Bilingualism, vocabulary knowledge and nonverbal intelligence: Turkish-English bilingual children in the UK

Zehra Ongun

Thesis submitted for the degree of

Doctor of Philosophy

in Applied Linguistics

School of Literature and Languages

Department of English Language and Applied Linguistics

University of Reading

March 2018

Declaration

I confirm that this is my own work and the use of all material from other sources has been properly and fully acknowledged.

Zehra ONGUN

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List of abbreviations

ACT	American College Testing
AWL	Academic Word List
BDS	The Bilingual Dominance Scale
BIA+MODEL	The Bilingual Interactive Activation Model
BLP	The Bilingual Language Profile
CATSS	The Computer Adaptive Test of Size and Strength
CMMS-3	Columbia Mental Maturity Scale-Third Edition
CPM	Coloured Progressive Matrices
CTONI	Comprehensive Test of Nonverbal Intelligence
CUP	Common Underlying Proficiency
DAS	Differential Ability Scales
EFL	English as a Foreign Language
EU	European Union
EVST	The Euro Centers Vocabulary Size Test
G(g)	General Intelligence
Gc	Crystallized Intelligence
Gf	Fluid Intelligence
IELTS	The International English Language Testing System
IQ	Intelligence Quotient
K-ABC	Kaufman Assessment Battery for Children
LEAP-Q	The Language Experience and Proficiency Questionnaire
Leiter-R	Leiter International Performance Scale-Revised
L1	First Language
LSBQ	Language, Social and Background Questionnaire
L2	Second Language
NNAT	Naglieri Nonverbal Ability Test

ONS	Office for National Statistics
P	Productive
PPVT	The Peabody Picture Vocabulary Test
R	Receptive
RHM	The Revised Hierarchical Model
RPM	Raven's Progressive Matrices
RCPM	Raven's Coloured Progressive Matrices
SAT	Scholastic Aptitude Test
SB5	Stanford-Binet Intelligence Scale- Fifth Edition
SES	Socio-economic Status
SPSS	Statistical Package for the Social Science
TCV	Total Conceptual Vocabulary
TONI	the Test of Nonverbal Intelligence-Third Edition
UK	United Kingdom
UNIT	Universal Nonverbal Intelligence Test
VLT	Vocabulary Level Test
X-LEX	Receptive Vocabulary Size Test
WAIS-IV	The Wechsler Adult Intelligence Scale
WASI	Wechsler Abbreviated Scale of Intelligence
WISC	Wechsler Scale for Children
WPPSI-III	Wechsler Preschool and Primary Scale of Intelligence
WRIT	Wide Range Intelligence Test

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Abstract

The rationale behind the present study comes from the assumption that the language proficiency level in the two languages of a bilingual are related (The Common Underlying Proficiency Theory; Cummins, 1980), and support in one language can be beneficial to the other (The Developmental Interdependence Hypothesis; Cummins, 1979). This study aims to investigate the relationship between the vocabulary size of sequential bilingual children in both of their languages (L1: Turkish, L2: English) and its relation to nonverbal intelligence scores. In addition, the study explores the effects of parental language dominance and home language use on the vocabulary size and nonverbal intelligence of bilingual children. The study involves 100 Turkish-English sequential bilingual children (aged 7-11) who were born and grew up in the UK and attend schools in which English is the language of formal instruction. The parents are middle-class (SES) first-generation immigrants from Turkey, and at least one parent of each child holds a higher educational degree. 25 English and 25 Turkish monolingual children (aged 7-11) were also involved in this study. The bilingual children were tested with the English X-Lex receptive vocabulary size test (Meara & Milton, 2003), the Turkish X-Lex (developed for this study) and a productive vocabulary test (Verbal Fluency Test) in both of their languages. The monolingual children were tested with the same tests in their languages. Raven's Progressive Matrices (Raven, Raven, & Court, 2004) were used to measure the intelligence levels of the bilingual and monolingual children. In addition, the Parental Language Dominance Questionnaire (Dunn & Fox-Tree, 2009), the Language and Social Background Questionnaire (Luk & Bilaystok, 2013) and Language Usage Questionnaire (developed for this study) were administered to the parents of the bilingual children. The results demonstrate a clear relationship between the vocabulary size scores of bilingual children in both languages. Bilingual children with a larger vocabulary in Turkish also showed a larger vocabulary in English. The findings show that bilingual children have a lower vocabulary size than monolingual children in each language separately, but when Total Conceptual Vocabulary (TCV) is taken into account, there is no significant difference between the productive vocabulary sizes of bilingual and monolingual children, and no vocabulary 'gap' between monolingual and bilingual children. The receptive vocabulary sizes in both languages are significantly related with nonverbal intelligence scores, and the relation between productive vocabulary sizes and nonverbal intelligence scores approaches significance, and the language dominance of parents and their home language use has a positive influence on the vocabulary size and nonverbal intelligence scores of the bilingual children. Turkish dominant parents and those using more Turkish at home are positively correlated with bilingual children's vocabulary size in both languages and nonverbal intelligence scores. Overall, the results of the study provide a clear evidence for the CUP theory and Interdependence Hypothesis in the area of vocabulary knowledge in terms of the relationship between the vocabulary sizes of bilingual children, and there is no bilingual disadvantage with regard to vocabulary size when both languages are considered. The results also show that nonverbal intelligence and vocabulary knowledge are related, and that a positive attitude of parents towards the minority language in an immigrant setting (Turkish in this case) has a positive effect on vocabulary size in both languages and on the nonverbal intelligence of bilingual children, and there is a bilingual cognitive advantage for children with more parental support for L1.

Acknowledgements

First and foremost, I would like to express my deepest and sincerest gratitude to my supervisor, Dr. Michael Daller, for his excellent guidance, continuous support, and endless encouragement, pinpoint expert advice, professional suggestions, insightful comments and valuable feedbacks that enabled this dissertation to be an accomplishment. His patience, inspiring thoughts, discussions and endless kindness made this work a pleasant journey. Without his guidance and intervention, this dissertation would not have been possible.

I am indebted to my beloved family: my husband Mehmet and my daughter Sinemis, for their love, positivity and spiritual support.

I am immensely indebted to my beloved mother, Nezahat, whose love and encouragement were always inspiring me.

I would also like to thank all the members of staff in the Department of Applied Linguistics at the University of Reading and the Department of Applied Language Studies at Swansea University, for their support in the series of talks and conference organisations.

Chapter one

INTRODUCTION

This chapter (Introduction) provides the rationale of the thesis with the main reasons for conducting the current study. This chapter also introduces the aims of the thesis and explains its significance, before closing with an outline of the thesis.

1.1 Rationale of the thesis

The current study is based on exploring the relationship between the vocabulary sizes (L1-L2) and nonverbal intelligence scores of Turkish-English bilingual children and the effect of parental L1 support. This section provides the rationale for the study, which is an important one for seven main reasons:

First of all, the world's bilingual population is rapidly increasing, and with the massive growth in global immigration, the field of research on bilingualism is of important interest, requiring further investigation and research. The literature still needs detailed description and understanding of the linguistic development of children with two languages (McCardle & Hoff, 2006), so more research must continue to focus on bilingual children.

Crystal (1997) estimated that two-thirds of the world's children grow up bilingual, with exposure to more than one language. For many bilingual children, growing up bilingual is simply a fact of life rather than a choice; they become bilingual growing up in a bilingual family with parents from different language backgrounds, or live in a country where the majority language differs from the minority language used by their parents (Genesee, Paradis, & Crago, 2004). Bilingual children have to learn both a minority and a majority language, and use them on a daily basis usually as a matter of necessity: their minority language allows fluent communication with their family and others of the same community who share the

common language, and their majority language provides access to communication with wider society, including school and the workplace.

Secondly, it has been established in the literature that vocabulary is a vital aspect of language proficiency, and it is acknowledged that vocabulary is the main component of language proficiency for both first and second languages (see Daller, Milton, & Treffers-Daller, 2007). Vocabulary knowledge is also closely connected to the development of other aspects of language proficiency, such as literacy and reading comprehension (Alderson, 2000; Joshi, 2005; Martin-Chang & Gould, 2008; Qian, 1999, 2002). It is important to analyse the link between the language proficiency of bilingual children in both languages (Cummins, 1979, 1980). Previous studies have found links between other aspects of language proficiency, such as pragmatic, phonological, lexical, morphological, syntactic and literacy abilities (Verhoeven, 1994), but there is not enough previous research on the link between vocabulary size in L1 and L2. The current study aims to contribute to the area of vocabulary knowledge studies by exploring the relationship between the vocabulary sizes of bilingual children in both of their languages, which has not been explored directly in previous studies.

There are only three well-known previous studies which are partly focused on the relationship between vocabulary size comparisons across two languages, but L1 and L2 vocabulary size relationship was not directly provided in these studies (e.g. Henriksen, 2008; Masrai & Milton, 2015; Sparks, Patton, Ganschow, & Humbach, 2009). As discussed in more detail in Chapter 2, Henriksen (2009) partly explored the relationship between L1 (Danish) and L2 (English) bilingual vocabulary sizes across different age groups and educational levels, and provided a rough estimate of the vocabulary size development in both languages. Sparks et al. (2009) also investigated the effects of L1 skills on L2 learning. In this study, vocabulary is analysed as a part of L1 skills alongside listening and reading abilities, phonological awareness and spelling. In a more recent study, Masrai and Milton (2015) attempted to

discern the link between first language lexical organisation and second language vocabulary development in the EFL setting, but there is still an unexplored area of research in our knowledge: investigating the link between the vocabulary sizes of bilingual children. With Cummins' Interdependence Hypothesis (Cummins, 1979, 1980) in mind, therefore, the current study aims to investigate the relationship between the vocabulary sizes of bilingual children in order to address this issue in the field of vocabulary size studies in L1 and L2.

Thirdly, a cross-language study across Turkish and English, which are different from each other in terms of vocabulary structure, would be revealing and interesting. For Turkish immigrant families in the UK, their minority language is Turkish and their majority language is English: bilingual children from Turkish families tend to speak Turkish when interacting with their family members and the Turkish community, but speak and learn English for life in society. Turkish has a different language structure than English. The current study aims to contribute to the area of cross-language studies by exploring the relationship between these two structurally different languages in terms of the vocabulary size of bilingual children, which has not been explored in previous studies.

Next, bilingualism researchers often disagree on how and what to test when studying bilingual vocabulary knowledge. Many researchers emphasize the importance of considering both languages of a bilingual to allow for a more accurate estimate of their vocabulary knowledge in terms of conceptual vocabulary when compared with monolinguals (Bedore, Pena, Garcia, & Cortez, 2005; Bialystok, 2001; Pearson, Fernandez, & Oller, 1993; Umbel, Pearson, Fernandez, & Oller, 1992). Grosjean (1998) pointed out that those who study both bilinguals and monolinguals tend to encounter more conflict and challenge when working with bilinguals. This study focuses on the vocabulary size development of bilingual children with regard to both of their languages, and compares them to monolinguals, so it must be

accepted that taking the bilinguals' vocabulary size in both of their languages into account is crucial when assessing their vocabulary knowledge.

Additionally, disagreements in the field can also be found regarding the cognitive advantages or disadvantages of bilingualism. The history of the cognitive effects of bilingualism began with discussions of the disadvantages (Saer, 1923) before progressing to advantages over the next half a century (Hakuta & Diaz, 1985; Peal & Lambert, 1962). One of the most influential ideas in the study of the cognitive advantages or disadvantages of bilingualism is the Threshold Hypothesis (Cummins, 1976). The Threshold Hypothesis posits the idea that cognitive advantage can only be observed for bilinguals who have a certain level of proficiency in both languages. The Threshold Hypothesis will be discussed in more detail in Chapter 2. According to Barac and Bialystok (2011), bilingualism has no negative effect on cognitive development, and the majority of studies on bilingualism have demonstrated that bilinguals have a cognitive advantage over monolinguals in a variety of verbal and nonverbal cognitive tasks. In more recent studies, bilinguals outperformed monolinguals in a variety of executive functioning and control tasks (e.g. Bialystok, 1999; Bialystok & Martin, 2004; Bruin & Della Sala, 2015; Carlson & Meltzoff, 2008; Morton, 2015), but later studies revealed no clear bilingual advantages on cognitive tasks (Paap, 2015; Paap, John, & Sawi, 2015).

Bearing in mind previous studies with conflicting results in the area of cognitive effects of bilingualism, it is crucial that the current study seeks to address this issue by exploring the relationship between the vocabulary size (language development) and nonverbal intelligence (cognitive development) of the bilingual children, in order to contribute to this area of research.

Another reason for this study is that early studies explored the positive relationship between vocabulary size and intelligence (e.g. Anderson & Freebody, 1979; Miner, 1957;

Terman, Kohs, Chamberlain, Anderson, & Bess, 1918), and some recent studies (e.g. Barac & Bialystok, 2011; Paap & Greeenberg, 2013) in this field have supported these early findings (e.g. Anderson & Freebody, 1979; Miner, 1957). Grzegorzewska (2015) partly explored the relationship between intelligence and vocabulary learning skills. In the area of research on bilingualism, nonverbal intelligence has still required further investigation as a part of the cognitive development of bilinguals. In one notable study, intelligence and bilingual proficiency were found to some extent to be related (Barac & Bialystok, 2011), and further evidence for a bilingual cognitive advantage has been found (see Paap & Greenberg, 2013). The potential link between vocabulary and intelligence still needs to be explored in more detail and systematic investigations measuring vocabulary and intelligence are needed. The current study aims to investigate this relationship in the case of bilinguals, contribute to an understanding of the relationship between vocabulary size and nonverbal intelligence, and provide empirical research findings for the development of both cognitive and linguistic development of bilingual children.

Lastly, parental language support and home language use play a crucial role in bilingual children's linguistic and specifically vocabulary development (Hart & Risley, 1995; Hernandez, Denton, & Macartney, 2007; Hoff-Ginsberg, 1991), but very little is known about the effects of parental L1 dominance and L1 home language use on children's cognitive development, and the area of research still needs to be investigated. The current study aims to address this issue by exploring the effects of parental language dominance and home language use on bilingual children's vocabulary (linguistics) and nonverbal intelligence (cognitive development).

1.2 Aims of the thesis

The main aim of this present study is to explore the relationship between the vocabulary sizes of Turkish–English bilingual children (in the 7-11 age group) in both of their languages in

relation to their nonverbal intelligence scores with the effect of parental language dominance and their home language on children's vocabulary sizes and nonverbal intelligence scores. The relationship between the vocabulary sizes of bilingual children in both languages in terms of both receptive and productive vocabulary size will be investigated, and a specific focus is given on the conceptual vocabulary size of bilingual children in comparison with their monolingual counterparts (both Turkish and English). Additionally, this study aims to examine the relationship between the vocabulary size of bilingual children in both languages and their nonverbal intelligence scores, and lastly, the effect of parental language dominance and home language use on bilingual children's vocabulary sizes and nonverbal intelligence scores.

1.3 Significance of the thesis

The current study has been carried out to provide a significant contribution to the field of bilingualism, cognitive development and vocabulary studies in general, and specifically to a better understanding of the relationship between the vocabulary sizes of bilingual children in both languages by providing results of both the receptive and productive vocabulary size of bilingual children with the relationship in the two languages of the bilinguals and provide results for the research area of bilingual vocabulary studies. The present study also proposes to investigate conceptual vocabulary of Turkish-English bilingual children in comparison with their monolingual counterparts and provide results for the field of conceptual vocabulary studies. This study also targets to contribute to an understanding of the relationship between the vocabulary sizes of bilingual children and their nonverbal intelligence scores, and provide results for the bilingual cognitive development. By investigating the effect of parental language dominance and home language use on bilingual children's vocabulary sizes and nonverbal intelligence scores, this study further aims to contribute to the research area of the effect of parental language support on children's bilingual profile in bilingual settings.

1.4 An overview of the outline of the thesis

This thesis includes six chapters: introduction, literature review, methodology, results, discussion, and conclusion.

The next chapter, Chapter 2, presents a review of the literature relevant to this thesis based on the aims of the current study. Following the introduction to bilingualism, definitions of bilingualism, types of bilingual and approaches to bilingualism are explained. Intelligence and the *g* factor are defined with respect to the study aims, and explorations of the relationship between intelligence and bilingualism and the effects of bilingualism on cognitive development are offered. Recent studies on bilingualism and cognitive development will be explained, as well as the bilingual mental lexicon, following Cummins' CUP Theory and Interdependence hypothesis (Cummins, 1979, 1984). As this study maintains that vocabulary is vital, the literature on the importance of vocabulary is analysed along with definitions of a "word", what it means to "know" a word, and details on types of vocabulary (receptive/productive) and vocabulary knowledge (breadth and depth). The review also contains an examination of vocabulary testing, questions around the reason for testing vocabulary size and a review of both receptive and productive vocabulary size tests. Focus is then given to previous studies on bilingual vocabulary research, including studies of both bilingual receptive vocabulary and bilingual conceptual vocabulary and how they relate to L1 and L2 vocabulary size. The literature review also looks at factors related to bilinguals' vocabulary development alongside studies on parental language dominance, SES, parental education and parental language support as it affects children's bilingual profile. Finally, Chapter 2 presents the research questions and the hypothesis of the current study.

In Chapter 3, the methodology of the current study is presented, including sections on the participants, the measurement instruments (tests and questionnaires) used, and the

procedure undertaken. Information on the data analysis process is also provided in this chapter.

Chapter 4 contains the results of the present study. The results of the relationship between the L1 and L2 vocabulary size of bilingual children are described in terms of both receptive and productive vocabulary size, as well as the bilinguals' conceptual vocabulary size (in both languages) as compared with that of their monolingual counterparts. Additionally, findings on the relationship between the vocabulary size of bilingual children and their nonverbal intelligence scores will be reported, and finally the effects of parental language dominance and home language use on bilingual children's vocabulary sizes in both of their languages and correlations with their nonverbal intelligence scores will be reported.

The penultimate chapter, Chapter 5, constitutes a discussion of the findings as they relate to the hypothesis. The discussion chapter compares the findings with previous findings from research in the same field, and looks at possible support for the hypothesis and theories of the present study.

Chapter 6, the final chapter, comprises conclusions in accordance with the aim of the study, as well as discussing on the limitations of the study, an examination of the implications for parents and policy makers, suggestions for further research, and a reflection on the contributions of the study.

Chapter two

LITERATURE REVIEW

2.1 Introduction

2.1.1 The Turkish immigrants in the UK

This section provides an overview on bilingual population by the estimations of bilinguals in the world, the number of the immigrants in the UK, and the facts of the Turkish immigrant population in the UK, as the bilingual children are from the Turkish immigrant families living in the UK in the present study.

As the bilingual population rises in accordance with increased free movement and migration, it is important to note some statistics about immigrants in the UK. The UK immigration process is very similar to those of other European countries, and it is a very popular choice of migration destination. According to the Office for National Statistics statistical data of the total Long-Term International Migration estimates of the United Kingdom, annual net permanent immigration to the UK was 330,000 for the year ending March 2015, a 28% increase on the previous year, and even higher than the previous record in 2005. Additionally, 9.000 fewer people have emigrated out of the UK since 2014 (Office for National Statistics, 2015) and 25,771 asylum applications were taken in the year June 2014 - June 2015, an increase of 10% over the previous year. The ONS quarterly report stated in February 2015 that non-EU migrants come to the UK for study (50%), work (25%), because they are accompanying or joining someone (20%), as well as various other reasons (5%). According to the Government Statistics Wales (2013), there are 31,132 (6.7% of the total) primary and secondary school pupils in Wales acquiring English as an additional language. Of these, those of White and Asian ethnic background aged 5 and over are 1,958 (0.5%).

Considering Turkish immigrants in the UK specifically, according to the 2011 UK census (ONS, 2015) and Home Office data, 500,000 people of Turkish origin are resident in the UK, a population made up of 150,000 Turkish nationals and 300,000 Turkish Cypriots, with the remainder comprising Bulgarian or Macedonian Turks. The Turkish-born population of the UK numbered around 101,721 in 2011, an increase of 72.3% since the 2001 census. The vast majority of these people (99,423) identified their first language as Turkish. The increasing immigration trends outlined above make research into the linguistic and cognitive development of the immigrant bilingual population even more urgent, in order to give valuable suggestions to both parents and policy makers. The aim of this thesis, therefore, is to contribute by analysing both linguistic (vocabulary size in this case) and cognitive (nonverbal intelligence in this case) development of Turkish-English bilingual children from Turkish immigrant families in the UK and provide the findings to help understand the important issues surrounding bilingualism.

2.1.2 The Turkish language

In this section, it is important to provide information about the general language and vocabulary structures of the Turkish language, as Turkish is the minority language of the bilingual children in the present study. The Turkish language is a member of the Ural-Altaic language family mostly spoken in the most part of Turkey. The Turkish lexicon has been influenced mostly by Arabic, Persian, Greek, Armenian, and French (Kornfilt, 2009), and its alphabet is based on Latin characters with 29 letters consisting of 8 vowels and 21 consonants. The Latin alphabet came into use for Turkish in 1928, replacing the Arabic that had been in use before it. Turkish is agglutinative, meaning that a phrase expressed in English by several separate components (prepositions, modal verbs, etc.) would be conveyed in Turkish with a single word made up of smaller units (Boeschoten & Lars, 2006; Kornfilt, 2009). The coverage of Turkish words is therefore larger than those of English, Turkish

vowel harmonization and consonant assimilation features differ from English (Geoffrey, 2001): vowel harmonization is a prominent feature of Turkish, which is controlled with a vowel occurring at the beginning of a word (e.g. uzaklar, paltolar, evler, kediler). There are no vowel harmonies or consonant assimilation rules in English. Turkish contains no prefixes, suffixes do not change depending on word type, and Turkish words have no grammatical gender (Gőksel & Kerslake, 2005). The language is rich in derivational and inflectional suffixes which are all linked to a root, and the meanings of the root are enriched through suffixes so a number of words can be derivable from one root word (Kornfilt, 2009; Pfaff, 1993): a word with nine or ten morphemes can occur in a corpus. A noun root can be derived with a suffix and become a verb, which derives with another suffix to become a noun again, or an adjective, so after several derivations, a root that began as a noun ended up an adjective or verb. High frequency words have only one morpheme, and the average word has three morphemes (Kornfilt, 2009). The two languages also display differing syntax, or word order. The standard word order in Turkish is subject + object + verb however, whereas English is a subject + verb+ object language, with Turkish containing a more flexibility with word order (Boeschoten & Lars, 2006; Boeschoten & Verhoeven, 1991; Gőksel & Kerslake, 2005; Pfaff, 1993).

2.1.3 Chapter Introduction

This chapter presents a review of the literature related to the current study. This review discusses and examines the relationship between the vocabulary sizes of bilingual children in both of their languages (L1 Turkish and L2 English) and how it relates to their nonverbal intelligence scores alongside the effect of parental language dominance and use of their home language. The chapter is divided into two main sections: bilingualism and vocabulary. Intelligence will be discussed in both of these sections.

In the bilingualism section, previous studies on bilingualism and its potential relation with nonverbal intelligence and vocabulary knowledge will be discussed. The section begins with a brief definition of bilingualism, types of bilinguals and approaches to bilingualism. As the main background theory to this study, the Interdependence Hypothesis (Cummins, 1979) and CUP (Common Underlying Proficiency; Cummins, 1980) are going to be discussed in some detail. This is followed by definitions of intelligence and the *g* factor and how they relate to bilingualism and, as the relationship between bilingualism and nonverbal intelligence is important for the present study, this section provides a review of studies on the relationship between them, and a look at the earliest to the most recent research on the effects of bilingualism on cognitive development. A review of nonverbal intelligence tests for children and a discussion on the intelligence test selected for use in this current study follows this. As a part of cognitive development, there will be also a brief discussion on bilingualism and working memory, and on the link between L1 and L2 bilingual mental lexicon, and since exploring the relationship between bilingual vocabulary size and non–verbal intelligence scores is one of the essential components of the current study, the literature around this will be discussed and a review of the relationship between vocabulary size and nonverbal intelligence studies provided.

The vocabulary section will examine research that includes the importance of vocabulary and a brief definition of a "word" and what it means to "know" a word, and an exploration of receptive and productive, breadth and depth of vocabulary knowledge and the differences between them (in this study, vocabulary knowledge of the participants is tested both receptively and productively). As these things cannot be known without vocabulary tests, the dimensions of a good vocabulary test, including examples from the literature of both receptive and productive tests will be explained. The reasons around how and why we test vocabulary knowledge will be reviewed as a topic essential to the aims of this study. As

measuring the vocabulary size scores of bilingual children in both of their languages in comparison with their monolingual counterparts is important for the current study, vocabulary studies on bilinguals will be discussed with reviews of both receptive vocabulary size and conceptual vocabulary size studies in comparison with monolinguals. Next, the potential link between L1 and L2 vocabulary size will be explained, before a discussion on the factors related to bilingual vocabulary development that under-pin the effects of parental language dominance, their home language preference and the effect of SES (socio-economic status) on children's bilingual vocabulary and nonverbal intelligence profile.

The summary section to this chapter contains an overview of the literature review of the dissertation. The content will be summarised and its importance to the current study will be explained.

2.2 Bilingualism

2.2.1 Definition of Bilingualism

It is possible to find different definitions of 'being a bilingual' in the literature. Most of the definitions are based on different aspects of language usage and acquisition. Despite differences between various definitions of bilingualism, however, the main questions remain the same: what is bilingualism and who is defined as a bilingual? Which criteria should be considered when forming a definition, and what kind of dimensions should be determined to construct such a definition? Bilingualism can be defined from different perspectives, so over the history of bilingualism studies, various definitions have been proposed different. Early definitions of bilingualism considered bilinguals as two separate monolinguals. This view is exemplified in Bloomfield's (1933) influential definition of a perfect bilingual as someone constituting a combination of two proper monolinguals. Oestreicher (1974) also defined a bilingual as someone possessing perfect knowledge of two languages without confusing them.

Previous conceptions of bilingualism considered only the usage of two languages like two monolinguals, but Grosjean (2008, p.10), crucially, distinguishes two different views of bilingualism with his "monolingual and bilingual view of bilingualism".The popular misconception of a bilingual is a person who possesses mastery of two languages, as though they were the sum of two monolinguals (Grosjean, 2010). Grosjean (1985) states that bilinguals have some unique language competence that differ from the combination of two monolinguals and bilinguals are placed in a different category from the conception of bilingualism as two monolinguals.

The monolingual view of bilingualism considers bilinguals to be two monolinguals, with their language proficiency defined either as perfect as a monolingual, or not. The main criterion is to be at the same proficiency level as two monolinguals, therefore defining bilinguals as those with full mastery of their two languages. As bilingual language proficiency is assessed with monolingual tests, the results are clear that bilinguals do not possess the language proficiency of monolinguals. Is it therefore fair to assess bilinguals with monolingual tests? Do such tests really consider all aspects of bilinguals? Grosjean (2008) claims that most studies in this area focus on L2 language proficiency and the interaction between L1 and L2 is ignored. Standard monolingual tests are still used to assess bilinguals, without taking into account the variety of bilinguals and their everyday language usage. Grosjean (2008, p.13) rejects the 'two monolinguals' definition, states that "bilinguals cannot be accepted as two monolinguals, thus bilinguals are accepted as competent speaker-hearers in their own category." This draws attention to the potential for considering bilinguals as a unique category of their own. Bilinguals possess special and different language structures, and these structures are not necessarily shared by monolinguals. This exclusive category is not explained when attention is on 'perfect' bilinguals (to the detriment of research), as it is not often that bilinguals are fully competent in both of their languages. This is why Grosjean (2008, p.14) maintains that bilinguals have developed 'a communicative competence' as

sufficient as they need for daily use. In this view, the fluency of language depends on the language use and needs of bilinguals. Grosjean (2010, p.22) defines bilinguals are those who 'use two or more languages in their everyday lives'. In this idea, language usage is considered the most important criterion of being a bilingual. Grosjean's (2008, p.10) definition also states that "bilingualism is the regular use of two or more languages (or dialects)", revealing the increased flexibility the definition of bilingualism has undergone in the past few decades: instead of categorizing and defining bilinguals as possessing full mastery of two languages, it provides a wider point of view.

Bilingualism was also defined in terms of four language skills (reading, writing, speaking and listening), and this idea has continued to the present, in recent research studies. In an early study, Macnamara (1967) categorises a bilingual as someone possessing at least a low level of proficiency in according to the four language skills, namely speaking, reading, writing and listening, in the second language. This view focussed attention on the value of linguistic skills. It is uncommon for bilinguals to use all of the four language skills in both languages, as they tend to use their two languages for different purposes and occasions. The four language skills may be at different levels in each of a bilingual's languages, and their abilities in these skills may differ. According to the Complementarity Principle (Grosjean, 1982, 2010), bilingual children do not need to use both languages at the same time in their daily life. Grosjean (1982) therefore stated that bilinguals' needs are the predictor of their use of the four language skills, and the language needs or preference of bilinguals can demonstrate differences in accordance with the various occasions of life. A bilingual can use a language according to the specific domains. For example, if a bilingual's language of education is their second language, they need to be able to write, read, speak and listen, but if their first language is used predominantly in the home or socially, they are more likely to need only speaking and listening skills, with little call for reading and writing in that language. Another example would be a bilingual who prefers to use their L1 for family communication,

writes poetry in their L2 and solves maths problem in their L1. These examples demonstrate the importance of a bilingual's situational language preferences, and support the idea of the Complementarity Principle (Grosjean, 1982, 2010).

Grosjean's (1982) view has been supported by recent studies. For example, in a previous study, Mackey (2000) emphasizes the value of linguistic skills in the degree of bilingualism. He explained the four language skills in terms of spoken and written language skills, with a view on focussing on these skills for testing the degree of bilingualism. Bilinguals can demonstrate different levels of mastery in a skill in terms of different linguistic levels, as Mackey (2000) points out that a bilingual can have perfect vocabulary knowledge but imperfect pronunciation, or good grammar knowledge but a lower level of vocabulary or speaking and listening skills. These linguistic skills are taken into account when determining a bilingual's mastery of the various skills. Mackey (2000, p.28) states that the bilingual proficiency can be vary between the languages with respect to the relationship between 'phonological graphic', 'grammatical', 'lexical', 'semantic', and 'stylistic' skills, and the level of these linguistic skills.

Definitions of bilingualism began placing greater emphasis on the needs of individuals when considering bilinguals' language usage, with Grosjean (1989) in particular emphasizing that their individual needs play a crucial role in determining language use. Grosjean (1982) proposed that bilinguals are those who use both languages naturally in the different domains, explaining usage in terms of an individual spontaneous and natural preference between two languages.

This trend continued, with more definitions concentrating on the individual characteristics of bilingualism. Ellis (1994) defines bilinguals as those who use two languages both individually and socially. The separation between individuals and the social community was emphasised in terms of using two languages, so taking individuals and social

communities into account in definitions of bilingualism became crucial. Mackey (2000) maintains that bilingualism can be defined in terms of individual rather than group features. It is assumed that there are two different social groups speaking two different languages, and the place of an individual bilingual operates in both social groups. There is contact between two social communities and bilingualism is defined as an interaction between two social communities who speak two separate languages. Bilinguals are assumed to be a bridge between these two separate social communities, and therefore have a choice to use one of their languages when interacting within these social communities.

Bilingualism can also be considered from the perspective of the willingness of bilinguals to use their languages.It has been found that different domains such as ethnic, cultural, social and psycolinguistic dimensions are key factors in determining language use (Grosjean, 2001). For instance, Weinreich (1953) wrote that bilingualism refers to the preference when choosing one of the two languages in accordance with the language in use in a specific domain. Grosjean (2001) explains bilinguals' language use willingness using the framework of the Language Mode Continuum Hypothesis, by dividing usage into monolingual and bilingual language modes. Bilinguals can be in a monolingual or bilingual language mode, or they can shift from one language to another in accordance with the domains of psychological or sociolinguistic factors. These language shifts occur mostly with code-switching, which is shifting from one language to another for a part of speech (this could be a verb, a noun, a phrase or a whole sentence). The idea of this hypothesis is that bilinguals can shift language modes in terms of willingness to use one of their languages in accordance with psycholinguistic, psychosocial or sociolinguistic factors (Bialystok, 2001; Grosjean, 2001). Grosjean (1982) was concerned with the psychosocial dimension, emphasizing the importance of motivation on bilinguals' language proficiency. For example, he states that if a bilingual is part of a particular environment or social group, it is clear that he

has no choice but to interact, therefore necessitating the use of one of his languages – that of the community or social group – so this situation creates an obligation for the bilingual to develop his use of the language. Grosjean's (1982) psychosocial factors also include socio-cultural factors that should be taken into account, as they have an important effect on the relative fluency of the two languages. Bialystok (2001) agrees with this, stating that such psychosocial factors have an important effect on bilingual language competence. More recent accounts (Grosjean, 2010; Li Wei, 2000; Mackey, 2000), therefore, have placed greater importance on concerns of ethnicity, culture and identity, and the roles they play in bilingual language proficiency. Each of these factors also constitutes a key determiner on the motivation of bilinguals and their attitudes toward their languages. Bilingualism cannot, then, simply be defined from only one perspective or dimension. According to Bialystok (2001), bilingualism also cannot be defined in terms of certain limits of language proficiency level, and she cautions against drawing clear limits of language proficiency. There are different kinds of bilinguals, such as those who have different language proficiency levels and this gap in the definition of bilingualism can lead to its re-examination. Bialystok (2001, p.8) also maintains that "bilingualism is a scale, moving from virtually no awareness that other languages exist to complete fluency in two languages." This denies the possibility that bilingualism can be defined according to categories or classifications.

Li Wei (2000, p.25) also proposes that "Bilingualism is not a static and unitary phenomenon. It is shaped in different ways, and it changes depending on a variety of historical, cultural, political, economic, environmental, linguistic, psychological and other factors". He clarified the importance of considering bilingualism as interacting with all of these disciplines. Mackey (2000) claims that research on bilingualism is a mixture of interrelationships with other disciplines, such as psychology, pedagogy, sociology, and linguistics, and recent studies have concluded that bilingualism should be considered in terms of these other disciplines that may affect bilingualism directly or indirectly. All of these

definitions have tried to explain the exact meaning of bilingualism and being a bilingual, taking into account a wide range of factors such as language proficiency level, occasions for language use, need of language use, individual and social language usage, and age.

2.2.2 Types of bilinguals

2.2.2.1 Additive and Subtractive bilinguals

Early studies on bilingualism with a focus on language acquisition provided disadvantages of bilingualism on cognitive development (Barke & Williams, 1938; Darcy, 1953) until Peal and Lambert (1962) provided positive evidence on bilingualism and the advantages of bilingualism on cognitive development. Following the cognitive advantages in bilingual studies, Lambert (1977) first identified two types of bilingualism, additive and subtractive, to clarify the advantages of bilingualism. In additive bilingualism, according to Lambert (1977), both L1 and L2 develop with similar opportunities; nothing is replaced or lost in L1 because of L2. In other words, bilinguals learn their majority language alongside their minority language. Most studies showing cognitive advantages of bilingualism were therefore focussed on bilinguals who developed both languages at the same time. There is no 'cost' to bilinguals in this model: the L2 is added to the bilingual's existing language knowledge.

Subtractive bilingualism, by contrast, proposes that bilinguals learn and acquire an L2 which is considered more important and valuable than their L1, and the L2 is acquired at the expense of the L1. In this form of bilingualism, the L1 is replaced and lost to the L2, with the L2 being acquired at a lower level of language proficiency. According to Lambert's 1975 study comparing French-Canadian and Canadian immigrant children's lower English language acquisition, the results indicated that the reason for immigrant children's lower scores in English was because of their L1 attrition and replacing with their L2 at a lower level.

The idea of additive bilingualism managed to gain importance in bilingualism studies as it offers an optimistic view of bilinguals' language capabilities. This move from disadvantages to advantages of bilingualism on the cognitive and linguistic development has been further supported by research (Bialystok, Luk, & Kwan, 2005; Bialystok & Majumder, 1998; Goetz, 2003).

2.2.2.2 Balanced and Dominant bilinguals

According to Peal and Lambert (1962), the difference between balanced and dominant bilinguals is based on the proficiency and fluency of languages. Lambert, Havelka and Gardner (1959) defined "balanced bilinguals" as those with full mastery in both of their languages. A balanced bilingual is one with sufficient proficiency in both languages at the same level. Dominant bilinguals, on the other hand, show a higher proficiency in one of their two languages, although balanced bilinguals do not exist in real life and it is very rare to find a bilingual fully fluent in both of their languages (Baetens- Beardsmore, 1982) or in all language skills (Fishman, 1972).

