined the reading, language and working memory skills of Portuguese-Canadian bilingual children (9 to 12 years old) whose education was in English at school although they spoke Portuguese at home. Their results suggested that although bilinguals with RD performed worse than monolinguals in English syntactic awareness and oral tasks, they performed comparably well on English pseudo-word reading as well as spelling tasks, and they had higher scores on word reading and working memory tasks in Portuguese. This enhanced performance was suggested to be linked to the effect of higher transparency (with more predictable/regular grapheme-to-phoneme rules) of the Portuguese language compared with English. Bilingualism was regarded as a resource that did not present obstacles for the development of language, memory and reading skills.

Everatt, Smythe, Adams and Ocampo (2000) showed that the performance of Sylheti-English bilingual children (7-8 years old) with specific literacy problems differed from that of English monolinguals in a range of screening tasks conducted in English, including phonological skills, rapid naming, shape memory, repeating sequences of nonverbal and verbal stimuli, visual and motor skills; as the bilingual children had significantly lower scores. Oren and Breznitz (2005) subsequently demonstrated that Hebrew-English dyslexic bilinguals scored significantly lower than typically developed bilinguals on phonological and orthographical processing tasks. This lower performance profile was specifically observed in terms of processing time and not for accuracy. In an interesting study that parsed the roles of the cognitive processes underlying RD and second-language acquisition difficulties, Swanson, Saéz, Gerber and Leafstedt (2004) found that English-Spanish bilingual children (6-7 years old) had lower scores on a short-term memory task. They suggested that although RD was suggested to be based on language-dependent (phonological) memory impairments, and difficulties due to second-language acquisition were linked to problems in approaching the working memory system as a language-independent system. They inferred that both phonological and executive functions should play important roles in first- and second-language reading.

The studies described above have mostly focused on exploring the substantial level of information processing skills with respect to language and reading abilities in the context of second language and RD and at the cognitive level. Thus, these studies were not directly designed to explore executive functioning or memory performance, the areas of exploration that are
specifically of interest in this dissertation. Many studies have partially confirmed that RD is closely associated with and is part of language-related problems. On the one hand, language (learning) is a special experience (e.g., Ganschow, Sparks, Javorsky Pohlman & Bishop-Marbury, 1991); therefore, there may be individual (within) differences in learning capacities for different linguistic/language-related components (e.g., stronger phonological skills vs. weaker grammar) or (between) differences among language components with other areas (e.g., weaker reading vs. intact good mathematical/memory skills) (Sparks, 2013). Therefore, children with RD in their first language have been suggested to be at risk for experiencing difficulties in learning their second language (e.g., Nijakowska, 2010; Sparks, 2001) despite having an average IQ.

Skills other than reading that have not been directly classified as language-related skills are believed to contribute to both reading development and bilingualism, such as executive function and memory. Moreover, it has been suggested that metacognitive strategies that intensively demand executive functioning skills such as monitoring and flexibility are mediated through language (Singer & Bashir, 1999) and that executive functions are related to and can predict language performance in children (e.g., Hungerford & Gonyo, 2007). Furthermore, executive function components build connections with long-term memory representations, by which the recollection of information is accomplished (e.g., Baddeley, 2007). Therefore, it is interesting to study the possible effects of RD on such skills within a second-language context (with bilingualism).
The existing knowledge suggests that bilinguals and monolinguals perform differently in terms of RD, at least with regard to reading and phonological processing skills. The current cognitive view on RD and in relation to bilingualism may hold implications for addressing the special needs of children with RD in general and of bilingual children who struggle to achieve the optimal level of reading in particular. As a result, this view places salient attention onto special education practices that address bilingual students in a minority linguistic/cultural context. For example, Frederickson and Frith (1998) found that bilingual English-Sylheti-speaking school children were provided less education support compared to their monolingual English-speaking peers. This may partly be due to inappropriate measures when identifying such shortcomings in bilingual children (e.g., Hedman, 2012). Generally, first-language education should be included in the dominant educational system and is highly appreciated by most parents. Furthermore, teaching approaches that specifically consider students’ strengths, motivational factors and learning styles have been highly recommended for bilingual learners with dyslexic problems (Deponio, Landon, Mullin, & Reid, 2000). Bilingual perspectives can be studied by a language ideology framework (Kroskrity, 2006) that can be explored within schools via teachers’ beliefs, preferred practices and teaching materials (e.g., Shohamy, 2006). Sweden has been recognized as one of the countries that contributes and invests considerably in mother tongue instruction (e.g., Gauza & Hedman, 2015). The extent of enrolment in special education services has changed over time. Persson (1997) noted that up to 60% of Swedish school students were included in special education in the 1970s. This number has been continuously increasing over time (Skolverket, 2000). Teachers who are responsible for delivering special education are important agents in the provision of this support. In general, special education teachers (Lindqvist, 2013) are certified for special education in Sweden. According to Westling Allodi and Fischbein (2000), the Swedish education system has faced several obstacles to achieving the goal of providing efficient education, especially for children with a non-Swedish background. The National Agency for Education (Skolverket, 2009) suggested that there have been unequal distributions of special education in schools. Ramberg (2013) also concluded that both the
presence and the availability of special education services vary across independent and public Swedish schools. Although the educational system within schools generally attempts to help non-native-speaking students to overcome their difficulties by providing them with extra learning methods and materials, there is not yet a clear understanding of the extent and type of assistance that students regularly receive in schools.
THE PRESENT DISSERTATION

The present dissertation goes beyond a theoretical cognitive view on bilingualism toward a didactic view that addresses bilingualism and special education in schools and in specific relation to the course of RD. The (group-level) comparison design of studies II and III is illustrated in Figure 4.

![Figure 4. Design for four group’s comparison on the effects of RD and Bilingualism on executive function and long-term memory performances (Studies II & III). BC (bilingual control group), BRD (bilinguals with RD), MC (monolingual control group) and MRD (monolinguals with RD) Note: * indicates the specific combined effect of RD and Bilingualism](image)

Through a fourth study, the current special education services in the Swedish schools were explored from teachers’ perspectives. The studies with children samples (I, II and III) were reviewed and approved by the Regional Ethical Review Boards in Tehran, Iran and Uppsala in Sweden.

Research questions

The specific research questions for each study were as follows:

Study I:

1. Does bilingualism differently affect performance on reading tasks that use different underlying routes: the lexical and the non-lexical (when testing the second language)?
2. Are the reading scores of bilingual second-language readers and monolingual first-language readers improved differently with higher school grades?

Study II:

1. What are the effects of bilingualism as well as RD on executive functioning?
2. What is the combined effect of bilingualism and RD on executive functioning?

Study III:

1. What are the effects of bilingualism as well as RD on episodic and semantic memory?
2. What is the combined effect of bilingualism and RD on episodic and semantic memory?

Study IV:

1. What are the types of special education services that bilingual students with dyslexic problems may receive within the Swedish school system?
2. What are teachers’ pedagogical beliefs and assumptions about their pedagogical practices?
OVERVIEW OF THE STUDIES

Study I
Dissociative effects in lexical and non-lexical reading tasks for bilingual children

Introduction
Research suggests that bilingualism is generally associated with higher phonological processing skills; however, the extent to which bilingualism has a differential effect in terms of diverse types of reading tasks is not clear. According to one of the most empirically supported theoretical models on reading aloud (i.e., DRC), reading is achieved through two fundamental routes that rely on two sources of either semantic or phonological representations. Dissociation and separate sources of reliance for these routes have been well documented in the reading literature (Coltheart et al. 2001). Whereas word reading, word chains, and word recognition tasks (e.g., Torgeson, Rashotte, Alexander, 2001; Williams & Bell, 2005) are assumed to use the lexical route, tasks that use the structure of the child’s stored phonological representations, such as the deletion of phonemes (e.g., Claessen, Leita’o & Barrett, 2010) or the detection of rhymes/alliteration (Hayes, 2001), are supposed to be employed more actively by the non-lexical route. Bearing in mind that every cognitive task relies on a certain cognitive origin and that it is the nature of the cognitive task to play a significant role in determining success or failure in task accomplishment in terms of bilingualism, two groups of reading tasks with different cognitive origins (lexical and non-lexical) were administered in terms of bilingualism vs. monolingualism. Additionally, the role of the degree of similarity between the first and second languages (more similarity for Persian and Kurdish vs. less similarity for Turkish and Persian) was taken into account for a marginal investigation. Additionally, it was of interest to examine whether the pattern of performance would vary through different school grades.