Grosjean (1982) points out that "balanced bilinguals, those who are equally fluent in both languages, are probably the exception and not the norm" (p.235). Likewise, Paradis (2007) maintains that typical bilinguals are more often proficient or dominant in one of their two languages even if exposure to both began at birth.

2.2.2.3 Folk and Elite bilinguals

Bilinguals can also be classified by the social status of their languages. Fishman (1977) writes that bilinguals can be classified as 'folk' and 'elite' in this way. According to Liddicoat (1991), folk bilinguals are often in minority language society and their minority language has no or very limited value or usage in the majority society and is not accepted as a formal language, so learning the dominant language of the society is an obligation for folk bilinguals. In contrast, elite bilinguals are those who speak the dominant language of their society and

also know another language which has value in the majority language society. Liddicoat (1991, p. 8) states that "elite bilinguals typically become bilingual through a free choice to learn a language." Learning the majority language is not a daily need for elite bilinguals, and they learn it in formal education settings.

2.2.2.4 Simultaneous and Sequential bilinguals

Bilinguals are also defined as simultaneous and sequential according to the age of first and second language acquisition. A 'simultaneous' child is exposed to both languages at the same level from birth (Patterson, 2002), whereas a 'sequential' bilingual is exposed to L1 from birth and begins to acquire L2 after the age of 3 or at school entry (Genesee, Paradis, & Crago, 2004). The participants in this study are Turkish-English sequential bilingual children: they were exposed to Turkish from birth and first started learning English at the age of 3, after nursery entry.

The definitions of simultaneous and sequential bilinguals are very close to the early and late bilinguals' definitions, and these terms are both used in the literature but the terms of simultaneous and sequential are mostly used in linguistic studies to define the bilinguals and the terms of early and late bilinguals are mostly used in psychological studies. So the only difference between these definitions is the area of research. Bilinguals are also categorized as early and late bilinguals according to the age of language acquisition. Age is considered an important factor in ultimate attainment of proficiency because of the strong relationship between age of acquisition and language proficiency (Long, 1990).

The terms "*early and late bilinguals*" are mostly used in the area of psychology as mentioned above. According to Swain (1972), early bilinguals learn two languages natively but late bilinguals cannot attain native L2 proficiency. Age of language exposure is considered a key factor in language competence, especially in L2, and according to Lennenberg`s (1967) critical period hypothesis, the most effective language capacity occurs in

early age, reducing with growth and maturity. However, further studies have found different sensitive ages of language exposure, such as after the age of 15 or 17 (Birdsong, 1992). Birdsong (2005) concludes that it is impossible to find a clear-cut sensitive age before native-like language proficiency can develop.

Age is a controversial issue in the field of bilingualism. A further important discussion on age of language acquisition is that of the advantages or disadvantages of early and late bilingualism. Some research describes the advantages of early bilingualism (Birdsong, 1999; Long, 1990) in terms of executive control (Bialystok & Martin, 2004). Executive control refers to a set of three main cognitive components: inhibition, working memory and switching attention (Miyake et al., 2000) (explained in more detail in the Cognitive Advantages of Bilingualism section in this Chapter). Further studies have demonstrated the advantages of lifelong bilingualism in terms of delaying the development of dementia (Atkinson, 2016; Bialystok, Craik, & Freedman, 2007) and the onset of Alzheimer's disease (Craik, Bialystok, & Freedman, 2010). Other research has found the effects of late bilingualism in terms of cognitive development (Link, Hoshino, & Kroll, 2008) including advantages in terms of executive control (Luk, De Sa, & Bialystok, 2011) and, again, delaying the development of dementia (Atkinson, 2016).

Recent studies produced conflicting results on the advantages and disadvantages of late bilingualism (e.g. Atkinson, 2016; Bialystok, Craik, & Freedman, 2007), but overall the results support the idea that early bilingualism has more cognitive and executive control advantages than late bilingualism.

To sum up, it is possible to describe various types of bilingualism. Bilinguals can be classified according to their age on language acquisition, language social status, effect of their L2 learning on L1, the relationship between their two languages and the organisation and

memory of linguistic units and their meanings. Bilinguals can have different bilingual characteristics and features and can be classified according to them.

2.2.3 Assessment of Bilingualism

Until recently, the monolingual (fractional) view of bilingualism has been one of the most dominant approaches in the study of bilingual language acquisition (Grosjean, 2008). Grosjean (2008, p. 10) criticized and rejected the monolingual view of bilingualism, which he defined as: "the bilingual has two separate and isolable language competencies; these competencies are similar to those of the two corresponding monolinguals; therefore, the bilingual is two monolinguals in one person." This view has meant that bilinguals have long been assessed and tested in terms of monolingual language norms and standards, but evidence shows that bilinguals are different from monolinguals in many language aspects, and monolingual tests are not appropriate for bilinguals (Grosjean, 2008).

Following from this, Grosjean (2008) points out that studies on bilingual language acquisition are mostly focussed on bilinguals' second language without consideration of their first, and mostly from the point of view of comparison between bilinguals and monolinguals in terms of second language acquisition. This raised questions around the assessment of bilinguals, including why bilinguals are assessed and tested within monolingual norms, why bilinguals are considered as two monolinguals, and why bilinguals are only evaluated in terms of their second or less developed languages.

The bilingual view of bilingualism can be considered a perspective able to answer all of these questions about the assessment of bilinguals. The bilingual (wholistic) view of bilingualism acknowledges the fact that "the bilingual is not the sum of two complete or incomplete monolinguals; rather, he or she has a unique and specific linguistic configuration" (Grosjean, 2008, p. 13). Grosjean (2008) goes on to explain that it is important to consider a bilingual's two languages specifically in the assessment of their language competence and in

comparisons between bilinguals and their monolingual counterparts. Assessment of bilinguals with monolingual norms or standards is inappropriate for the nature of a bilingual's language development, so a bilingual's language features in both languages should be taken into account in assessments and the evaluations.

To sum up, in contrast to the monolingual view of bilingualism, the wholistic view of bilingualism considers the assessment of the two languages of bilinguals. Each bilingual should be assessed as different from monolinguals and monolingual norms, as they demonstrate different language and linguistic aspects (Grosjean, 2008).

2.3 Bilingualism and Cognition

2.3.1 What is Intelligence?

Intelligence is a very controversial topic (Westwood, 2004), and there is no agreement on a single definition (Legg & Hutter, 2007). Numerous definitions of intelligence have been proposed throughout the literature, and the debate continues. Early definitions of intelligence focussed on the idea of a traditional 'single' form of intelligence (see Spearman, 1904), and this was widely accepted until multiple intelligence theory (Gardner, 1983) was developed in the early 1980's. In the nineteenth century, Galton (1869) believed genetics to be the most important factor in intelligence, with his genetic intelligence approach (Hereditary Genius Approach), which considered genetic as the measurement of intelligence.

Later, at the dawn of the twentieth century, the British psychologist Spearman (1904) proposed one of the first psychometric definitions of intelligence with general intelligence (*g* factor) theory, which underlies all mental and intellectual abilities. According to Spearman (1904, p.284), "all branches of intellectual activity have in common one fundamental function (or group of functions)…" Spearman (1904, 1927) first considered single-factor intelligence and carried out several mental ability measurements which were correlated positively with each other. Spearman's theory had two important components: general (*g*) and specific (*s*)

factors. The *g* was defined as a common factor across different types of abilities and the specific *s* as the specific factor for unique activities. There were different tests to measure individuals' cognitive abilities and explain positive correlations between mental ability tests with a single common factor which underlies all kinds of intellectual abilities; he called this the *g* factor (general intelligence factor). This implies that human intelligence levels can be explained with a single common factor and that those who perform well in one cognitive domain also tend to perform well in other cognitive domains (Spearman, 1904). For example, a person achieving high scores in problem solving tasks will also have high scores in verbal ability tests, because the underlying psychological trail is the same, namely the general intelligence or '*g*', so Spearman (1927) stated that different mental ability tests or tools measure the same thing.

However, Spearman's *g* theory drew criticism in terms of its concept. Thorndike, Lay, and Dean (1909) wrote that:

> In general, there is evidence of a complex set of bonds between the psychological equivalent of both what we call the formal side of thought and what we call its content, so that one is almost tempted to replace Spearman's statement by the equally extravagant one that there is nothing whatever common to all mental functions, or to any half of them. (p.368)

Later, in the 1960s, the Cattell-Horn theory (Cattell, 1963; Horn & Cattell, 1966) proposed a two-factor model of intelligence (Flanagan et al., 2000). Cattell and Horn divided general intelligence (the *g* factor) into two components: fluid (G*f*) and crystallized (G*c*) intelligence. These two components were accepted as the most important factors of intelligence (Taylor, 1994). G*f* is defined as the ability to solve complex, novel problems by using reasoning ability and relationships (Martinez, 2000) and G*c* is defined as a knowledge-based ability acquired by previous educational experiences (Carroll, 1993). G*f* has been

thought the most reliable measure for predicting educational and academic achievements (Rohde & Thompson, 2007) and high quality job performance (Gottfredson, 1997). In contrast to G*f*, G*c* is mainly related to long-term memory, which allows access to previously acquired knowledge, including vocabulary, general and cultural knowledge. G*c* in terms of vocabulary can be measured by vocabulary or verbal tests.

Following on from the Cattell-Horn theory, Carroll (1993) developed Carroll's hierarchical theory which added a further eight broad abilities, so it was then known as the Cattell-Horn-Carroll theory. The broad abilities in the hierarchical model are arranged as fluid intelligence (G*f*) (with G*f* at the top level in the hierarchical model [Carroll, 1993], with a very similar concept to *g*) , crystallized intelligence (G*c)*, quantitative reasoning (G*q*), reading and writing ability (G*rw*), short-term memory (G*sm*), long-term storage and retrieval (G*lr*), visual processing (G*v*), auditory processing (G*a*), processing speed (G*s*) and decision/reaction time and speed (G*t*).

While *g* theories have received criticism over the years, the concept is still accepted as the dominant view of intelligence in psychometric assessments even though different theorists have proposed various types of intelligence concepts (Gardner's Multiple theory, 1983; Sternberg's Triarchic theory, 1984). Psychologists and researchers who focus on factor analysis and use standardized tests still find the *g* factor important in research designed to measure and define intelligence as accurately as possible (Schlinger, 2003). Despite the fact that Horn and Blankson (2005) stated that there is insufficient evidence to support a single general factor which inter-correlates with all cognitive abilities, Johnson, te Nijenhuis, and Bouchard (2008) indicated that as long as there are different types of test batteries in a test, the *g* factor is well correlated with different types of test. Besides perfect correlations between *g* and different test batteries, according to Jensen (1992), high correlations between the different intelligence tests are explained by reference to Spearman's clasification of the

indicator theory and the *g* factor. Carroll (1993) stated that Spearman's theory is still relevant today as it is the first attempt to consider individual differences in intelligence with a set of correlations between the various types of mental ability tests.

In the history of intelligence testing, psychometric tests have been used to assess and predict the level of human intelligence in several studies (Carroll, 1993; Deary, Strand, Smith, & Fernandes, 2007; Gottfredson, 1998; Neisser et al., 1996; Schlinger, 2003). These tests aim to measure different cognitive aspects such as abstract thinking, reasoning, reading, general intellectual ability, rapid decision-making, short and long-term memory, executive control, meta-linguistic awareness, spatial imagery and so on. Psychometric tests cannot only measure intelligence, but also other related aspects for the purpose of studies on, for example, different scholastic aptitudes (such as the Scholastic aptitude test: SAT and the American college testin: ACT used in the USA), school or academic achievement, job placement, and so on (Neisser et al., 1996), and have been used largely in educational, business, employment or military settings.

There are tests used mainly for measuring G*f* that are generally accepted as good predictors of the general intelligence factor, such as Raven's progressive matrices (RPM) (Raven, 1938, 2004) or Raven's coloured progressive matrices (RCPM) (Raven, 1962). RPM and RCPM are some of the standardized tests used for assessing mental nonverbal and matrix reasoning tasks. In such nonverbal reasoning tasks, participants are instructed to find the missing piece of a presented pattern from a choice of six (Bors & Vigneau, 2001). Additionally, there have been several test measures designed specifically to assess both G*f* and G*c*, such as the Wechsler Adult Intelligence Scale (WAIS-IV). The first part of the test is the performance scale (perceptual reasoning index from block design, matrix reasoning, visual puzzles sub-tests) to measure G*f*, and the second part is the verbal scale (verbal comprehension and general ability index from vocabulary and information sub-tests) for G*c*

(Lichtenberger & Kaufman, 2009). The original Wechsler subtests have undergone revisions and four further subtests added (i.e. verbal comprehension, perceptual organization, working memory, and processing speed indices) to be more more appropriate to current cognitive theorems (Zhu, Weiss, Prifitera, & Coalson, 2004). In a similar way, the Stanford-Binet intelligence test is a good example to demonstrate testing both verbal and nonverbal reasoning, such as vocabulary, comprehension, pattern analysis, memory patterns, abstract and visual reasoning etc. (Roid, 2003). The Comprehensive Ability Battery (Hakstain & Cattell, 1975) is another intelligence test, which aims to evaluate both G*f* and G*c* using 20 ability sub-tests, and the Kaufman Adolescent and Adult Intelligence Test (Kaufman & Kaufman, 1993) includes scales for assessing both G*f* and G*c*.

Around the same time, other prominent researchers devised their own definitions. Binet and Simon (1905, 1916) who developed the first intelligence test (the Binet-Simon scale), defined intelligence as a perceiving things outside oneself and to store these perceptions in memory, as well as thinking about the concept of such perception and self-critique. They also went on to define intelligence as the ability to adapt to a new environment and behave in a practical manner.

Later intelligence was also defined in terms of the social intelligence approach. Thorndike (1920) divided intelligence into three complementary categories: Abstract (verbal), Mechanical (visual/spatial) and Social Intelligence, and defined intelligence from the social perspective as having good social relationship. In the same vein, Thurstone (1938) stressed social intelligence in his social intelligence approach.

Wechsler (1939, p.3) defined intelligence as “the aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment”. While Wechsler (1939) rejected Spearman’s *g* factor, his own definition of intelligence is not so different to Spearman’s. Wechsler defined intelligence as global and

considered an individual's intelligence as a whole concept with some specific independent components (Zhu et al., 2004). Wechsler believed that intelligence could be expressed in two ways, verbally and nonverbally, rather than conceiving of these as two independent intelligences (Flanagan, McGrew, & Ortiz, 2000). Similarly, Piaget (1963, 2001) defined intelligence as the ability to think and behave by adapting to new situations and environments, and developed cognitive development theory. In these early definitions, intelligence was considered a whole concept of necessary thought and behaviour suited to environmental perceptions, and adaptation to novel circumstances and changes.

Since the 1980's, new theories have been proposed due to dissatisfaction with the traditional definitions, and the traditional single form has gradually been replaced by a conception of multiple forms of intelligence. One of these new concepts was Salovey and Mayer's (1990) Emotional Intelligence Theory, which posited emotional intelligence as a kind of subfield of intelligence related to an individual's ability to understand, use and manage emotions effectively.

Gardner (1983, 1999) developed Multiple Intelligence theory in the late 1970's and early 1980's, which asserts that there are different types of intelligence that relate to individual differences. This theory considers not only 'normal' children or adults, but also individuals who may have brain damage, mental retardation. According to this theory, intelligence can be divided into at least eight different components: logical-mathematical (problem solving and learning higher mathematic functions), linguistic (communicating in both speech and writing), spatial (conception of objects' orientation in space), musical (composing and learning music), bodily-kinesthetic (mastery over use of the body), naturalistic intelligence (understanding of natural features), intrapersonal (auto-self-conscious, understanding one's own body and mind) and interpersonal (to understand and connect with others). In contrast to traditional intelligence tests aiming only to measure

linguistic and logical abilities in pen and paper format, multiple- intelligence considers several intelligence types and measures them in different ways, such as speech or bodily movement, finding a route in a new city, or learning to play a piano, etc.

Since Gardner's (1983, 1999) theory, multiple intelligences have been defined by other researchers. Sternberg (1985), for example, argues that intelligence has three fundamental sub-components: analytic, creative and practical, which have a balanced interrelationship with each other (The Triarchic Theory of Intelligence).

In the early 1990's, Ceci (1990) proposed the bio-ecological approach as a reaction to Spearman's (1904) general intelligence theory (the *g* factor) and described intelligence as a mental potential based on biological factors. Shortly after, Herrnstein and Murray (1994) proposed a new debate on the meaning and features of intelligence in their book *The Bell Curve*. The book argued that intelligence is the greatest determining factor for different SES (socio-economic status) groups, and in the criminal misbehaviour of different ethnic groups in society. This has since been heavily criticized as racist and inflammatory.

As a response to *The Bell Curve*, 52 researchers proposed and signed a joint definition of intelligence, known as 'Mainstream Science on Intelligence' (Gottfredson, 1997), which states that "intelligence is a very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly and learn from experience" (Gottfredson, 1997, p.13). It proposes that intelligence is a measurable thing and can be mostly well measured with intelligence tests, and even if these tests differ in concept or format, they all intend to measure intelligence with the same aim.

The American Psychological Association (APA) also responded to *The Bell Curve* in a different way from 'Mainstream Science on Intelligence' by emphasising individual differences in intelligence, stating that "individuals differ from one another in their ability to understand complex ideas, to adapt effectively to the environment, to learn from experience,

to engage in various forms of reasoning, to overcome obstacles by taking thought" (Neisser et al., 1996, p. 77). According to Neisser et al. (1996), it is important to accept individual differences when considering intelligence, as individuals have different environmental experiences and they learn according to these experiences, and some do not have the chance to learn a specific ability. The level or learning of ability should not be considered as 'intelligence'. These important notes were considered and explained in the APA report. Of the 11 experts who produced the APA report, three were also signatories to the 'Mainstream Science of intelligence' (Gottfredson, 1997).

2.3.2 Early studies on Bilingualism and Cognitive development

Prior to the 1960s, research on the relationship between bilingualism and cognitive development tended to the conclusion that bilingualism had a negative effect on linguistic and cognitive development, and that bilinguals were at a disadvantage in comparison with their monolingual counterparts (Arsenian, 1902; Arsenian, 1937; Fucuda, 1925; Graham, 1926). For example, Jones (1928) found that bilingual children in a majority language community aged 8 to 16 scored very poor medians on a vocabulary and oral test at each age and grade level. Darcy (1953, 1963) referred to the negative effects of bilingualism as a handicap, and this view of the deficient interference of bilingualism was supported by several early studies in terms of linguistics. Several studies prior to 1960 (e.g. Kelley, 1936; Tireman, 1955) concluded that bilingualism has a negative effect on a child's cognitive, linguistic and intelligence development. The negative associations of bilingualism and cognitive development had been found through academic and verbal tests of intelligence, showing that bilinguals were at a lower level than monolinguals in terms of intelligence and academic achievement tests (e.g. Doyle, Champagne, & Segalowitz, 1977; Macnamara, 1966; Torrance, Gowan, Wu, & Aliotti, 1970; Tsushima & Hogan, 1975).

However, in an early study, Saer (1923) conducted two studies using the Stanford-Binet intelligence and vocabulary test, for example, involving urban and rural samples of school-children aged 7-12 and university students. While no significant difference was found between urban Welsh bilinguals and English monolinguals, differences were observed for rural Welsh bilinguals. The study reported that monolinguals had a significantly higher vocabulary score than rural Welsh-English bilingual children and university students in both languages. He argued that urban children were better at resolving the emotional conflict between Welsh and English at an earlier age than rural children because English was the language of play for urban bilingual children. Similarly, in their study on Welsh-English bilinguals, Barke and Williams (1938) found an advantage for monolinguals on English verbal vocabulary tests, but discovered no significant difference in nonverbal intelligence between the groups.

Hakuta and Diaz (1985; Hakuta, 1986) examined the early studies, and emphasized several methodological flaws in which verbal standardized intelligence tests were used. Additionally, Cummins (1976) found these early studies unreliable as they lack a well-designed methodology. One of the most serious flaws is the fact that results are not controlled for SES level differences between groups, and the bilingual participants were mainly from lower economic classes than the monolinguals (Anastasi & Cordova, 1953; Barke, 1933; Saer, 1924). A further weakness of early studies was the quality of assessment and how levels of bilingualism were defined and evaluated (Brill, 1936; Carlson & Henderson, 1950). Subjects were categorized according to their parents' nationality (and place of birth) or language backgrounds (Brunner, 1929), and no clear description of the bilingual participants was offered (Bossard, 1945), raising real questions as to whether the participants were bilinguals at all.

In addition to all of this, a methodological problem with early studies was that the verbal-intelligence tests were administered in English only (Barke & Williams, 1938; Darcy, 1946; Darsie, 1926; Pintner & Keller, 1922). Arsenian (1945), for instance, compared bilinguals and monolinguals with verbal and nonverbal intelligence tests and found that there was no significant difference between bilinguals and monolinguals in nonverbal intelligence but that there was in the verbal intelligence test. Similarly, Darcy (1946) administered both verbal (Stanford-Binet) and nonverbal (Atkins Object-fitting) tests to assess Italian bilingual and English monolingual pre-schoolers in Manhattan, and discovered that while bilinguals achieved similar scores in nonverbal tests to monolinguals, they scored lower in the verbal test. Darcy (1953) concluded that this difference was a result of the negative effect of the bilingual's second language.

In their 1962 study, Peal and Lambert (1962) broke through these methodological weaknesses by experimentally controlling group differences in terms of SES, age, sex and language when comparing age 10 French-English bilinguals and English monolinguals on both verbal and nonverbal intelligence tests. In this study, bilinguals were defined as 'balanced bilingual', carefully selected and categorized according to four different standardized measures, in contrast to early studies where subjects were not necessarily fully proficient in both languages. Peal and Lambert argued that balanced bilinguals had to be involved in order to draw accurate conclusions about the effects of bilingualism on intelligence. In contrast to the findings of the early studies, they found that bilinguals had significant advantages over their monolingual peers in both verbal and nonverbal cognitive tests which required mental and symbolic superiority. The bilinguals in this study outperformed the monolingual counterparts in concept formation skills and reorganizing visual symbols, and their research had significant influence on education policy and immersion programs in Canada. Peal and Lambert's (1962) research can be considered to

have been the cutting edge in terms of methodologically well-controlled studies, and among the first of many to find bilingual advantage over monolinguals.

Since then, several studies have lent support to the notion that bilingualism positively affects cognitive development to some extent. Researchers began to explore further positive effects of bilingualism on cognitive development from different perspectives, and found several advantages in terms of language and cognitive development ability as well as different areas of aptitude, such as superiority in separation of sound and meaning (Leopold, 1953), awareness of the systematicity of two languages and linguistic operations (Vygotsky, 1962), analytic orientation and strategies to language and linguistic interference (Ben-Zeev, 1977) meta-linguistic awareness (Cummins, 1976, 1978a, 1978b) and nonverbal intelligence (Hakuta & Diaz, 1985).

The majority of studies into bilingualism conducted in the 1970s (e.g. Carringer, 1974; Dubé & Hébert, 1975; Lambert, 1977; Scutnabb-Kangas & Toukomaa, 1976; Swain & Cummins, 1979; Tremaine, 1975), however, showed that bilingualism has a positive effect on the child in terms of their linguistic, intelligence and cognitive development, reporting that, contrary to previous research, bilinguals achieved a higher level in linguistic and cognitive skills tests than their monolingual peers. Throughout the 1970s, research on bilingualism and cognitive development focussed on the advantages of bilinguals' meta-linguistic awareness over monolinguals. Feldman and Shen (1971) were the first to clarify such a meta-linguistic advantage in their study on five-year old Spanish-English bilinguals in the United States, who were found to be better than their monolingual peers at using different kinds of labels like common-switched, non-words and standard in the context of sentences. Similarly, Ianco-Worrall (1972) found meta-linguistic advantages of Afrikaans-English bilinguals between the ages of 4 and 6 over monolinguals in terms of semantic-phonetic interpretation and preference, and Cummins and Gulutsan (1974) used several tests of memory, reasoning and

divergent thinking on 11-year old bilinguals, who over-performed on verbal ability and general reasoning. These results were linked to bilingualism in terms of the common operation of two labels for one referent.

Cummins (1976) developed more elaborate view with regard to the contrast between negative early and more recent positive findings on bilingualism and cognitive development by developing a theory about bilingual linguistic competence in both languages. According to Cummins (1976), earlier studies had mainly focussed on bilinguals whose L1 was gradually replaced by L2, whereas more recent studies focussed on balanced bilinguals at a high level in L2 and showing no deficit in L1. He hypothesised that there is an important threshold level of both L1 and L2 that must be attained to observe the positive effects of bilingualism on cognitive development. He suggested that linguistic factors on their own cannot be enough to explain the positive and negative effects of bilingualism on cognitive development, therefore the level of linguistic competence in both languages can affect the bilingual learning experience. In this study, Cummins (1976) proposed a three-level chart related with cognitive development in terms of bilingualism. According to the Threshold Hypothesis, bilinguals have a high level of competence in both languages at the top level and bilingualism demonstrates cognitive advantages at this level, whereas at the bottom level, bilinguals are at a low level of competence in both of their languages and bilingualism shows cognitive disadvantages. In the middle level of chart, bilinguals have high level competence in one of their languages, bilingualism leads to neither cognitive advantages nor disadvantages (In the lower threshold level of competence, whereby bilinguals have a low level of competence in both of languages, bilingualism does have negative cognitive effects, whereas at the higher level, with bilinguals at a high level of competence in both of their languages, bilingualism shows positive cognitive effects).

This hypothesis explains the relationship between degree of bilingualism and cognition, suggesting the notion that bilinguals with high levels of competence in both languages experience the cognitive advantages of bilingualism while low levels of competence in both languages result in cognitive deficits. The Threshold Level Hypothesis (Cummins, 1976, 1979) attempts to explain the cognitive effects of bilingualism in terms of low and high language competence, according to the bilingual's cognitive stage and academic language proficiency level.

In the eighties, building on the earlier Threshold hypothesis, Cummins and Swain (1986, p.18) proposed the 'Dual Threshold Model' of bilingual proficiency. This model posited that that L1 and L2 proficiency level is directly related to cognitive ability and cognitive advantage can only be possible for balanced bilinguals (equal language proficiency in both languages). In this model, bilingual proficiency is divided into three levels: balanced bilinguals, second threshold and first threshold (see Baker, 2007 describing the three floors of a house, above), and it takes into account the value of L1 level as well as L2 level. Later, more advantages were found around bilingualism, like Romaine (1986), who wrote that if bilinguals have a suitable atmosphere, they find it easier to develop their language proficiency in both languages.

While the Threshold Level Hypothesis has been criticised in terms of categorization of bilingualism (Diaz, 1985a, 1985b), several studies have been carried out using it as a framework (Barik & Swain, 1976; Cummins & Mulcahy, 1978; Duncan & DeAvila, 1979), focussing on the effects of different degrees of bilingualism on cognitive ability. Barik and Swain (1976) carried out the first longitudinal study on the effects of bilingualism on intelligence, and found that high L2 achievers in a French immersion program performed higher in subtests of analogies and following verbal instructions than low L2 achievers. High L2 achievers also had higher IQ scores than low L2 achievers at the end of the immersion

program. This study supported the Threshold hypothesis, and suggested that in bilingual groups including both high and low competency bilinguals (above and below the threshold), the mixture of results can conceal the outperformance of bilinguals in comparison to monolinguals.

Similarly, Cummins and Mulcahy (1978a) found positive effects of bilingualism on meta-linguistic awareness in a study, carefully controlled in terms of SES, IQ and school, on Ukranian-English balanced bilingual children in grades 1 and 3. The bilingual children were significantly better at analysing ambiguous sentence structures than the monolinguals. Around the same time, Cummins (1978b) carried out a study on Irish-English bilinguals in grades 3 and 6, and found they demonstrated advantages in awareness of the arbitrariness of language tasks and non-empirical statement questions (with SES and IQ controlled). These studies supported Vygotsky's (1962) hypothesis that bilingualism had a positive effect on the awareness of language operations: Vygotsky (1962) had discussed the effects of bilingualism and claimed that bilinguals have the ability to recognize their language system specifically, and this ability leads the bilinguals to identify their language operation features with a high level of awareness.

Duncan and DeAvila (1979) demonstrated the effect of degree of bilingualism on cognitive abilities. They classified Spanish-English bilinguals with different language proficiencies into five groups: proficient bilinguals, partial bilinguals, monolinguals, limited bilingual and late second-language learners. The results supported Cummin's (1976) Threshold hypothesis in finding that 'proficient bilinguals' performed the highest in all measures of cognitive ability. The study demonstrated a clear limitation, however, in that subjects' IQ and basic intellectual abilities were not controlled.

To avoid methodological limitations surrounding control of the variables of IQ, SES, first and second language proficiency etc., Diaz (1985a) and Diaz and Padilla (1985)

suggested the use of control group techniques. Hakuta (1985) demonstrated this in a study finding that low-SES Hispanic bilingual children with a high proficiency in L1 and L2 in bilingual education programs performed better on measures of both intelligence and meta-linguistic awareness when samples were controlled. Hakuta and Diaz (1985) carried out a longitudinal study involving measuring the progress of both languages in a bilingual education program of more than 300 low-SES Spanish-English elementary school children with a low level of L2 proficiency. They found that degree of bilingualism was positively related to nonverbal intelligence when SES and age was controlled. As the children's L2 improved over time, their scores in nonverbal intelligence tests also increased, suggesting that development in L2 leads to cognitive improvement. This study has important implications in terms of explaining the relationship between degree of bilingualism and intelligence, and for examining the direction of causality. Diaz (1985 a) also carried out a similar longitudinal study examining Spanish-English kindergarten children enrolled in a bilingual education program, finding L2 proficiency to be a good predictor for nonverbal intelligence and meta-linguistic awareness and clarifying the cause and effect issue with regard to bilingualism and cognitive development.

Many of the studies which have found a positive correlation between bilingualism and cognitive development examined bilinguals, and there has been criticism of the Threshold hypothesis regarding categorization of bilingualism on cognitive ability: Garcia (1985) argued that the hypothesis primarily supported similar studies on balanced bilinguals with a high level of L2 and with high SES, but failed to represent low-level L2 bilingual achievers with low SES, concluding that studies on the former cannot be generalized to all bilinguals. Diaz (1985b) discussed the difficulties of Threshold hypothesis evaluation, finding that degree of bilingualism can only be a good predictor for cognitive variability only before a certain threshold level has been reached. While positive effects of bilingualism have predominantly

been found in additive bilingualism, children with subtractive bilingualism showed academic difficulties and cognitive deficits.

Baker (2007) described the Threshold hypothesis as three floors of a house. On the first floor, the language competence of learners in both their first and second language is not adequately developed and at a low level, and their academic performance is poor. On the second floor, learners are good at only one language and they use their more developed language in the classroom, but demonstrate cognitive disadvantages when compared with monolinguals. The third floor represents balanced bilinguals with age-appropriate language competence in both of their languages, and these show cognitive advantages over monolinguals, as well as superior academic performance. Although as stated earlier, "balanced" bilinguals hardly exist in real life.

Li Wei (2000) has criticised earlier studies, which found negative effects of bilingualism on children's cognitive and linguistic development, as having several methodological and testing problems. Most of these earlier studies focussed on the bilingual subjects' non-dominant language, and most of them used intelligence or IQ tests to measure linguistic or cognitive ability. This discrepancy explains why these studies showed negative results for bilinguals, and why monolinguals achieved greater mastery in intelligence and cognitive tests: the bilinguals' second languages were being held to the same standard as the monolinguals' first languages – an unfair standard. Wei (2000) points out if language proficiency level is low, the reason cannot be bilingualism, but one or several different social, economic or political reasons. He therefore concluded that if a bilingual has a problem in his language development, the reason could be from one of a plethora of other factors unrelated to bilingualism.

Cummins (1980) further proposed the common underlying proficiency theory to clarify the language operating system of bilinguals. Cummins' (1980) CUP theory refers to

the interdependence of concepts, language and linguistic skills in a central processing system. Cummins further explained his Common Underlying Proficiency (CUP) model with the dual iceberg analogy (Cummins, 1980). Two languages are presented as two icebergs on the surface, but there is a common operating language system underlying both languages. In this model, even if the two languages appear separate on the surface, there is a joint operating system which processes both languages, therefore all knowledge developed in one language can be easily transferred to a second (or more) language consistently. The dual Iceberg model (Cummins, 1980) is depicted in Figure 1 (below).

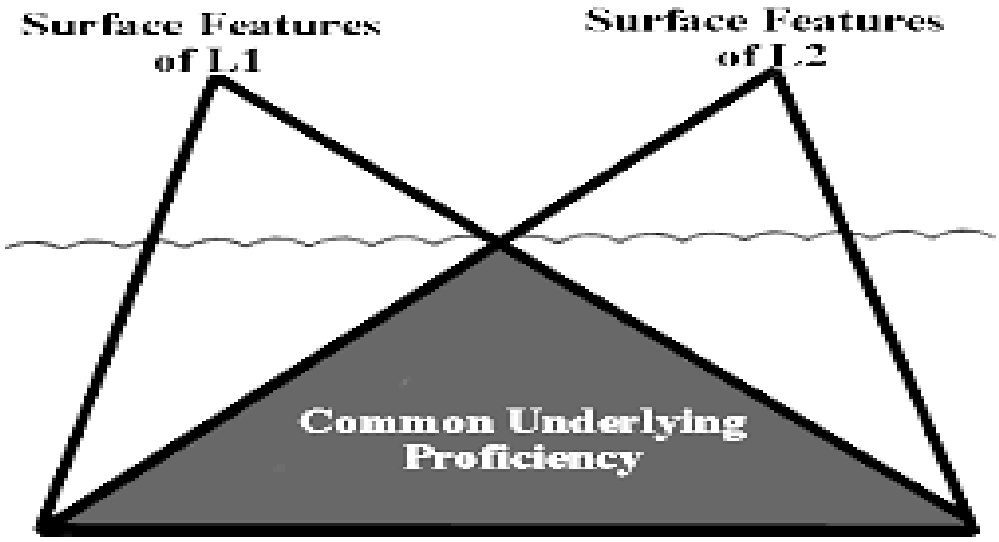

Figure 1. The Dual-Iceberg representation of bilingual proficiency (adapted from Cummins, 1980, p.36)

The CUP theory is the basis of the linguistic interdependence hypothesis, developed by Cummins (1979) to clarify the relationship between first and second language competence. Cummins (1979) describes a bilingual's second language competence as partly dependent on the level of first language competence they had reached when began to learn L2. The positive effect of L1 competence on L2 can only be seen when a bilingual attains a high level in L1 competence before learning L2 intensively. If a bilingual has a low L1 level when they start learning L2, the L2 will be limited to a low level as well, so a high L1 level competence is crucial for achieving a similar level of L2 competence.

In formally defining the Developmental Interdependence Hypothesis, Cummins (1984, p. 41) stated that "to the extent that instruction in Lx is effective in promoting proficiency in Lx, transfer of this proficiency to Ly will occur provided there is adequate exposure to Ly (either in school or environment) and adequate motivation to learn Ly". According to this statement, Lx refers to L1 and Ly refers to L2. If bilinguals have sufficient L1 language proficiency with good L1 learning support, their high L1 proficiency is transferred to their L2 proficiency with sufficient L2 formal or informal learning support. So both L1 and L2 language support are important for beneficial transfer of L1 proficiency to L2.

A number of studies have provided evidence for the Interdependence hypothesis in terms of different language and literacy skills. Early research demonstrated a positive relationship between L1 and L2 in terms of reading and literacy abilities (Cummins, 1991; Skutnabb-Tangas & Toukomaa, 1976; Verhoeven, 1991a, 1991b, 1994, 2000), conceptual and discourse strategies (Rehbein, 1984), phonological awareness (Verhoeven, 1994, 2007) and writing performance (Lanauze & Snow, 1989).

Some prominent studies have provided research findings in support of CUP Theory in the literature. Verhoeven (1991a) carried out a study on the literacy development of 138 first grade Turkish-Dutch bilingual children in Netherlands. One group of children were provided L2 literacy instruction before their L1 in an L2 submersion program, and an L1 transition group of children were provided L1 literacy instruction before L2. Positive transfer of L2 literacy skills to L1 was observed in the L2 submersion program and there was positive transfer of L1 literacy skills to L2 literacy skills in the L1 transition group as well. Van Gelderen, Schoonen, Stoel, de Glopper, and Hulstjn (2007) examined 389 adolescent bilinguals over three years from grades 8 to 10. The results demonstrated a positive correlation between L1 Dutch and L2 English reading comprehension development, and the study concluded that L1 reading comprehension is a good predictor for L2 comprehension rather than other linguistic skills. Verhoeven (2000) also examined the positive relationship

between L1 and L2 reading and spelling skills of bilinguals in grade 1 and 2 children at a primary school. The findings suggested a positive transfer in reading abilities between L1 and L2, and that vocabulary knowledge has a positive effect on L2 reading comprehension. Droop and Verhoeven (2003) later demonstrated a positive correlation between L2 language skills and L2 reading comprehension, and stated vocabulary knowledge can be a good predictor for L2 reading comprehension. No clear evidence was found, however, to support the idea of lexical knowledge relations among L1 Turkish and L2 Dutch in these studies (Droop & Verhoeven, 2003; Verhoeven, 1994, 2000).

Verhoeven (2007) carried out a more recent study on a different language aspect which supports the Interdependence Hypothesis, demonstrating the relationship between L1 and L2 phonological awareness. 78 Turkish-Dutch bilingual children's phonological awareness progress in kindergarten was assessed at the beginning and end of the kindergarten year, and the findings supported transfer from L1 to L2 in terms of phonological awareness. This evidence also supported Cummins' (1979) Interdependence hypothesis in terms of language skills. With respect to vocabulary, however, there is limited research evidence that supports vocabulary knowledge transfer between two distant languages such as Turkish-Dutch or Turkish-English. Verhoeven (1994) had previously carried out a study to analyse the interdependence and transfer between L1 and L2 of 98 Turkish- Dutch bilingual children in the Netherlands in terms of pragmatic, phonological, lexical, morphological, syntactic and literacy abilities. The findings demonstrated a strong positive correlation across Turkish and Dutch in pragmatic, literacy and phonological aspects, but little interdependence evidence in lexical, morphological and syntactical skills.

Most recent studies have provided evidence on the vocabulary knowledge relationship between two dissimilar languages, such as Turkish-Dutch. Scheele, Leseman, and Mayo (2010) investigated the cross-language transfer of vocabulary skills from L1 to L2 in 55

Turkish-Dutch and 46 Moroccan-Dutch bilingual children, compared in terms of vocabulary skills in both languages. The results supported the idea that the bilingual children with different first language knowledge in early age use their L1 vocabulary skills to develop their L2 vocabulary skills to some extent.

Evidence has also been found of first language input effects on first- and second-language vocabulary knowledge. Demir-Vegter, Aarts, and Kurvers (2014) investigated the relationship between vocabulary knowledge in maternal input and subsequent vocabulary size in L1 and L2 with 15 preschool children in the Netherlands. The vocabulary input was analyzed both qualitatively and quantitatively in three different settings. Children were tested in Turkish at the age of 3 and 4, in Dutch at the age of 5 and 10 months. The findings suggest that vocabulary knowledge of input in L1 at an early age can be a good predictor for L2 lexical richness at a later age. Vocabulary knowledge in maternal input has an important impact on vocabulary size of children in L1, and also in L2 over a period of a time. Another empirical study by Masrai and Milton (2015) examined the relationship between L1 lexical organization and L2 vocabulary development of 191 Arabic male students between 16 and 18 years old in a secondary school. The findings showed a positive correlation between L1 Arabic and L2 English mental lexicon sizes.

Previous studies have provided evidence of the relationship between bilinguals' L1 and L2 for reading comprehension, literacy and spelling skills, phonological awareness and vocabulary skills (Lanauze & Snow, 1989; Verhoeven, 1994, 2007) although studies providing direct evidence for the relationship between L1 and L2 vocabulary sizes are very scarce. Recent findings aside, there is still very limited research in this field of study in terms of investigating the relationship between L1 and L2 vocabulary size, so additional research is needed to empirically examine the vocabulary size interdependence between two distinct languages. The differences between the Turkish and English languages are explained in the

Turkish Language section (2.1.2) in more detail. The current study aims to examine the link between receptive and productive vocabulary in L1 and L2.

When it comes to languages with typologically similar structures (like Spanish-English), most recent studies have provided positive findings on the relationship between L1 and L2 lexical knowledge. Umbel and Oller (1995) reported a positive relationship between L1 Spanish and L2 English receptive vocabulary knowledge with 102 Spanish-English bilingual children from the first, third and sixth grade in Miami. The findings suggest that L1 Spanish receptive vocabulary is a good predictor for L2 English vocabulary. Additionally, Ordonez, Carlo, Snow, and McLaughlin (2002) investigated superordinate vocabulary transfer from L1 Spanish to L2 English with 88 Spanish-English bilinguals in grades 4 and 5, finding that the children showed a similar performance on both L1 and L2 superordinate vocabulary identification.

There are other studies that show results along the same lines. Freeman and Freeman (1998) suggested that progress in a bilingual's first language increased the speed of their L2 progress, and Jiang and Kuehn's (2001) findings supported the idea that the level of L1 language proficiency positively affects L2 language proficiency. Baker (2007) also found that development in L1 leads to easier L2 development. These results all support the Linguistic Interdependence hypothesis in terms of initial language skills transferral from L1 to L2.

Another important implication from Cummins' Interdependence Hypothesis is the importance of bilingual immersion education programs. According to the Interdependence Hypothesis (Cummins, 1986), instruction through a minority language is effective for academic proficiency in the minority language, and this academic proficiency can transfer to the majority language when sufficient language exposure occurs. The possible interrelationship between L1 and L2 of bilingual children also affects their academic proficiency. Cummins (1986) argues that bilingual children instructed through the minority

language for all or part of the school day perform as well as children instructed entirely in English (presuming English is the majority language), so language of instruction has no effect on English academic skills development. Cummins (2000) later suggested that bilingual students be empowered through the school curriculum, which should include the minority language and culture, as if a minority language child's home language and culture are not included in the curriculum, the child may become academically disabled. Including the minority language in the school curriculum may also have positive effects on bilingual children's self-confidence, personality, attitudes, and social and emotional well-being, so bilingual education programs should be supported in bilingual settings to reap more benefit for the academic achievement of bilingual children. This point will be expanded later, in the 'Implications for Policy Makers' section of Chapter 6 (Conclusion).

2.3.3 Recent studies on Bilingualism and Cognitive development

In the late 1990s, Baker and Prys Jones (1998) argued that the advantages of bilingualism can be seen in communicative, cognitive and cultural factors. In communicative language, bilingual children can communicate with their parents in their preferred language that may differ from their second language. This communicative ability is of benefit for bilinguals in their relations with their relatives, and contributes toward the development of a bilingual's communication in a community: a bilingual child can act as a bridge between two social communities. Viewing bilingualism in this way helps draw attention to the importance of communication skills, and communicative awareness can be directly related to cultural benefits, as two or more different cultures can be learned at the same time. Bilingualism was also found to have a positive effect on a bilingual's job prospects. All of these potential advantages can be seen in cognitive development: bilinguals may possess wider thinking abilities, and greater sensitivity in communication, allowing them to view the same thing from two (or more) different, wider perspectives.

Psycholinguists have been paying attention to the relationship between bilingualism and cognitive development in terms of meta-linguistic awareness. Bialystok (1988) investigated the relationship between bilingualism and meta-linguistic awareness used by the analysis and control framework, and found that high L2 bilinguals were better in analysis tasks than low L2 bilinguals, and that bilinguals were better at process control than monolinguals. In the same line, Ricciardelli (1992) found that bilinguals with a high level of language proficiency scored better than those with a low level of proficiency in meta-linguistic and nonverbal achievement tests, and also outperformed their monolingual peers on divergent thinking tasks. This study supported Cummins' (1976) Threshold hypothesis, as described earlier. Bialystok and Hakuta (1994) went on to argue the linguistic benefits of being a bilingual: use of two different languages gives rise to gains in meta-linguistic awareness (distinguishing different grammatical and syntactical structures, understanding the arbitrariness of labels, etc). Similar studies have demonstrated several advantages of bilingualism on cognitive development in terms of meta-linguistic awareness factors such as distinguishing grammatical and syntactical errors (Bialystok, 1987), symbolic representation of the written word (Bialystok, 1997), problem solving (Bialystok & Majumder, 1998), stronger meta-linguistic skills (Goetz, 2003) and reading ability (Bialystok, Luk, & Kwan, 2005). Bialystok and Hakuta (1994) therefore argued that bilinguals gain several benefits from their two languages which give generalized cognitive advantages over monolinguals (particularly regarding meta-linguistic awareness).

Researchers have in recent years continued to develop alternative theories and methodologies around the effects of bilingualism on cognitive ability, and the number of studies on bilingualism and cognition has enormously increased, especially in the area of executive functioning system). According to Barac and Bialystok (2011, p.37), executive functions are those cognitive processes and abilities such as 'attention', 'selection', 'inhibition', 'shifting' and 'flexibility'.

Bialystok (1999) has made a significant contribution to the area of bilingual advantages on cognitive development by carrying out several experiments that show bilinguals outperforming monolinguals in terms of executive control, and suggesting that bilingualism gives an individual advantage of better attention control in several cognitive areas. Bialystok (1999) compared 4-5 year old bilingual and monolingual children in terms of attentional control with the dimensional change card sort task and the moving sort task, and bilinguals outperformed monolinguals on both tasks. This study demonstrated clear evidence for bilingual advantage over monolinguals in executive functioning and attention. In a follow-up study, Bialystok and Martin (2004) found a determining factor: the ability to create new mental representations using previous associations. Goetz (2003) found a bilingual advantage in inhibitory control and greater sociolinguistic ability over monolinguals, and this advantage in executive control was found in bilinguals from different SES and ethnic backgrounds. Mezzacappa (2004) examined 6-year old Hispanic bilinguals from low-SES backgrounds, demonstrating their high performance on executive attention tasks. Carlson and Meltzoff (2008) drew a similar conclusion with their results that showed bilinguals outperformed monolinguals on executive tasks when SES backgrounds, age and receptive vocabulary were statistically controlled.

Recently, Morton and Harper (2007) demonstrated that bilinguals from higher SES families have an advantage in the Simon task over bilinguals from low SES families, suggesting that SES and ethnic differences may cause a reduction to this bilingual advantage on cognitive control. The Simon Task was developed to assess if the reaction times of participants are faster or more accurate for each given stimuli. During the test, participants are given stimuli on either the right or the left hand side and asked to response by pressing either the right or the left vibration handle. The Simon Task consists of four blocks with 100

congruent and incongruent trials each and 200 trials in each modality. The response time for each trial is recorded.

Even more recent studies, though, have continued to find bilingual advantages on cognitive development in terms of executive control and attention (Bialystok, 2010; Bialystok & Viswanathan, 2009; Kovacs, 2009). Adesope, Lavin, Thompson, and Ungerleider (2010) carried out 63 studies focussed on bilingual advantage on cognitive development and found bilingualism to have several advantages on cognitive development in terms of executive functions defined as problem solving, inhibitory control, attentional control, mental flexibility, working memory and task switching, and concluded that bilinguals enjoy benefits in such cognitive processes.

Valian (2014) recently criticized prior studies on bilingual advantage in executive control, arguing that there was no clarification about the definition and measurement of executive control. She maintains that researchers use different procedures and tasks to measure similar executive functions, or use the same tasks for different targets of executive function. Paap (2015) supported Valian`s (2014) discussion of bilingual advantages on executive function, and agreed that there are different mechanisms which affect the correlation between bilingualism and executive functioning. The relationship between the advantages of bilingualism and executive functioning should be explored with consideration of underlying cognitive mechanisms.

Kaushanskaya and Prior (2014) have also discussed similar methodological problems surrounding the lack of control for variables in measuring bilingual executive control, and recommend more specificity with definition and measurement, not only of executive control, but also bilingualism itself. In this vein, Marton (2015) has called for theoretical models to clarify the possible interaction between the executive control and language processing abilities of bilinguals that do not suffer from the methodological problems of comparing

bilinguals and monolinguals. Most recently, Paap, John, and Sawi (2015) have provided a summary of the studies on the advantages of bilingualism since 2011. Interestingly, more than 80% of the studies with larger sample sizes demonstrated evidence for no bilingual advantage in the executive control and functioning tests. They concluded that a bilingual advantage in executive control does not exist, and occurs only rarely in some circumstances. This idea has caused a compelling argument on the advantages of bilingualism and received criticism across the field. De Bruin and Della Sala (2015) provided an overview of 108 studies on bilingualism and executive control and found that the studies from 2004 to 2014 did not demonstrate a bilingual advantage. Morton (2015) similarly criticised the idea of bilingual advantages on cognition, pointing out the lack of method and interpretation of the study findings and suggesting a common methodology that could provide clear results of the bilingual advantage in cognition.

2.3.4 Approaches to Nonverbal intelligence assessment

Intelligence tests are used clinically, psychologically, psychometrically and educationally in other research areas. In accordance with the aim of the present study, Raven's Coloured Progressive Matrices (Raven, Raven, & Court, 2004) is used to measure the nonverbal intelligence of the participants (This will be discussed in more detail in the Methodology section). With this in mind, it is useful to review commonly used nonverbal intelligence tests for assessing children, in order to understand the general features of these tests and the differences between them, and to clarify why Raven's Coloured Progressive Matrices has been selected for this study.

The first group of nonverbal intelligence tests for children comprises tests which have only nonverbal sub-tests with no mixed verbal sub-tests. In this group, some of the most commonly used nonverbal intelligence tests will be summarized. One of the most commonly used nonverbal intelligence tests is the Columbia Mental Maturity Scale - Third Edition

(CMMS-3; Burgemeister, Hollander, & Lorge, 1972), designed for children between 3 years and 6 months and 9 years and 11 months. The test consists of nonverbal subtests which provide a series of pictures or figures to select for completing a task. The test instructions are given verbally and the maximum time to complete the test is 20 minutes. Another nonverbal intelligence test is Kaufman and Kaufman's (1983) Kaufman Assessment Battery for Children (K-ABC), designed for children between 4 years and 12 years and 6 months. The test is between 35 and 50 minutes in duration, making it longer than other nonverbal intelligence tests of its kind (CMMS, Raven's Coloured Progressive Matrices or Stanford-Binet Intelligence Scale). Children carry out tasks using photographs, cards and coloured foam squares and triangles. One of the sub-tests is face recognition, whereby the children are asked to perform a face-matching task, and this is specifically for 4-year old children along with another sub-test on hand movement imitation, in which the instructor makes a hand movement and the children are asked to do same thing. For the children between 5 and 12, matrix analogies for picture selection or spatial memory for identifying the shapes of pictured items are used. The most challenging sub-test is that of organising a series of photographs according to the chronological order of a story, used for children between 6 and 12. The test also contains achievement and mental processing sub-tests.

The Leiter International Performance Scale – Revised (Leiter-R; Roid & Miller, 1997) is designed for children (and young adults) between 2 and 20 years and 11 months. In this test, children use foam shapes to complete a figure, find pictures in illustrations, and use picture cards to complete design and visual analogies. Other sub-tests include sequential ordering of pictures, classification of foam shapes, tasks for finding the most suitable shape or picture for the illustrated pattern, a picture matching task and a paper-folding task.

There are nonverbal intelligence tests designed for both children and adults, such as the Comprehensive Test of Nonverbal Intelligence (CTONI; Hammill, Pearson, &

Wiederholt, 1997), a nonverbal intelligence test for a wide range of age groups from age 6 to 90. The test takes between 40 and 60 minutes, longer than Kaufman Assessment Battery for Children. The CTONI has several sub-tests involving pictorial and geometric identification, such as pictorial analogies for testing ability to identify the relationship between picture matrices, and categories for identifying geometric designs.

Another of these is the Test of Nonverbal Intelligence – Third edition (TONI-3; Brown, Sherbenou, & Johnsen, 1997), developed for participants between 6 and 89 years and 11 months in a range of age groups. The test completion time is shorter than other tests such as Kaufman's and CTONI, at only 15 to 20 minutes. The test focuses on problem solving of abstract figures, and logical completion of a picture series from a selection.

The Universal Nonverbal Intelligence Test (UNIT; Bracken & McCallum, 1998), however, is designed only for those between 5 and 17 years and 11 months, and takes 30 minutes. Testees of UNIT use cubes, plastic chips, pencils and circular plastic response chips to complete symbolic and spatial memory tasks, and the test includes a sub-test for analogic reasoning by requiring testees to complete an analogy by choosing the appropriate picture, and a test for three-dimensional picture design (using a Cube design).

The Naglieri Nonverbal Ability Test (NNAT; Naglieri, 2003) is for precisely the same age group as the UNIT, and takes the same amount of time. The test is based on completing figural matrix items by choosing a pattern to complete a whole, and like UNIT there are no sub-tests.

The Stanford-Binet Intelligence Scale – Fifth Edition (SB5; Roid, 2003) contains several different sub-tests, such as object matrices, picture absurdities, form board and form patterns, procedural knowledge, quantitative reasoning, block span and delayed response. The test is for a large range of age groups from 2 to 89 years and 11 months, and only takes 30 minutes in spite of the quantity of sub-tests. Testees are asked to solve figural problems by

choosing appropriate target pictures and objects in object matrices, and the picture absurdities sub-test requires testees to select missing details in a whole picture and complete the whole picture by finding the missing words.

The last test in this group is Raven's Coloured Progressive Matrices (RCPM; Raven, Raven, & Court, 2004), a 45-minute test designed for children between 5 and a half and 11 and a half years old. The matrices have patterns to complete so testees are asked to choose the appropriate pattern for the missing part of the matrices from six options. RCPM is the test chosen for the nonverbal intelligence section of this study, as it is a culture-fair test (Raven, Raven, & Court, 2004) and there is no verbal sub-test (like the other tests in this group), so RCPM can be used for both bilingual and monolingual children from anywhere in the world. It is also age-appropriate for the participants of this study. RCPM is discussed in greater detail later, in the methodology section, as it is used in the current study.

The second group of intelligence tests also focuses on nonverbal intelligence, but include verbal sub-tests. One of these is Differential Ability Scales (DAS; Elliott, 1990), developed for children between 2 and a half and 17 years and 11 months. It contains a verbal cluster component for testees aged between 3 and a half and 17 and a half. For the nonverbal section, testees are asked to use wooden blocks, plastic cubes, picture cards and foam squares to complete nonverbal tasks such as finding picture similarities, which is designed for ages between 2 and a half and 5 and 11 months, block building tasks for ages 2 and a half to 3 and a half, copying line drawings for those between 3 and a half and 5 and 11 months, and both sequential and quantitative reasoning and drawing abstract designs for between 6 and 17 and 11 months. This test takes between 15 and 30 minutes to administer, which is short test in comparison with other tests described above.

The Wechsler Abbreviated Scale of Intelligence (WASI; Psychological Corporation, 1999) is fairly similar to DAS containing nonverbal and verbal components such as matrix

reasoning and block building. WAIS is the shortest of the nonverbal intelligence tests and is designed for anyone aged 6 to 89, with a specific version for children aged 6 to 16 and 11 months called the Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV; Wechsler, 2003). WISC-IV has modified versions of the block design and matrix reasoning sub-tests, as well as tests for picture concepts which are based on selecting pictures for a concept design. A third variation, the Wechsler Preschool and Primary Scale of Intelligence-Third Edition (WPPSI-III; Wechsler, 2002) is specifically designed for children between 2 and a half and 7 and 3 months. This contains verbal sub-tests and children are asked to use blocks, puzzle pieces and cardboard to solve tasks. Testees complete a cardboard puzzle, a block design using blocks, a matrix reasoning section by selecting a picture for completing the picture rule based matrix, and also selecting pictures for picture concepts. This test takes 25 minutes to complete, like WISC-IV. The final example of this second group of nonverbal intelligence tests with verbal components is the Wide Range Intelligence Test (WRIT; Glutting, Adams, & Sheslow, 2000) which is designed for ages 4 to 85. WRIT comprises verbal sub-tests and and others including designing diamond shapes and matrices for completing tasks. WRIT takes between 20 and 30 minutes to complete.

In accordance with the aim of this study, it is important to use a nonverbal intelligence test with exclusively nonverbal components to measure both the bilingual and monolingual children of different language backgrounds as there is no language effect of nonverbal tests. This is needed to ensure an appropriate and equal assessment for bilingual and monolingual children without finding any language effect on the test scores, so as to provide accurate estimates of nonverbal intelligence.

Most of these tests contain matrices for selecting pictures to complete a series of designs or patterns; RCPM (Raven, Raven, & Court, 2004) has 36 questions, all of them based on selecting pictures for matrices. As the participants of this study are between 7 and 11 years

old, RCPM emerges as the most suitable test, as it is for those aged 5 and a half to 11 and a half. Additionally, RCPM is the most appropriate test for both groups (bilingual and monolingual) without seeing any language effect on the assessment, due to the fact that RCPM contains only nonverbal question and answer types (patterns).

While WAIS also seems to be suitable for this age group, it contains both verbal and nonverbal sub-tests, which are not suitable for the language background of the participants. Finally, RCPM is a culture and language-free test, again making it the most appropriate choice. RCPM is explained in further detail in Chapter 3 in terms of both reliability and validity as a test measurement, as well as information on the test administration procedure.

2.4 Bilingualism and Parental support

In this section, parental factors affecting the vocabulary development of bilinguals will be reviewed. Parental language dominance and home language preference, education, occupation and literacy skills and the link with the vocabulary development of bilingual children will be discussed in related with the effect of SES. Since one of the aims of the current study is to explore the effect of parental language dominance and home language preference on children's vocabulary knowledge, these aspects will be discussed. As the participants in the current study are from middle-class immigrant families with at least one parent possessing a university or higher educational degree, the effect of SES and parental education level as well as parents' language dominance and language preference on children's vocabulary development will be explained.

2.4.1 Parental language dominance, Education and Socio-economic status

Parents play a vital role in their bilingual children's vocabulary development, shown by the growing number of studies that have demonstrated parental verbal input to be one of the most important determiners on children's vocabulary development (Hart & Risley, 1995; Hoff, Laursen, & Tardif 2002; Lawrence & Shipley, 1996; Rowe, 2008). Research on middle-

class families has demonstrated a strong relationship between the quantity and variety of parental verbal input and the rate of vocabulary growth in young children (Dickinson & Tabors, 2001; Hart & Risley, 1995; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991; Pan, Rowe, Singer, & Snow 2005). According to Hart and Risley (1995), children tend to use similar words to their parents in conversation, so when parents use a greater variety of words, children will do the same, pointing to a direct relationship between parent's and children's speech acts. If parents produce more speech variables, in a parallel way children learn more vocabulary from their speech.

Grosjean (2002) writes that while bilinguals are in the process of learning a second language, there can be some attrition in their first language, which is why language dominance is an important factor for bilinguals during the process of second language learning. Grosjean (1998) earlier argued that bilinguals can lose lexical and syntactic knowledge in their first language due to lifestyle changes such as moving to a new country, getting a new job, receiving education, etc.

Parental language dominance is often mentioned in research studies concerning language proficiency assessment and the measurement of language competence in two languages. The term 'dominance' can be defined as an existing relationship between competencies in two languages (Treffers-Daller, 2011). It is possible to select or devise different assessment tools to measure language dominance in different languages. One of the most recent language dominance assessment tools is the Bilingual Dominance Scale (BDS) (Dunn & Fox-Tree, 2009), which contains 12 questions with different weighting scores for each language. Points are added up depending on the relevant language, with some questions having points for both languages, and the scores provide an estimate of the language dominance rates between the two languages. If the score is close to zero, the bilingual is balanced in both languages, positive numbers indicate first language dominance and negative

ones indicate second language dominance. The Bilingual Dominance Scale (Dunn & Fox-Tree, 2009), which is used to assess the language dominance of the parents of the bilingual children in this current study, is explained in more detail in Chapter 3 (Methodology).

Another recent tool is the Language Experience and Proficiency Questionnaire, LEAP-Q (Marian, Blumenfeld, & Kaushanskaya, 2007). This is a quick, easy questionnaire that can be administered in fifteen minutes. It focuses on literacy in each language separately at the high-school level, assessing three components of competence separately: language proficiency, dominance and preference, and estimates the percentage of language preference demonstrated by a bilingual subject. While this test is useful to determine language preference, which allows an insight into language dominance, there is no formal scoring procedure for language dominance.

Another recent test is the Bilingual Language Profile (BLP) (Gertken, Amengual, & Birdsong, 2014), a multiple-choice test that assesses bilingual dominance with a scalar response. The test rating demonstrates language history, use, proficiency and language attitude, with these ratings used for correlating with participants' Oxford Placement Test scores (Allan, 2006).

All of these self-assessment tests, however, are for adult bilinguals; most studies focussing on child bilinguals use parental reports to estimate their children's language dominance rate (Bedore et al., 2012; De Houwer, 2007; Flege, MacKay, & Piske, 2002). In one recent study, Bedore et al. (2012) found that parental reports on child bilingual's language dominance and proficiency were significantly correlated with their Spanish-English language ability test scores. Despite this, even if parental reports can successfully be used to assess bilingual children's language dominance, there is a lack of research on the direct responses of children. A direct language dominance test for children would provide great insight that takes into account the child's own experience and language preferences.

Besides variables such as parental language dominance, education of parents or their socio-economic background can have a strong effect on the connection between parental input and children's vocabulary development. Studies have supported a clear relation between parents' socio-economic status (SES), education and income with children's vocabulary development (Hernandez, Denton, & Macartney, 2007; Hoff-Ginsberg, 1991). Vocabulary knowledge development appears to have a direct link with SES. Hart and Risley's (1995) well-known study demonstrates that parents with a higher economic status tend to use a more varied vocabulary when speaking with their children, and this leads to a growth in the children's vocabulary. There is still discussion, however, over why parents' SES is so influential in this way. Some recent studies have focussed on this question and provided evidence on the relation between SES and parental language speech and their children's vocabulary knowledge development. Hoff (2003) provided research results that showed parents from high-SES families produce longer speeches and use more varied vocabulary in their conversations with their children than parents from low-SES families, and other studies have shown that the children of parents with a higher level of education have possess larger and faster vocabulary skills development in early age than those of less educated parents (Hart & Risley, 1995; Hoff, Laursen, & Tardif, 2002; Lawrence & Shipley, 1996). According to Hart and Risley's (1995) study, by the age of three, children from high-SES families had produced more than 1000 different words compared to only half of that for children from low-SES families.

Socio-economic status is a heavily influential factor affecting bilingual children's vocabulary knowledge, as mentioned above. Recent studies have supported Hart and Risley's (1995) findings on bilingual children's vocabulary size and its positive correlation with higher SES (Goldberg, Paradis, & Crago, 2008; Hoff, 2003). These studies emphasised that SES is most effective in combination with higher levels of parental education, as parental education level is positively correlated with high SES in these studies and the results demonstrated that

well-educated parents from high SES tend to have children with a larger vocabulary size in both of their languages. In these studies, the positive effect of SES was considered together with parental education together, but some interesting findings can be seen in a study by Arriagada (2005). The study compared low and high SES ethnic minority families in terms of language input and their language and literacy knowledge. Parents from low SES families were found to be more likely to use their ethnic language than their host language at home due to a lack of host language proficiency and that they therefore preferred to use their first language when communicating with their children, whereas high SES parents tend to use the host language as a result of their higher proficiency level and general education. The surprise of these results came with the finding that even though low SES parents used their ethnic (first) language more frequently with their children than high SES parents, children from low-SES families still showed a lower level of language knowledge in both languages than those from high SES families. Arriagada (2005) stated that the main reason for this is that high SES parents produce more language input in *both* languages than low SES parents, leading to more effective language acquisition for their children. This study emphasized the importance of both quality and quantity of parental input, sufficient parental language input and parental home literacy support on the language development of bilingual children. Despite the fact that bilingual children's language development in both languages did not seem to be directly affected by SES in this study, it drew attention to the equally important factors of parental language input, proficiency and educational level. Parents are one of the most important sources of language development for bilingual children, particularly before school age, and their language use has been shown to differ according to their SES.

There are some possible reasons for why children from different socioeconomic backgrounds have differences in their vocabulary size and why children have different communicational features with their parents in different SES settings. One possible reason is

that low-SES mothers produce less variation in their speech than high-SES mothers (Hart & Risley, 1995; Hoff, 2003), whereas parents from high-SES and educated backgrounds have more varied language and greater literacy knowledge, and use these skills in their interaction with their children. Several studies have supported the effect of maternal education on children's language development (Hoff, 2006; Huttenlocher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010), but according to Pan, Rowe, Singer, and Snow (2005), maternal verbal input and literacy skills are more effective on children's vocabulary development than maternal education level.

Another possible reason might be the relationship between parental child development knowledge and parental education and income. According to Rowe (2008), high-SES parents who follow formal education sources such as books, education experts etc., talk more, produce more varied vocabulary and have longer duration of speech than low-SES parents, who tend to follow informal or anecdotal sources such as parents, neighbours' experience, etc. Therefore, the beliefs of parents from different SES backgrounds about child development and their sources of information lead them to behave differently when child rearing in their daily life. These reasons might help explain why SES makes a difference to the relationship between parental verbal input and children's vocabulary size. Rowe (2008) cautions, however, that further clarification is required on the relationship between SES, children's language development and the interaction between parents and children.

The socio-economic status of families and parental education have been shown to be such important variables affecting children's vocabulary size and development, therefore, the current study controls for SES: the participants (children) are all from middle-class families and at least one parent has a university degree.

2.4.2 Parental language input, Literacy support and Occupation

Since parental input is related with parental language preference in the same way as monolingual study findings, the impact of parental input on bilingual children's vocabulary

development has been examined in some study findings (De Houwer, 2007; Roberts, 2008). Parents from ethnic minority society prefer to use one or both of their languages, as they have two language options and, according to their preference and knowledge, communicate in either their first or second language: when parents speak with their children, they simultaneously produce language input in either or both languages. Recent studies on the relationship between parental language input and bilingual children's vocabulary knowledge development have provided positive findings (De Houwer, 2007; Roberts, 2008), so it can be said that parental language input has a positive influence on bilingual children's vocabulary size (Hoff et al., 2012; Mancilla- Martinez & Lesaux, 2011; Roberts, 2008). According to De Houwer (2007), parental input is an important factor in the ethnic language development of bilingual children, and children with greater language input from their parents have subsequently improved language proficiency.

Bilingual vocabulary knowledge development is also subject to the amount of exposure to the L1 and L2 languages (Pearson, Fernández, Lewedeg, & Oller, 1997). Parental language input is one of the most important channels of bilinguals' language exposure in both languages, and the quality of language input is a vital determinant. Hammer et al. (2012) defines several language exposure determiners: parents' and teachers' speech to bilingual children, the length of stay in a host country, bilinguals' age when they start using two languages regularly, and so on.

In a recent study, Pearson et al. (1997) found that the amount of speech time of children experienced in both languages had a positive correlation with the bilingual children`s productive vocabulary in that language: the more children are spoken to, the greater their productive vocabulary. Similar results have been found in recent studies. For example, Cobo-Lewis, Pearson, Eilers, and Umbel (2002) concluded that more language input to bilingual children yields better vocabulary scores in several different vocabulary tests, and

Thordardottir (2011) compared 84 5-year old English-French bilingual children and their monolingual peers, finding a positive effect of language exposure on both receptive and productive vocabulary development. These findings support the notion that bilinguals who have sufficient language exposure in either language can obtain the same scores as monolinguals in each of their languages. Hoff et al. (2012) also found that frequency of exposure leads to higher vocabulary scores.

Next, parental language and literacy support is an important factor in the vocabulary development of bilingual children, with reading being of particular importance. As with the findings of monolingual studies, it has been shown that reading activities such as story-telling or reading a book (activities related with high SES) have a positive influence on bilingual children's vocabulary size in both languages. For example, Kalia and Reese (2009) found that parents from high SES families involved their children in more reading activities that subsequently gave rise to higher vocabulary size scores. Scheele, Leseman, and Mayo (2010) carried out a study that showed that frequency of reading was strongly correlated with bilingual children's receptive vocabulary, and Patterson (2002) described a link between reading activities and bilingual toddlers' productive vocabulary development in both Spanish and English. Similarly, maternal language and literacy skills are closely related to bilingual children's L1 and L2 vocabulary scores. Hammer et al. (2012) found that higher maternal language and literacy skills provided a properly higher level of vocabulary in bilingual children's first and second languages.

Additionally, parental occupation and professional background is another factor affecting the development of bilingual vocabulary knowledge. Daller, Yıldız, H. de Jong, Kan, and Başbağı (2010) found that the occupation (professional background) of the mother was related with the amounts of word production (*words per second*) of both bilingual (German- Turkish) and monolingual children.

Although it may be considered more complex to grow up learning two languages rather than one, these factors are all precisely the same for monolingual children (Patterson, 2002). SES, parental input, the education level, parental occupation, literacy and language skills of parents and the parent's attitude to language and the sources they trust when raising their children have great influence on the language and vocabulary development of bilingual children in their two languages. As with many aspects of the language process, it is difficult to assess these variables separately, as these factors are all closely interrelated.

2.5 Bilingualism and Vocabulary

2.5.1 Importance of Vocabulary

Vocabulary is one of the most important aspects of the development of language proficiency in L1 and L2 (Jarvis & Daller, 2013) and vocabulary knowledge plays an important role in language learning (Daller, Milton, & Treffers-Daller, 2007). It is evident that vocabulary is the main component of language proficiency (Daller et al., 2007; Laufer, 1989; Nation, 2001; Milton, 2009). The importance of vocabulary is also made clear by research on the role it plays in language development (Richards et al., 2009). Vocabulary received little attention as a research topic before 1980, so there are few empirical statements that can be made on the role of vocabulary on language proficiency. One such rare statement from an early study is that "without grammar very little can be conveyed; without vocabulary nothing can be conveyed" (Wilkins, 1972, p.111). From this, it can be seen that vocabulary is accepted as a more important aspect of language than grammar. As vocabulary is an important language learning component, testing and measuring vocabulary knowledge is also important. The main aim of vocabulary testing in the research in this field is to estimate a learner's vocabulary size in a second language (Laufer, 1998), and measurements are based on receptive and productive vocabulary knowledge, with each component estimating the vocabulary size of a learner in terms of their word knowledge (Nation, 2001).

The first and the most relevant link for the current study is that which is between vocabulary and intelligence: it has been found that vocabulary knowledge can predict the intelligence of bilinguals. One of the earliest examples is Terman, Kohs, Chamberlain, Anderson, and Bess (1918), who explained the relationship between vocabulary and intelligence broadly, and found a strong positive correlation ($r = .91$) between vocabulary and intelligence.

Recent studies have mainly been concerned with vocabulary knowledge and its effect on the other aspects of language, such as its role in the development of communicative proficiency with the usage of linguistic forms (Paul, 2001) and communication skills (Staehr, 2008). Another key role of vocabulary is on comprehension skills (Staehr, 2008), such as sentence comprehension (Altman, 1995), or the comprehension of a new input, particularly in L2 (Gass & Selinker, 1994).

Vocabulary is accepted as a good predictor of reading, writing and listening (Meara & Jones, 1988; Staehr, 2008, 2009). Staehr (2008) explored the link between receptive vocabulary size scores and the skills of listening, reading and writing scores of 88 Danish EFL learners and found strong positive correlations between receptive vocabulary size, reading ($r = .83$, $p < .01$) and writing ($r = .73$, $p < .01$). The study also found that vocabulary size scores were significantly correlated with listening scores ($r = .69$, $p < .01$).

Besides reading, writing and listening skills, vocabulary is also related to the grammatical development of learners in the same language (Conboy & Thal, 2006; Marchman, Martínez-Sussmann, & Dale, 2004; Meara & Jones, 1988; Parra, Hoff, & Core, 2011). Conboy and Thal (2006) found that the development of the grammar skills of 2-year old Spanish-English bilingual children was related more to their development of vocabulary than other language skills like lexical conceptual development.

Vocabulary has also been linked with syntactic development (Conboy & Thal, 2006; Fenson et al., 1994). Conboy and Thal (2006) concluded that sentence complexity and the length of utterances in both first (Spanish) and second (English) languages are related to the development of vocabulary in the same language.

Vocabulary size is also accepted as a key predictor of the other language skills in a first language (Anderson & Freebody, 1981), as shown by several studies that have explored, for example, the relationship between vocabulary size and reading comprehension (Alderson, 2000; Joshi, 2005; Martin-Chang & Gould, 2008). Literacy skills can also be shown to be linked with vocabulary in L2. There are studies which have demonstrated the importance of vocabulary for reading comprehension in L2 (Hazenberg & Hulstijn, 1996; Hu & Nation, 2000; Laufer, 1998). Additionally, the positive effect of L2 learners' vocabulary knowledge growth on their reading comprehension has been demonstrated in a range of studies (Alderson, 2000; Anderson & Freebody, 1979, 1981; Joshi, 2005; Qian, 1999, 2002).