Aim
The primary aim of this study was to examine the possible differential effects of bilingualism in terms of different types of reading tasks (lexical vs. non-lexical). The secondary aim was to investigate the role of academic grades on children’s reading performance to determine whether bilingual
and monolingual groups’ reading scores improved differently with higher school grades.

**Design**
This study was designed to assess the reading statuses that contribute to a bilingual cognitive profile in children in relation to two factors: bilingualism and school grade. Bilingual and monolingual children were randomly selected from several primary schools in three cities (Tehran, Tabriz, and Sanandaj) in Iran, which is a multilingual country. Exclusively Persian-speaking children living in Tehran (a Persian-speaking city) were selected as a monolingual group, whereas Turkish children living in Tabriz (a Turkish-speaking city) and Kurdish children living in Sanandaj (a Kurdish-speaking city) were selected as two groups of bilingual children (Kormi-Nouri et al. 2008). According to the Iranian academic constitution, Farsi is the official instructional language, and learning to read in Farsi is vital to academic success. Turkish and Kurdish are two languages that are spoken widely in these two cities of Iran, where there are many Iranian students whose mother tongue language is not Farsi (Turkish or Kurdish). By choosing two different groups of bilingual children, it was possible to compare the effects of bilingualism under two conditions: when the two languages are similar (Persian and Kurdish, in this case) in certain linguistic respects, such as phonology, morphology and syntax, and when the two languages (Persian and Turkish) are less similar (Nilipour, 1988; Kormi-Nouri et al. 2008). To control for SES, 70 elementary schools (public and private) were randomly selected from different geographical districts of the north, south and central districts and across different school types (with children belonging to different social classes) for all three cities.

**Participants**
The total number of participants was 1614 (770 boys and 844 girls), all of whom were primary school children in five school grades (1 to 5 and aged 7-12 years old) in the three Iranian cities (582 primary school children from Tehran, 513 children from Tabriz, and 519 children from Sanandaj). The official language in Iranian schools is Farsi, and reading and writing are both taught in Farsi. The mother tongue languages of the bilingual children (Turkish or Kurdish) are not taught in schools but are used in communications with peers and people in everyday life.
Measures
The word reading and word chain tasks were selected as lexical route tasks, whereas rhyming, phoneme deletion and non-/pseudo-word reading tasks were selected as the non-lexical route tasks. All measures were in the Farsi.

- **Word reading**: The children had to accurately and rapidly read 52 meaningful words for a limited time (Miller-Guron, 2002).
- **Word chain**: The children had to silently read 50 chains of high frequency words that were concatenated by the deletion of inter-word blank spaces. They were asked to mark each word’s boundary with a pencil (Miller-Guron, 1999).
- **Rhyming**: The children had to distinguish whether 20 (target) words’ rhymes matched the rest of the words (Miller-Guron, 2002).
- **Reading for non/pseudo word**: The children had to read 20 non-words (following the phonological/orthographic principles of real words in Farsi) as well as pseudo-words (that did not follow the phonological/orthographic principles of real words).
- **Phoneme deletion**: The children were asked to orally produce 30 words without pronouncing a specific sound after the test leader (e.g., "Say stop, but without /p/").

Statistical analysis
Using SPSS software, two-way between-group multivariate analyses of variance were employed for comparisons between the bilingual and monolingual groups. Independent variables included bilingualism/monolingualism and school grade, whereas the dependent variable was performance on five lexical and non-lexical tasks.

Results
According to the results, Persian monolingual children were shown to have significantly higher scores than Kurdish-Persian and Turkish-Persian bilingual children in lexical reading (word reading and word-chains) tasks conducted in Farsi. In contrast, they were observed to have a lower performance level in non-lexical reading tasks (non-/pseudo-word reading and rhyming) than bilingual children ($P < .001$). Bilingual and monolingual groups had comparable performances in phoneme deletion task ($P > .20$). These findings provided an answer to the first question and showed that second-language bilingual and first-language monolingual readers perform differently in terms of different reading tasks. In relation to the second question, there
was a general significant increase in scores through grades ($P < .001$). The significant interaction effects (language group and school grade) in word reading and non-/pseudo-reading tasks are shown in Figures 5-6.

![Figure 5. Bilingual and monolingual groups’ performances through 5 grades in word reading task](image)

![Figure 6. Bilingual and monolingual groups’ performances through 5 grades in non/pseudo word reading task](image)

As shown in Figures 5-6, whereas monolinguals had higher scores in word reading in grade 1 than both bilingual groups, they had comparable levels of performance as monolinguals in grades 4 and 5. In addition, both bilingual groups had higher scores than monolinguals (with higher scores for Kurdish-Persian than for Turkish-Persian bilinguals) in the first grade for
the non-/pseudo-word reading task. The rest of the interaction effects on the other three tasks were not found to be significant.

Conclusion
In conclusion, this study suggests that bilinguals might put different weight on lexical and non-lexical reading routes, consistent with the DRC model of reading. In line with the higher phonological processing skills of bilinguals, especially in the early grades (e.g., Campbell & Sais, 1995), they were observed to perform better in comparison to monolinguals in rhyming and non-/pseudo-word reading tasks. However, this was not true for the phoneme deletion task. In contrast, monolinguals were shown to have higher performance in semantic/lexical tasks (word reading and word-chains). This finding re-confirmed the notion that outcome performances may vary in terms of both bilingualism/monolingualism and the type of cognitive task. There have been few theoretical explanations with respect to bilinguals’ slightly lower-level (or comparable) performance in terms of analysis of representational knowledge compared with monolinguals. For example, the general observed pattern of delayed processing has been attributed to the reduced frequency of language use for bilinguals vs. monolinguals and the assumption that bilinguals have a less rich or practiced vocabulary/semantic representational repertoire (e.g., Gollan et al. 2005; Ivanova & Costa, 2008), although they compensate for their phonological processing skills through development and throughout academic years in school. It is likely that reading (especially in the primary grades) is based more on phonological processing than on orthographic/semantic processing, in accordance with Frith’s reading model (1985). This theory assumes that children’s reading starts with and relies on phonological processing more in the lower grades and develops through the upper grades, when it relies more on orthographic and semantic processing. An extra explanation that can be presented is the hypothesis of probable advantages in terms of the similarity of the Kurdish and Persian vs. Turkish and Persian languages in reading performance, consistent with a number of findings that suggest this link (e.g., Bialystok et al. 2003). However, because all children were tested in Farsi and the first languages of bilinguals were not considered in the assessments, the findings must be interpreted cautiously.
Study II
The role of executive functions in bilingual children with reading difficulties

Introduction
The generally positive effect of bilingualism on executive functioning performance is well evidenced, although the idea of problematic or impaired executive control skills in terms of RD is also supported in the research. On the one hand, through numerous bilingualism studies have shown that bilingualism is associated with a superior executive functioning system. On the other hand, there is a strong association (and also causal link) between executive function deficiencies (often together with phonological awareness, rapid automatic naming and short-term/working memory impairments) and the emergence of RD. Cross-linguistic studies exploring the possible links between RD and cognitive skills in terms of a bi-linguistic environment are still rare, and there is a gap in the literature in this area. No other study has explored this paradoxical link to investigate the combined effect of bilingualism and RD on executive functioning performance. This study was conducted with Swedish-Persian bilingual immigrant children and Swedish monolingual children living in Sweden.

Aim
The overarching aim of this study was to explore how executive functioning performance is influenced by bilingualism and RD as one condition. The expectations with regard to a single effect of bilingualism and RD were that bilingualism would have an enhanced effect on executive functioning performance, whereas these functions are supposed to be impaired in RD.

Design
To perform comparisons at the group level, both bilingual and monolingual children were divided into two groups: those with RD and those with typically developed reading. Thus, the study included a total of four groups of children. To reach the subjects, the Swedish tax agency that maintains registration information on the inhabitants of the country was initially asked to randomly provide the researchers with 5000 names and contact information of registered families with children between 9 and 12 years old throughout Sweden. Those with Persian and Swedish family names were sent an invitation letter by post that provided a brief but comprehensive description of the project. In an attached form, parents/guardians were
asked whether their child had some type of dyslexic problem. They were also asked to actively reply declaring their agreement with or denial of the child’s participation in the project. Parents were also asked about their educational level and professional career to calculate and control for SES across groups. For the children who participated in the project, the school principals and the children’s teachers were contacted and asked for cooperation. The teachers were specifically asked whether they considered the student to have RD. The reports of parents and teachers that were inconsistent were excluded. Both bilingual and monolingual student groups were interviewed and administered the tasks in schools. It took approximately 45-50 minutes (excluding pause) for each student to answer the questions and perform the tests.