For instance, Laufer (1998) found that vocabulary is more strongly related to reading comprehension than the other components of reading in L2 such as handwriting, spelling and fluency. The study suggested that good vocabulary knowledge leads to good comprehension in reading. The picture for bilingual settings is not so different than for L2 language settings, as vocabulary knowledge has been found to be a predictor of literacy for bilingual children (August & Shanahan, 2006; Oller & Pearson, 2002). In a recent study, Lindsey, Manis, and Bailey (2003) examined the expressive vocabulary abilities of Spanish-English kindergarten bilingual children, concluding that the expressive vocabulary abilities of bilingual children were a good indicator for their reading comprehension skills in the two languages. A few years later, Hammer, Lawrence, and Miccio (2007) found that receptive vocabulary knowledge in L1 (Spanish) and L2 (English) predicted reading comprehension in both languages, and specifically letter-word identification skills.

Next, vocabulary size scores have been used for academic reading comprehension estimates (Laufer, 1992a; Laufer, 1996; Qian, 2002; Zhang & Annual, 2008), as vocabulary size is accepted as a good determiner of academic success in L2 settings (Daller & Xue, 2009; Roche & Harrington, 2013; Treffers- Daller & Milton, 2013).

Vocabulary size is also one of the most important aspects of measuring second language proficiency (Meara, 1996) and the most crucial dimension of vocabulary knowledge (Daller, Milton, & Treffers-Daller, 2007): learners with larger vocabulary sizes tend to have higher language proficiency in other language skills than learners with smaller vocabulary sizes in L2. Learners use their existing vocabulary knowledge in all language skills such as reading comprehension, writing and speaking / listening. Learners cannot achieve reading, writing or speaking and listening skills without word knowledge, as they first need to know the words used for all language skills.

The importance of vocabulary has been emphasized with regard to language proficiency tests. Vocabulary knowledge in L2 is linked to language proficiency tests such as IELTS. Milton, Wade, and Hopkins (2010) demonstrated a significant correlation between vocabulary size scores measured with X-Lex (Receptive vocabulary Size Test, Meara & Milton, 2003) and overall IELTS scores ($r = .683$, $p < .01$), and between A-Lex (Milton & Hopkins, 2005) (The Aural-Lex was developed to measure the aural vocabulary size of English second language learners on a listening test) and overall IELTS scores ($r = .546$, $p < .01$).

Staehr (2009) found that VLT (Vocabulary Level Test) scores of 115 advanced EFL learners correlated significantly with their Cambridge Certificate of Proficiency listening test scores, suggesting that learners with a high level of vocabulary knowledge achieve higher language proficiency test scores.

A further use of vocabulary knowledge found in the literature is its function as an early warning sign of possible language disorders or the development of language deficits in bilinguals (Bloom, 2000). Vocabulary knowledge investigations provide knowledge of the early symptoms of language deficits or impairment, and information from these investigations can be used practically for dealing with these developmental deficits (Goldstein, 2006) to help bilinguals with language impairments find a suitable educational curriculum at an early stage (McCardle & Hoff, 2006).

In the literature, the importance of measuring vocabulary size is observed in terms of its relation with other domains. Increased interest in vocabulary research may lead to further findings on vocabulary size and its implications, and the current study seeks to contribute to this. The fact that the bilingual population is rapidly growing only increases the relevance of exploring their linguistic and cognitive development. Vocabulary and the other aspects of language have been broadly explored, but in regard to cognitive development, there is at present not enough evidence on the relationship between vocabulary and nonverbal intelligence. Considering the importance of vocabulary in the field of language and the lack of research studies on the relationship between vocabulary and nonverbal intelligence, it is clear that this area is still in need of research studies that focus on measuring vocabulary size and analysing the relationship between vocabulary sizes in both of the languages of bilinguals.

2.5.2 What is a word?

In the literature, the question of how to define a ‘word’ is an important issue in counting and estimating the vocabulary size and knowledge of learners (Milton, 2009; Read, 2000), and determining the number of words in a dictionary (Goulden, Nation, & Read, 1990). The question lacks a universally accepted answer, and there is controversy over what counts as a word in the field of vocabulary size estimation. Goulden et al. (1990) state that there are two important decisions to be made in order to arrive at a reliable and valid estimate of the

number of words in a dictionary. The first is to have a clear definition of what constitutes a word (For example, should proper names and abbreviations be counted as words?) and the second is to be clear about which words are considered base or derived words. It is possible to find different vocabulary size estimates based on how a word is defined and counted. According to Milton (2009), it is difficult to formulate a single definition of a word involved in a vocabulary test in which vocabulary knowledge and learning are measured, as there may be differences in terms of the usage of the word units on vocabulary knowledge measurement depending on individual learner or setting.

Nation (2001, 2016) describes several ways in which words can be counted. Token counting is simply counting every word in spoken and written language, even if same word occurs multiple times, which can be useful for finding the raw length of articles, newspapers, books etc. One may also count by word type, whereby repeated words are not counted multiple times, but only once per text. For example, the sentence *it is not easy to say it correctly* has eight tokens and seven types. Counting by type is useful to determine how many words must be understood in order to read a book, or how many words a dictionary contains. The problem with counting word type, however, is that words will be classed as repeated even if they employ different meanings: the word *well*, for instance, can be used twice in the same sentence with two different meanings, but it would only be counted as one word.

Another way is counting words is by lemma, which is the basic uninflected form of a word. In an early study, Francis and Kuĉera (1981, p.1) define the lemma "a set of lexical forms having the same stem and belonging to the same major word class, differing only in inflection and/ or spelling". This definition can be problematic, however, in that there is no restriction for irregular verb forms tied to the same stem, like *go*/ *went* and the different forms of *be.* In some recent definitions, a lemma is defined as a headword and its inflections, as in its basic form, a lemma only involves the same morphological form (Nation 2001), the base

and inflected forms of a word (Read, 2000). Lemmatised counting can be used for purposes like minimising a word corpus. Bauer and Nation (1993) use lemmatised word forms converted from types to lemmas in the Brown corpus, and by doing so reduced the number of items by approximately 40 percent.

Further, Milton (2009, p.10) states that "A lemma includes a headword and its most frequent inflections, and this process must not involve changing the part of speech from that of the headword". For instance, *govern* is a headword and *governs, governed* and *governing* are its inflected forms, but *government* is a noun and counted as a different word not included in the inflected forms. According to Milton (2009), lemmatised counting is the most useful way to estimate foreign language learners' vocabulary knowledge from elementary and intermediate level, so well-known vocabulary tests such as Nation's Level test (Nation, 1990) and X-Lex (Meara & Milton, 2003) use lemmatisation in their word counts and estimates.

Words can also be counted by word family, which consists of a headword and both its inflected and derived forms (Nation & Gu, 2007). The headword *'absent'*, would therefore include the inflected forms *'absented'*, *'absenting'*, *'absents'*, and the derived forms *'absentees', 'absenteeism', 'absently'* (Nation & Gu, 2007, p.20). Goulden et al. (1990) used this type of counting for their tests to estimate native speaker vocabulary knowledge, and Coxhead (2000) used it to develop the AWL (Academic Word List).

Read (2000) notes that it is important to draw a clear distinction between word forms and word families in native speaker vocabulary size estimates. Some researchers only take account of word families while others have focussed on word form, and this has led to a huge variation of native speaker vocabulary size estimates. For example, after excluding entries such as derived forms, proper names, compound nouns, abbreviations and affixes, Goulden et al. (1990) found 54,000 word families in *Webster's Third New International Dictionary* (1961), Nation (2000) reported the same number, and Schmitt (2000) estimated 114.000 word

families for the same dictionary. In a more recent study, Milton and Treffers-Daller (2013) pointed out that counting lemmas or word families is considered a standard way of assessing second and foreign language acquisition reliably and meaningfully, but the point of contention is whether or not to take into account proper nouns.

Questions still exist in the literature around how a word is to be defined and to what extent this affects measuring vocabulary knowledge: if a learner knows only a single form of a word, do they necessarily know all other relevant forms of that word? If a learner knows only one meaning of a word, is it enough to say that the learner 'knows' that word? Read (2000) isolates two issues when defining a word. The first is that if a learner knows the word *critical*, do we assume that learner also knows *critically*, *crisis* and *criticism*? How do we assess knowledge of a word, whether in only one of its forms or all of its forms? The second is around the problem of homographs, or words with a single form but distinct meanings, like *bank*. *Bank* has four distinct meanings, each with different word families, and there is no common meaning which can be linked to the others. If a learner knows only one meaning of this word, can it be assumed that they know any of the other meanings? How these questions are answered can profoundly affect vocabulary size estimation.

With respect to the notion of word, it is also possible to find various estimates of the vocabulary size of bilinguals in the literature on vocabulary testing. This will be discussed in more detail in the following sections.

2.5.3 What is it to 'know' a word?

The meaning of 'knowing' a word is more than to understand its single definition and form, but also its pronunciation, collocates, meanings, connotations, synonyms, antonyms, hyponyms, frequency, and morphological, syntactical properties (Chapelle, 1998; Qian, 1999), as well as how it relates to words in other word families. Word knowledge is an essential issue when assessing second language learners' vocabulary (Milton, 2009).The

definition of ‘word knowledge’ suffers similar problems as those described above, around measuring and counting vocabulary size (Milton & Treffers-Daller, 2013).

In an early study, Richards (1976) stated that knowing a word involves understanding of its semantic and syntactic features, its relationship with other words, its form variations, its functional variations and its existing different meanings. In a further step, Nation (1990) added the distinction between receptive and productive knowledge to Richard’s assumption, before later (2001, p.27) demonstrating the components of word knowledge in a more analytic and detailed way (shown in Table 1, below).

Table 1. What is involved in knowing a word (adapted from Nation, 2001, p. 27)?

Form	Spoken	R	What does the word sound like?
		P	How is the word pronounced?
	Written	R	What does the word look like?
		P	How is the word written and spelled?
	Word parts	R	What parts are recognisable in this word?
		P	What words parts are needed to express meaning?
Meaning	Form and meaning	R	What meaning does this word form signal?
		P	What word form can be used to express this meaning?
	Concepts and referents	R	What is included in the concept?
		P	What items can the concept refer to?

	Associations	R	What others words does this word make us think of?
		P	What other words could we use instead of this one?
Use	Grammatical functions	R	In what patterns does the word occur?
		P	In what patterns must we use this word?
	Collocations	R	What words or types of word occur with this one?
		P	What words or types of words must we use with this one?
	Constraints on use	R	Where, when and how often would we meet this word?
		P	Where, when and how often can we use this word?

(R = *Receptiv*e, P = *Productive)*

It can be seen in the table above that Nation divided word knowledge into the three categories of form, meaning and use, and further sub-divided these in terms of receptive and productive dimensions. The first category, 'form', includes the phonological and written forms of a word, and its parts, such as affixes, which may change its meaning and usage. The category of 'meaning' is divided into sub-categories such as 'form meaning', which relates form and meaning in cases such as translation from a second to a first language, and 'concepts', 'referents' and 'associations', terms involved in how a word can possess differing meanings and refer to different concepts in different languages. It is important to be clear what a word means in terms of its concept features and associations in another language, as a word can

have different connotations in different language settings. Vermeer (1992) argued that concept has an important role in word meaning and connotation in different cultural settings. The word *varken* (pig) in Dutch, for example, and the Turkish word *domuz* refer to the same animal, but the association for most Dutch people is *pork* or *bacon*, whereas the first association for most Turkish people is *unclean*. Finally, the category of 'use' is divided into *grammatical functions*, related to the pattern of words such as adjective + noun, collocations that involve other words the given word is typically used with, and *constraints of use*, illustrating when the word may and may not be appropriately used.

The lists provide a descriptive distinction between receptive and productive knowledge of a word in terms of *form, meaning* and *use*. Schmitt and Meara (1997) state that the list lacks a demonstration of the relationship between various kinds of word knowledge, that it contains gaps between receptive and productive word knowledge distinctions, and that it is impossible to create a study which considers all of these aspects of word knowledge. Receptive (passive) and productive (active) vocabulary knowledge have been long understood as the main types of word knowledge in the field of vocabulary studies.

A further distinction in word knowledge is that of breadth and depth. Another point of difficulty is in drawing a clear distinction in terms of vocabulary breadth and depth. Breadth and depth of vocabulary knowledge can be said to have a consistent relationship with one another, and according to Vermeer (2001), it is difficult to assess both breadth and depth of vocabulary knowledge without taking this interrelationship into account because vocabulary development demonstrates a strong relationship with vocabulary input.

According to Milton (2009), breadth knowledge might be involved in both the form category and the form-meaning sub-title of the meaning category, and depth knowledge might be involved in all of them. Breadth of vocabulary knowledge relates to vocabulary that a learner knows. Milton (2009) states that breadth of vocabulary knowledge might only involve

recognition of a word form without its meaning or translation equivalent, or that the learner can only remember a word when it is seen or heard, whereas depth of knowledge refers to what a learner understands about that word.

Discussion continues on the various definitions of word knowledge, which may cause discrepancies when counting and measuring vocabulary size. For instance, Aitchison (2003) estimated the average vocabulary size of educated monolingual speakers of English as 60,000 words, whereas just over a decade earlier Goulden et al. (1990) had averaged this figure as 17,200.

2.5.4 Receptive (passive) and Productive (active) vocabulary

Receptive and productive knowledge were referred to in the previous section, and it is possible to find some key definitions for receptive and productive vocabulary knowledge in the literature.

Receptive vocabulary knowledge refers to whether or not a learner recognizes a particular word when it is heard or read (Nation, 2001), relating this type of knowledge to listening and reading skills (Schmitt, 2000). Productive vocabulary knowledge involves whether or not a learner can use a given word in writing or speech (Nation, 2001). Although this definition seems clear, the distinction between receptive and productive vocabulary knowledge is under debate. Nation (1990), for example, argued that productive word knowledge *includes* receptive knowledge, and the term merely suggests an extension of this knowledge.

Nation defines them in terms of usage: receptive knowledge of vocabulary means "perceiving the form of a word while listening and reading and retrieving its meaning" (Nation, 2001, p. 24, 25). Productive knowledge of vocabulary involves "wanting to express a meaning through speaking or writing and retrieving and producing the appropriate spoken or written word form" (Nation, 2001, p.25). Laufer, Elder, Hill, and Congdon (2004) associate

receptive knowledge with word form and productive knowledge with word meaning, and stated that receptive vocabulary refers to knowing a word when hearing or reading it and productive vocabulary refers to knowing a word in order to use it in speech and writing (Laufer & Goldstein, 2004).

Research findings have consistently shown that the distinction between receptive and productive vocabulary knowledge can be explained in terms of the length of time of vocabulary acquisition and the amount of overall vocabulary growth (Melka, 1997; Milton, 2009). It is accepted that the receptive vocabulary knowledge of second language learners is larger than their productive vocabulary knowledge, and also that learners with larger receptive vocabulary knowledge tend to have larger productive vocabulary knowledge in their second languages (Laufer, 1998; Laufer & Goldstein, 2004; Laufer & Patribakht, 1998). According to Webb's study (2008), Japanese second language learners produced 93% of productive knowledge of vocabulary that they already knew as receptive vocabulary knowledge. Receptive vocabulary growth takes less time than productive vocabulary growth (Laufer, 1998; Laufer & Goldstein, 2004; Laufer & Patribakht, 1998), and productive vocabulary knowledge usually develops after the receptive, so productive vocabulary knowledge is often defined as more difficult to acquire (Melka, 1997).

2.5.5 Breadth and Depth of Vocabulary knowledge

Vocabulary knowledge cannot be explained with a single dimension, so it is considered more accurate to explain it multi-dimensionally (Quian & Schedl, 2004). As mentioned earlier, as well as receptive and productive vocabulary knowledge, learners also differ with regard to breadth and depth of vocabulary knowledge. Breadth and depth of knowledge are considered important dimensions of vocabulary knowledge (Ordonez et al. 2002; Qian, 1999; Vermeer, 2001; Wesche & Paribakht, 1996). Ordonez et al. (2002, p.719) state that "although lexical knowledge is most commonly thought of and assessed as a number of words known, or

breadth of vocabulary, it is now increasingly clear that richness of the representation of the words known is also a key dimension of variability. We refer to this dimension as depth of vocabulary". Read (1993, p.357) defined depth of vocabulary knowledge as "the quality of the learners' vocabulary knowledge". According to Nation (2001), breadth of vocabulary knowledge involves the number of words that learners know or acquire at a certain level of language proficiency, thus breadth of knowledge can be said to be the number of words learners know. Depth of vocabulary knowledge refers to what a learner knows about the aspects of vocabulary, such as all forms and meanings of a word, or syntactical and morphological features of a word. Further, Qian (2002) defined depth of vocabulary knowledge as inclusive of all lexical features such as phonemic, graphemic, morphemic, syntactic, semantic and collocation. Depth of vocabulary knowledge is accordingly considered more difficult to measure than breadth (David, 2008).

Studies on the relationship between breadth and depth of vocabulary knowledge provide clarification of differences between these two types of knowledge (Milton, 2009; Nation, 1990; Read, 2000). These studies compare and illuminate breadth and depth differences: Milton (2009) concludes that it is difficult to draw a distinction between them, and that they might be connected. As Read (2000) maintains that breadth and depth of vocabulary knowledge can be considered as a whole, rather than dividing them.

2.5.6 Review of Early vocabulary studies in bilingual children

Early studies (before 1960) mostly used IQ tests to assess bilinguals' linguistic and cognitive development. For example, in Saer's 1923 study, 1,400 Welsh-English bilinguals were tested in terms of IQ level, finding that bilinguals possessed a lower level of intelligence than monolinguals. Interest in the study of the relationship between vocabulary and intelligence can also be traced back to the early 20th century. In the earliest study, Terman et al., (1918) carried out a study that used a vocabulary test to measure the IQ of bilinguals, and found that

vocabulary was a good predictor for bilinguals' IQ scores, with a positive relationship between vocabulary and mental age scores. Terman et al., (1918) explored the relationship between mental age and the vocabulary subtests of the Stanford Revision scale of the Binet-Simon Intelligence Test. In this study, 631 American school-age children from grade 1 to the first year of high school were tested, and their intelligence quotients ranged between just under 50 to just over 150. The Stanford Revision of the Binet-Simon scale was used for exploring the relationship between mental age and the vocabulary scores of the participants. The researchers did not claim that this scale was the perfect measure, but decided that the degree of reliability was high enough to use it. The mental age of the participants ranged from 5 to 19 years, and their vocabulary scores from 5 to out of 85. The findings suggested that vocabulary scores were significantly correlated with the mental age of the participants (r = .91) (Terman et al., 1918, p.453). The study also examined 300 Portuguese and Italian bilingual children during a period of two or three years. Their home languages were their first languages, and their second language was usually English. The bilinguals were divided into median mental age groups, just as the monolingual children were, to allow comparison between bilingual and monolingual American children. Table 2 (below) shows the results of the comparison between English monolingual and Portuguese/ Spanish bilingual children's median vocabulary scores with their mental age and the three levels of the monolinguals' IQ (Terman et al., 1918, p.459).

Table 2. Comparison between median vocabulary scores of Portuguese/ Spanish and American children at each mental age (adapted from Terman et al., 1918, p.459)

Mental Age	Below 86 IQ	86-115	Above 115 IQ	Latins

13-6 to 14-5		51.7	50	50
12-6 to 13-5	46.7	47.5	43.5	42.5
11-6 to 12-5	43.7	41.4	40.2	33.3
10-6 to 11-5	34	33.7	35.2	30
9-6 to 10-5	32.5	29	30.6	25
8-6 to 9-5	24	22.2	21.7	16.4
7-6 to 8-5	18.3	18	20	12.3
6-6 to 7-5	13.7	12.3	12.5	9

The findings suggest that the vocabulary scores of the bilingual children after the mental age of 12 years reached a similar level that the English monolingual children. The most important finding regarding comparison between the monolingual and bilingual groups is that there was no difference in median vocabulary size after the mental age of 12 years. However, the bilingual group displayed a lower median of vocabulary scores in the first, second and third years of school than American children of the same mental age. This can be explained by reference to the fact that the home language was other than English, so these children may have only spoken their first language before beginning school. The effect of the different home language can be observed in the results of the children at early school age. After sufficient exposure to English (mental age 12), the difference between the groups disappeared, as the bilinguals had ‘caught up’ with their monolingual counterparts. In addition, the vocabulary scores of the group of 132 Latin children was highly correlated with their mental age (r = .84), in the same range as the American children (in the ‘below .86 IQ’ group). This study also found no difference between girls and boys in terms of the median vocabulary scores at each mental age, and vocabulary development and progress was consistent between them across all mental age groups.

Since the Terman et al. (1918) study, much research has been conducted to find the correlations of various vocabulary tests and general intelligence, and many studies support the findings of Terman et al. (1918) by finding significant correlations between vocabulary and general intelligence. Miner (1957, as cited in Anderson & Freebody, 1979) carried out a summary of previous studies, reporting the positive correlations of vocabulary and general intelligence scores. Anderson and Freebody (1979) give a general overview of these previous studies where vocabulary and intelligence scores are correlated in the range of .71 to .98. One of the first examples is that of Mahan and Witmer (1936, as cited in Anderson & Freebody, 1979), who found a high significant correlation (r = .87) between the vocabulary measures (Terman, 1916) and the Binet and Simon (1916) intelligence scale scores of 269 school age children. In another study, Spache (1943, cited in Anderson & Freebody, 1979) reported a correlation of .92 (Pearson) between the Terman (1937) vocabulary measure and the Binet & Simon (1916) intelligence scale, and with the same measures of vocabulary and intelligence, White (1942, as cited in Anderson & Freebody) found a correlation of .86 (Pearson) in the study of 753 children. Elwood reported a .98 correlation with 1161 school age children, and McNemar (1942, as cited in Anderson & Freebody, 1979) provided correlations from .71 to .86 (Pearson) on 710 participants ranged between 5 and 18 years old.

Besides these findings, Wechsler vocabulary and intelligence scale was used to find out the relationship between vocabulary and general intelligence by following the previous studies. For instance, Wechsler (1949, as cited in Anderson & Freebody, 1979) explored and reported the correlations of the Wechsler vocabulary test and WISC intelligence scale on 1000 participants in each range of the ages 7.5 (r = .71), 10.5 (r = .87) and 13.5 (r = .78). Raven (1948, as cited in Anderson & Freebody, 1979) found a positive correlation (r = 93) between vocabulary and general intelligence using the Raven vocabulary test and the Binet intelligence scale with 150 children.

Miner (1957) conducted a survey of several studies and found a median correlation of .83 (Pearson) between scores on short vocabulary tests and general intelligence tests such as Stanford- Binet, Wechsler and 10 standard tests, a finding consistent with those of previous studies. The correlation (r = .83) between the short vocabulary tests and various general intelligence tests was higher than the median of the correlations (r = .73) between the standardized intelligence tests and more standardized vocabulary tests reported previously. The findings supported the idea that the short vocabulary test scores highly correlated with general intelligence tests at least as well as an intelligence test correlated with others. Miner (1961, p.159) concluded that "the 20-item tests yield correlations with the more general measures of intelligence which are comparable to those found between the general measures themselves." However, these short form vocabulary tests received lots of criticism regarding lack of adequate reliability and validity, so Miner (1961) carried out research to validate the short vocabulary tests used in the previous study (1957). The A and B versions of the short vocabulary tests contained 20 questions. The A version of the test significantly correlated with the scores of the WAIS verbal intelligence test (r =.84), with the correlation of the B version of the test at .86 (Pearson). These two versions of the short vocabulary test significantly correlated with the scores of the Army General Classification intelligence test (r = .70 for version A and r = .77 for version B), with a sample (n = 868) in form A, and (n = 883) in form B (Miner, 1961: 159). The study provided evidence for the assumptions of lack of reliability and validity of the short form vocabulary tests used in experiments (Miner, 1957, 1961).

Through the 1960s and 1970s, more positive attitudes towards bilingualism than Saer's began to emerge. Vygotsky (1962, p. 110), for example, argued that using two languages to express the same thought allows the child to "see his language as one particular system among many, to view its phenomena under more general categories, and this leads to

awareness of his linguistic operations", a view that supports focus on bilinguals' linguistic ability instead of their intelligence. In addition to these positive findings, Dupuy (1973, as cited in Anderson & Freebody, 1979) used the Stanford Achievement test (1973) for intelligence measures and a vocabulary test with total achievement test scores on a sample (n = 275.000) from grades 2 to 8 to standardize the Stanford achievement test, and the correlations varied from .82 (Pearson) to .89. Anderson and Freebody (1979) give a general summary of these previous studies where vocabulary tests are correlated with the general intelligence test, and the authors concluded (1979, p.2) that "the strong relationship between vocabulary and general intelligence is one of the most robust findings in the history of intelligence testing."

According to Grosjean (1982), early studies on vocabulary used vocabulary tests to focus on the bilinguals' word knowledge and fluency in their two languages comparatively. Several different tests were used to assess vocabulary, such as rating scales, fluency tests, flexibility tests (synonyms, associations, word frequency) and dominance tests. Cummins and Gulutsan (1974) used word association, self-rating, and teacher-rating of fluency tests to select bilingual participants for their cognitive development study. These word association and vocabulary tests were used in most of the studies because of two competing hypotheses surrounding the question of whether bilinguals have one lexicon or two. When research efforts concentrated on these hypotheses, some studies (e.g. Caramazza & Brones, 1979; Kolers, 1966) found that bilinguals had only one lexicon, but the majority (e.g. Taylor, 1971; Tulving & Colotla, 1970) supported the 'two lexicon' hypothesis. In these earlier studies, word association tasks and conceptual word association tests were used and bilinguals were assessed according to their responses to the stimulus word lists with their association and semantic meanings. While the bulk of these studies supported the two lexicons view, some demonstrated that bilinguals possessed neither one nor two lexicon storage/s. For example, in

Kolers' study (1963, 1968), bilinguals were asked to give association meanings in a list of stimulus words. The responses were not sufficient to support any of the lexicon hypotheses, suggesting that some participants used one lexicon in their answers and some of them used their dual lexicon storage. However, as Grosjean (1982) describes, the discussion over these hypotheses lost popularity in the 1980s. At this time, comparison of the operations of the two languages became more popular, with greater focus on two languages: researchers were more interested in the comparison of bilinguals and monolinguals in terms of language operations such as word recognition, semantic and syntactical progressing in two languages and language skills. More recent views of bilingualism tend to devote far more attention to the use of appropriate methodology to assess bilinguals than previous studies ever did.

If a vocabulary test measure is a good predictor for general intelligence, it is also possible for the case of bilinguals. It is very striking, then, that interest in the relationship between vocabulary and general intelligence has fallen dramatically since the late 1980s, and there is no current research in this field of study. In one notable recent study, Grzegorzewska (2015) partly investigated vocabulary and general intelligence in terms of learning strategies of vocabulary, testing 192 adult learners of English with Raven's Progressive matrices and exploring the relationship between uses of vocabulary learning strategies. The findings suggested that learners with high intelligence scores use a variety of vocabulary learning strategies, whereas learners with lower intelligence scores utilise only a limited set of learning strategies. This might also be the case for bilingual children, but there is as yet no study on the learning strategies of bilingual children.

If vocabulary and general intelligence are strongly related then, it is possible that bilinguals who have vocabulary knowledge in two languages possess advantages over monolinguals: unfortunately, this has scarcely been explored. The topic of the relationship between vocabulary and intelligence is in urgent need of a large body of systematic research

focussing on measuring vocabulary and intelligence and finding any relationship that might exist between them. The current study aims to investigate this relationship in the case of bilinguals, with the hope that the results contribute to the understanding of the relationship between vocabulary size and general intelligence scores (in this case, of Turkish-English bilingual children) and provide empirical research findings.

2.5.7 Review of Receptive vocabulary studies in bilingual children

In an earlier study, Doyle, Champagne, and Segalowitz (1978) compared bilinguals with monolinguals in terms of the receptive vocabulary size in their dominant language. The findings suggest that bilinguals are slower than monolinguals in their receptive vocabulary development in the dominant language, but bilinguals score higher in verbal fluency tests, and even when bilinguals scored lower than monolinguals in terms of vocabulary size, they were proficient at verbal skills. Each skill in language development can have a different value and contribution, thus, combinations of different language aspects can produce more accurate estimates of bilinguals' language development.

McLaughlin (1984) noted that some studies on bilinguals only focussed on one language possessed by bilinguals and compared them to the same language used by monolinguals, and there has been little research on both of a bilingual's languages and interactions between them (language interaction in bilinguals is another area that has not been primarily explored). This concern is the same for assessing bilinguals' receptive vocabulary knowledge in their two languages. For instance, Bialystok, Craik, and Luk's (2008) study examined the relationship between bilingualism and receptive vocabulary size processing. There were ninety-six participants selected from bilingual and monolingual people from younger and older age groups, with the aim of demonstrating the level of lexical fluency and cognitive control of participants from different age groups. The bilinguals were from different language backgrounds such as French, Arabic, Somali, etc, and the results showed that

monolinguals obtained higher scores on lexical retrieval tasks than bilinguals with no age effect, but that bilinguals were better than monolinguals on letter fluency tasks. English monolingual participants scored higher on receptive vocabulary size and measurement tests than bilinguals, and when applied to those speaking second languages other than English, similar results are found.

Several recent studies have compared the receptive vocabulary knowledge of bilingual children and their monolingual peers, reporting that bilingual participants consistently have lower vocabulary measurement scores than monolinguals (Bialystok & Feng, 2009; Bialystok, Luk, Peets, & Yang, 2010). In a Dutch study by Verhallen and Schoonen (1993), Turkish bilingual students were found to score lower than Dutch monolinguals on a word definition task (word-semantic knowledge test). In another study, Bialystok and Feng (2009) examined both young and adult participants with a proactive interference task, finding that even if bilinguals scored lower on vocabulary tests than their monolinguals peers, they had equal results from the proactive tests. Bilinguals who achieved higher vocabulary scores were better on verbal memory performance. Even if bilinguals had lower language proficiency, their high-level executive controls helped them to achieve the same or higher scores than monolinguals.

A later study by Bialystok et al. (2010) examined 1,738 children between the ages of 3 and 10. Participants were 772 English speaking monolingual children and 966 bilingual English-speaking children, who completed the Peabody Picture Vocabulary Test (PPVT). The findings suggest that the mean standard scores for bilinguals were significantly lower than those of monolinguals, a result which held across each age group. This study is important, as it used a large group of participants between 3 and 10 years old. Even if bilingual children used both languages fluently on a daily basis, monolingual children of every age group still scored higher in L2. The results were not surprising, as previous smaller-scale studies with

different age groups had reported the same findings (Bialystok et al., 2008; Bialystok & Feng, 2009; Fernandes, Craik, Bialystok, & Kreuger, 2007; Verhallen & Schoonen, 1993). As there were no differences between age groups (same age groups) with regard to the bilinguals' and monolinguals' receptive vocabulary size tests, this study also demonstrated that there was no difference between bilingual participants who had a different language background, so both Asian and non-Asian bilinguals scored lower than English monolinguals. According to this study, neither age group nor first language background can determine vocabulary score differences between bilinguals and monolinguals.

2.5.8 The Bilingual Mental Lexicon

In the literature on bilingual language development, the bilingual mental lexicon is considered a broad, complex topic, and currently there is a lack of consensus on the issue of bilingual mental lexical organisation, storage and process. 'Mental lexicon' was defined in a relatively early study by Fay and Cutler (1977, p.509), who described it simply as a word list in a brain. It is clear, however, that a mental lexicon is more complex than a word list or a dictionary (as a dictionary can only contain words, their meanings and a phonological reference), and it must be defined more analytically.

More recent studies provide more detailed definitions of a mental lexicon. According to Singleton (1999), the mental lexicon is a module in bilingual memory which includes all knowledge related to words in a learner's language. Navracsics (2007, p.17) wrote that "the mental lexicon is a kind of internal dictionary that contains not only the 'entries' for each word a speaker knows but also all the linguistic information about the word: its semantic content, syntactic properties, phonological shape, and so on". In an even more recent definition, Roux (2013, p.82) referred to the mental lexicon as "the collective representation of words in the mind, which draws together contextual, personal and interpersonal dimensions

of meaning, and assists most fundamentally in the acquisition, retention and expression of language".

Research on bilinguals' mental lexicon is one of the most compelling areas in this field. Consideration of the two language operations in bilinguals and their mental lexicon processing has been part of the ongoing debate around whether bilinguals develop two separate lexical storages or use one common integrated storage (Costa, 2005; Finkbeiner, Forster, Nicol, & Nakumura 2004; Gollan, Forster, & Frost 1997). Although there is an agreement around an integrated two-system model now, in early studies, the discussion was around whether bilinguals had one common storage or two separate storages of mental lexicon. Weinreich (1953) distinguished bilinguals according to their linguistic memory storage and representation organization. The memory storage system was proposed by Weinreich (1953) and it has three different levels: compound, coordinate and subordinate, according to the bilingual's level of lexicon representation and storage. The memory storage system (Weinreich, 1953) is depicted in Figure 2 below.

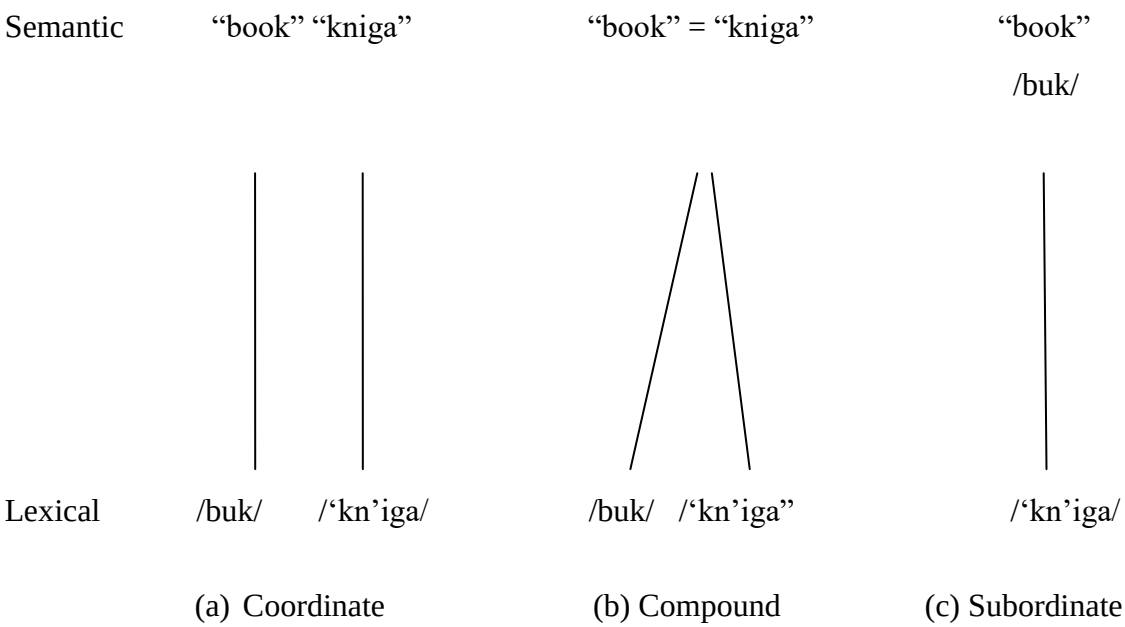

Figure 2. The bilingual memory storage system, Russian-English examples (adapted from Weinreich, 1974, p. 9)

Weinreich (1953, 1974) explained the existing relationship between L1 and L2 lexicons in bilinguals with these three levels: compound (only form is language specific), coordinate (both meaning and form are language specific), and subordinate (the form in the weaker language is linked to the form in the dominant language). In compound bilinguals, there is one conceptual meaning for words which is used in both L1 and L2. For example, "cat" and "kedi" are stored as one meaning for Turkish (L1) - English (L2) bilinguals, so there is one semantic meaning for both. Coordinate bilinguals store each linguistic unit with two different meanings separately for L1 and L2: one meaning is stored for the word in L1, another for the word in L2. For subordinate bilinguals, it is assumed that linguistic units are learned and interpreted in terms of their dominant language, with one meaning for two linguistic units in L1 and L2 only accessible through L1 if it is more dominant than L2. According to Kroll (1993), however, these early studies failed to demonstrate clear evidence on the bilingual mental lexicon storage debate as the findings provided conflicting results on the issue of lexical and semantic representations of lexicons in L1 and L2.

While a few studies provide evidence for separate lexicon storage (Li, Mo, Wang, Luo, & Chen, 2009) there is a widespread agreement on integrated bilingual lexicon processing. Several studies have supported the idea that there are two lexicons, but they are integrated with each other (de Groot, Delmar, & Lupker, 2000; Kroll & Stewart, 1994; Paradis, 2001), with the idea of integrated lexicon processing based on the interrelationship between the two languages in terms of lexical and conceptual levels of representation. As Paradis (2004) stated, there is one conceptual framework linked to both languages in the bilingual mind. The conceptual system is language independent, developing and progressing as both languages are acquired. Some influential models address the issue of different mental lexicon storage and processing, and they attempt to explain and define bilingual mental lexicon features with different approaches (Dijkstra & van Heuven, 1998, 2002; Kroll &

Stewart, 1994; Pavlenko, 2009), overall contributing to an improved understanding of the process of bilingual mental lexicon representations.

More recent studies present analytical models to explain the complex features of bilingual lexical storage and organization. One of these is the basis of the Revised Hierarchical Model (Kroll & Stewart, 1994; Kroll, Van Hell, Tokowicz, & Green 2010), which posits two types of word representation: lexical representations on word form and conceptual representations on word meaning. The Revised Hierarchical Model (Kroll & Stewart, 1994) is illustrated in Figure 3 (below).

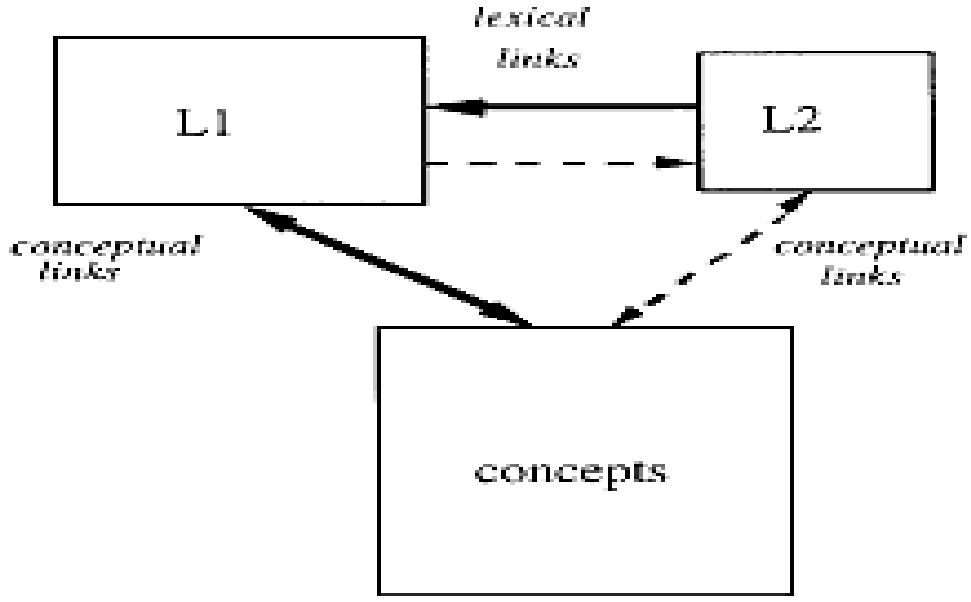

Figure 3. The Revised Hierarchical Model (adapted from Kroll & Stewart, 1994, p.154)

According to the Revised Hierarchical Model (Kroll & Stewart, 1994), each language has a separate lexical storage at the level of lexical representation, and two lexicons share a common joint conceptual store. The common concept store underlies separate lexical storage of each language. According to Kroll (1993), there is a connection between bilinguals' two languages in terms of lexical and conceptual representations but the connection between the lexicons demonstrates differences in strength. The lexical connection from L2 to L1, for instance, may be stronger than that from L1 to L2. During L1 acquisition, the existing link

between L1 and its corresponding concepts may be stronger than that between L2 and its concepts, or L2 lexical representations may be more strongly linked to the L1 lexical store, especially at the early stages of L2 acquisition: in this instance, most words in L2 are learned with their L1 translations. With regard to translation from one lexicon to another, the revised hierarchical model also predicts translation links between the two lexicons. When words are semantically ordered and tested, word translation took longer from L1 to L2 (forward) than L2 to L1 (backward). This might be explained by reference to the strong link between L1 and concepts, therefore L2 is not mediated conceptually.

The model posits direct asymmetrical links between L1, L2 and a common joint conceptual store in the bilingual lexical process, and supports the idea that there is a strong asymmetrical connection between L1 and L2. If connection from L1 to L2 is weak, link from L2 to the common conceptual store is also weak. To sum up, Kroll and Stewart (1994) proposed the Revised Hierarchical Model to draw a separation between lexical and conceptual level of representations, and it provides evidence for strong asymmetrical connections between L1 and L2 language processing in terms of bilingual lexical processing. Wolter (2006) supports the idea of RHM in terms of the importance of the effects of the link between L1 and conceptual knowledge on the development of L2 lexical knowledge. Therefore, according to Wolter (2006), L1 lexical knowledge and conceptual representations play an important role in the development of L2 lexical knowledge. High development in L1 lexical concepts leads to similar development in L2 lexical knowledge by transferring existing concepts in L1 to L2.

The RHM is not free from criticism, however, particularly surrounding its methodology. Its tests include only concrete words and no abstract ones, and it has been found that concrete words have a larger extent in word meaning than abstract words, and they are faster and more accurately translated than abstract words in bilinguals, so the translation

and response differences between word types can be considered a methodological deficiency of this model (De Groot, 1992, 1993). In response, De Groot developed the Distributed Conceptual Feature Model (De Groot, 1992, 1993), positing that bilingual mental lexicon organisation can be represented at the word type level in both L1 and L2. Literally, word types are categorized as concrete, abstract and cognates in terms of lexical and conceptual level of bilingual memory representation. Even if concrete and cognates in both languages also connect at the conceptual level, abstract words do not have a joint connection at the conceptual level of representation. The main point of this model states that word types are an important determiner in bilinguals' mental lexicon organisation and memory, especially at the conceptual level of representation.

Another experimental mental lexicon model is the Bilingual Interactive Activation (Dijkstra & van Heuven, 1998) and its updated version, the BIA+ model (Dijkstra & van Heuven, 2002) which focuses on visual word recognition. In this model, the lexicon modes in L1 and L2 are integrated at lexical, sub-lexical and conceptual levels of representation, and the model posits that there are two interactive subsystems, which are word identification and task-decision. In the word identification subsystem, the visual input first activates orthographical and phonological representations, which simultaneously activates a whole lexical orthography. In the same mechanism, both lexical orthographical and phonological representations activate semantic representation and language nodes. All of these representations are used to activate the task-decision subsystem. In BIA+, words are presented separately without context, and high frequency usages of words are recognized faster than low frequency words (Dijkstra & van Heuven, 2002).

As far as the RHM and BIA+ models of mental lexical representations go, a key difference is the conception of the increase of L2 proficiency. The RHM model states that an increase in L2 proficiency leads to stronger connections between L2 and the conceptual level

of word representation, whereas in the BIA model, increase in L2 proficiency leads to learn infrequent words. Nonetheless, L2 proficiency level cannot be a single determiner in the whole mental lexical map, as there are other determinant effects on bilinguals' mental lexicon organisation such as age of language acquisition, language background, language dominance and language preference. Singleton (1999) maintains that word form and semantic similarity between L1 and L2, as well as the environment in which the words were acquired and how they were learned are important factors affecting the interaction between the L1 and L2 lexicon maps. Bilingual mental lexicon organisation and processing is a complex picture that must be assessed from various perspectives. As Grosjean (1998) states, bilinguals from different language groups cannot be defined and assessed in the same model, adding further distinguishing factors like their learning strategies and the features of the words they learn. It is therefore impossible to make generalisations about individual bilinguals using single models. Grosjean (1998) also points out that there are several different models which attempt to map bilingual language development and processes, but a lack of global models providing a general picture of bilingual language processing and acquisition.

A recent model is the Modified Hierarchical Model (Pavlenko, 2009), which posits that conceptual representations are not fully shared in a bilingual's two languages. The Modified Hierarchical Model (Pavlenko, 2009) is depicted in Figure 4 (below).

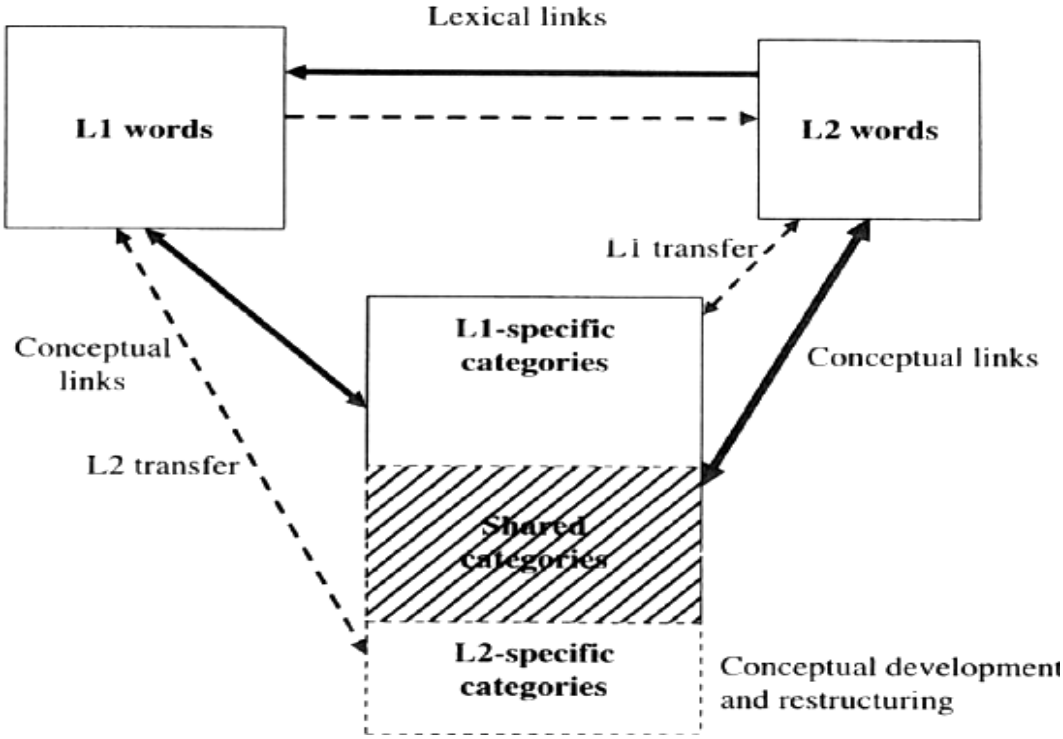

Figure 4. The Modified Hierarchical Model (adapted from Pavlenko, 2009, p.147)

In this model, all word knowledge in one language cannot be equally transferred and lexicalized in a second language, therefore conceptual representations can be considered as language specific. This means that conceptual representations cannot always give clear word–semantic translation equivalence across the two languages of bilinguals. For example, an L1 English speaker of L2 Russian can use the English word *cup* (paper drinking container without a handle) to refer to the Russian word *chaska* (similar to a cup), but *cup* is only partly referred to in this word as it actually refers to another Russian word, *stakanchiki*, which means 'little paper glasses without a handle' (Pavlenko, 2009, p.131). This example demonstrates that each word in a language cannot be fully transferred into another language, and that learners need to apply conceptual restructuring to discern the equivalent for a word in another language. The English word *cup* only partly refers to a *chaska*, but after conceptual restructuring, the exact referent can be found and used in language in the monolinguals would.

Henriksen (2008) explains the types of lexical knowledge across three semantic knowledge levels. The link between the knowledge provided within the three levels of lexical representation (Henriksen, 2008) is shown in Figure 2.1 (below). Henriksen categorized the level of lexical knowledge in the organisation of semantic memory, with semantic memory categorized as "conceptual knowledge", "intra- lexical entries", and "meta-semantic knowledge" (Henriksen, 2008, p. 29).

At the first level, conceptual knowledge is a representation of lexical knowledge, related to the learning experience of the general language knowledge. This means that most conceptual knowledge is the same for all languages and is shared between cultures. *Yellow*, for instance, is a colour, and the term is used for the concept of this colour. Some words, however, may refer to different meaning and usage in different cultural settings: *romantic* is an emotional feeling, the word used for expressing the feeling as a concept, but the concept of *romance* may differ across cultures, as seen in Figure 5.

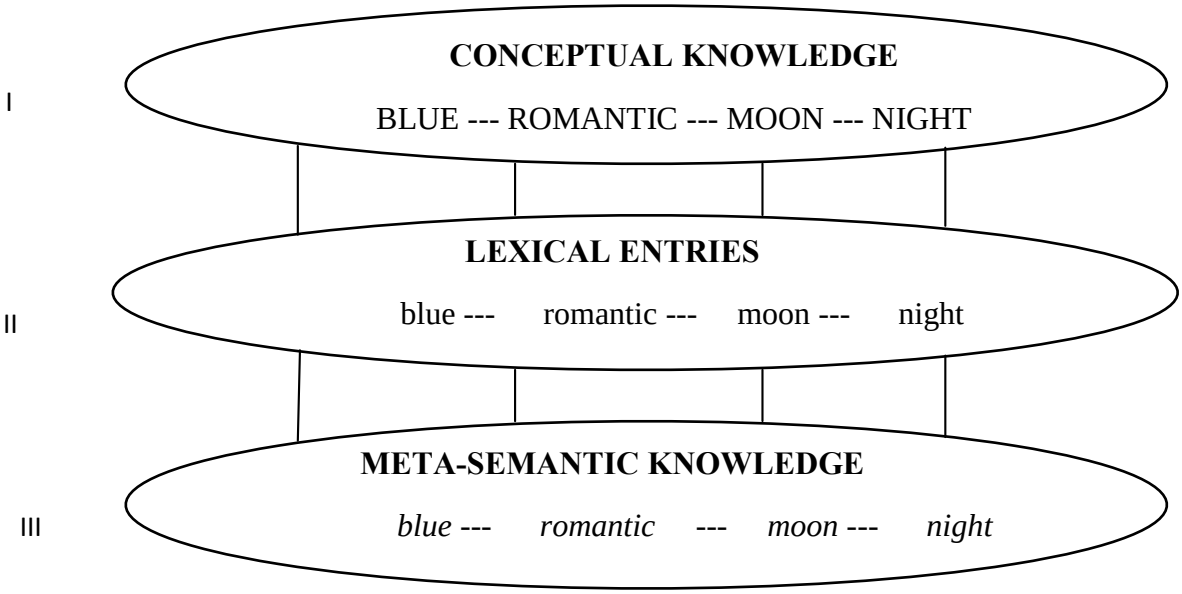

Figure 5. Links between and within the three levels of lexical representation (adapted from Henriksen, 2008, p.29)

Level two represents the lexical entries of lexical knowledge. At this level, lexical entries are categorized in terms of formal and semantic level. The lexical entries are related to language-specific features of a lexicon, such as a cognate. The same form of a lexicon may have different semantic meanings and representations, and this may affect the degree of overlap between the two languages. At level three, meta-semantic knowledge is represented, related to the semantic knowledge of the lexicons. It is mostly concerned with pragmatic, syntagmatic and analytic representations of a lexicon, and is related to other lexicons. For example, *moon*, *sun* and *planet* have a pragmatic relationship, but *moon* is also related to *shine* and *full* syntactically, and to *yellow* and *round* analytically (Henriksen, 2008, p.30).

To sum up, there are various models which attempt to demonstrate the possible map of bilingual mental lexicon organisation and processing in their two languages. Even though these models demonstrate different approaches in terms of lexical and conceptual representations in the bilingual lexicon, all of them agree on a cross-language relationship. As is the nature of bilingual language development, it is difficult to determine a clear distinction between lexical and conceptual levels of representation of the bilingual mental lexicon in all language pairs, but the models explained above attempt to draw a bilingual mental lexicon map. Understanding in this field is still incomplete, and questions remain about the nature of bilingual mental lexicon representations and their relations in two languages.

2.5.9 The relationship between L1 and L2 vocabulary size of bilingual children

It is important to consider the link between L1 and L2 language proficiency of bilinguals. As mentioned above, according to the Interdependence hypothesis (Cummins, 1979), bilinguals can use their existing L1 language knowledge to develop their L2 skills, and the relationship between L1 and L2 is partly dependent on the learner's first language proficiency. It is important to remind that sequential bilinguals who develop their vocabulary in both languages develop a large amount of vocabulary in L1 in their early years, with parents and daily

communication as their L1 source, whereas the L2 vocabulary source is usually formal schooling and social communication outside of the home.

In the literature, the interrelationship of L1 and L2 grammar, writing skills (Woodall, 2002; Wang, 2003), phonological awareness (Durgunoglu, Nagy, & Hancin- Bhatt, 1993; Lopez & Greenfield, 2004) and reading skills (Leafstedt & Gerber, 2005) have been explored most often, but there is a lack of research directly exploring the relationship between L1 and L2 vocabulary size. The current study aims to address the under researched area.

One of the examples for exploring the link between L1 and L2 from the literature is the study of Henriksen (2008). Henriksen (2008) partly investigated the relationship between L1 and L2 vocabulary size in L1 Danish and L2 English in a study on declarative lexical knowledge by examining the organisation of vocabulary knowledge through word association and connection tasks. The study explored the difference between the vocabulary size scores of L1 Danish-L2 English children across the three different educational levels. 87 Danish participants took part, in groups of 29. The groups were organized into three educational levels: grades 7, 10 and 13. Participants had the same educational background and the same exposure to English from the same age. The participants' receptive vocabulary size was tested in English with the second version of Nation's VLT (Schmitt, Schmitt, & Clapham, 2001), without the academic word level of the test. A parallel L1 receptive vocabulary size test, adapted from VLT receptive vocabulary size test with words generated from the Danish frequency dictionary, was used to find the participants' L1 vocabulary size. The format used was as close as possible to the VLT, the only difference being that the parallel test was designed to include more low frequency words than the VLT in English for the advanced Danish native speakers. The number of the words in each test was 120. The study predicted a substantial difference between L1 and L2 vocabulary size across the three educational levels,

and expected a similar difference in frequency levels between vocabulary sizes across the three levels.

Table 3. L2 and L1 vocabulary size scores (adapted from Henriksen, 2008, p.59)

		G.7	G.10	G.13
L2	M	33.79	71.86	94.79
	SD	22.44	20.59	14.71
L1	M	50.24	83.52	102.10
	SD	18.4	18.74	10.12

*M= mean, *SD= standard deviation, *G= grade (out of 120)

Table 3 (above) demonstrates the vocabulary size scores in L1 Danish and L2 English, showing that the mean scores of L1 across the three grades are higher than those of L2. The study (Henriksen, 2008, p.59) also found statistically significant differences between the three educational levels in both L1 Danish and L2 English for G.7 (ANOVA: F (1, 28) = 27.874, p <.001); G.10 (ANOVA: F (1, 28) = 13.525, p <.001); G.13 (ANOVA: F (1, 28) = 10.667, p <.003). Participants had a larger vocabulary size in L1 than in L2, and their vocabulary size increased more quickly in L1 in all grades, even when the L1 vocabulary size test included more less frequent words than the L2 test. Overall, participants' vocabulary size grew in both languages in relation to their age and educational level. The study did not provide vocabulary size scores for each range of the frequency bands, so the results can only provide a rough estimate of the vocabulary size scores of the participants, rather than detailed estimates for all ranges of individual word knowledge.

In another study, Sparks, Patton, Ganschow, and Humbach (2009) explored the relationship between L1 skills in early elementary school years and L2 learning in high school. Participants were divided into three language proficiency levels: low, middle

(average) and high. L1 skills were tested in reading and listening comprehension, vocabulary, spelling and phonological awareness, and L2 proficiency was tested after two years of L2 learning. Oral and written language proficiencies were tested in L2 separately in Spanish, French and German. The findings suggested an existing relationship between L1 skills in elementary school and L2 (in both oral and written proficiency) in high school. The study supported the idea that participants with strong L1 skills have better L2 proficiency than those with low L1 skills, and indicated that vocabulary in L1 is one of the most important predictors for L2 proficiency as combined with other L1 skills.

In a more recent study, Masrai and Milton (2015) investigated the relationship between first language lexical organisation and second language vocabulary development. One of the aims of this study was to explore the link between L1 lexicon size and organisation and L2 lexicon size of EFL learners. 191 male participants aged 16 to 18 took part, randomly selected from the final year of two secondary schools in Saudi Arabia. The participants were tested with X-Lex (Meara & Milton, 2003) in L2 (English) and the Arabic-Lex test in L1 (Arabic). The results demonstrated a strong positive correlation between L1 Arabic and L2 English vocabulary size (r =.799, p <.001), supporting the idea of a relationship between L1 and L2 vocabulary size, and that learners with a large L1 vocabulary size tend to have a concordantly larger L2 vocabulary size.

To sum up, there are not many studies to date investigating the relationship between the L1 and L2 vocabulary size of bilinguals. Studies that have been carried have been described in this section, but there is still a gap in the field of vocabulary size studies relating L1 to L2. However, the general implication from the studies suggests a link between L1 and L2 vocabulary size. Age and the length of study of L2 also affect the relationship between the two languages, as older learners tend to have a greater vocabulary size in their L1, and the connection between their languages is stronger than that of young learners.

2.5.10 Review of Total Conceptual Vocabulary (TCV) studies in bilingual children

Early studies mainly considered only one language of bilinguals when comparing bilingual and monolingual vocabulary knowledge and the findings demonstrated that bilinguals consistently performed at a lower level of vocabulary in each language than monolinguals (Ben-Zeev, 1977; Bialystok, 1988; Doyle et al., 1978; Rosenblum & Pinker, 1983). The possible reason for this seems to be that bilingual children have to learn two different labels for each word, which causes a reduction in the frequency of a particular word in each language (Ben-Zeev, 1977), and learning, sorting and differentiating word and meaning in two languages is more difficult than in one language (Doyle et al., 1978). Additionally, early studies used monolingual norms to assess vocabulary knowledge, and there are necessary questions around whether or not bilinguals should be assessed as a monolingual in each language. Grosjean (1989, p. 4) maintained that "the bilingual is not two monolinguals in one person" as a precaution for the accurate assessment of bilinguals, so according to this holistic view, bilinguals have unique dual-language acquisition which must yield to an integrated language assessment. Scoring and assessing bilinguals must be suitable for the features of two integrated languages, which is different to assessing the one language of monolinguals. Pearson (1998) stated that it is impossible to expect bilingual children to demonstrate similar vocabulary knowledge as monolingual ones in each of their languages, as their vocabulary knowledge is distributed in two languages, some concepts of which occur only in L1, and others in L2. Similarly, several researchers (Bedore, Pena, Garcia, & Cortez, 2005; Pearson, Fernandez, & Oller, 1993; Umbel et al., 1992) have raised similar questions about whether monolingual norms are appropriate for assessing bilinguals or not.

Bialystok (2001) suggested that it is important to assess bilinguals' vocabulary knowledge with a clear estimate of their vocabulary size in both of their languages. Bialystok (2001), for example, noted that it is important to assess bilinguals from the perspective of

both of their languages, as a true estimate cannot be achieved if they are assessed only with regard to their second language to the exclusion of their first. More recently Bialystok (2010, p.530) states that "bilingual children are constructing the world through two telescopes, and their two vocabularies provide the lenses". Unfortunately, it can be difficult to assess bilinguals in both of their languages, and determine differences between them. According to Umbel et al. (1992), standardized tests in L2 were commonly used for measuring bilinguals' vocabulary knowledge, as they seemed to give more reliable and valid results on the prediction of bilinguals' vocabulary knowledge. However, Bialystok (2001) argued that although bilinguals are assessed in their both languages in most studies, the interaction between the two languages and total and conceptual vocabulary knowledge should also be considered in the assessments.

Bialystok et al. (2010) also point out that it is important to consider a bilingual's vocabulary knowledge in terms of home and school language use, and importantly, the total vocabulary of bilinguals should be considered when assessing their lexical processing. School vocabulary knowledge of bilinguals can be comparable with that of monolinguals, as Bialystok et al. (2008) found that while bilinguals' total vocabulary knowledge is higher than monolinguals, they also had the advantage in cognitive, linguistic and academic achievement. Bilinguals tend not to use English at home in the same way as their monolingual peers, and they understand vocabulary used at home, in their first language, and vocabulary used at school in English. This observation leads to the recommendation that bilinguals are assessed in both of their languages.

At this point, conceptual scoring can be accepted as a more accurate vocabulary assessment approach for bilinguals whose vocabulary knowledge is distributed over two languages. De Houwer, Bornstein, and Putnick (2014) define total conceptual vocabulary as the combination of lexical knowledge of both a bilingual's languages. This approach can be considered to measure the concepts of bilingual vocabulary knowledge in *either* language,

rather than language-specific word knowledge: conceptual scoring considers the total number of concepts for which a child knows a word in at least one language (Pearson et al., 1993).

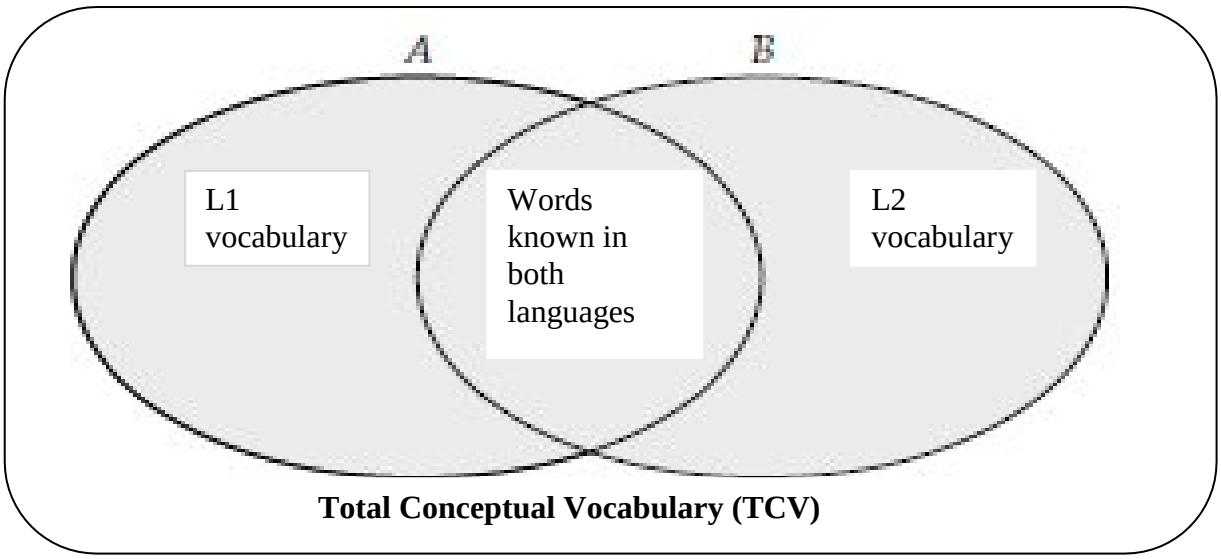

Figure 6. The total conceptual vocabulary representation (Source: the author)

As shown by Figure 6, L1 and L2 vocabulary represent the number of the words bilinguals know in each language separately, and conceptual vocabulary (TCV) represents the items for which bilinguals know the words in both languages with the same meaning and concepts (De Houwer, Bornstein, & Putnick, 2014). Total conceptual vocabulary scoring counts the words known in both languages as one word. The following example demonstrates total conceptual vocabulary knowledge whereby word knowledge in both languages overlaps. Consider a bilingual child is asked to utter words relating to school stationery items, and knows the words below in L1 (Turkish) and L2 (English).

Turkish		**English**	
Not known in Turkish		pen	
cetvel	↔	ruler	→ (TCV; same meaning or concept)
kitap	↔	book	→ (TCV; same meaning or concept)

defter not known in English

According to the list of the words in both languages, the bilingual child seems to know 3 words in Turkish and 3 words in English, but when conceptual vocabulary is considered, the words ‘cetvel-ruler’ and ‘kitap-book’ are produced in each language with the same meaning and concept. The bilingual child knows a word with the same meaning but produces twice in each language separately. At this point, these two words are refered to the same concept, and counted as one known concept. ‘Pen’ and ‘defter’ are only known in one language and are again counted as one known word. Therefore, in this scoring, the bilingual child knows 4 concepts and the total conceptual vocabulary in this example is 4.

Pearson et al. (1993) first considered both Total vocabulary and Conceptual vocabulary assessment for bilinguals in comparison with monolingual counterparts in their study and found no difference between bilinguals and monolinguals in conceptual expressive vocabulary. Bilingual results were lower, however, in single language scores. The findings suggest that conceptual scoring might be a more effective method than single language scoring in assessing bilingual vocabulary knowledge. Pearson went on to state that if bilinguals are tested in their dominant language with single language norms, their vocabulary knowledge can be an underestimated with respect to the distribution of lexical-semantic knowledge, so conceptual scoring should be taken into account to assess bilingual vocabulary knowledge.

Umbel et al. (1992) asserted the evidence of lexical overlap in bilinguals’ two languages, and showed that it demonstrated differences from child to child. Combining two language vocabulary scores without considering lexical overlap cannot be sufficient to accurately estimate bilingual vocabulary knowledge in comparison with monolinguals. Lexical overlap must therefore be taken into account in order to form an accurate and valid assessment of bilingual vocabulary knowledge.

Oller, Pearson, and Cobo-Lewis (2007) pointed out the importance of double language vocabulary knowledge for which bilinguals often demonstrate higher scores than single vocabulary in productive vocabulary assessments. With respect to the distributed nature of lexical-semantic knowledge, assessing bilingual vocabulary knowledge by considering only one language can underestimate total vocabulary knowledge.

More recent studies also supported conceptual scoring as a methodology for assessing the lexical knowledge of bilingual children in both languages (Bedore et al., 2005; Gross, Buac, & Kaushankaya, 2014; Marchman & Martínez- Sussmann, 2002). Marchman and Martínez- Sussmann (2002) used conceptual scoring in their study. Language production was combined with Spanish and English and administered tests using combination language production, and the results suggested that this can be a good predictor for assessing bilingual children's vocabulary knowledge (supporting Pearson's (1993) previous findings). However, despite using conceptual scoring norms, these studies often used vocabulary tests designed for monolingual children (Kan & Kohnert, 2005), as it has been very difficult to find or develop standardized vocabulary tests based on bilingual language norms. This issue can be considered an uncertainty of conceptual assessment methodology.

A further point is that these studies took place with Spanish-English (languages within the same language family) bilingual toddlers and children, but there is no previous study on such conceptual scoring (in either productive or receptive vocabulary knowledge) with bilingual children possessing two structural different languages, such as Turkish and English. The current study aims to address this deficit to some extent.

To summarize, it is crucial to assess bilinguals' vocabulary knowledge in both of their languages, so as to be comparable with monolingual vocabulary scores (Bialystok, 1988; Genesee & Nicoladis, 1995). Due to the previously mentioned vocabulary overlap, however, this cannot be sufficient to form an accurate estimate for the differences between bilingual

and monolingual vocabulary knowledge (Pearson, 1993; Umbel et al., 1992). In the literature, there are fewer expressive vocabulary studies than receptive vocabulary assessments. In bilingual expressive vocabulary experiments, the results are not different to receptive vocabulary studies on bilinguals, and conceptual scoring has been commonly used in expressive vocabulary assessments. In one recent study, Yan and Nicoladis (2009) found that some French-English school-aged children tend to have similar receptive vocabulary scores as monolinguals, but a smaller expressive vocabulary size than their monolingual counterparts even when both languages are considered together (TCV).

Conceptual scoring in vocabulary estimation can be a better methodological way to assess bilingual vocabulary knowledge than monolingual or single-language scoring or combining two language scoring. As bilinguals have two languages from which to choose words for concepts in different settings, cultural background or contexts (Iglesias, 2001; Pena, 2001). Some questions remain, even if this is the case, around whether or not conceptual scoring has a similar way for different bilingual groups, across different language settings, ages or SES.

2.5.11 What makes a good Vocabulary size test?

Nation recently defines (2016, p.180) that "A vocabulary test measures how many words a learner knows in the language, and this can then be used to see how many more words need to be learned to do certain language tasks." In the literature, factors that make a good vocabulary test have been described frequently, but constructing a vocabulary test is by no means easy (Milton, 2009). According to Milton (2009), it has been difficult to find a standardized test in the field of vocabulary testing, so drawing accurate comparisons between research studies is almost impossible, and extremely difficult to discern reliable and valid vocabulary size estimates. The important question, then, is what factors need be considered when constructing

a good vocabulary test, or what kind of criteria should be taken into account for such a good test. To answer this question, reliability and validity must be assessed.

Reliability refers to the test's ability to consistently and accurately measure performance in a certain task (Milton, 2009). Burnett (1974) argues that the most important aspect of reliability is the comparison of two parallel forms of the same test. If a learner is tested with two forms of the same test on the same day, the score must be similar in both tests (Milton, 2009). So using two parallel forms of the same test can be a good way to test its reliability. It is therefore important to carry out two forms of a vocabulary test for the same participants on the same day to ensure the test is reliable.

Validity indicates whether what a test measures what it is intended to measure (Milton, 2009). Validity can be broken down into various categories: content validity, construct validity, concurrent validity and face validity.

Content validity refers to the extent to which a test is is relevant to the given topic area and measures what it should. Bachman (1990, p. 244) explains content validity as "a test is relevant to and covers a given area of content or ability". Vocabulary breadth tests, for instance, are usually evaluated from the content of frequency word lists to achieve an accurate prediction of learners' vocabulary size. Frequency lists are generally accepted as the most appropriate method of choosing words for vocabulary tests because of the reducing sampling mistakes (Nation, 2016). Nation (2016, p.180) explains the word-sampling procedure from a frequency list as "A random sample can be taken from each frequency level or every nth word can be sampled from each frequency band".

As regards the current study, the Turkish X-Lex is based on the content of the Turkish frequency word list, where 100 Turkish words were selected from each frequency band, so each individual word in the test can be said to represent 50 words from that band. To ensure content validity, it is necessary to construct a test from the most relevant content, even if that

content is difficult to assess and measure. As Hughes (1989, p.23) states: “too often the content of tests is determined by what is easy to test rather than what is important to test”. Relevance is more important for content validity than convenience.

Construct validity demonstrates whether a test measures what it is intended to. If similar tests measuring the same construct, such as vocabulary size, correlate with each other, it is assumed the test has construct validity in use.

Concurrent validity is a term used to establish whether or not the results of a particular test correspond to those of a previously established measurement for the same construct and content. If the results of a newly developed test, for example, correlate with those of previous other tests which have already been found to be valid, the test has concurrent validity.

Face validity refers to whether or not a test is accepted by participants as measuring what it is intended to measure. This is related to the level of transparency of the test, and relates to how it is perceived by participants. Face validity must be borne in mind to ensure the most accurate results.

However, According to Messick (1993, 1995) the traditional conception of validity does not include all of the aspects of validity, specifically the value of the total scoring implications and the effects of social factors on the scores are ignored. Therefore, Messick (1993) developed a new framework of validity, which considers both the aspects of score meaning and considerations of the effects of social factors. Messick (1995) defined validity as not a simple ‘measuring / scoring’ tool, but also as interpreting the meaning of the scores, considering all of the relevant social and ethical aspects behind them and validity cannot be divided into independent categories.

2.5.12 Approaches to Vocabulary Knowledge Asssessment

In this brief review, some well-known vocabulary size tests in the field of vocabulary testing will be presented. It is important to select the most appropriate vocabulary size test according to the purpose of a given study, and the aim of the current study is to explore the relationship between the vocabulary size scores of Turkish-English bilingual children in relation to their nonverbal intelligence scores with the effect of parental language dominance and home language preference. The following review is therefore useful to decide the most appropriate vocabulary size test for assessing the vocabulary knowledge of the bilingual children in this study.

In the literature, vocabulary size tests are predominantly used to measure receptive vocabulary size in L1 or L2. Vocabulary size tests are mainly based on a dictionary list or a frequency list gathered from a language corpus (Nation, 2010). Each method can be used to sample words and develop a word list for the vocabulary test. Each method is frequently used for the aim of testing vocabulary, but frequency band-based tests are most commonly used for second language learners, as these tests include high frequent words that are more suitable for measuring beginner learners of a second language. The most commonly used of these receptive vocabulary tests are VLT (Nation, 1983, 1990), the Yes/No vocabulary test (Meara & Buxton, 1987), the Eurocentre Vocabulary size test (Meara & Jones, 1990), X-Lex (Meara & Milton, 2003) and LexTALE (Lemhöfer & Broersma, 2012). These tests will be described below, with particular attention to the X-Lex as it is the test used for measuring the English receptive vocabulary knowledge of the participants in the current study. Productive vocabulary size tests include VLT (productive version) (Laufer & Nation, 1999) and Lex 30 (Meara & Fitzpatrick, 2000), and CATSS, a test that deals with both receptive and productive vocabulary (Laufer & Goldstein, 2004). It can be seen that there are more receptive tests than

productive ones, and more studies on the validity and reliability of receptive tests than productive ones.

The aim of receptive vocabulary size tests is to measure learners' receptive vocabulary knowledge, the basic foundation of which is recognizing a given word (Nation, 2001). In this review, some well-known receptive vocabulary size tests are described.