Participants
The final sample consisted of four groups of 190 (9- to 12-year-old) children, including 41 bilinguals with RD (17 girls and 24 boys), 45 monolinguals with RD (25 girls and 20 boys), 45 bilinguals without RD (29 girls and 16 boys), and 59 monolinguals without RD (32 girls and 27 boys).

Measures
To screen out RD, three core reading tasks were used. Executive functioning was measured by using three tasks. Also, the Raven intelligence test and a background questionnaire were used as follows:

- Reading Tasks: Word reading, word chains and reading for non-/pseudo-word tasks were used, all of which were administered in Swedish. The same instructions on word reading and word chain tasks used in Study 1 were employed in Study 2, but in the Swedish version (Jacobsson, 2004; Johansson, 2010; Miller-Guron, 2002).

- Working Memory: The memory card game (concentration), which consisted of 32 picture cards (16 pairs), was used as a measure of working memory. The objective of the game was to collect as many matching pairs as possible. First, the cards were placed face down in rows on the table. The child was asked to choose a card and to turn it over. Then, the child selected another card and turned it over. If the two cards were a matching pair, the child started another matching pair until all cards were played. The number of trials and total time were recorded (Schumann-Hengseler, 1996).
- **Attentional/Inhibitory Task**: The Stroop task included control as well as experimental conditions, each of which consisted of congruent/incongruent trials. In the control condition, children were asked to name the colour of the ink or to read the word with a compatible colour ink (e.g., red was written in red ink). In the experimental condition, they were asked to name the ink colour and to read the word written with an incompatible colour (e.g., green was written in blue ink). The total time needed for the four conditions was measured (MacDonald & MacLeod, 1998).

- **Problem-solving Task**: The Tower of Hanoi (TOH) was used (Welsh, 1991). The TOH consists of three rods and a number of disks of different sizes that can slide onto any rod. The puzzle starts with the disks in a neat stack in ascending order by size on one rod with the smallest at the top, thus making a conical shape. The objective of the puzzle is to move the entire stack to another rod. Three disks were included in the test, so the puzzle could be solved in 7 moves. The number of trials and total time to perform the task were measured.

- **Raven Intelligence**: To ensure that there were no major intelligence differences among the groups, all children were administered the Raven Intelligence IQ test consisting of 60 multiple-choice questions listed in order of difficulty. For each test item, the child was asked to identify the missing element that completed a pattern (Court & Raven, 1982).

- **Family-Child Background Questionnaire**: The children were also given a questionnaire that included several questions about the children’s demographic information, their duration of residency in Sweden, their parents’ language and background factors that may play a role in language learning (e.g., extra educational support practices from either home or school, peer relationships). Appendix 1 (reported in the following sections) provides information on the analyses of these data for the differences between bilingual and monolingual groups on these variables. In addition, there was a self-rating scale to measure the language proficiency of bilinguals. A short description of the results of this scale is presented in Table 1. Two versions of questionnaires for bilinguals and monolinguals were used. The questionnaire for monolinguals did not include some of the questions addressing bilingualism.
Table 1. Means of children’s responses to number of questions in questionnaire

<table>
<thead>
<tr>
<th></th>
<th>Bilinguals</th>
<th>Monolinguals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RD control</td>
<td>RD control</td>
</tr>
<tr>
<td>Years of residence in Sweden (bilinguals only)</td>
<td>7.9</td>
<td>8.1</td>
</tr>
<tr>
<td>Self-rating scores of different language abilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Swedish</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Listening</td>
<td>3.6</td>
<td>4.4</td>
</tr>
<tr>
<td>Speaking</td>
<td>4.0</td>
<td>4.4</td>
</tr>
<tr>
<td>Reading</td>
<td>1.1</td>
<td>4.3</td>
</tr>
<tr>
<td>Writing</td>
<td>1.5</td>
<td>3.9</td>
</tr>
<tr>
<td><strong>Farsi</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Listening</td>
<td>3.2</td>
<td>4.1</td>
</tr>
<tr>
<td>Speaking</td>
<td>2.2</td>
<td>2.6</td>
</tr>
<tr>
<td>Reading</td>
<td>1.0</td>
<td>2.2</td>
</tr>
<tr>
<td>Writing</td>
<td>1.0</td>
<td>2.0</td>
</tr>
</tbody>
</table>

*Note.* On the self-rating scale, 1 = very poor to 5 = very good.

All bilingual children learned Farsi as their first language and Swedish as their second language. They mainly used Farsi at home and in communication with siblings and parents, whereas they mainly used Swedish at school and in peer relations (cf. Naemi, 2008). As shown in Table 1, the bilingual children rated themselves better at speaking Swedish than Persian.

**Statistical analysis**

First, analyses were conducted with respect to age, gender and intelligence differences. These analyses showed no overall between-group differences in terms of age (bilingual groups: \( p > 0.70 \); monolingual groups: \( p = 0.10 \)) or non-verbal IQ scores \( (p > 0.80 \)). Across-group differences were also found to be non-significant for both age \( (F(3, 189) = 0.3, p > 0.30 \) ) and gender \( (\chi^2 (2) = 4.61, p > 0.20 \) ). Furthermore, to calculate SES, an index was made based on parental educational level and occupation (Hedman, 2009) for which a Kruskal-Wallis test revealed no significant between-group differences \( (p > 0.50 \) ). Next, analyses of reading tasks were conducted. According to these analyses, RD was identified when the children’s performance was in the 25th percentile lower than expected based on their age and intelligence (e.g., Bourassa & Treiman, 2003), as shown in Figure 7.
Results
Data on executive function tasks were analysed using SPSS. Two measures of the total number of trials and the total time taken for the concentration and TOH tasks were recorded. Two series of two-way ANOVAs (reading language) were conducted for the number and time measures of each task. With respect to the Stroop effect, a series of ANOVAs yielded on reaction times and were analysed in three levels, including colour naming, word reading and interference indices. The ANOVA analyses showed that no generally significant differences were found between the bilingual and monolingual groups in terms of move measures, but there were significant group-level differences on time and in terms of RD across all three tasks [concentration: \( p < .001 \); TOH: \( p < .01 \) & Stroop/naming (for both congruencies/incongruences): \( p < .01 \); Stroop/reading (for both congruencies/incongruences): \( p < .01 \)], such that it took more time for all children (both bilinguals and monolinguals) with RD to complete the tasks. Additionally, the generally increasing pattern of time scores was observed in terms of interaction effects of bi-/monolingualism and RD [concentration: \( p < .05 \); TOH: \( p < .05 \); Stroop/naming (for congruencies: \( p < .01 \) & for incongruences: \( p < .05 \); non-significant for Stroop/reading)], especially for bilinguals [concentration: \( M^1 = 221.81 \); TOH: \( M = 98.35 \) & Stroop/naming (for congruencies: \( M = 12.83 \) and for incongruencies: \( M = 26.10 \)) than monolinguals [concentration: \( M = 193.86 \); TOH: \( M = 75.67 \) and Stroop/naming (for congruencies: \( M = 11.62 \) and for incongruencies: \( M = 22.62 \))]. The Stroop effect was assessed with interference indices as the average difference ratios between the congruence and incongruence conditions, whereas naming and reading were

\[ M: \text{Mean score} \]
regarded as baselines (e.g., Delaloye, Moy, Baudois, De Bilbao, Dubois Remund, Hofer, Ragno Paquier, Weber, Urben & Giannakopoulos, 2009). Figure 8 indicates the interference differences across naming and reading conditions for bilingual and monolingual groups.

![Figure 8. Stroop interference index scores across groups with Naming and Reading as control conditions](image)

The highest interference scores were observed in terms of bilingualism and RD, whereas bilingualism without RD was associated with the least interference scores.