Vocabulary Level Test (VLT) (Nation, 1990) is a well-known word frequency based test which aims to estimate the vocabulary size of second language learners. The VLT consists of five bands of the frequency list: the second, third, fifth and the tenth, representing the first 2000, 3000, 5000 and the 10,000 most frequent words in Standard English and the academic words. The structure of the test is based on a form-recognition matching format, whereby 60 words represent each band and are presented in six sets, with three definitions provided for each set. Participants are asked to select three of the six words in each set which match one of the three definitions given. Read (1988) analyses the validation of the VLT, and shows that scores in the low frequency bands were good predictors for the scores in the high frequency bands (so, learners who recognize low frequency words are more likely to recognize high frequency ones). He also found that the VLT is a reliable and valid test for measuring vocabulary size based on frequency bands.

The VLT was used to assess vocabulary size in several studies (Cobb, 1997; Laufer & Paribakht, 1998; Schmitt & Meara, 1997), prior to a full validation study carried out by Schmitt et al. (2001). The Schmitt study provided evidence for the validation of the two versions of the VLT and suggested further investigatory directions for the validation of this test. Schmitt posits that the VLT is more suitable for use in placement and diagnostic assessments rather than for full vocabulary size estimates, as it is designed to estimate the general or academic vocabulary size of second language learners based on relevant word

frequency levels. An example of the VLT's question and answer structure is given below (Nation, 1990, p. 265).

1. bake

2. connect _____ join together

3. inquire _____ walk without purpose

4. limit _____ keep within a certain size

5. recognize

6 .wander

Another receptive vocabulary size test is the Yes/No test, developed by Meara and Buxton (1987), is a meaning-recall test. Examinees are given a list of words and asked to tick the words they know (word lists are usually generated from a frequency band). According to Meara (1989), one of the advantages of this test is to measure a large number of words in a limited time, which other types of tests, such as multiple choice or cloze, cannot do. Further, Meara (1996) claims that Yes/No tests are appropriate for testing vocabulary at a variety of language proficiency levels, from beginner to advanced, and Beeckmans, Eyckmans, Janssens, Dufranne, and Van De Velde (2001) state that Yes/No tests are easy to administer and score than the multiple choice or cloze tests.

There is some criticism around the procedure of this test, however, as examinees can tick words that they do not know, making over-estimation of scores a distinct possibility (Anderson & Freebody, 1983), which affects the reliability and validity of the test. To compensate this, Schmitt (2010) suggests that non-words or pseudo-words can be added to the test, and if an examinee ticks more than 10% of these, they are removed from the the study. A further criticism is that the test only measures passive knowledge of vocabulary, but

Meara (1990) argues that passive vocabulary is an important skill to which other vocabulary skills are linked, and that passive vocabulary is a good predictor for active vocabulary, as learners with a high level of passive vocabulary also tend to have a high level of active vocabulary.

The EVST (Eurocentre Vocabulary Size Test) is a computerized version of the Yes/No Vocabulary size test developed by Meara and Jones (1990), developed to measure the English vocabulary size of second language learners. The test is based on ten frequency bands, each representing 1000 words, with the structure comprised of blocks (Meara, 1990): The first block represents the 1000 most frequent words of English; the second block represents the next 1000 most frequent words, and so on down to the tenth. Examinees indicate 1 for the words they know and 0 for the words they do not. Instructions appear to examinees on the first screen of the test: “If you know what the word means in English, press 1 or if you don’t know what the word means in English, press 0. You repeat this for about 150 words. Please note: some of the words are pseudo words”. The test consists of 150 items from 100 real words and 50 pseudo ones, and these items are presented randomly (in sections beginning with the most frequent word band) on the screen one word at a time, as intermixing words reduces overestimation in the test scores. When the test has been completed, the examinee’s score appears on the screen automatically, and if the examinee has obtained a high score, the program begins again with words from the next frequency band. There is no opportunity to go back and check the answers, so if a mistake is made, there is no way to correct this. Calculation of the final score is based on the rate of hits for correct words and false alarms (selecting pseudo words). EVST has no printed format, and uses what can be considered dated software (lognostics).

LexTALE (Lemhőfer & Broersma, 2012) is a new test for measuring vocabulary knowledge in English specifically at high proficiency levels, used mainly with advanced

learners. It has a similar procedure to EVST (Meara & Jones, 1990), consisting of 60 items (40 real English words and 20 fictional ones). Examinees are asked to indicate if they know the word or not. LexTALE is mostly used for psycholinguistic assessments and based on the frequency bands of words in English. It is easy to administer and takes only three to five minutes to complete, and can be carried out online or in a manual format according to the aim and procedure of the study.

The X-Lex is a receptive vocabulary size test developed by Meara and Milton (2003), designed in a Yes/No format. The aim is to measure L2 learners' vocabulary size from the 5000 most frequent words of English, generated from Nation's (1984) and Hindmarsh's (1980) frequency lists, and can be easily administered in pen and paper (see appendix A) or as a computer- based format. The pen and paper format comprises 100 real English words and 20 pseudo- or non-words in six columns, each column containing twenty words representing the 1000 words of that frequency band. The test includes the most frequent words from the first, second, third, fourth and the fifth band. The 20 real words for each column are selected randomly from each frequency band, and the final column consists of pseudo- or non-words that resemble real English words (as in previous tests, these are included to reduce the effect of guesswork and overestimation). Examinees are required to tick the words that they know; each tick for a real English word is counted, multiplied by 50 and added to the score, but each tick for a pseudo or non-word is multiplied by 250 and deducted from the total score.

In the computer version, words appear on the screen one by one, and examinees are required to click the smiley face for words they know and the sad face for words they do not know. A frequency band chart representing the 1000 to 5000 most frequent word bands and an error column representing the pseudo or non-words is shown on the screen to demonstrate progress in each band. After the scores are calculated, the raw score is out of 5000.

For the purposes of the current study, the X-Lex (Meara & Milton, 2003) pen and paper version is considered the most appropriate vocabulary size test for measuring the participants' vocabulary size in English. One of the reasons for this is that participants were visited at home, and the test carried out separately. The pen and paper version therefore made administering the test easier. A further reason is that the different frequency levels made it possible to measure the vocabulary size of the participants from different age groups (7-11), as it provides a vocabulary knowledge profile from a range of different frequency bands (from 1k to 5k).

The X-Lex format and procedure can be adapted to develop a vocabulary size test in a different language other than English. As the aim of this study is to examine the relationship between the vocabulary size of the two languages of Turkish-English bilingual children, the X-Lex format was adapted to Turkish (see Appendix 1 for English and Appendix 2 for Turkish, and the Turkish X-Lex is explained further in Chapter 3, Methodology) to measure the participants' first language (Turkish).

The X-Lex is appropriate for the ages of the participants of this study (7-11) as the instructions are clear, and a final benefit is that the scoring system is straightforward and easy to calculate in a short time.

In the following review, some examples of well-known productive vocabulary size tests are also given. It is again worth noting that there are far fewer of these than receptive tests. Productive vocabulary size tests are used to estimate learners' productive vocabulary knowledge in a language. Productive vocabulary knowledge is more complex than receptive vocabulary knowledge, as it not only tests if a word is recognized, but also if a word's meanings and associations are understood (Laufer et al., 2004).

Laufer and Nation (1999) developed this test as a version of the VLT (explained above). Examinees are asked to complete a word in a sentence, with the first few letters

provided as a cue. Like the VLT (Nation, 1990), words are generated from word frequency bands. It seems possible to assess examinees' productive vocabulary with tests like this.

Another productive vocabulary size test is the Lex 30 (Meara & Fitzpatrick, 2000). In this test, examinees are given 30 stimulus words and asked to produce as many associations as they can. At the end of the test, the number of given associations beyond the 1000 word frequency level are counted and used for the examinees' total productive vocabulary size. The structure of the test is clear but it may take more than 1 hour to complete, so the Lex 30 may not be suitable for all age groups, especially children and teenagers. The nature of the words could not be suitable for all age groups; this could be explained with the word usage or the word familiarity, which is based on a life experience or routine. Examples from a completed Lex 30 test are shown below (Fitzpatrick, 2007, p.120).

1. attack ……*war, castle, guns, armour*……..
2. board ……*plane, wood, airport, boarding pass*…..
3. close ……*lock, avenue, finish, end*…….....
4. cloth ……*material, table, design*…….
5. dig ……*bury,spade, garden, soil, earth*…….

CATSS (The Computer Adaptive Test of Size and Strength), developed by Laufer and Goldstein (2004), aims to measure both breadth and depth of vocabulary knowledge. It is based on four degrees of knowledge which are assessed in terms of both active and passive recall and active and passive recognition. The examinees are asked to supply the form of a word for a given meaning and the meaning of a given form of a word. The advantage of this kind of test is to make comparable assessments from different types of vocabulary knowledge possible. One of the most important implications of the CATSS measurement is that there is a different hierarchical level between receptive and productive vocabulary knowledge, as the

amount of the passive vocabulary is larger than that of active vocabulary, and while the most advanced level of vocabulary knowledge is active recall, lower advanced knowledge is passive recognition (Laufer & Goldstein, 2004).

2.6 Chapter summary

This section provides a brief summary of the Literature Review to provide a clear outline of Chapter 2. This chapter presented a review of the literature relevant to the current study. Bilingualism, vocabulary knowledge and nonverbal intelligence were discussed and related with one another. First of all, this chapter provides an overview on bilingual population by the estimations of bilinguals in the world, the number of the immigrants in the UK and the facts of the Turkish immigrant population in the UK. Following this, this chapter provides information about the general language and vocabulary structures of the Turkish language.

In the first section of the review, bilingualism was described in terms of definition, types and approaches. In the same section, the Interdependence Hypothesis (Cummins, 1979) and CUP (The Common Underlying Proficiency) (Cummins, 1984) were explained and research findings based on them in terms of different aspects of language such as the relationship between reading and literacy skills, phonological awareness and language proficiency in L1 and L2 were discussed. Next, nonverbal intelligence and the *g* factor were explained in relation to bilingualism along with a review of the various nonverbal intelligence tests used with children to help justify the test chosen for use in this current study. Bilingualism and nonverbal intelligence were described and followed by early and recent studies on the relationship between bilingualism and cognitive development: in this section, the cognitive advantages or disadvantages of bilingualism were discussed. Even though most early studies concluded that bilingualism held disadvantages for cognitive development, recent ones have found advantages.

Research on the relationship between vocabulary size and intelligence was described, beginning with the earliest studies. As before, there is little recent research in this area in the case of bilinguals, so the current study seeks to address this deficit by investigating the relationship between the vocabulary size and nonverbal intelligence scores of bilingual children and provide systematic results.

In the second section of the review, the factors related to bilingual vocabulary development were discussed in terms of the effect of parental language dominance, home language preference, language input and exposure, parental education, occupation, knowledge of literature and SES (socio-economic status). Findings on the positive effects of parental language dominance in L1, home language preference for L1, parental language input, education and occupation and high SES on vocabulary development of bilingual children were examined.

In the final section of the review, the importance of vocabulary was explained in terms of language proficiency and definitions for ‘word’ and what it means to know a word were given. In accordance with the aim of the current study, both receptive and productive vocabulary knowledge and breadth and depth vocabulary knowledge were described and their differences explained.

Since the importance of the link between L1 and L2 mental lexicon(s) is important to the current study, a ‘mental lexicon’ was defined and the relationship between L1 and L2 discussed, a review of mental lexicon models provided in the literature. While the link between vocabulary size in L1 and L2 has been sparsely investigated, those that have been carried out reported positive correlations. Additional research is still needed to empirically examine the vocabulary size interdependence between two distinct languages, and the present study aims to help address this. A summary of vocabulary studies on bilinguals in terms of receptive vocabulary in comparison with monolinguals, with particular focus on bilingual

conceptual vocabulary studies followed this. The section continued with a discussion of the link between vocabulary size in L1 and L2 in the light of Cummins' Interdependence hypothesis (Cummins, 1979), about which there is again not enough research (with the exception of three recent studies that found a positive relationship between L1 and L2 vocabulary size.

Following this, the dimensions of an effective vocabulary test were given, before a discussion on how and why vocabulary is tested. Some of the most widely used receptive and productive vocabulary tests were described, in order to justify the current study's selection of the X-Lex to measuring participants' receptive vocabulary size (the X-Lex is discussed further in Chapter 3, Methodology).

2.7 Research questions

The present study aims to investigate the following research questions based on the literature review:

1. What is the relationship between the vocabulary knowledge of bilingual children across two languages?
2. Is there any bilingual advantage or disadvantage over monolinguals in terms of vocabulary knowledge when the Total Conceptual Vocabulary assessment is taken into account?
3. What is the relationship between the vocabulary knowledge of bilingual children and their nonverbal intelligence?
4. What is the effect of parental support for L1 on bilingual children's vocabulary knowledge and nonverbal intelligence?

2.8 Hypotheses

In the light of this literature on bilingualism, vocabulary and nonverbal intelligence, and considering the research questions addressed above the present study seeks to investigate the following hypotheses:

1. There is a positive relationship between the vocabulary sizes of Turkish-English bilingual children .

2. a. Bilingual children have lower vocabulary size than monolingual children in both languages.

   b. When both languages of bilinguals are taken together and the total conceptual vocabulary (TCV) is counted, there is no bilingual disadvantage. The TCV of bilinguals is not smaller than the vocabulary size of monolinguals.

3. There is a positive relationship between the vocabulary size of bilingual children in both languages and their nonverbal intelligence scores.

4. Parental L1 dominance and L1 use at home have a positive effect on bilingual children's vocabulary size in both languages and their nonverbal intelligence scores.

Chapter three

METHODOLOGY

This chapter describes the methodology of the current study, which constitutes both quantitative and qualitative research methods to investigate the relationship between the vocabulary size of Turkish-English bilingual children and their nonverbal intelligence scores. The effect of parental language dominance and home language on vocabulary size and nonverbal intelligence is also analysed, in comparison with their monolingual counterparts. The study is based on the four hypotheses given at the end of Chapter 2. According to the aims and objectives of this study, the collected data was analysed using the SPSS-22 statistical package. This chapter includes a description of the participants (3.1), the measures used to collect data (3.2), the procedure (3.3) of the study, with a timetable of the data collection process and methodological (3.3.1) - ethical issues (3.3.2), and finally, an analysis (3.4) of the data with regard to the hypotheses.

3.1 Participants

The participants in this study were 100 Turkish-English sequential bilingual children living in the UK, along with 25 age-matched English monolinguals living in the UK and 25 Turkish monolingual children living in Turkey. The bilingual group includes 43 male and 57 female bilingual children between 7 and 11 years old (mean age = 9.4 years; range 7;1- 11;9), the Turkish monolingual group consisted of 12 male and 13 female children very close in age to the bilingual group (mean age = 9.3 years; range 7;1- 11;10), and the English monolingual group comprised 12 male and 13 female children, again very close in age (mean age = 9.4 years; range 7;1- 11;6).

All participants are from middle-class (SES) families, with at least one parent in each family holding a university or college degree. No trilinguals participated in this study. All of the bilingual participants live in the UK and attend UK community schools between (years 1 to 6). Children begin Year One at the age of 6-7 after the nursery and reception years. The first language of all of the bilingual children is Turkish and their second language is English, therefore the current study has controlled for differences between L1 and L2 (all bilingual participants have the same language background in terms of first and second language). The parents (N = 83) of the bilingual children are Turkish immigrant families and their children were born in the UK. The children were first exposed to Turkish as a home language before starting to learn English consistently at the onset of pre-school at the age of four. They have very occasional communication with Turkish speakers, but no Turkish people in their immediate neighbourhood. Additionally, of the 100 bilingual participants, 33 have a sibling relationship with another participant.

The Language Usage Questionnaire created for the current study (see Appendix E) was used to gather detailed background information from the parents. 94 % of the participants (parents) did not want to go back to Turkey and only 6 % wanted to return within 5 years. Additionally, according to results from the Language, Social and Background Questionnaire (LSBQ; Luk & Bialystok, 2013) (see appendix F); All of the parents were born in Turkey, with their first language as Turkish, and learned English as a foreign language. They use no other languages in their daily lives.

3.2 Measures

3.2.1 X-Lex

As explained briefly in Chapter 2, the X-Lex was developed by Meara and Milton (2003) and designed to measure the receptive vocabulary size of EFL learners at college level using words from five word frequency bands. In the current study, the bilingual children and

English monolingual children were tested with the pen and paper version of X-Lex (see Appendix A) to measure their receptive vocabulary size in English. X-Lex has previously been used in research to assess children aged 7 (Milton, 2006), therefore X-Lex is considered an appropriate test considering the age of the participants. X-Lex is a Yes / No format test, where participants demonstrate whether they know a word or not. The test presents 100 real words and 20 pseudo-words (designed to look like English words but not existing in English) in six columns, with each column consisting of 20 words. The real English words are divided into 5 columns with words selected randomly from the first five word frequency bands (from K1 to K5, 1000 words in each band). In the sixth column, 20 pseudo-words are presented, in a column of their own instead of mixing in to the real words. Some participants ticked these words, claiming to know them, which is of course impossible, revealing that they did not realize or understand the existing of the pseudo words in this test. The designers of the X-Lex have previously used it with the same original structure and provided the reliability of the test, with the pseudo-words listed in the final column.

The participants were simply asked to tick the words they know and to leave a gap for words that they do not know. Test instructions were given verbally in English to avoid any potential misspelling problems and to ensure all participants understood the instructions clearly. The final scores were computed by giving 50 points for each ticked real English word and removing 250 points for each pseudo-word ticked (‘false alarms’). The assumption is that scoring pseudo-words in this way helps reduce the effects of overestimation or guesswork. The X-Lex is easy to administer and time-efficient, with an uncomplicated scoring system: the final scores can be worked out with a calculator.

3.2.2 The Turkish X-Lex

The Turkish X-Lex (see Appendix B), adapted from the English version, was developed for this study, to measure the Turkish receptive vocabulary size of the Turkish bilingual and monolingual participants. Like the English X-Lex, it uses the first 5000 most frequent words

of Turkish, based on the largest Turkish corpus (3.3. million words) provided by Sketch Engine (Ambati, Reddy, & Kilgarriff, 2012). The Turkish X-Lex contains 100 real and 20 pseudo-words in total, with the real words in columns 1 to 5 and the pseudo-words in column six, each column including 20 randomly chosen words from each frequency band from K1 to K5 (1000 words in each band). Each real word was randomly selected with a random number generator (https://www.random.org/) for representing 50 words from the 5000 word frequency list (Sketch Engine; Ambati, Reddy, & Kilgarriff, 2012).

The scoring system is identical to that of the English X-Lex (50 points for each correct real word, -250 points for each accepted pseudo word). The words in the test were read out to the participants to prevent misunderstandings. The instructions were also given verbally, in Turkish, to prevent spelling misunderstandings. In all tests, then, instructions were given verbally in the language of the test to avoid confusion between two languages.

Two parallel versions of the Turkish X-Lex (A and B) were developed and piloted with 20 Turkish-English bilingual participants. The findings from the pilot study suggested that both versions were reliable and that the correlation between the parallel tests was highly significant (r = .921, p < 0.01), while the mean difference between the versions was not statistically significant (p = . 311).

The Turkish X-Lex demonstrates sufficient reliability for measuring participants from different age groups and language backgrounds (Turkish-English bilinguals and monolingual Turkish speakers). The test is easy to administer to children in a reasonable time frame and uses a simple scoring system. Both X-Lex tests (English and Turkish) were used with the bilingual children to discover any relationship between their vocabulary sizes in both languages and to allow comparisons with their monolingual counterparts.

3.2.3 Verbal Fluency Test (The semantic fluency task)

A semantic (category) fluency task was administered to measure the productive vocabulary knowledge of Turkish-English bilingual children in both languages separately and both English and Turkish monolingual children. As Deutsch (1995) and Lezak (2010) noted, verbal fluency tests are mostly used in psychological and neuropsychological clinical practice and research to measure productive vocabulary knowledge in a language. However, verbal fluency tasks are also used to test verbal ability such as lexical knowledge (e.g. Cohen et al., 1999; Federmeier et al., 2002) and to measure executive control (e.g. Fitzpatrick, Gilbert, & Serpell, 2013). Such tests are typically administered with semantic (category) and letter (phonemic) fluency elements. In a recent study, Friesen, Luo, Luk, & Bialystok (2015) used verbal fluency tasks in category and letter fluency to analyse the performance of both bilingual and monolingual participants from different age groups and related the results to the effects of age, bilingualism, language proficiency, executive control, vocabulary knowledge and semantic memory. In the standard form of the tests, the participants are given one minute to produce as many relevant words as possible within a semantic category or words that start with a given letter in a letter phonemic fluency task. In the current study, the semantic (category) fluency task was used. The participants were given two minutes for each category instead of one; taking into account their younger age (7-11). The test was based on four semantic categories: ‘food’, ‘body parts’, ‘clothing ’and ‘colours’ in both Turkish and English separately, and was administered with a time gap of two weeks between languages to avoid priming effects. The answers for each category were recorded with a voice recorder and saved as files for transcription and scoring. Like the receptive vocabulary test, the verbal fluency test instructions were given in the language of the test. The test was based on conceptual scoring: as explained in Chapter 2, conceptual scoring has been used for assessing bilingual vocabulary knowledge and is accepted as a good predictor of bilingual vocabulary knowledge without underestimating such knowledge in both languages (e.g. Marchman & Martínez-

Sussmann, 2002). The idea of conceptual scoring is to count the words produced in each language separately, but if the same word is produced in both languages within the same category, the word is counted as one instead of two. For example, if the word *banana* is produced in English and also in Turkish (*muz*), the word is counted as only one in conceptual scoring.

3.2.4 Raven's Coloured Progressive Matrices (RCPM)

Raven's Progressive Matrices (see Appendix C) was first developed in 1939 by Raven to measure and assess nonverbal and abstract reasoning ability. Raven's Progressive Matrices are used in psychological, neuropsychological and clinical settings, and extensively in research as it is a culture-free test (Jensen, 1980). Raven's Matrices found the clearest measure of *g* loading (Spearman & Jones, 1950) and has been accepted as the best predictor and measurement of *g* (Court, 1983; Jensen, 1998). As described in Chapter 2, Raven's Progressive Matrices has three versions based on different age groups, such as the Standard Progressive Matrices for those 6 and up, the Coloured Progressive Matrices for children between 5½ and 11½ years old and the Advanced Progressive Matrices for older adolescents and adults with higher mental ability.

Raven's RCPM is an internationally recognized and standardised culture-free test of nonverbal intelligence (Raven, Raven, & Court, 1990). The patterns of the test are designed to measure "mental development up to the stage when a person is sufficiently able to reason by analogy to adopt this way of thinking as a consistent method of inference" (Raven et al., 1998, p. CPM2). RCPM was first standardized in the UK with 627 Scottish school children in 1949, again in 1982 and more recently in the USA (Raven et al., 1990). As stated earlier, RCPM was designed for children between 5½ and 11½ years old (Raven et al., 1990), appropriate for the participants of the current study, considering the median scores of mental development in childhood not equally arranged for the years of age.

In accordance with the aim of this study, the Coloured Progressive Matrices (RCPM) was used to measure the nonverbal intelligence scores of bilingual and monolingual children to discover any cognitive advantage of bilingual children over their monolingual counterparts in terms of nonverbal intelligence scores. RCPM was given to both the bilingual and monolingual children due to its age appropriate nature (Raven, 1962; Raven et al., 2004), used as a test of nonverbal intelligence in the current study because there is no language effect. RCPM is therefore the most appropriate assessment for bilingual and monolingual groups without seeing any language effect on the test scores and to allow accurate estimates of nonverbal intelligence. Due to the culture-free nature of this version of the test, RCPM can be used with bilingual and monolingual participants with different parental cultural backgrounds (bilingual children with Turkish parents, English monolingual children with English parents etc.). In this study, RCPM is appropriate for both the bilingual and monolingual children who have similar access to modern education, including maths, geometry etc. However, RCPM may not be considered completely culture-neutral for children who have not been exposed to the formal educational system or formal education in a school setting.

RCPM is an easily carried out, pen-and-paper test and takes 45 minutes to complete. It contains three sets (A, Ab and B) with 12 matrices (pattern) in each set (the total number of matrices is 36). The matrices are organized from easy to more difficult, as Martin and Wiechers (1954, p. 143) stated: “the figures in the patterns to be completed remain simple but the relations between figures become increasingly complex”. The test consists of a series of patterns, each with a missing part, and each pattern is colourful to make the test more attractive for children. Six similarly shaped pieces are placed below each pattern, and participants are required to select the correct one, making this a kind of multiple-choice test (Martin & Wiechers, 1954). In the current study, answer sheets were provided for each participant to write their answers in the corresponding section of the record form. However, as

Lezak (1995) suggested, participants also point to their answer and a researcher can record it. The total score of the test was carried out by counting up correct answers, without marking down for incorrect answers. The maximum score in this test is 36, so if the total number of matrices is completed correctly, the test score is 36.

3.2.4.1 Reliability of RCPM

In term of reliability, studies of RCPM have provided findings using split-half or test-retest reliability. For example, Jensen (1974, as cited in Raven et al., 1998) explored the split-half reliability of r = .90 with 1,662 Anglo, Black and Hispanic children between kindergarten and Grade 6. According to the investigation, there were no significant sex or ethnicity differences, but age differences were not provided. In another study on the test's reliability, Carlson and Jensen (1981, cited in Raven et al., 1998, p. CPM27) reported a correlation of r = .81 as a split-half estimate and specifically reported correlations for ages 6 (r = .65, 7(r = .86) and 8 (r = .85). The correlations for young children were lower than those for older children. Another study used 970 Chinese children with a non-English language background (Teng, Li, Chen, & Jin, 1991 as cited in Raven et al., 1998, p. CPM28). In this study, a split-half estimate of r =.97 was reported. Besides split-half reliability, test-retest reliability has also been examined: Li et al. (1988, as cited in Raven et al., 1998) reported a reliability of r = .95 using 1017 Chinese children from grades 1 to 5, and Freyburg (1966, as cited in Raven et al., 1998, p. CPM28) provided a test-retest reliability of .87, .83 and .81 for children aged 5, 7 and 8 respectively.

3.2.4.2 Validity of RCPM

As mentioned earlier, RCPM is accepted as a good predictor of *g* and has high *g* loadings (Jensen, 1998). Jensen (1998) discussed the factor analysis of the Progressive Matrices tests with a variety of other tests, demonstrating that RCPM had the highest *g* loadings at around r =.80. According to Raven et al. (1998, p. CPM29), even if RCPM is not a direct measurement

of “general intelligence”, it tends to measure “a person’s intellectual output in a rather pure factorial sense.” Further studies have explored test’s validity in cross-cultural settings. Martin and Wiechers (1954) investigated the correlation between RCPM and WISC (Wechsler Scale for Children), and found significant correlations between the range of r = .83 to r = .91: the study concluded that RCPM is a culturally-reduced measure of nonverbal abstract thinking. Other studies in Asian, African and Indian cultural contexts have validated RCPM (Raven et al., 1998), and validations have been carried out seperately in clinical and educational settings to determine if the test measures what it intends to measure. Some interesting results from educational settings have been described: Martin and Wiechers (1954, as cited in Raven et al., 1998), for example, found a high correlation (r = .91) with the WISC regarding the RCPM’s concurrent validity, and Orpet (1976, as cited in Raven et al., 1998, p. CPM34) found *g* loadings as r = .70 for set A, and r = .74 for sets Ab and B, identifying only one factor to *g* (convergent-cognitive figural).

The test has generally revealed positive and high predictive validity when compared with other tests like the WISC, and gives only one factor on the total variance, which is *g* loading.

3.2.5 The Bilingual Dominance Scale

As mentioned in the previous chapter, the Bilingual Dominance Scale (Dunn & Fox-Tree, 2009) (see Appendix D) has been used to assess the language dominance of the parents of the Turkish-English bilingual participants to ascertain their language dominance for L1 (Turkish) and L2 (English). It was defined as “an easy-to-implement and quick and useful tool” to assess the participants’ language dominance between two languages (Dunn & Fox-Tree, 2009, p. 273). The original validation of the test was provided with a Spanish/English translation task score of the participants (Dunn & Fox-Tree, 2009). The original form of the

scale is set to Spanish and English, but the current study used Turkish for the first language and English for the second language.

The original scoring system in the study of Dunn and Fox-Tree (2009) was used in the current study. The paper-and-pen manual scale consists of a questionnaire of 12 closed questions, weighted differently for the final score. The final score produces a number that demonstrates the participants' degree of dominance between their two languages. The score 0 represents a 100% balanced bilingual whose languages have equal dominance. Negative scores (below 0) demonstrate English dominance (weighted), with a maximum score of -31, and positive scores (above 0) demonstrate Turkish dominance, with a maximum score of +31.The questions are designed to be clear to understand. In the current study, mothers and fathers were assessed separately.The parents followed the instructions of the questionnaire, and all completed the questions in order. They were instructed that they were free to not answer any questions they wanted.

3.2.6 Language Usage Questionnaire

The Language Usage Questionnaire (see Appendix E) was created to gather background information on the parents in terms of their life, background and languages with respect to the aim of the current study. This provided important information, such as the length of their UK residence, how long they had been married and if they wanted to return to Turkey permanently or not, and if they did, when they wanted to do so. The questionnaire consists of 5 closed and 4 open-ended questions. The open-ended questions are not used for measuring parental language usage, thus the responses for these questions will be used for a further study on the relationship between the vocabulary sizes of parents in their L1 and L2.

The test was specifically carried out to gather more information about the parents of the bilingual children in this study. The parents were clearly informed of the aim of this

questionnaire, and were free to begin anywhere they chose. There was no time limit, but more than 85% of the participants completed the test within 15 minutes.

3.2.7 Language and Social Background Questionnaire (LSBQ)

The LSBQ was developed by Luk and Bilaystok (2013) to assess language usage experience on a daily basis (see Appendix F). The questionnaire contains two sections: demographic and language background (questions 1-19) and daily usage of languages and self-rated proficiency (questions 20-23). LSBQ is a pen-and-paper self-rated questionnaire, and takes only ten minutes to complete. In the current study, the parents of the bilingual children were assessed with both parts of the questionnaire, excluding language usage at school (question 21), as the aim of this study is to find out the parents' home language usage and its effect on their children's vocabulary size in both languages and nonverbal intelligence scores. The aim of the demographic questions (first section) was to find out the language experience of the participants. The first section consists of background information, such as age, place of birth, age of arrival in the UK, years of education, language of education, language usage on a daily basis, first and second languages and history (background) of English language learning. The aim of the second section (home and school language) is to assess self-rated usage and language proficiency in both languages, as well as home and school language usage experience. The parents were asked to rate their proportion of English to non-English (Turkish in this case) language usage on a 10cm visual analogue scale (see Appendix F). At the left end of the scale lies 0, representing no English usage (only Turkish), and at the right end of the scale lies 100, representing English only. The participants' responses were measured in millimetres and recorded. The 'self-rated proficiency' section consisted of speaking, listening, reading, writing, watching TV and listening to music for home. In the final part of the second section, participants rated their language proficiency in both languages on an analogue scale of 0 to 100 in speaking, understanding (comprehension), and reading and writing in their first (Turkish) and second (English) languages.

3.3 Procedure

As laid out by the aims of the current study, 100 Turkish-English bilingual children were tested with the X-Lex receptive vocabulary size tests (X-Lex English and Turkish X-Lex) in both languages (L1 = Turkish and L2 = English) to determine their vocabulary size in both languages and to find out the relationship between their receptive vocabulary sizes in Turkish and English, with a gap of two weeks between tests to avoid priming effects. The Turkish X-Lex was used for Turkish monolingual children and the X-Lex (Meara & Milton, 2003) in English was administered for English monolingual children in order to make comparisons between the vocabulary sizes of bilingual children in both languages.

Next, verbal fluency tests (Deutsch, 1995) were used to measure the productive vocabulary of the bilingual children in both languages and to discover the productive vocabulary size relationship between their two languages. This test was also carried out with the Turkish and English monolingual children to allow comparisons between bilinguals and monolinguals to be drawn. Bilingual participants were tested in both languages, again with a two-week gap.

All of the participating children were tested with Raven's Coloured Progressive Matrices (Raven, Raven, & Court, 1962, 2004) to determine their nonverbal intelligence scores and to allow comparison between the bilingual and monolingual groups to discern any bilingual advantage or disadvantage on nonverbal intelligence.

The parents were interviewed with the Bilingual Dominance Scale (Dunn & Fox-Tree, 2009) to quantify the effect of parental language dominance on their children's vocabulary size in both languages and their nonverbal intelligence scores, and with the Language Usage Questionnaire, which was created for this study to assess the parents' language usage profile and gather more background information. Finally, the parents were tested with the Language and Social Background Questionnaire (LSBQ; Luk & Bialystok, 2013) to explore their home

language preference, their language experience and the effect of their home language usage on their children's vocabulary size and nonverbal intelligence scores. Before starting the each questionnaire, there was a pre-questionnaire discussion with parents. The questions were explained to avoid any potential misunderstandings and to ensure all parents understood the questions clearly. Each questionnaire was used with a gap of at least three weeks. Each questionnaire was carried out separately for each parent of each child.

An overview of the process of data collection is provided in Table 4 (below). The table shows the time of the tests and questionnaires.

Table 4. Timetable of the procedure

Measures	Turkish-English bilingual children (N=100)	Turkish monolinguals (N = 25)	English monolinguals (N = 25)	Parents of the bilingual children (N = 83)
X-Lex (English)	March- May 2014		June 2014	
X-Lex (Turkish)	March-June 2014	July-August2014		
Verbal fluency tests	December/January/February 2014-2015	April 2015	February 2015	
RCPM (nonverbal intelligence test)	March-June 2014	July-August 2014	June 2014	
The Bilingual Dominance Scale				June 2014
Language Usage Questionnaire				September 2015

Language and Social Background questionnaire				December 2015

3.3.1 Methodological issues

There are some key methodological issues in researching the linguistic and cognitive development of bilinguals. According to Marian (2008), research on bilinguals is mainly based on different methodological research designs. The first is *'descriptive research (naturalistic observation)'*, which refers to the process of observing the participants naturally and recording and describing the data scientifically, for example, observing children in a classroom setting or in a playing area. The second is *'experimental research'*, which refers to controlling the participants and measuring them experimentally in a controlled time limit, for example, participants are tested with a vocabulary test or a mental ability test with the aims of an experiment. Experimental research makes summarizing the cause and effect results easier by controlling variables. Another research method for bilinguals is '*correlational research'*, which is based on the relationship between the variables used in an experiment. Correlation research can be helpful for finding the results without "causal judgements" (Marian, 2008, p. 15), for example, in experiments on the relationship between vocabulary size and intelligence, the result can be that two variables are related but no information about the casual relation is obtained.

The methodology of the current study is based on both experimential and correlational research method designs in accordance with the aims of this study.

3.3.2 Ethical issues

Ethical consideration is vital when conducting research and a number of ethical considerations had to be taken into account in this study, particularly around consent. The

letters of consent (see Appendix G) were given to all of the parents, and parents were asked them read them carefully and, if they were to agree for their children to take part in the current research study, to sign and return them. The consent form includes the aim of the current study, the confidentiality of the participants' personal data, uses of the data (only for the current research), agreement for audio/video recording of their child, and an assurance that they were free to withdraw themselves and their children from the study at any time. The forms were collected from the parents and saved. According to the aim of this study, the data gathered from the verbal fluency test was collected with a voice recorder and participants' speech productions were recorded as voice records. All recordings were saved with password protection. All hard copies of data (vocabulary tests, nonverbal intelligence tests and parental questionnaires) were kept safely and confidentially. In this study, it was very clear that the research was purely for academic purposes; all participants were volunteers.

3.4 Data analysis

The data collection process has been explained in the Measurements (3.2) and Procedure (3.3) sections of this Chapter. The total vocabulary and intelligence test scores and questionnaire scores were computed, marked in a systematic way and recorded for statistical analysis. All data was analysed using the SPSS-22 statistical package in accordance with the aims of the current study and the sequences of the hypothesis.

The first hypothesis of the current study is that there is a positive and significant correlation between the vocabulary sizes of the bilingual children in both languages. With regard to this, the data from both receptive and productive tests were analysed with descriptive statistics to demonstrate the means, maximum and minimum scores and standard deviation of both receptive and productive vocabulary size tests (X-Lex in English and Turkish and verbal fluency test in both languages). Correlations and scatter/dot graphs were computed to find out the relationship between the L1 (Turkish) and L2 (English) receptive

vocabulary size scores of the bilingual children and the same analyses were applied to the relationship between the Turkish and English productive vocabulary size scores of the bilingual children (N = 100). A correlation was also carried out to determine the relationship between the receptive and productive vocabulary size of the bilingual children in each of their languages separately.

The second hypothesis of the study is based on the comparison between the receptive and productive vocabulary sizes of the bilinguals and their monolingual counterparts in the same language. Data analyses was processed to find descriptive statistics of the bilingual and monolingual children in both languages and to compare the bilingual and monolingual receptive and productive vocabulary size in each language separately. The effect of the total conceptual vocabulary assessment of bilingual productive vocabulary in comparison with monolinguals in both languages was also explored. Results were provided with tables and figures of box-plot graphs. Regarding the total conceptual vocabulary of the bilingual children, the comparison between the bilingual and monolingual groups was analysed with box-plot graphs to find out the advantage/ disadvantage of the Total Conceptual Vocabulary assessment on the bilinguals' vocabulary size in comparison with their monolingual counterparts. (The total conceptual vocabulary was only assessed for bilingual children because of their two languages, and compared with the productive vocabulary size of the monolinguals, as conceptual vocabulary can only be tested in two languages).

Data analyses were also processed for the third hypothesis, to discern any relationship between the vocabulary size of bilingual children in both languages and their nonverbal intelligence scores. The correlation was used to analyse the data collection from the test scores of the participants in vocabulary size tests and the nonverbal intelligence test. The analyses were provided with a table of the correlations between receptive and productive vocabulary size in both languages and the nonverbal intelligence test.

The fourth hypothesis is based on examining the effect of parental language dominance and home language on children's vocabulary size profile and nonverbal intelligence scores in comparison with their monolingual counterparts. The nonverbal intelligence scores of all of the bilingual and monolingual children were compared with one-way Anova analysis to find any general bilingual advantage/ disadvantage over monolinguals in terms of nonverbal intelligence scores. Next, bilingual groups were divided into two sub-groups according to their parental language dominance and home language use. Bilinguals were grouped as L1 and L2 dominant and compared with both English and Turkish monolinguals (between groups) and with each other (strong and less strong L1 dominant) in terms of nonverbal intelligence scores. The data were analysed with one-way ANOVA to determine any potential difference between the groups and within the bilingual sub-groups: analysis was provided with box-plot graphs. For examining the effect of parental home language usage, bilinguals were divided into two sub-groups once more: more Turkish use at home and more English use at home. Analysis was carried out to examine the correlation between the two sub-groups of bilinguals (more Turkish and more English use at home) for nonverbal intelligence scores. Lastly, the data was analysed in terms of correlations between parental language dominance and language use at home and children's vocabulary sizes in receptive, productive and conceptual vocabulary and nonverbal intelligence scores separately.

3.5 Chapter summary

This chapter described the methodological issues and the procedures employed to address the aim of the current study. Information about the participants and the measures used for gathering data were provided. Procedures for the study in terms of how participants were tested and data was gathered and a discussion of methodological and ethical considerations during and after the data collection were presented, in the latter case, in terms of the security of the data and ethical rules are upheld both theoretically and practically. Additionally, the

data collection and analysis process of this study were discussed and relevant information provided.

Chapter four

RESULTS

This chapter reports the results of the data analyses in the sequence in which the hypotheses appeared at the end of the Literature Review (Chapter 2). Firstly, the descriptive analyses of the receptive and productive vocabulary size of bilingual children in both of their languages(Turkish-English) will be presented, with a summary of their scores, followed by the correlation analysis between the receptive and productive vocabulary sizes of the bilingual children across the two languages (Turkish and English), demonstrated with scatter-plot graphs, along with scatter-plot graphs representing the correlations between their receptive and productive vocabulary sizes.

Secondly, a summary of both descriptive and mean comparison analyses will be provided for the vocabulary sizes of bilingual and monolingual children in both receptive and productive vocabulary sizes in each language separately (Turkish and English), and the comparison of means will be analysed between the Total Conceptual Vocabulary size of the bilinguals and the productive vocabulary size of the monolinguals to discern the effect of the Total Conceptual Vocabulary assessment on bilinguals' vocabulary size in comparison with monolinguals.

To investigate the third hypothesis, a summary of the correlation between the vocabulary size and nonverbal intelligence scores of the bilingual children will be presented, including correlations between their receptive and productive vocabulary in both of their languages and their nonverbal intelligence scores, with scatter-plot graphs for the two languages of the bilingual children separately.

Finally, with regard to hypothesis four, a summary of the analysis of variance (ANOVA) for nonverbal intelligence scores for comparison between bilinguals and monolinguals will be given, to find group differences in nonverbal intelligence scores. Bilinguals were divided at the median of the parental language dominance scores into two sub-groups to allow for comparisons to be made between the nonverbal intelligence scores (see 3.2.5 in Chapter 3 Methodology; positive scores for more English dominant; negative scores for more Turkish dominant parents). The two sub-groups of bilinguals (strong L1 dominant parents and less L1 dominant parents) will also be compared with the monolingual groups in each language in terms of nonverbal intelligence to discover the effect of parental L1 language dominance on bilinguals' nonverbal intelligence. The bilinguals were also divided into two sub-groups at the median of the parental home language use scores (see 3.2.7 in Chapter 3 Methodology; score 0 for the maximum Turkish use at home; score 100 for the maximum English use at home). A comparison between these two sub-groups of bilinguals (parents using more Turkish at home and parents using more English at home) will also be made in terms of nonverbal intelligence scores to find the effect of L1 home language use on nonverbal intelligence. Lastly, a correlations analysis between parental language dominance / home language use and children's vocabulary size in both languages / nonverbal intelligence scores will be provided.

4.1 Summary of the Receptive vocabulary size scores of the bilingual children in Turkish and English

This section deals with data relating to the first hypothesis of this study. As mentioned in Chapter 3, the data were collected from 100 Turkish-English bilingual children (aged 7-11) in the UK with the X-Lex test in English and in Turkish (see 3.2.1 and 3.2.2 Measures in Chapter 3). In this section, the results of the receptive vocabulary tests, scored out of 5000, of the bilingual children in both languages will be presented with descriptive statistics along with the correlation between the receptive vocabulary test scores in Turkish and English. A

summary of the descriptive statistics of the receptive vocabulary size test of the bilingual children are presented in Table 5 (below) for Turkish and English.

Table 5. Summary of descriptive statistics for bilingual children's receptive vocabulary size scores in Turkish and English (max. score = 5000), (adapted from Daller & Ongun, 2017, p. 8)

	n	min	max	mean	St.Dev
Receptive Turkish	100	3900	4650	4337.0	162.0
Receptive English	100	3900	4750	4328.0	208.9

Table 5 shows that the lowest test scores for both languages are the same, at 3900, but the highest score appears in English (English = 4750, Turkish = 4650). The mean scores of both receptive vocabulary tests are very close (*Mean* Turkish = 4337.0, *Mean* English = 4328.0), but Turkish slightly higher, and the standard deviation of the English scores is higher than that of the Turkish scores (St. Dev. English = 208.9, St .Dev. Turkish = 162.0).

To find out the relationship between the receptive vocabulary size scores of the bilingual children in both languages, the correlation between the receptive vocabulary size scores controlled by age are presented in Figure 7 (below).

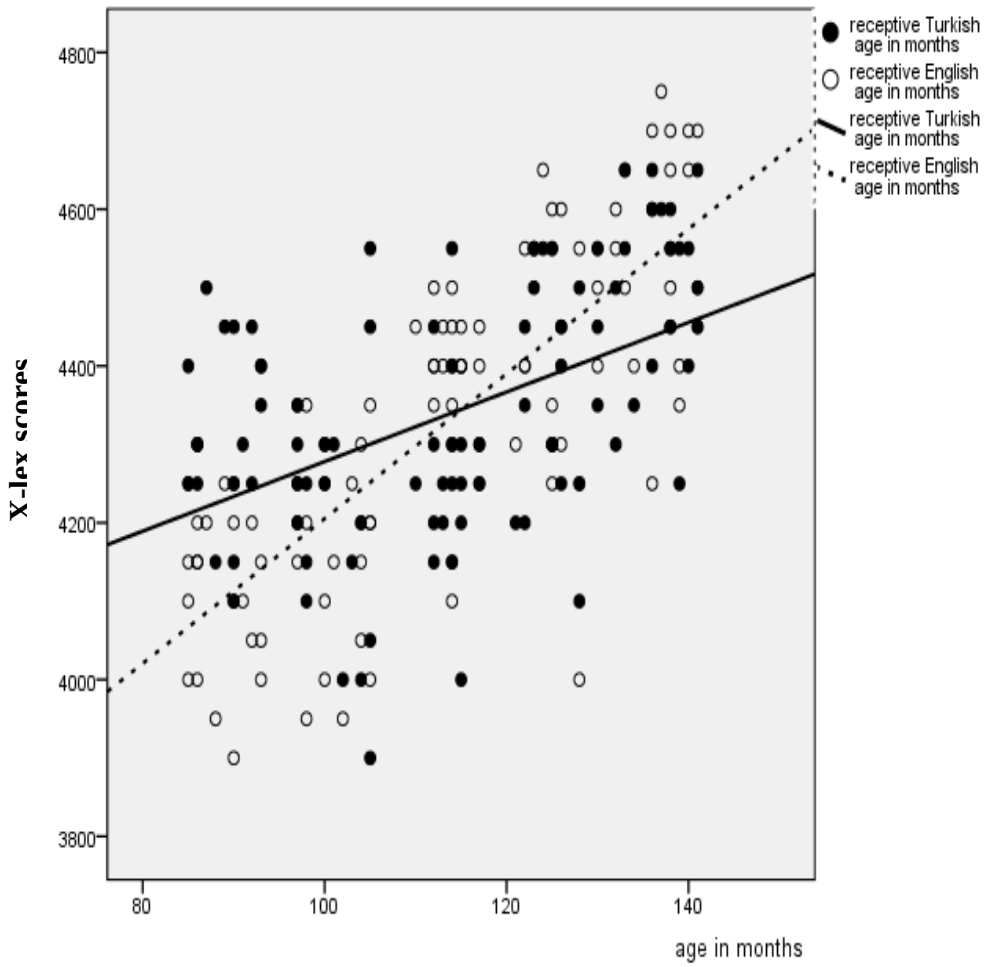

Figure 7. Scatter-plot for bilingual children's receptive vocabulary size (X-Lex) scores in Turkish and English by age (adapted from Daller & Ongun, 2017, p.8)

Figure 7 demonstrates the partial correlation between the receptive vocabulary size test scores of the 100 Turkish-English bilingual children. There is a strong significant correlation between the receptive vocabulary size scores (r = .611, p < .001) in Turkish and English. The correlation was calculated specifically to see any relationship between the receptive vocabulary scores of the participants and their age, and it can be seen that there is a significant correlation between the receptive vocabulary size scores and age in Turkish (r = .477, p < .001) and English (r = .770, p < .001). The receptive vocabulary size scores of the children in both of their languages increased steadily with age. The youngest children show higher Turkish scores than English, but the English scores increase gradually to equal the Turkish

scores by the age of 9-10. The oldest children show higher English scores than Turkish, but the Turkish scores continue to increase steadily with age.

4.2 Summary of the Productive vocabulary size scores of the bilingual children in Turkish and English

The same group of participants was tested with the Verbal Fluency Test (See 3.2.3 Measures in Chapter 3), with the four productive sub-tests as colours, body parts, clothing and food. With regard to the reliability of the tests, Cronbach's alpha was computed for the reliability of the four sub-tests. Cronbach's alpha is at .829 for Turkish and .841 for English, suggesting that the test is reliable: it is uni-dimensional and measures only productive vocabulary knowledge in each language. Descriptive statistics of the productive vocabulary scores of the bilingual children in both languages are presented in Table 6 (below).

Table 6. Summary of descriptive statistics for productive vocabulary scores in Turkish and English (adapted from Daller & Ongun, 2017, p. 9)

	n	**min**	**max**	**mean**	**St.Dev**
Productive Turkish	100	19	65	37.41	12.203
Productive English	100	16	87	42.25	14.017

According to Table 6, the lowest test score of the Productive Turkish test (min = 19) is slightly higher than lowest English score (min = 16), but this is reversed for the highest score (max Turkish = 65, max. English = 87). The mean scores are close, but not as close as those of the receptive test (Turkish mean = 37.41, English mean = 42.25).

It is interesting to note that there is a positive and highly significant correlation between the scores of the productive vocabulary tests in Turkish and English (r = .732, p < .001), demonstrated in Figure 8 (below). Children with higher productive vocabulary scores

in Turkish also have higher vocabulary scores in English, as found with the receptive vocabulary test scores (r =.611, p < .001).

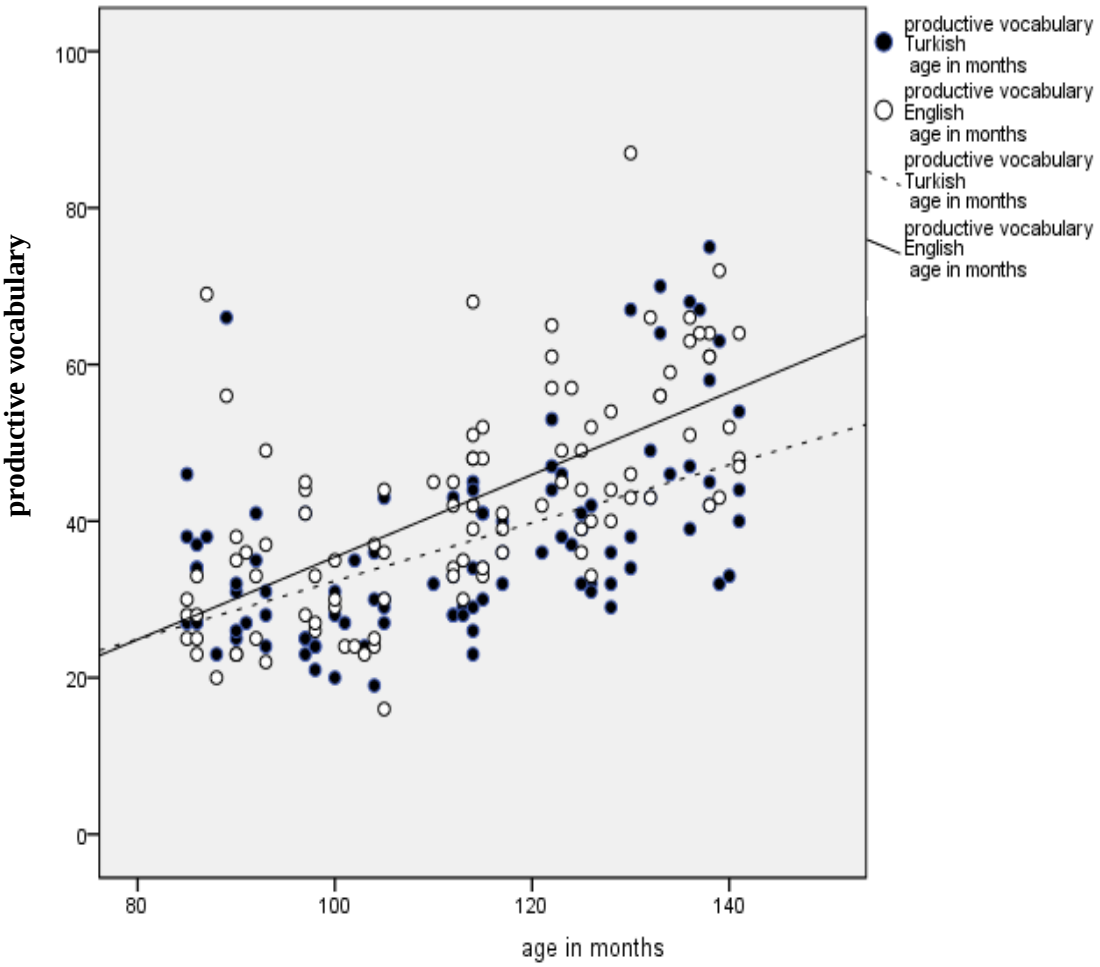

Figure 8. Scatter-plot for bilinguals' productive vocabulary size test (Verbal fluency test) scores in Turkish and English by age

The correlation was calculated to find out any relationship between the productive vocabulary scores of the participants and their age, and it can be seen that there is a significant correlation between the productive vocabulary size scores and age in Turkish (r = .479, p < .001) and English (r = .271, p < .001). As shown in Figure 8, the productive vocabulary size of the bilingual children in both languages increases rapidly with age. The English score increase at a higher rate than the Turkish, which may be related to the effect of English as a school language (all participants attend English speaking schools and the language of their

education is English). However, the productive vocabulary sizes of the bilingual children increase by age in both languages.

One of the most important findings of the present study is that both receptive and productive vocabulary size scores are highly and significantly correlated between the languages (receptive vocabulary size Turkish/ English: $r = .611$, $p < .001$; productive vocabulary size Turkish/ English: $r = .732$, $p < .001$), so participants with a higher receptive Turkish vocabulary also have a higher English receptive vocabulary, and likewise with productive vocabulary. The findings suggest that the vocabulary sizes of bilingual children in both languages are related, in terms of both receptive and productive vocabulary knowledge. The findings will be discussed in detail in the next chapter.

Looking at the relationship between the receptive and productive vocabulary sizes of the bilingual children in each language, it can be seen (Figures 9 and 10, below) that the correlations are highly significant for both Turkish and English (Turkish receptive/ productive vocabulary size: $n = 99$, $r = .571$, $p < .001$; English receptive / productive vocabulary size: $n = 100$, $r = .640$, $p < .001$), in line with expectations. 32% of variance in the productive Turkish is explained by the receptive Turkish, meaning 68% of the variation in the productive Turkish is not accounted for by the receptive Turkish ($R^2 = .326$). Additionally, the receptive English explains 40% of the productive English, and the receptive English does not explain 60% of the productive English ($R^2 = .410$). This may be due to inherent variability in productive test scores or to homogeneity group factors that affect the level of the receptive test scores.

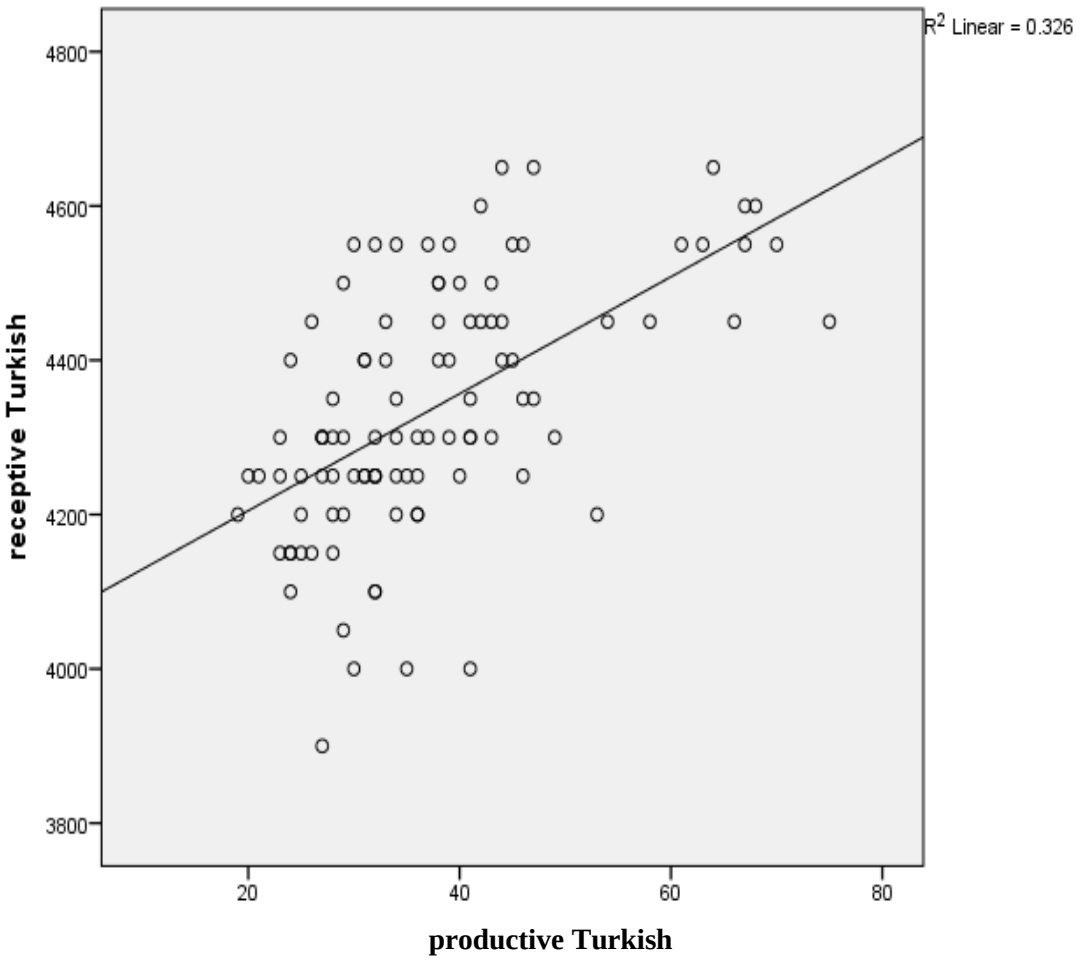

Figure 9. Correlation between receptive and productive vocabulary size of bilingual children in Turkish

Figure 9 demonstrates that bilingual children with a high receptive vocabulary in Turkish also have a high productive vocabulary in Turkish.

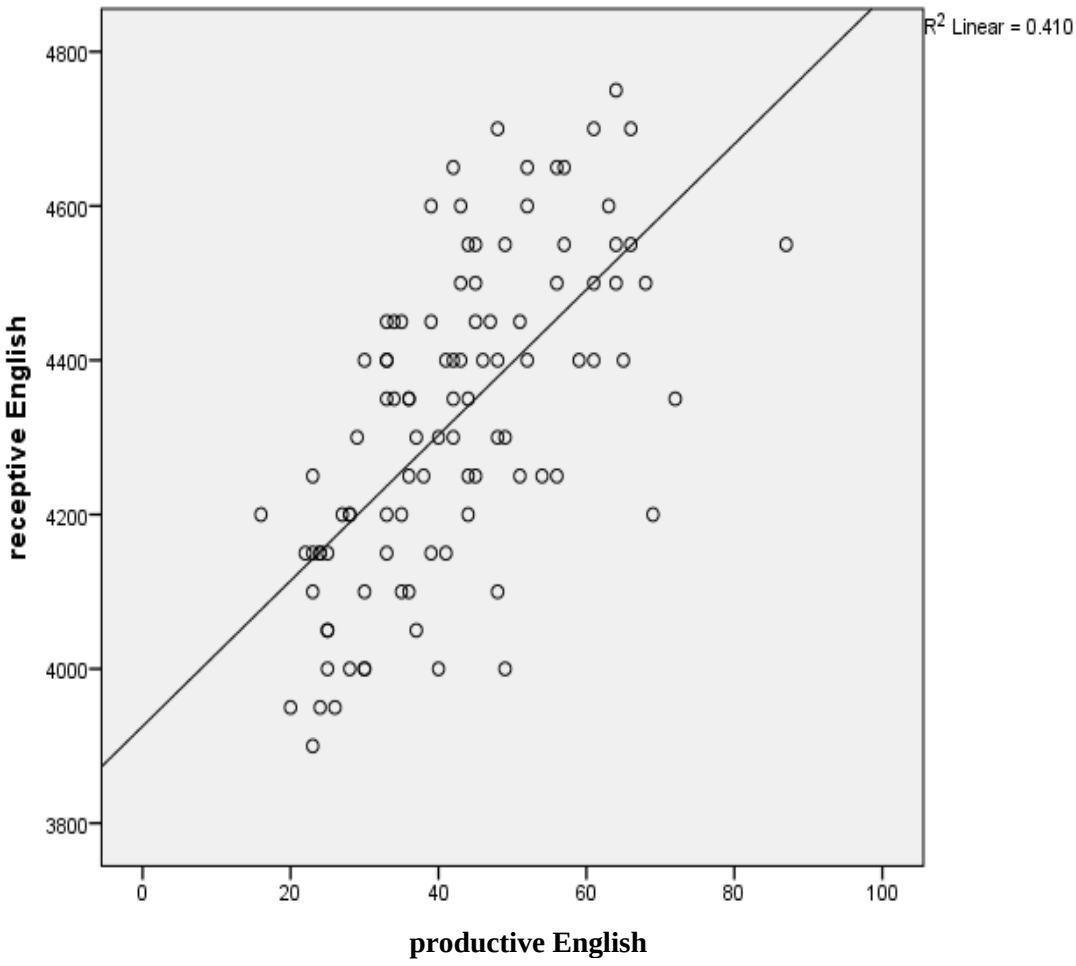

Figure 10. Correlation between receptive and productive vocabulary size of bilingual children in English

As with Turkish, Figure 10 shows that bilingual children with a high English receptive vocabulary also have a high English productive vocabulary.

4.3 Comparison between Bilingual and Monolingual scores for Receptive vocabulary size in Turkish

The comparison between receptive vocabulary scores in Turkish for Turkish-English bilinguals and Turkish monolinguals (using the X-Lex in Turkish) is demonstrated with group statistics between the mean scores of the bilinguals and the Turkish monolinguals, shown in Table 7 (below). An independent *t*-test for comparing the bilingual and monolingual vocabulary scores in Turkish will be demonstrated with a box-plot graph in Figure 11.

Table 7. Comparison of mean scores for bilingual and Turkish monolingual receptive vocabulary scores

Language	N	Mean	Std. Deviation	Std. Error Mean
Turkish- English bilinguals	100	4337.00	161.998	16.200
Turkish Monolinguals	25	4798.00	205.386	41.077

Table 7 demonstrates the mean and standard deviation for the Turkish receptive vocabulary scores of both bilinguals (n = 100) and Turkish monolinguals (n = 25). The table shows that the mean scores for bilinguals' Turkish receptive vocabulary size is lower than the mean for Turkish monolinguals, and an independent t-test statistics shows that the bilinguals have significantly lower receptive vocabulary scores than Turkish monolinguals (t = 12.033, df = 123, $p < .001$, $\eta^2 = .541$), in line with expectations. Comparison between the Turkish receptive vocabulary scores of the Turkish-English bilingual (n = 100) and Turkish monolingual children (n = 25) is illustrated in Figure 11 (below).

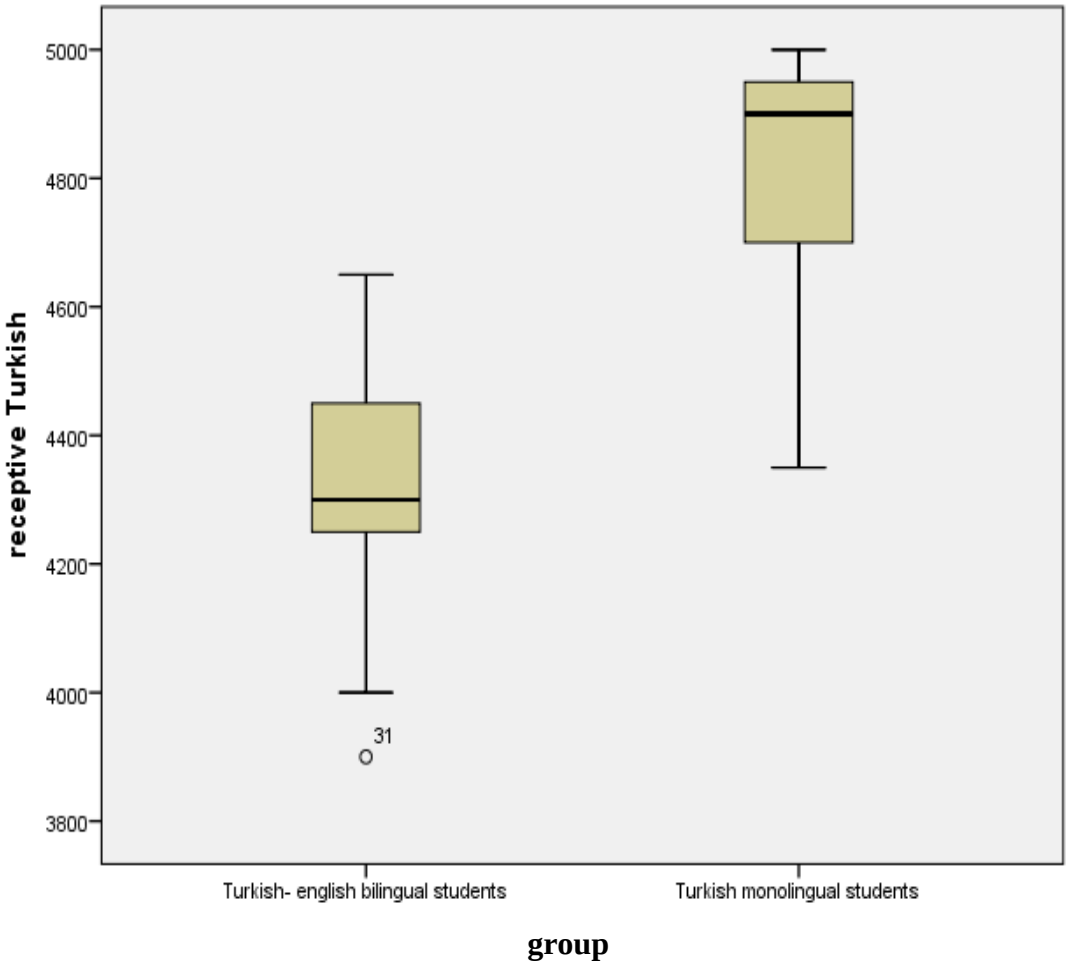

Figure 11. Box-plot for comparison between Turkish-English bilingual and Turkish monolingual children for Turkish receptive vocabulary size scores (X-Lex), (adapted from Daller & Ongun, 2017, p.10)

Figure 11 shows the comparison of the Turkish receptive vocabulary scores of bilinguals and Turkish monolinguals. It is clear that bilingual participants achieved lower vocabulary scores in Turkish than Turkish monolinguals.

4.4 Comparison between Bilingual and Monolingual scores for Productive vocabulary size in Turkish

A statistical analysis was also carried out to compare the productive vocabulary scores of bilinguals and monolinguals in Turkish. The results can be seen in Table 8 and Figure 12 (below).

Table 8. Comparison of mean scores for bilingual and Turkish monolingual productive vocabulary scores

Language	N	Mean	Std. Deviation	Std. Error Mean
Turkish- English bilingual students	100	37.41	12.203	1.220
Turkish Monolingual students	25	63.68	14.761	2.952

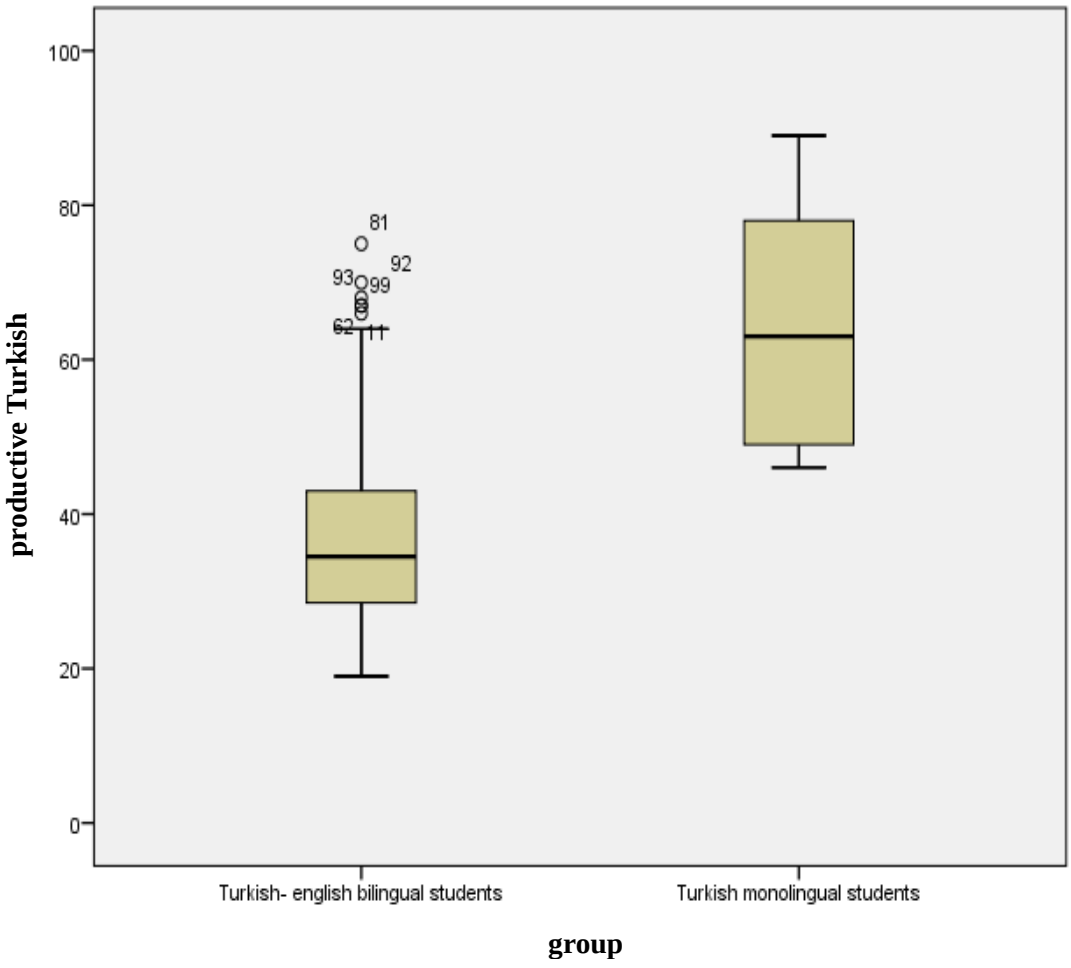

Figure 12. Box-plot for the comparison between Turkish-English bilingual and Turkish monolingual scores for Turkish productive vocabulary test (Verbal Fluency Test), (cited in Daller & Ongun, 2017, p. 10)

Figure 12 shows that the bilingual children achieved lower productive vocabulary scores in Turkish than the Turkish monolinguals, as with the receptive vocabulary scores. The results

of the independent T-test demonstrate that the bilinguals' productive vocabulary score in Turkish is significantly lower than that of the monolinguals (t = 9.22, df = 32.670, p < .001); equal variance not assumed, (η^2 = .409).

To sum up, the Turkish-English bilingual children (n = 100) scored lower on both receptive (X-Lex) and productive vocabulary (Verbal Fluency Test) tests in Turkish in comparison with Turkish monolingual children (n = 25).

4.5 Comparison between Bilingual and Monolingual scores for Receptive vocabulary size in English

The bilingual children were compared with their English monolingual counterparts in terms of English receptive vocabulary size, with the same data analysis procedure (see above for procedure). Comparison of the mean scores of bilinguals and English monolingual children is given in Table 9 (below).

Table 9. Comparison of mean scores for bilingual and English monolingual receptive vocabulary scores

Language	N	Mean	Std. Deviation	Std. Error Mean
Turkish- English bilingual students	100	4328.00	208.932	20.893
English Monolingual students	25	4526.00	253.772	50.754

Table 9 shows that Turkish-English bilingual children (n = 100) achieved lower mean scores (4328.00) in the receptive vocabulary test than English monolinguals (4526.00), and the standard deviation of the bilingual scores is lower than that of monolinguals.

The Independent T-test statistics show that the bilingual group have a lower receptive vocabulary size in English than English monolinguals (t = 4.054, df = 123, p < .001, η^2 =

.118). Comparison of bilingual and monolingual scores for English receptive vocabulary size (X-Lex) is given in Figure 13 (below).