**Conclusion**

The findings of this study suggested that the individual effect of bilingualism (as expected and consistent with the general theme highlighted by the literature) was associated with increased executive functioning performance. In contrast, the combined effect of bilingualism and RD was linked to delayed response retrieval. This finding re-confirmed the impairment of executive functioning by RD. It is likely that deficiencies with respect to executive function in RD are so pronounced that reaction time did not decrease, despite the superiority of these functions in bilingualism. When measuring working memory performance of highly proficient bilinguals, Vejnović, Milin and Zdravković (2010) concluded that reading spans are shorter in bilinguals’ second language than in their first language based on the notion that it is more difficult to process information in the second language than in the first language. Therefore, it might be reasonable to infer that memory capacities are even more restricted in terms of existing RD. To explain the poor working memory performance of bilinguals with RD, in line with previous research, it was suggested that phonological processing deficits in the
working memory system may cause children with dyslexic problems to face many challenges in terms of a second language (Baddeley et al. 1998; Lundberg, 2002). RD was also associated with lower performance on the TOH (e.g., Aguilar-Alonso & Moreno-Gonzalez, 2012) as well as Stroop. Bilingualism was associated with larger interference rates in naming congruities (expected to be less demanding for inhibitory/control skills) and smaller interference rates in reading incongruity conditions (expected to be more demanding). This finding can be explained in light of the notion of the superiority of bilinguals in terms of more difficult tasks that rely on inhibitory control and perceptual representations (e.g., Bialystok, Craik & Luk, 2008). Further, the phonological and orthographical dissimilarity of Farsi and Swedish languages might affect the outcome performances based on the notion that linguistic proximity can be regarded as an advantageous factor in relation to bilingualism and cognitive consequences (e.g., Bialystok et al. 2003; Kormi-Nouri et al. 2012). It was suggested that the observation of lower working memory performance (because of shorter working memory spans) in the second language than in the first language may have implications with respect to learning strategies in the second language (Hummel & French, 2010). Overall, consistent with previous research, this study concluded that bilingualism and RD were associated with higher and lower executive function performances, respectively; whereas the combined effect did not support a positive relationship between time consumption and executive functioning.

Study III
Bilingualism and reading difficulties: An exploration of episodic and semantic memory

Introduction
In study II, it was shown that bilingualism and RD together were associated with lower executive functioning performance, especially in terms of processing time. This study took a similar perspective in relation to exploring the long-term memory performance (at the group level) of bilingual and monolingual children with RD compared to their counterparts without RD. The justification for taking long-term memory into consideration emerged from several pieces of evidence. First, executive functions such as working memory build multiple connections with long-term representational storage (Baddeley 1986, 2001). Second, whereas bilingualism is associated with superior executive functioning and hypothetically extensive long-term
memory retrieval, impaired working memory and executive function skills have been suggested to underpin RD (e.g., Lee-Sammons & Whitney, 1991). Expectations of lower long-term memory performances of (bilingual) children with RD are based on the idea that dyslexic problems should crucially hinder sequential (novel) learning (Bogaerts et al. 2014) and therefore learning a second language. Such problems have been suggested to rely on the impairment in short-term (e.g., Bogaerts et al. 2014; Hachmann, Bogaerts, Szmalec, Woumans, Duyck & Job, 2014) and long-term memory retrieval (Szmalec, Loncke, Page, & Duyck, 2011) as well as phonological skill deficits (Baddeley et al. 1998).

Aim
The principal aim was to explore how episodic and semantic performance can be affected in terms of bilingualism and RD as one condition.

Design
The design of this study was the same as study II, in which bilingual and monolingual children were divided into four groups of those with and without RD, for a sample of four groups of children. This study was subdivided into two smaller studies (a-b). The first series of investigations explored episodic memory, and the second examined semantic memory.

Participants
The sample participants were the same children as those included in study II.

Measures
Episodic memory measures:
To measure episodic memory, two phases of encoding and retrieval were studied. At encoding, a list of 20 imperative sentences (in Swedish) (e.g., “write on the paper”) with half encoded as SPTs and the remaining half as VTs were presented (by a tape) for the children. At retrieval, the children had to remember as many command sentences (presented at encoding phase) as possible. The retrieval phase consisted of free recall (FR) and cued recall (CR) conditions. In FR, the children were asked to freely remember as many sentence items as they could, whereas in CR, they were provided with a list of 20 verb cues (a mixed order of SPT and VT items) (e.g., “write on the....”) to be completed with noun targets. All sentences were taped for the children at the time of testing. The SPTs and VTs were triggered by
“Do” and “Say” key words in the playlist. To examine the long-term memory effect, the testing procedure included some intervals. After the encoding phase, two semantic memory tests (as measures of study b) were used: one before FR and another before the CR tests. Both strict and lenient scoring methods were employed. As strict scoring, only those sentences that were intact and exactly the same as those in the list were accepted as correct responses. In the lenient scoring, responses were accepted as correct if they had the same meaning as the original items. We adopted the lenient scoring because the present study was related to children’s memory and language, so the gist of information would be more important than the exact words in a population of children (Kormi-Nouri et al., 2003).

**Semantic memory measures:**

Letter fluency and category fluency were used as measures of semantic memory (Kormi-Nouri et al. 2012). For the letter fluency test, the children were asked to say as many words as they could beginning with the letters F, A and S. For the category fluency task, they had to say as many words as possible in the categories of fruits, kitchen instruments and body parts.

**Statistical analysis**

Using SPSS, in study a, a repeated-measure ANOVA [2 (language: bilingual/monolingual) × 2 (reading: normal/RD) × 2 (encoding: SPT/VT) × 2 (retrieval: FR/CR)] was used with reading and language as between-group variables and encodings and recall as within-group variables. In addition, 2 indices of enactment effects (on FR and CR) as well as cueing effects (on SPT and VT) were created. For the enactment effect, the score difference of encoding types (SPTs-VTs) was calculated, and for the cueing effect, the difference of retrieval scores (CR-FR) was calculated.

In study b, using the data from each test, a 2 (language: bilingual/monolingual) × 2 (reading: with/without RD) ANOVA with reading and language as between-group variables and letter or category fluency as the within-group variables was used.
Results

- Study a

Table 2 presents summaries for the ANOVA analyses.

Table 2. Summary of ANOVAs on main and interaction effects on free and cued recollection data

<table>
<thead>
<tr>
<th></th>
<th>main effect of language</th>
<th>main effect of reading</th>
<th>main effect of encoding</th>
</tr>
</thead>
<tbody>
<tr>
<td>FR</td>
<td>MSE 20.96</td>
<td>F 9.63*</td>
<td>MSE 248.10</td>
</tr>
<tr>
<td></td>
<td>interaction effects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(language, reading)</td>
<td>MSE 8.99</td>
<td>F 4.13*</td>
<td></td>
</tr>
<tr>
<td>(language, encoding)</td>
<td>MSE 10.12</td>
<td>F 6.28*</td>
<td></td>
</tr>
<tr>
<td>(encoding, reading)</td>
<td>MSE 31.68</td>
<td>F 19.66**</td>
<td></td>
</tr>
<tr>
<td>(language, reading, encoding)</td>
<td>MSE 9.00</td>
<td>F 5.58*</td>
<td></td>
</tr>
<tr>
<td>CR</td>
<td>MSE 9.81</td>
<td>F 2.99</td>
<td>MSE 168.61</td>
</tr>
<tr>
<td></td>
<td>interaction effects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(language, reading)</td>
<td>MSE .15</td>
<td>F .04</td>
<td></td>
</tr>
<tr>
<td>(language, encoding)</td>
<td>MSE 1.64</td>
<td>F .98</td>
<td></td>
</tr>
<tr>
<td>(encoding, reading)</td>
<td>MSE 4.01</td>
<td>F 2.40</td>
<td></td>
</tr>
<tr>
<td>(language, reading, encoding)</td>
<td>MSE .95</td>
<td>F .57</td>
<td></td>
</tr>
</tbody>
</table>

Note. * p < .05, ** p < .001

According to Table 4, in general, bilinguals (.9) had significantly higher mean scores than monolinguals (.8) in FR and in CR (bilinguals: 2.13 vs. monolinguals: 2). Furthermore, the scores decreased significantly in terms of RD for both FR (.48) and CR (1.79) data. In addition, SPTs (3.98) were generally recalled more than VTs (1.76) across both FR and CR. Bilingual FR scores (but not CR scores) increased in typically developed reading (.65), whereas this increasing pattern was not found in terms of RD (.25). Additionally, bilingual FR scores were generally shown to be higher for SPTs (.75) than for VTs. The results of the analyses of the enactment and cueing effect indices are shown in Figures 9-10.
According to Figures 9 and 10, the smallest enactment effect was for bilinguals and monolinguals with RD in FR. Additionally, the enactment effect was more pronounced in typically developed reading than in RD in both FR and CR. With respect to the cueing effect, the largest effect was shown for bilinguals with RD in SPTs, and the smallest was for bilinguals (without RD) in SPTs.
Table 3 summarizes the ANOVA analysis data.

Table 3. *Summaries of ANOVAs on letter and category fluency data*

<table>
<thead>
<tr>
<th></th>
<th>main effect of language</th>
<th>main effect of reading</th>
<th>Interaction effect</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MSE</td>
<td>F</td>
<td>MSE</td>
</tr>
<tr>
<td><strong>Letter fluency</strong></td>
<td>655.24</td>
<td>4.21*</td>
<td>15685.45</td>
</tr>
<tr>
<td><strong>Category fluency</strong></td>
<td>319.33</td>
<td>1.86</td>
<td>10929.01</td>
</tr>
</tbody>
</table>

*Note.* *p* < .05, **p** < .001

As shown in Table 3, on the letter fluency task, bilingualism (66.75) and typically developed reading (81.38) were significantly associated with higher scores than monolingualism (59.23) and RD (44.6), respectively. Also, there was a pronounced difference between bilingual (44.82) and monolinguals (36.55) in typically developed reading and not in terms of RD. Due to category fluency, the bilingual’ and monolingual’ scores were comparable, whereas RD was found to be linked to the production of fewer words (53.9). In addition, there was found a significant difference between bilinguals with RD (23.74) and their monolingual counterparts (30.16).

**Conclusion**

The results of this study reconfirmed the general bilingual advantage on episodic and semantic memory performance. However, with regard to RD, this enhanced pattern of performance did not persist. Better bilingual recollection in episodic memory (and specifically in FR data) was explained in relation to the idea of the reliance of FR testing paradigms on more extensive involvement of executive functioning (as more cognitively demanding tasks) than CR (e.g., Bialystok, 2009). Additionally, RD was generally associated with episodic memory underperformance. This finding was explained in relation to the notion of the entanglement of working and long-term memory representational systems during reading tasks, which are assumed to be deficient in RD. Generally, the finding of lower episodic memory performance among (bilingual) children with RD can be discussed in light of the idea of suggested impaired (long-term memory) recollection in terms of RD and learning new items (e.g., Baddeley et al. 1998; Szmalec et al. 2011). However, there was no bilingual/monolingual difference (in
terms of RD) found for letter fluency task. This finding can be discussed in light of the notion of impairments of control/executive abilities in RD which cause processing deficits and so would impede the bilingualism enhanced effect to appear. Moreover, although (both bilingual and monolingual) children with RD did not benefit from encoding (enactment) support, retrieval (cueing) support had an enhancing effect for bilinguals with RD in recollecting items. This finding may have implications for teaching strategies for children with RD in general and for bilingual children with RD in particular; as executive functioning skills and memory play important roles in learning and academic achievement (e.g., Titz & Karbach, 2014).

Study IV
Literacy support for bilinguals with dyslexia in Swedish special education: A bilingual lens vs. difference blindness

Introduction
In this smaller-scale study that was situated within a qualitative framework, the state of educational support for students with dyslexic problems was investigated through the lens of special education teachers in compulsory Swedish schools. In this study, the special education teachers’ perceptions and beliefs regarding their teaching approaches and pedagogical choices were further explored. Prior to describing this study, it is worth noting that additional analyses were conducted on the data from the children’s answers to the questionnaire about the extra educational support that they received from both home and school to determine whether there were any differences between the bilingual and monolingual students (see Appendix 1). As shown in Appendix 1, significant differences between the bilingual and monolingual groups were found in terms of the provision of extra educational support, either from home or from school. These results triggered the idea of conducting study IV and justified an investigation of the types and state of special education support for bilingual and monolingual students with dyslexic problems. Since studies on educational provision for bilingual students with reading and writing difficulties are scarce, a qualitative research approach was chosen to examine these educational practices in more depth. According to the Swedish Education Act, students who cannot achieve the academic syllabus goals are entitled to special education support (SFS 2010:800, Ch. 3, 7-9§). However, it has been reported that sufficient knowledge about the relevant types of educational support is missing and that the levels of support vary greatly across municipalities (the Swedish
Schools Inspectorate, 2011). As mentioned previously, studies on special education services for bilingual students with dyslexia are scarce (see, however, Deponio et al. 2000; Sunderland, Klein, Savinson & Partridge, 1997). Nevertheless, some findings indicate that bilingual students with dyslexia may experience more difficulties in receiving appropriate support compared to monolingual students (e.g., Frederickson & Frith, 1998; Glæsel & Kidde, 2005) and that the process of identifying dyslexia in bilingual students may be complicated by the use of tests in the majority school-language only as well as the use of monolingual test norms (e.g., Hedman, 2012; cf. Mortimore, Hansen, Hutchings, Northcote, Fernando, Horobin, Saunders & Everett, 2012). Study IV draws on previous research on teacher cognition (e.g., Borg 2006) and considers special education teachers’ own perceptions about their educational support as well as their beliefs regarding their pedagogical practices. Studies of teachers’ perceptions of their own teaching can contribute to a deeper understanding of teachers’ motivations for their pedagogical choices (cf. Ganiuza & Hedman, 2015) and to an understanding of special education provision for bilingual students with dyslexia in Swedish schools because “the [teacher’s] role can be conceptualized like a physician’s role – as an active, clinical information processor involved in planning, anticipating, judging, diagnosing, prescribing, problem solving” (Borg, 2006, p. 8).

**Aim**

The principal aim of this study was to explore the types of special education support for bilingual students with dyslexic problems from the perspective of special education teachers. The teachers’ own perceptions and stances toward their pedagogical practices were also investigated. The focus was possible similarities and differences regarding special education support for bilingual and monolingual students with dyslexia as well as the teachers’ stances on the involvement of languages other than Swedish to augment biliteracy development in bilingual students with dyslexia.

**Design**

To reach the teachers, more than 150 special education teachers in a random selection of compulsory schools in Swedish middle-to large-sized cities were sent emails about the objectives of the study. The emails were sent to both “special education resource teachers” (specialpedagoger) and “special education teachers” (speciallärare). The teachers were asked to reply if they were interested in participating in the study. Those who replied (a total of
35) were sent a questionnaire by email about types of educational support for bilingual and monolingual students. Fifteen of the teachers who answered the questionnaire volunteered to take part in an in-depth interview that followed up their answers to the questionnaire. The interviews took place in the teachers’ schools and lasted approximately an hour. The interviewer (author) used English for most parts of the interview, although the teachers were free to use Swedish and clarifications were given in Swedish by the interviewer.

Participants
Of the 35 teachers who declared interest in participating, 32 (27 females and 5 males) answered and returned the completed questionnaire. Of these 32 special education teachers, 15 volunteered to take part in the in-depth interviews. The teachers’ years of experiences in special education varied from two to 37 years.

Measures
The data include answers from a questionnaire as well as from in-depth interviews. The questionnaire was in Swedish and encompassed five comprehensive questions/themes revolving around the special education support in use for both bilingual and monolingual students with reading and writing difficulties, the objectives of this educational support, the perceived shortcomings of the special education services for both bilingual and monolingual students, and suggested improvements. To follow up these questions, almost half of the teachers’ responses were explored further in the in-depth interviews.

Analytical tools
The in-depth interviews were audio-recorded and transcribed into the Nvivo software, where the main and overarching themes of the special education teachers’ responses (as they emerged in both the questionnaire and the in-depth interviews) were classified thematically into several categories as the main areas for discussion.

Results
It was found that bilingual and monolingual students with dyslexia were offered the same types of special education support. Although the teachers primarily emphasized on phonological awareness training, they believed that this type of training would not be sufficient and advocated additional
forms of support, such as multimodal approaches. All teachers found that the process of identifying dyslexia in bilingual students was more difficult because obstacles in learning a second language may overlap with signs of dyslexia (e.g., Mortimore et al. 2012) and because the teachers did not think that enough time for special education services was allocated by the schools. The special education teachers expressed a generally positive attitude toward bilingualism. Additionally, the value of collaborative work with other school teaching staff was strongly emphasized, specifically with mother tongue teachers, to avoid the risk of under- or over-identifying dyslexic problems in bilingual students. The teachers also emphasized first-language support for newly arrived students, although this form of support was outside the realm of special education services. At the same time, the special education teachers were reluctant to highlight any particular special education needs for bilingual students with dyslexia and/or to discuss the students in terms of bilingual/second-language learners of Swedish (cf. the term “difference blindness” by Kubota, 2004). This seemingly ambiguous stance could partly be related to the teachers’ reliance on the research literature regarding “good practice” for students with dyslexia, which largely tends to overlook bilingual perspectives (cf. the division of “the two worlds of dyslexia support and literacy development”, Mortimore et al., 2012, p. 105). In addition, the issue of research-based knowledge gaps regarding both bilingualism and writing difficulties/special education needs were regarded as a major obstacle in the special education services in Swedish schools.

Conclusions
A general conclusion was that the special education services, which emphasized phonological awareness training as well as structured reading and writing activities in the school language of Swedish, were biased toward monolingual Swedish-speaking students with dyslexia. Nevertheless, the special education teachers emphasized the value of collaborative work with mother tongue teachers to facilitate the process of identifying dyslexia in bilingual students as well as to gain a more comprehensive picture of bilingual students’ language use and competencies. It was considered more time-consuming to identify dyslexia in bilingual students with Swedish as a second language compared to monolingual Swedish-speaking students, and this extra time was not allocated by the schools. Accordingly, the special education teachers did not think that the bilingual students with dyslexia received a sufficient amount of support. The fact that the teachers advocated
collaboration with bilingual staff, such as mother tongue teachers, could reflect a need for a wider focus within (special) education services in Sweden, where bilingual practices that take bilingualism into account are developed in order to offer increased opportunities for biliteracy development in bilingual children with dyslexia.
GENERAL DISCUSSION

This dissertation has tested hypotheses regarding whether reading outcome performances vary in terms of bilingualism and explored how bilingual and monolingual children with RD performed on executive functioning and long-term memory estimates compared to their counterparts without RD. In addition, the teachers’ pedagogical assumptions were underscored as an informative source for exploring the state of special education support provision for (bilingual) students with RD in Swedish schools. The findings of this dissertation offer support in relation to existing knowledge, on the one hand, and challenge some fields of research, on the other hand. Figure 11 provides a thematic conceptual framework to illustrate the empirical findings of this dissertation. At a general level, bilingualism research in cognitive psychology takes multiple factors into account and, in many cases, calls for vigilance in terms of interpreting and expanding the findings. Bilingualism may have a selective effect on a certain subject area depending on the extent of reliance on the different cognitive origins of information processing. Bilingualism differentially affects outcome performance on diverse cognitive tasks with different origins, such as inhibitory control or representational knowledge (Bialystok, 2001). This idea shaped the chief testing hypothesis for study I, specifically with regard to different reading tasks. This study demonstrated that bilingualism is associated with both enhanced phonological processing and decreased semantic representation processing.
More advanced phonological processing

Less advanced semantic processing

Competent executive functioning system

Inhibition

Working memory

Flexibility

Episodic memory

First language lexicon

Second language lexicon

Transfer effect

Long-term memory (Mental representations groundwork)

Insufficient transfer

Context of RD

Context of typically developed reading

Bilingualism

Effect of age

General phonological/semantic processing deficits

First language lexicon

Second language lexicon

Semantic memory

Figure 11. The conceptual framework
As demonstrated in Figure 11, in terms of (typically developed) bilingualism, phonological skills are enhanced more than semantic processing skills, although the ability of semantic processing of bilingual children would arguably improve by increasing knowledge and developing a representational system in later years. This pattern of results was clearly shown by study I. Notably, this advantage profile was found to be more pronounced for more similar pair-languages than for less similar pair-languages (i.e., Kurdish-Persian vs. Turkish-Persian). Study I can be explained based on the DRC model of reading, in which two major routes of information processing are assumed to be involved in reading. Semantic representations develop more elaborately in monolinguals than in bilinguals because bilinguals’ language frequency is distributed throughout two sets of languages and because they practice their languages less extensively (e.g., Ivanova & Costa, 2008). Therefore, it is suggested that bilinguals have a less rich vocabulary repertoire and thus have delayed verbal and lexical processing in a second language (e.g., Bialystok et al. 2010; Gollan et al. 2005; Runnqvist et al. 2011); because vocabulary learning is accomplished through an item-to-item procedure and across each language, which is obviously achieved more slowly in comparison to, for example, grammar acquisition (e.g., Oller, Cobo-Lewis & Pearson, 2004). The phonological processing skills of the first and second languages are generally suggested to be correlated (e.g., Durgunoglu, 1998), and bilinguals are supposed to have an advantage in phonological processing performance, especially in the early years of literacy learning (e.g., Bialystok, 1988). The results from study I expand knowledge by specifically considering diverse reading tasks with both semantic and phonological bases. Bilinguals’ less advantageous lexical reading outcome profile was shown not to persist through the upper grades, and performance improved to a level comparable to that of monolinguals in later school years. This finding supports the idea that bilingualism is associated with an advantageous cognitive profile and that reading skills develop more easily and efficiently in bilinguals based on the skills transferring from the first to the second language (Bialystok, McBride-Chang & Luk, 2005).

It is important to mention that the bilinguals in this study were tested in their second (and not first) language. This point should be considered because the decreased semantic processing may relate to the fact that bilingual children’s semantic knowledge was likely less developed and/or that they had less frequent access to the semantic lexical representations in their second language (Persian). Education in the Turkish and Kurdish languages is not supported by schools in cities in Iran (with Turkish and Kurdish as the
first languages) and instead is exclusively given in Persian. Thus, these two languages (Turkish and Kurdish) would have different (unbalanced) opportunities for development compared with Persian. However, the idea of mother tongue education provision is gaining increasing attention in Iran. Despite this absence of educational practices in Kurdish and Turkish, second-language (Persian) reading for bilinguals was significantly associated with higher phonological processing in comparison to (first-language) reading for Persian monolinguals. This result has consistent implications with the notion of transferring phonological skills from the first to the second language (e.g., Durgunoğlu, Nagy & Hancin-Bhatt, 1993). In addition, phonological processing is suggested to be involved in reading difficult items and in items with less familiar/odd content (e.g., Colheart et al. 2001), in which bilinguals are generally believed to perform better.

Typically, the more cognitively demanding and difficult tasks are, the more extensively executive functions and control mechanisms are employed. These functions play important roles in both second-language development and in performing cognitively challenging tasks such as reading (Baddeley, 2007). Therefore, deficits in executive functioning processing have been suggested to be causal links for the emergence of subsequent RD. Based on this understanding, children who are poor readers and those with specific RD have been suggested to potentially experience more difficulties in terms of learning new input, including a second language (Baddeley et al. 1998; Bogaerts et al. 2014). These difficulties have been shown to be based on insufficient/impaired short-term (Hachmann et al. 2014) and working memory (Baddeley et al. 1998) as well as long-term memory (Szmalec et al. 2011) skills. Furthermore, dyslexic bilingual learners are believed to have delayed phonological processing (e.g., Everatt et al. 2000; Frederickson & Frith, 1997), which in turn would contribute to inefficient general processing in working memory (Baddeley et al. 1998).

The paradoxical link of superior vs. inferior executive functions in bilingualism and RD, respectively, on executive functioning performance was explored in study II. Bilingual children’s performances were associated with an increased level of executive function performance in typically developed reading (shown in Figure 11). However, because these data (especially with respect to reading the Stroop input) were restricted to the second language, discussions of a general bilingualism effect require caution when generalizing. However, the core finding was that there was executive function underperformance in terms of the combined effect of RD and bilingualism.
Such an outcome was explained in light of the idea of impairment of executive functioning in terms of RD. This executive functioning impoverishment is suggested to consistently affect performance in terms of bilingualism; the bilingual enhanced effect no longer appears. Due to the cross-sectional nature of the data, this explanation cannot provide support for the causality of such an effect, but it replicates previous findings by providing theoretical support for evidence that bilingualism and RD are associated with superior and deficient executive processing, respectively, and that (time) processing deficiencies in executive functions are profound in RD. As suggested in Figure 11, the overall deficient (phonological) processing was hypothesized to contribute to less competent executive functioning skills because phonological processing is inevitably entangled in the executive control system and in higher-order cognition.

This delayed profile was not recovered by the improved executive function processing skills of bilingualism. Although both groups of bilinguals (those with RD and those with typically developed reading) rated themselves as better in Swedish than Persian, the tests were exclusively administered in their second language (Swedish). Therefore, ideal information about levels of bilingualism (and in relation to language proficiency) was not comprehensively provided. Although interesting, the conclusions do not have a firm basis for generalization due to the differences in the effect of bilingualism vs. monolingualism in general. Instead, decreased outcome profiles in terms of executive functioning can more reliably be attributed to the impaired executive function skills of RD, which in turn are believed to negatively affect reading as well as second-language development. All (bilingual and monolingual) children with RD had significantly lower scores in screening reading tests than the control groups. This lower level performance, which is hypothetically consistent with theories that underscore the central processing hypothesis, can be expected in the other language as well. Thus, with respect to the possibilities of these data, it is more appropriate to orient the rationale for the conclusions (due to the combination of RD and bilingualism) toward the notion of executive functioning processing deficits in RD rather than toward the bilingualism effect per se.

The findings of studies II and III indicate that higher-level cognitive processing can be negatively associated with RD and bilingualism together. However, consistent with previous research findings (e.g., Bialystok al. 2004; 2010; Colzato et al. 2008; Kormi-Nouri et al. 2003, 2008 & 2012), bilingualism’s enhanced effect for higher cognition (i.e., executive function and long-term memory) was observed when there was no involvement of
RD. Albeit, the finding of delayed executive functioning processing in the combination of RD and bilingualism was discussed in light of the assumption proposing that working memory and control abilities are likely to work inefficiently in RD. This explanation was based on the observation that processing time was generally longer for individuals with RD and that this delayed processing pattern was even more pronounced for bilinguals. Therefore, it was suggested that it is most likely the phonological and control deficits of RD that contribute to longer processing time and that create an overload of cognitive processing complexity for bilingual children. Bearing in mind that the bilingual children in this study were tested exclusively in their second language, it was not possible to draw conclusions about the precise contribution of the bilingualism effect (as a united condition with RD) because sufficient information about the level of bilingualism was not available. However, insofar as reading is achieved and mediated through executive functions and long-term memory representations (the entire mental lexicon), one may infer that the multiple cognitive problems (especially in terms of executive functions) of RD are so comprehensive that bilingualism may not produce this effect; as the bilingual advantage effect (on executive functioning) was observed in terms of typically developed reading. Relying on the idea that higher-order cognitive skills such as long-term memory have many connections with executive functions, the combined effect of bilingualism and RD was further explored in terms of episodic and semantic memory performance (as two types of long-term memory) in study III. Again, bilingualism and RD together were associated with decreased long-term memory performance (especially for free than cued item recollections on episodic memory and for category than letter fluency on semantic memory). The prominent findings due to the bilingualism and RD joint effect in episodic memory was that although (typically developed reader) bilingual children free recalled more items than monolinguals, their performances were comparably low as with monolinguals in terms of RD. Interestingly, the advantage effect observed for FR was not found for cued recollections. Such an outcome would on the one hand re-suggest the idea of increased level of performance for bilingualism (over control conditions) in FR which are supposedly more difficult recollection conditions than CR. On the other hand, this could be explained in light of the notion of the impaired control and working memory skills in RD that passably impede the efficient cognitive processing and free recollections (e.g., Jalali-Moghadam & Kormi-Nouri, 2015). In addition, whereas (in free recollections), enactment effect was found to be more profound for bilinguals than
monolinguals with typically developed reading, such an effect was not found in terms of RD. First and above, the first part of this finding due to the enhanced action memory in relation to bilingualism is in line with the previous studies (e.g., Kormi-Noruri et al. 2003; Ljungberg Hansson, Andrés, Josefsson & Nilsson, 2013); the outcome which can be found in consistent with the assumptions suggesting that the overall integration level in subject-performed than verbal tasks is increased and that bilingualism per se is of an integrative linguistic nature thereby promoting the cognitive flexibility competency (Francis, 1999). Furthermore, this finding once more gives an additional support to the idea of more entanglement of executive demands in free than cued retrievals. Explaining the second part of the finding due to observation of fading the enactment effect in terms of bilingualism and RD, one may infer that it might be the impaired processing skills in RD that possibly make causal links for inefficient action memory recollections. Moreover, although cueing effect was not found as beneficial for bilingual and monolingual children in typically developed reading condition, both bilinguals and monolinguals (especially bilinguals) gained more benefit of retrieval support for remembering SPT items. It is suggested that both verbal (cue) and motor (action performance) information would contribute to an increased degree of information integration in episodic buffer of working memory system. Therefore, the working memory would function more smoothly/efficiently which as a result contributes in enhanced recollections.

With respect to semantic memory examination, it was shown that bilinguals and monolingual children with RD had comparably recalled on letter fluency task; however, in the typically developed reading condition, bilingual children remembered more items than monolinguals. This finding could again be explained in consistent with the idea of impaired executive/control skills in RD; since these skills are extensively demanded by letter fluency tasks. As an explanation, it could be suggested that such impairments are the probable casual sources for such an indifference pattern of results (however, there is bilingualism). Further, this would in some sense confirm the theory of inter-connections between working memory and executive function mechanisms with long-term memory semantic representational system (Hambrick & Engle, 2002). Regarding category fluency, among children with typically developed reading, there was found no bilingual/monolingual differences. However, bilingual children with RD significantly recalled less items than typically developed reader bilinguals. The result of the no between (language) group differences is partially consistent with part of studies (e.g., Ljungberg et al. 2013); although it also stands in
contrast to some other part (e.g., Kormi-Nouri et al. 2012). Providing an explanation for this inconsistency, it can be suggested that probably our bilingual children did not extensively differ from their monolingual counterparts in terms of competency in Swedish language semantic knowledge; as they generally rated their language abilities (in Swedish) as comparably good as Swedish children. Moreover, the finding of smaller rate of recollections on category fluency task for bilinguals with RD could be interpreted in line with the previously brought up suggestion of the likely slower access and/or lesser retrieval rate for semantic knowledge in the case of bilingualism and RD together. However, the underlying mechanisms responsible for emerging such an effect is not clear.

A similar (delayed/less efficient) pattern of outcome performances for both executive functioning and long-term memory may permit the inference that some common (or at least interconnected) mechanisms (with shared contributions) lead to the retrieval of information from executive functions and the mental lexicon. This finding confirms connections between executive functions and long-term memory and that control/executive mechanisms are retrieved during recollections from long-term memory (Baddeley, 2007; Henry, 2012). Notably, the decreased performance was observed in terms of processing time and degree (rate). It means that while it took more time for bilinguals with RD than other groups to perform the executive function tasks, they generated less items in recollection tasks (although this was not true for letter fluency). This is an important result that can be partially explained in light of theories on bilinguals’ delayed lexical processing in a second language (e.g., Gollan et al. 2005). These findings should be replicated in future studies with different methodologies and with bilinguals of other language groups to explore the causalities of such outcome profiles.

Because the participants of this study were the same children as in study II, the points of caution must also be considered here. In particular, episodic and semantic memory were measured in Swedish and not in Persian. Some research has shown that episodic and semantic memory can be language dependent (Marian & Neisser, 2000; Saalbach, Eckstein, Andri, Hobi & Grabner, 2013). Research suggests that there should be a general pattern of processing (especially phonological) deficits in terms of RD (e.g., Snowling, 2000) and that these problems are closely associated with inefficient control skills (e.g., Peng et al. 2013; Swanson, Kehler & Jerman, 2010). Consistent with these findings, this dissertation partially concludes (see Figure 11) that
this cognitive deficit profile of RD is overwhelmingly widespread, which can contribute to creating a general delayed processing deficit profile. This general deficit processing may contribute to an overload of cognitive burden for bilinguals.

As mentioned, study III also found that bilinguals with RD benefitted more from retrieval support (cueing effect) in recollecting items, especially in terms of enacted rather than verbal items. This finding has implications for special education and teaching approaches for (bilingual) children with RD because memory and executive functions play important roles in learning, academic performance and achievement (e.g., Diamond, 2013; Titz & Karbach, 2014). Through a further study (IV), the state of special education with respect to the types of special education support used in Swedish schools with a high proportion of bilingual students who speak a first language other than Swedish was explored by investigating special education teachers’ and special education resource teachers’ perspectives (Borg, 2006). The results of this study underscored the importance of special education services for bilingual students, which, according to the teachers, are not usually provided. In general, being bilingual was commonly understood as a resource, although the importance of provision/allocation of higher levels of research-based competencies about bilingualism in general as well as the special education needs’ policy among school teachers were highlighted. Very few studies (Deponio et al. 2000) have explored literacy support for bilingual students with RD. Along with theoretically and conceptually oriented directions (mostly driven by cognitive research and partially by pedagogy), this dissertation has demonstrated that cognitive outcomes might change in terms of bilingualism based on the type of cognitive source and that there may be a consistently negative outcome performance when RD exists despite bilingualism. Furthermore, there may be some shortcomings in terms of special education for children with RD, consistent with teachers’ perspectives. In addition, the findings of study IV suggest that there are unbalanced levels of special education support for bilingual and monolingual students with RD in the school system, in line with previous research (e.g., The Swedish Schools Inspectorate, 2011) and according to teachers’ perspectives. This study has made an attempt to examine teachers’ cognition, which, according to Borg (2003), “refer[s] to the unobservable cognitive dimension of teaching –what teachers know, believe, and think” (p. 81). The main line of findings emerged as similar to the theoretical line on difference blindness developed by Kubota (2004), which stresses the indifference of special education policy that ignores students’ bi-/multi-linguistic
backgrounds and differences. Some issues and practical obstacles, such as insufficient collaboration with classroom teachers, specifically mother tongue teachers, were highlighted by the special education teachers. To relate these findings to the previous ones from studies II and III, it can be suggested that children with RD, specifically those who are bilingual, require different special education that is adjusted to their cognitive and individual resources.

**Limitations and strengths**

This study has some methodological limitations that may limit the generalizability and interpretations of the conclusions. First, for study I, we did not have access to information about SES with respect to parental economic and educational levels. However, to reach the (bilingual and monolingual groups of) children, different types of primary schools (private or public) were selected across different geographical districts and social classes for Iranian inhabitants in the three cities. In Iran, geographical area and the type of school can be regarded as indicators of social and economic class. The children were also randomly selected in these areas. Through this type of selection, we attempted to include all types of SES (high, moderate, low) in our population. Second, because the data from studies I, II and III were restricted to the bilingual children’s second language and were not included the information from their first language, caution is needed when discussing the bilingualism effect because there may be other variables with important roles that affect the outcome performance. For example, in study I, the bilinguals’ superior phonological processing skills may also be explained in light of the concept that reading difficult or low-frequency items in the second language relies more on phonological than semantic processing. That is, Kurdish-Persian and Turkish-Persian bilinguals may have relied on phonological route processing more extensively for reading in Persian as their second (less-practiced) language. They may have shown different patterns of outcome performance if they were tested in their first languages. Also, in studies II and III, the pattern performances may differ if these bilinguals were tested in their first language (Kurdish or Turkish) instead of their second language (Persian). However, Kormi-Nouri et al. (2008) previously examined bilingual children’s word memory and letter fluency in both their first language (Turkish) and their second language (Persian). Although the bilingual children recalled and generated more words (especially the older children) from the Turkish list than from the Persian list, the bilingual advantage was found in both memory tasks and in both language lists. The
results of studies II and III are mostly in line with the argument that second-language processing is generally more demanding than first-language processing (Szmalec, Brybaert & Duyck, 2012). The points that require caution relate to the issue of determining the level of bilingualism and bilinguas’ language proficiency. Therefore, we could not fully control for the possible variables due to under- and over-identification (Hedman, 2009; 2012). With respect to strength, it is noteworthy that this dissertation includes three different databases of several participant groups. Although these databases encompassed large samples of both children and teachers, they were adjusted by cross-sectional designs, so it was not possible to explore the causality of the effects through longitudinal designs. This issue can be explored in future research.

**Implications for future research agendas**

Much has been learned in recent years about bilingualism research, but there is still much to be learned. More studies are needed to assess the level of language proficiency of bilingual groups. In addition, longitudinal studies that can indicate the directions of effects and address causalities are still rare; thus, there is a need to develop studies that can explore the underlying mechanisms that govern outcome patterns with respect to the combined effect of bilingualism and RD. For example, it would be interesting to examine whether bilingual (and monolingual) children with RD catch up on their delayed processing, either over time or through more intensive exposure to their second language. In addition, there may be further implications with respect to linguistic variables (e.g., Marian & Kaushanskaya, 2004); it is possible that the pattern of performance would vary across languages other than the languages tested in these studies. Also, some research suggests the role of orthography in phonological processing and reading acquisition (e.g., Frith, Wimmer & Landerl, 1998; Treiman, Goswami & Bruck, 1990). Cross-orthographic studies of reading are important to consider the role of cross-linguistic orthography. In addition, future research studies that consider bilingual standards (in terms of vocabulary use) by using suitable vocabulary tests are needed (e.g., Thordardottir, 2015). Many bilingual children usually use their second language in the school context (and not often at home) and therefore become richly lexicalized in their second language later than their first language and compared with monolinguals, particularly with respect to the vocabulary pertaining to issues outside of the school context (home). In Sweden, bilingual children are offered mother tongue instruction by a voluntary educational service in schools once a week for
approximately two hours. This amount of instruction is not sufficient; in many cases, the linguistic skills of (immigrant) bilingual children living in a host society will fade in favour of the second (majority) language, which is the dominant language in the educational setting.

Also, this work was not designed to include a societal/individual perspective. This could be a meaningful orientation, especially when dealing with literacy problems. As Ingesson (2007) noted, literacy problems are associated with many socio-emotional consequences, and there is still much work to be done with respect to individual and societal attitudes toward literacy problems.

On a broader level, to link a cognitive framework in which the conclusions are driven by the children’s outcome performances to a pedagogical perspective derived from teachers’ perspectives, we would most likely obtain a more comprehensive view if we could either include the students’ perspectives. In addition to teachers’ perspectives, another means of evaluating interventions has been to focus on dyslexic individuals and how they experience educational support provision (e.g., Westling Allodi, 2002). In this line, Kormos (2013) noted that no previous studies have explored how instruction can affect dyslexic students’ motivation to learn a second language. Prospective studies that include both perspectives would be interesting for future research.
REFERENCES


who speak English as an Additional Language. London: London Language and Literacy Unit.


# Appendices

Appendix 1. **Group differences of children’ answers to the questions about language education provision**

<table>
<thead>
<tr>
<th>Class of questions</th>
<th>Semantic themes of questions</th>
<th>Bilinguals</th>
<th>Monolinguals</th>
<th>The overall between-group differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>a: Direct teaching provided by specialist teacher</td>
<td>Special help from special pedagogue/teacher</td>
<td>yes</td>
<td>21</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>no</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Spelling/reading training</td>
<td>yes</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td></td>
<td>no</td>
<td>21</td>
<td>19</td>
</tr>
<tr>
<td>b: Alternative and augmentative educational support</td>
<td>Spelling/reading training</td>
<td>computer</td>
<td>15</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>spelling books</td>
<td>14</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>reading training</td>
<td>10</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td></td>
<td>others</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Types of helps</td>
<td>word</td>
<td>2</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td></td>
<td>spelling</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>voice book</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>private room</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>silent room</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>longer writing time</td>
<td>8</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>extra help is needed</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>The teacher reads loud</td>
<td>every day</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>almost every day</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>almost once a week</td>
<td>2</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>almost never</td>
<td>12</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>never</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>c: Other (e.g., reading support in classroom, home-work support)</td>
<td>Evening newspaper</td>
<td>always</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>almost always</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sometimes</td>
<td>8</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td></td>
<td>almost never</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>never</td>
<td>22</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Reading news on internet</td>
<td>yes</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>no</td>
<td>22</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Somebody (in home) reads aloud in Swedish for you</td>
<td>always</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>almost always</td>
<td>12</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sometimes</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>almost never</td>
<td>9</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>never</td>
<td>12</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Parent’s follow up about reading practices</td>
<td>often</td>
<td>13</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sometimes</td>
<td>8</td>
<td>21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>never</td>
<td>20</td>
<td>7</td>
</tr>
<tr>
<td>How frequent are the reading lessons</td>
<td>every day</td>
<td>2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>-----------</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>almost every day</td>
<td>1</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>almost once a week</td>
<td>27</td>
<td>19</td>
<td></td>
<td></td>
</tr>
<tr>
<td>almost never</td>
<td>10</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>never</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Browsing in reference books, wordlists, instruction and atlas books</th>
<th>every day</th>
<th>10</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>almost every day</td>
<td>10</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>almost once a week</td>
<td>11</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>almost never</td>
<td>4</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>never</td>
<td>6</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Referring to the library (in or out of school)</th>
<th>every day</th>
<th>1</th>
<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>almost every day</td>
<td>19</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>almost once a week</td>
<td>10</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>almost never</td>
<td>11</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>never</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Satisfaction with school work</th>
<th>very good</th>
<th>2</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>almost good</td>
<td>20</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>not so good</td>
<td>15</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>not at all</td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

Note. * Ps < .05, ** Ps < .001
Publications in the series
Örebro Studies in Psychology


* Finns sedan tidigare utgiven i serien "Örebro Studies".