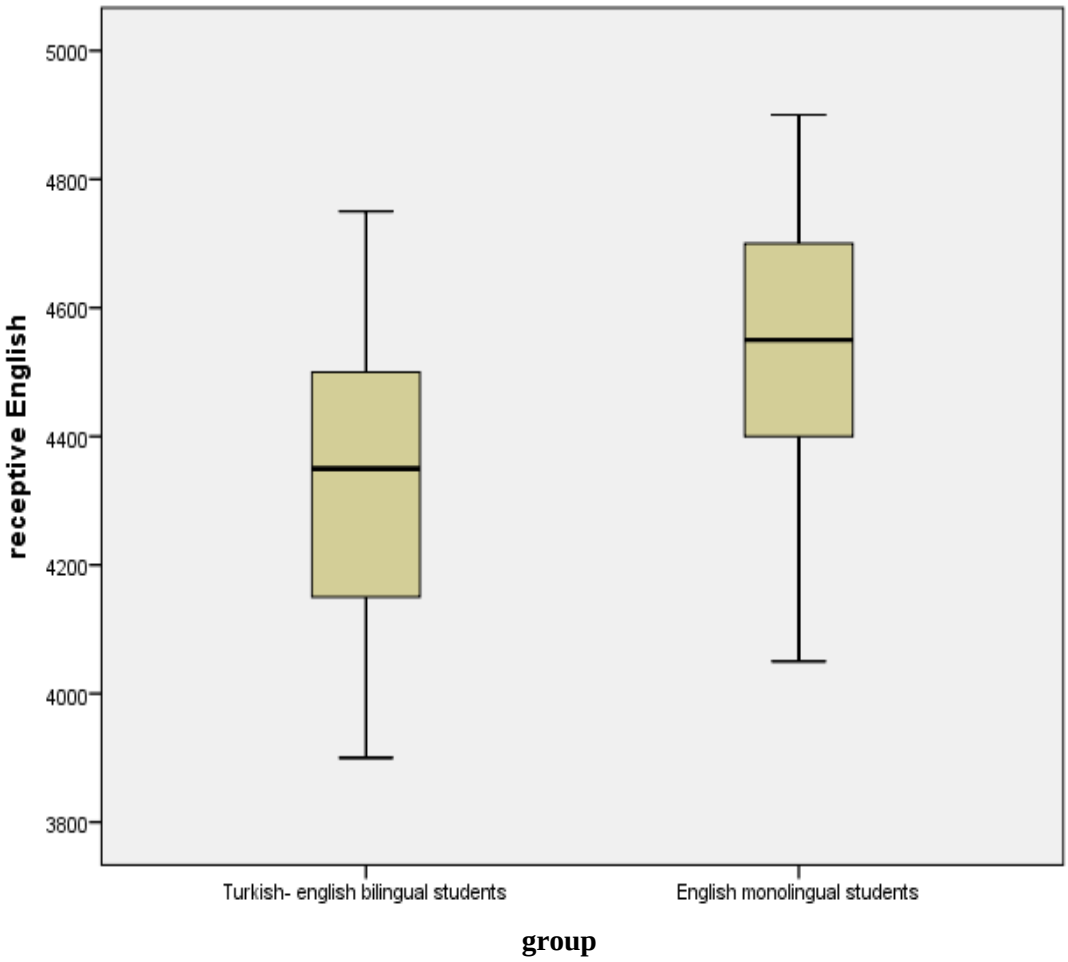

Figure 13. Box-plot for comparison between Turkish-English bilingual and English monolingual scores for English receptive vocabulary test (X-Lex), (adapted from Daller & Ongun, 2017, p. 11)

Figure 13 shows the comparison between the receptive scores for bilinguals and monolinguals in English. It is clear from the figure that the bilingual group scored lower than the monolingual group, as with Turkish. Bilinguals were therefore shown to have a lower receptive vocabulary size in both languages (Turkish & English).

4.6 Comparison between Bilingual and Monolingual scores for Productive vocabulary size in English

The comparison between the bilingual and monolingual group scores for productive vocabulary sizes in English is showed with the mean scores of the productive vocabulary test in English. The mean scores of the groups in the Verbal Fluency Test are provided in Table 10 (below.)

Table 10. Comparison of mean scores for bilingual and English monolingual productive vocabulary scores

Language	N	Mean	Std. Deviation	Std. Error Mean
Turkish- English bilingual students	100	42.25	14.017	1.409
English Monolingual students	25	62.84	14.848	2.970

The mean score of the productive vocabulary test for Turkish-English bilinguals (n =100) is lower than the mean score of the English monolinguals. The independent T-test demonstrates that the bilingual children achieved significantly lower scores in English productive vocabulary than the English monolingual children (t = 6.484, df = 122, p < .001, η^2 = .256). The comparison between the bilingual and monolingual scores for productive vocabulary in English (Verbal Fluency Test) is shown in Figure 14 (below).

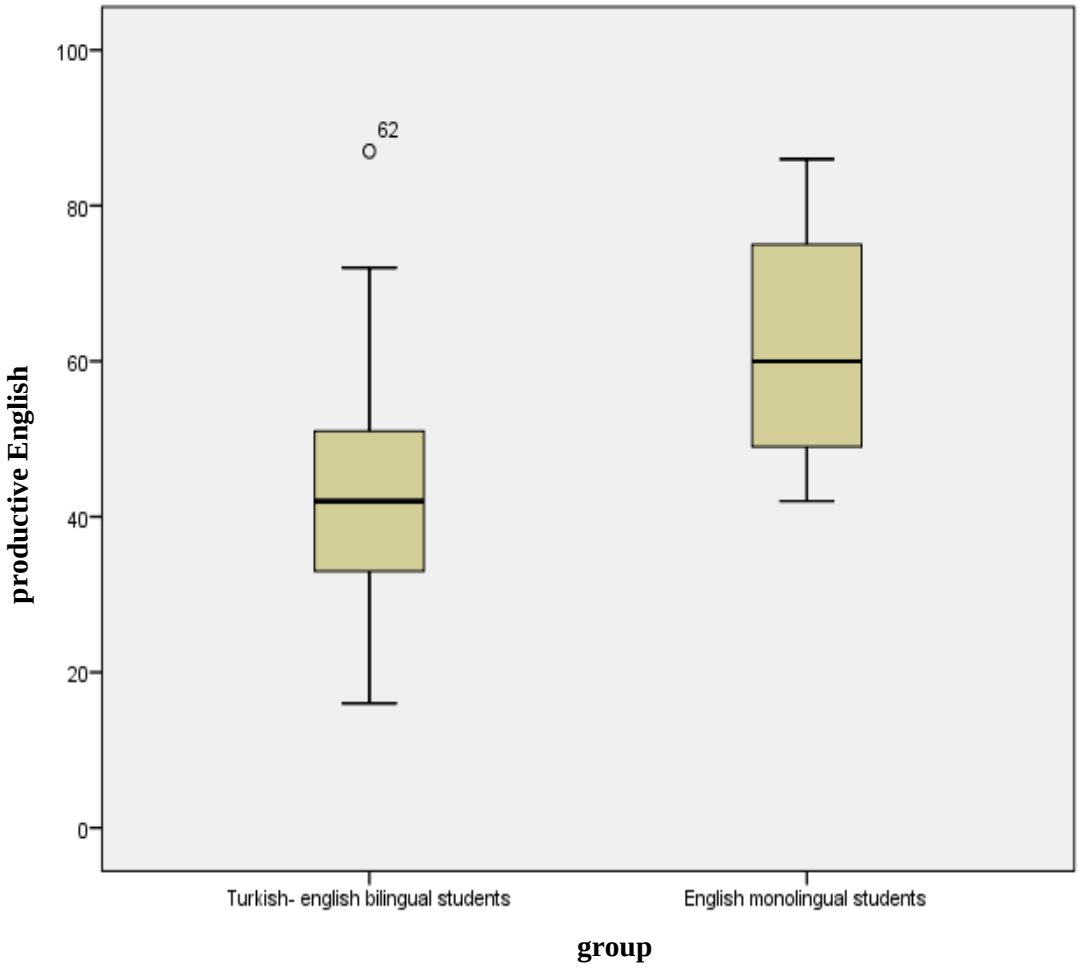

Figure 14. Box-plot for comparison between Turkish-English bilingual and English monolingual scores for English productive vocabulary test (Verbal Fluency Test), (adapted from Daller & Ongun, 2017, p.11)

Figure 14 shows Turkish-English bilinguals scored lower on productive vocabulary than English monolinguals, similar to the comparison between the receptive vocabulary scores of bilinguals and English monolinguals.

As required for hypothesis two, bilinguals are compared with their monolingual counterparts in each language separately in terms of both receptive and productive vocabulary size scores. Each comparison between bilinguals and monolinguals is demonstrated with mean scores of the vocabulary size tests first, then an independent T-test analysis is carried out for each comparison between the groups and both receptive and productive vocabulary size scores in each language are demonstrated with box-plot graphs separately. The overall comparison analyses demonstrate that bilinguals have a lower vocabulary size both

receptively and productively in each language in comparison with monolinguals, and the vocabulary gap can be identified in bilingual children's vocabulary size in each language. The findings suggest that when bilinguals are compared with their monolingual counterparts in each language separately, achieve lower vocabulary size scores than their monolingual counterparts, which is in line with expectations. This study also aims to assess the bilinguals' vocabulary size in total conceptual vocabulary to find out whether bilinguals still demonstrate lower vocabulary scores than monolinguals when this is taken into account. However, the total conceptual vocabulary assessment for this study can only be carried out for the productive vocabulary of the bilinguals, as it is possible to match the concepts for each language with bilinguals. However, it is impossible to assess the receptive total conceptual vocabulary with the receptive vocabulary size tests selected, as receptive vocabulary size test has different test items and there is no known receptive vocabulary size test to convert for measuring the same concepts in both languages. In this study, the comparison between bilinguals and monolinguals with bilinguals' total conceptual vocabulary scores and monolinguals' productive vocabulary scores will be explored (since total conceptual vocabulary can only be tested in bilinguals). The following section provides comparison between bilinguals and monolinguals with the total conceptual vocabulary size of the bilinguals.

4.7 Comparison between Bilingual and Monolingual scores for the Total Conceptual Vocabulary Size in Turkish and English

As in the previous sections, this section provides comparisons between the bilingual and monolingual groups, with the mean scores of the TCV in Table 11 (below).

Table 11. Mean scores for total conceptual vocabulary (TCV) scores

Language	N	Mean	Std. Deviation
Turkish- English bilinguals	100	57.50	16.559
Turkish Monolinguals	25	63.68	14.761
English Monolinguals	25	62.84	14.848

Table 11 shows that the mean scores of the Turkish-English bilinguals (n = 100) are close to both the Turkish (n = 25) and English (n = 25) monolingual groups.

Comparison between the groups is demonstrated in Figure 15 (below).

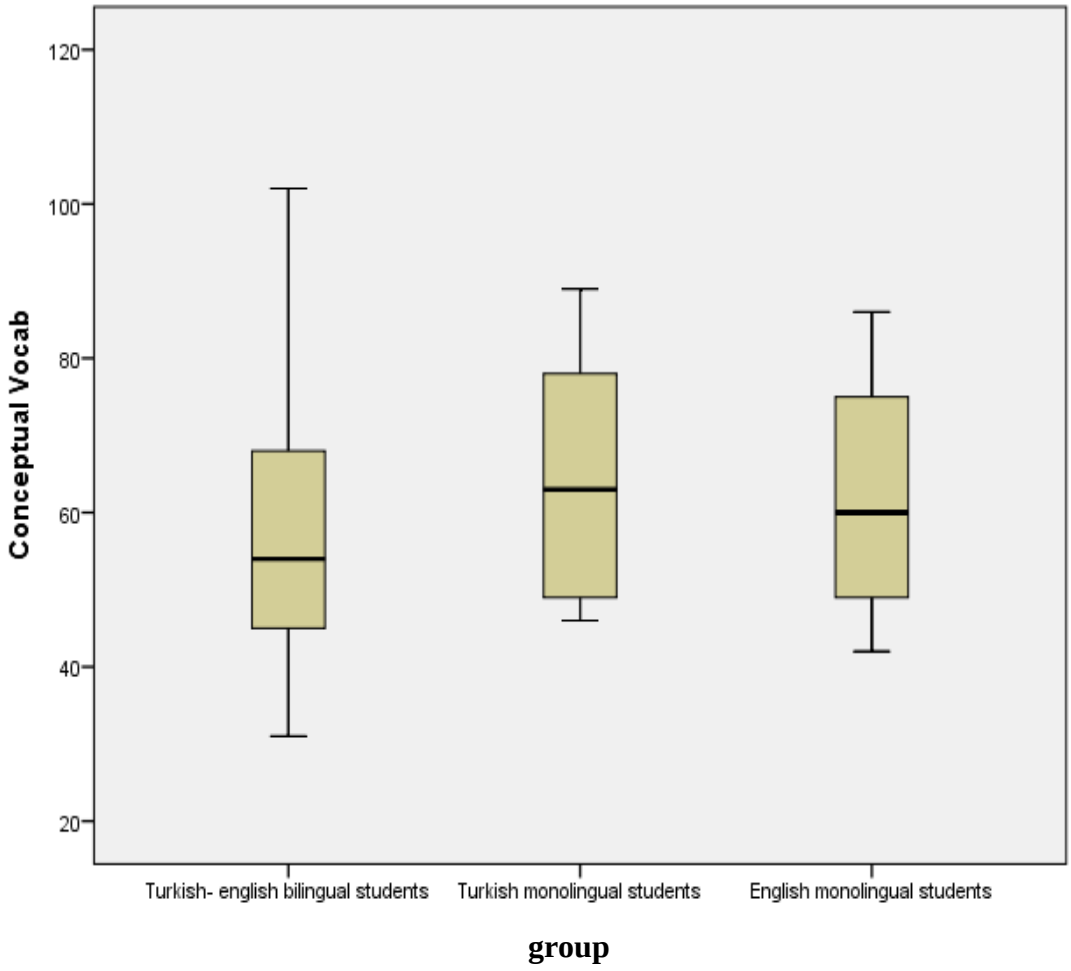

Figure 15. Box-plot for comparison between Turkish-English bilingual and monolingual control groups in total conceptual vocabulary (TCV), (adapted from Daller & Ongun, 2017, p. 12)

Figure 15 reveals that even if there is more variance between scores in individual cases for bilinguals, overall there is no significant difference between bilinguals and monolinguals in either language when bilinguals had the advantage in the TCV assessment (one-way Anova, F (2, 147) = 2.175, p = .117). In contrast to the vocabulary gap found between the vocabulary size scores of bilinguals and monolinguals in each language separately, there is no vocabulary gap effect found in the TCV assessment. These findings are discussed in more detail in the next chapter.

4.8 Correlations between Vocabulary size and Nonverbal intelligence scores of bilingual children

According to the third hypothesis of the current study, the relationship between the vocabulary size of bilingual children and their nonverbal intelligence scores is investigated. A partial correlation, controlled for age, has been carried out, corresponding to the aim of the third hypothesis. The correlations between vocabulary size scores (both receptive and productive) in each language separately, and the nonverbal intelligence scores of the Turkish-English bilingual children are reported in Table 12 (below).

Table 12. Pearson partial correlation between vocabulary size and nonverbal intelligence scores of bilingual children (controlling for age) (adapted from Daller & Ongun, 2017, p.12)

Turkish-English bilingual children (n = 96)		Receptive Turkish	Productive Turkish	Receptive English	Productive English
Nonverbal Intelligence scores	Correlation	*r* = .266	*r* = .186	*r* = .209	*r* = .188
	Sig.	.008	.067	0.38	.064

**p < .01; *p < .05

The results presented in Table 12 demonstrate that the correlation between the receptive vocabulary size scores in both languages (Turkish/English) and the nonverbal intelligence scores of the bilingual children is statistically significant with a weak correlation, but the correlation between productive vocabulary size scores and nonverbal intelligence only approaches significance with a very weak correlation. A scale of values from the range +1 to -1 is used for determining the strength. 22% of variance in the receptive Turkish is explained by nonverbal intelligence, so 78% of the variation in the receptive Turkish is not explained by

nonverbal intelligence (R^2 = .220). Additionally, nonverbal intelligence can account for only 30% of the receptive English (R^2 = 319). This may be due to the variability in the receptive and productive test scores or to other factors that may affect the level of the nonverbal test scores. Nonverbal intelligence explains 20% of the productive Turkish (R^2 = .200) and 25% of the productive English (R^2 = .251).

The correlations between the receptive vocabulary scores in each language and nonverbal intelligence scores are showed in Figures 16 and 17 (below).

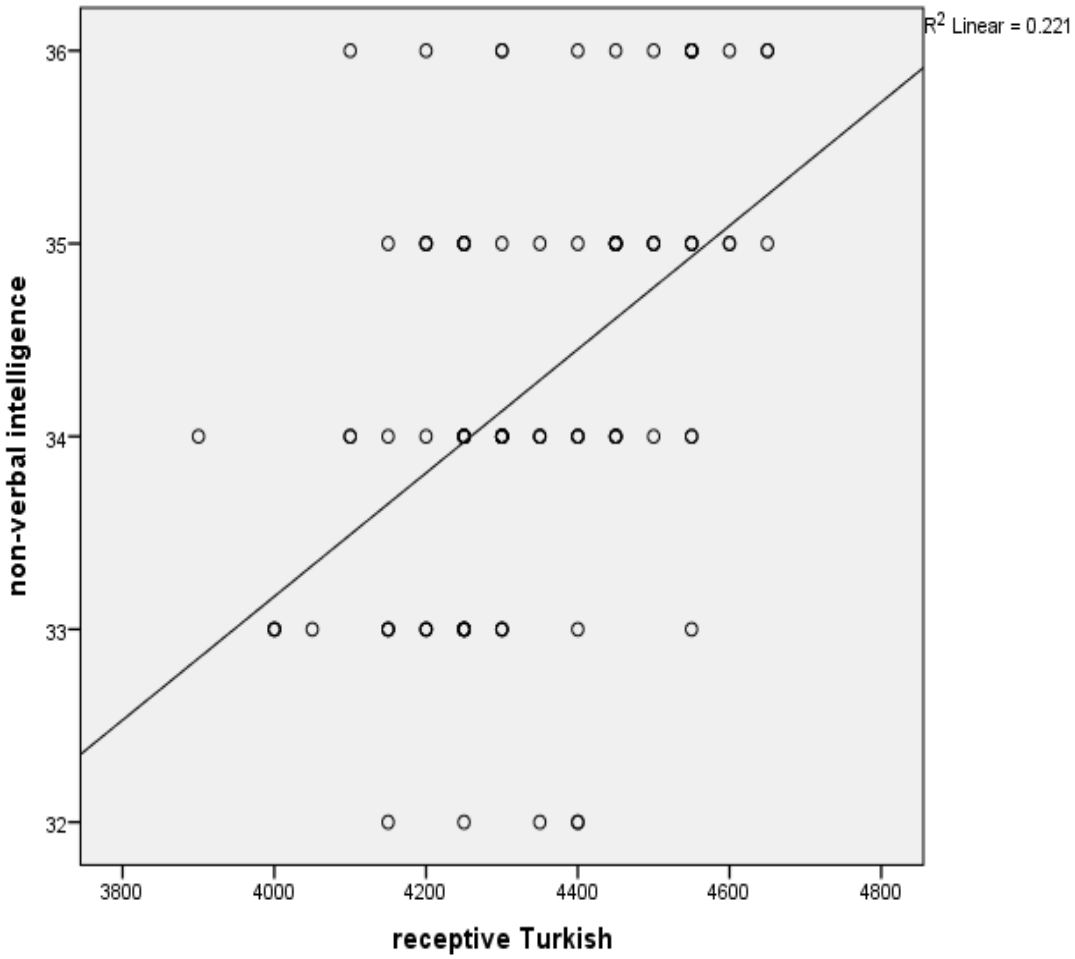

Figure 16. Correlations between Turkish receptive vocabulary size (X-Lex in Turkish) and nonverbal intelligence scores

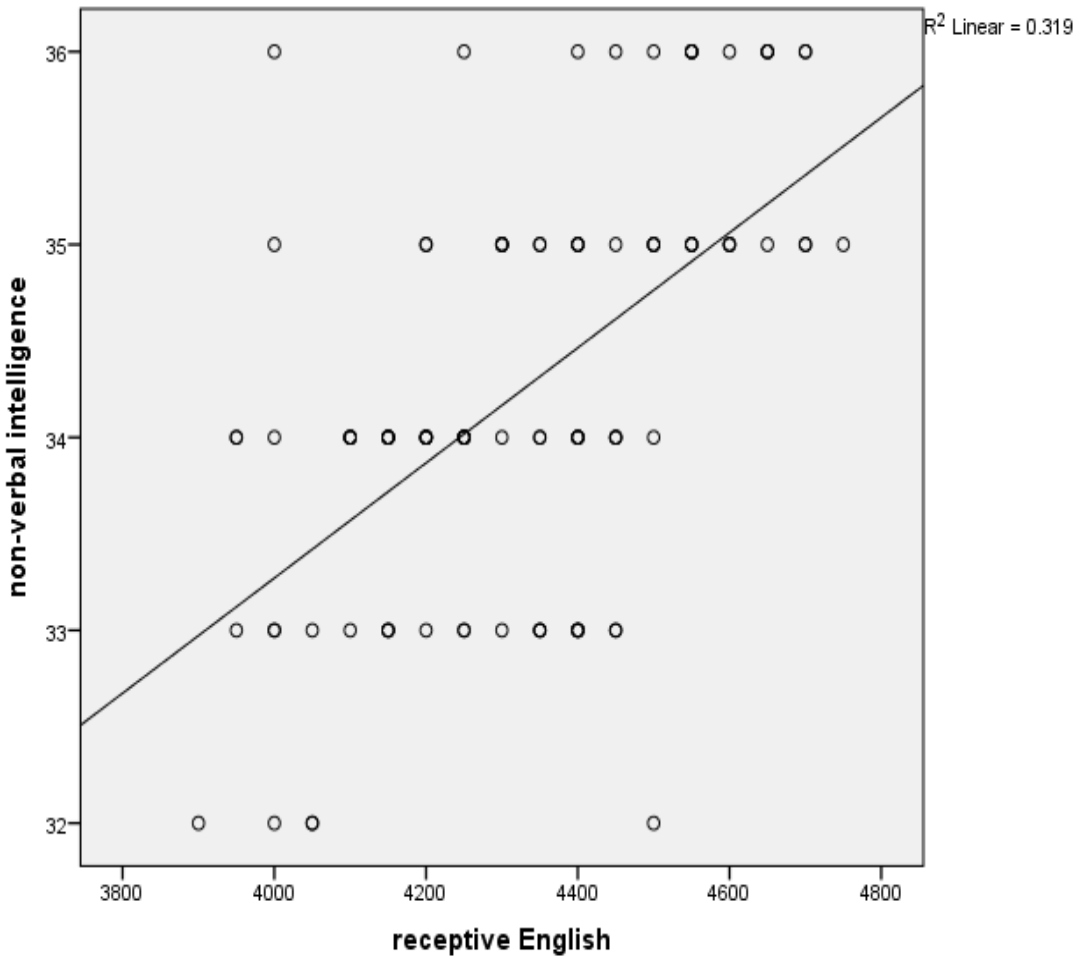

Figure 17. Correlations between English receptive vocabulary size (X-Lex in English) and nonverbal intelligence scores

As can be seen from Figures 16 and 17, the correlation between the receptive vocabulary size scores (X-Lex) and nonverbal intelligence scores are significant for both languages. Figure 4.11, however, shows that the correlation between English receptive vocabulary size and nonverbal intelligence is higher than the Turkish receptive vocabulary scores. This could be due to the fact that the children attend English-speaking schools.

The correlation between the productive vocabulary scores (Verbal Fluency Test) for both languages are showed in Figures 18 and 19 (below).

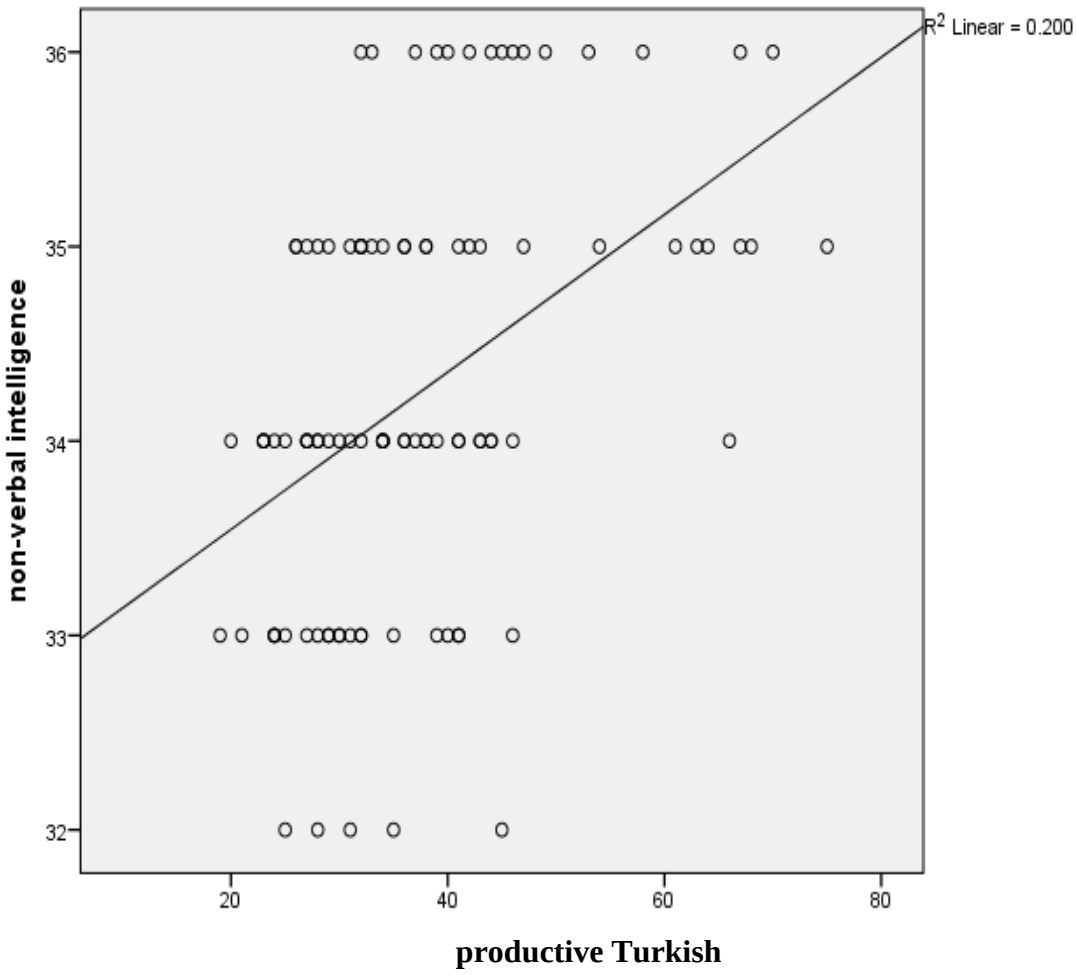

Figure 18. Correlations between Turkish productive vocabulary size (Verbal Fluency Test) and nonverbal intelligence scores

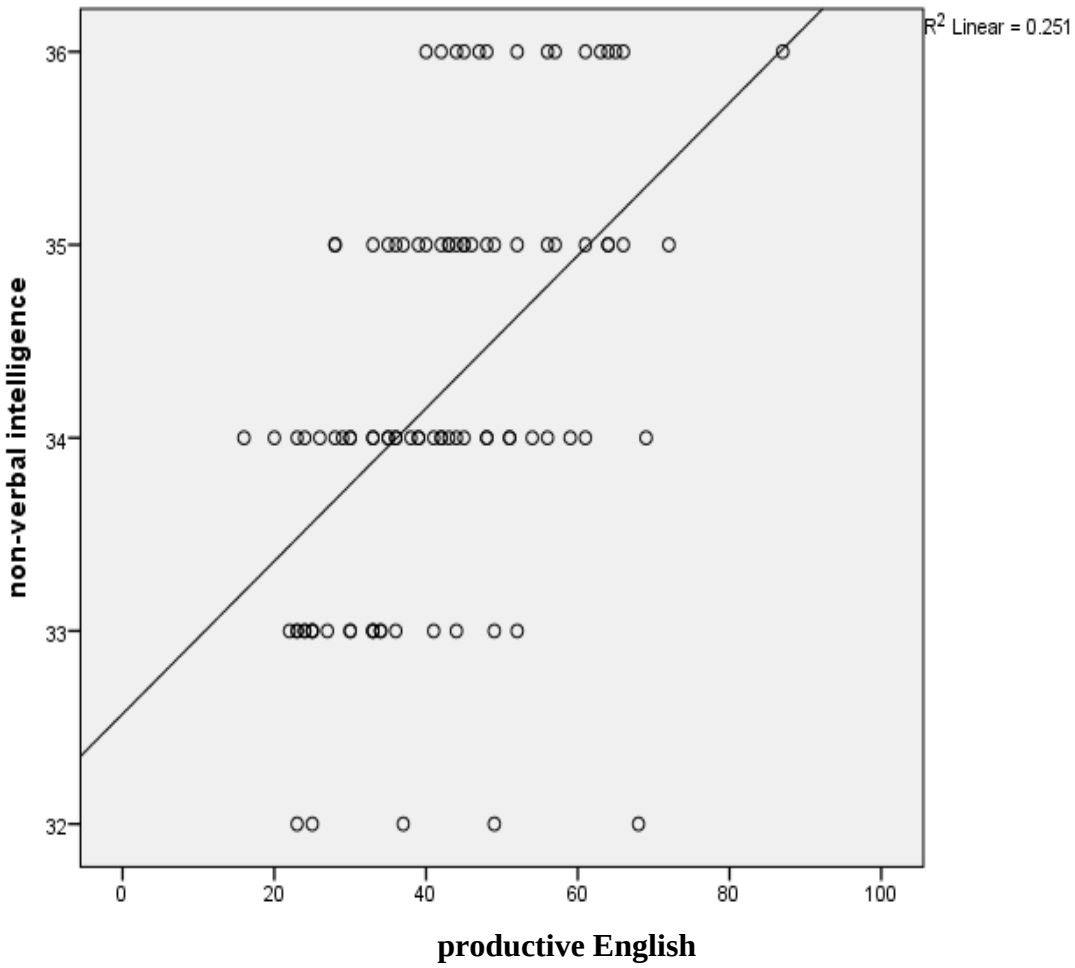

Figure 19. Correlations between English productive vocabulary size (Verbal Fluency Test) and nonverbal intelligence scores

The English productive vocabulary score correlates more highly with nonverbal intelligence than the Turkish productive vocabulary score. As with the correlation of receptive vocabulary size scores, this may be explained by the fact the children attend English-speaking schools, and that older children achieve higher nonverbal intelligence scores than younger children.

It must be noted that the correlations between both receptive and productive vocabulary size scores and nonverbal intelligence scores are low, but the correlation between receptive vocabulary scores and nonverbal intelligence scores is higher than that of the productive vocabulary size scores of the bilingual children in both languages. Figures 18 and 19 demonstrate that the correlations between productive vocabulary size scores and nonverbal

intelligence are not as high as those for receptive vocabulary size scores. This may be because receptive vocabulary development is a better predictor of the development of nonverbal intelligence scores than productive vocabulary (discussed in detail in the next chapter).

4.9 Comparison of Bilingual and Monolingual groups for Nonverbal intelligence scores

The fourth hypothesis of the current study requires, firstly, comparison of nonverbal intelligence with Anova statistical analysis, and secondly, comparisons between bilingual sub-groups (strong L1 dominant parents versus less strong L1 dominant parents / more Turkish use at home versus more English use at home). The two bilingual sub-groups will be compared with monolingual groups in Turkish and English in terms of nonverbal intelligence with Anova statistical analyses. Anova analysis will also be carried out to compare bilingual sub-groups with monolinguals in terms of nonverbal intelligence scores, and lastly, the effect of parental language dominance and language use at home on bilinguals' receptive, productive and conceptual vocabulary scores will be explored with the Pearson correlation analysis.

Comparison of the mean scores of bilinguals and monolinguals in the nonverbal intelligence test is demonstrated in Table 13 (below).

Table 13. Comparison of mean scores for nonverbal intelligence scores of bilingual and monolingual groups

Groups	N	Mean	Std. Deviation
Turkish- English bilingual students	100	34.25	1.104
Turkish Monolingual students	25	34.20	.913
English Monolingual students	25	34.24	.879

The table shows that the mean scores of bilinguals (n = 100) and both monolingual groups are close, and the nonverbal intelligence scores of the bilinguals and both monolingual groups are almost identical. A one-way Anova analysis shows that there is no significant difference between bilinguals and monolinguals in nonverbal intelligence scores (one-way Anova, F (2, 147) = .023, p = .977). This suggests that bilinguals have no advantage/disadvantage over monolingual groups in terms of nonverbal intelligence. Figure 20 (below) shows the comparison between bilinguals and monolinguals in nonverbal intelligence scores.

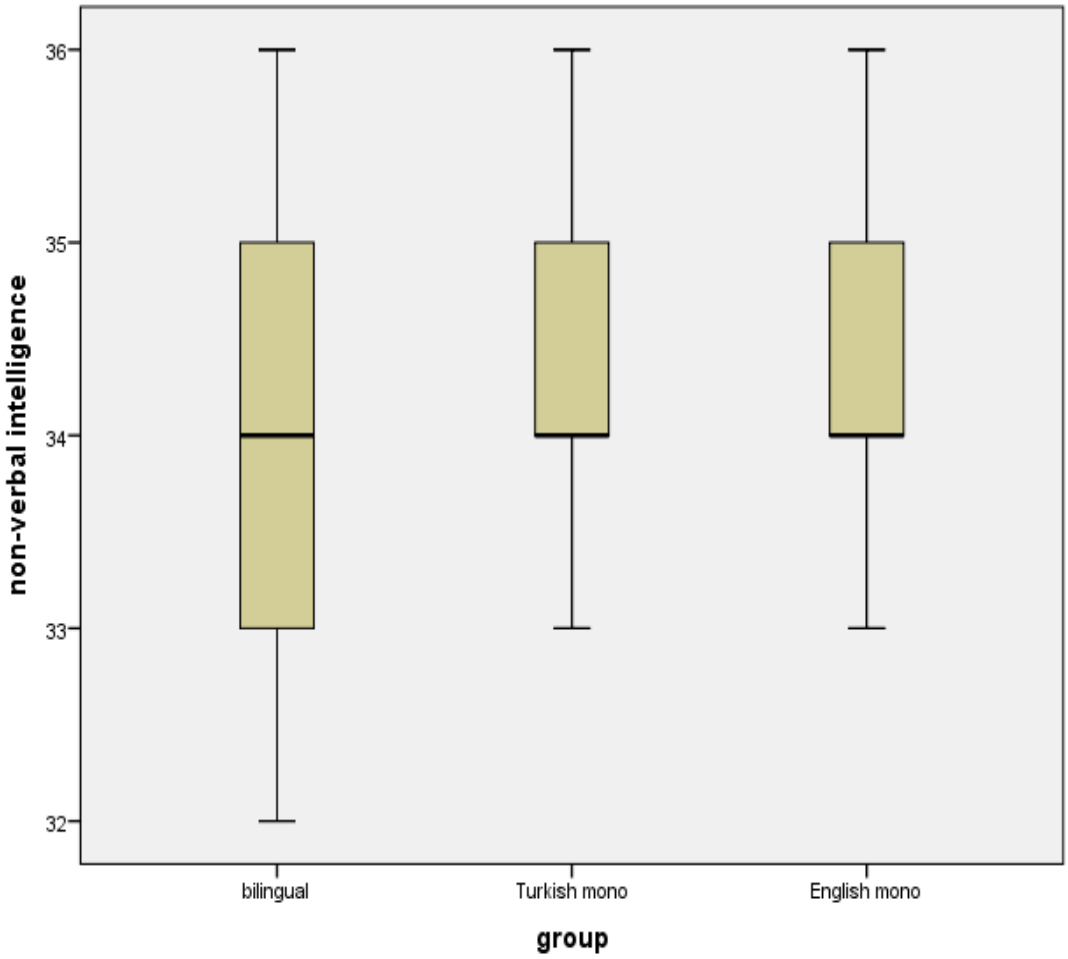

Figure 20. Box-plot of comparison between the nonverbal intelligence scores of bilingual and monolingual children

The figure 20 shows no significant difference between the three groups. The bilingual group shows a higher variance, meaning individuals attained scores above or below those of the monolingual groups, but the overall difference is not significant. The results also show that,

with respect to nonverbal intelligence, neither bilinguals nor monolinguals have the advantage. There is no advantage of bilingualism for nonverbal intelligence, but the only advantage is for children with more Turkish dominant parents (see below).

4.9.1 Comparison of Language Dominance sub-group (Low and high Turkish dominant) for Nonverbal intelligence scores

To determine the effect of parental language dominance on bilinguals' nonverbal intelligence scores, the bilingual group was divided into the sub-group 'strong L1 dominant parents (High Turkish dominant) versus less strong L1 dominant parents (Low Turkish dominant)'.

Table 14 (below) shows the mean scores of this bilingual sub-group.

Table 14. Comparison between the nonverbal intelligence scores of bilingual sub-group (Low-High Turkish dominant)

Sub-groups of bilinguals	N	Mean	Std. Deviation	Std. Error Mean
Low Turkish dominant	50	33.68	.935	.132
High Turkish dominant	50	34.82	.962	.136

Table 14 shows that the mean score of the low Turkish dominant group (n = 50) is lower than the score of the high Turkish dominant group (n = 50).

Figure 21 (below) displays the comparison of the sub-group with both monolingual groups with respect to nonverbal intelligence scores.

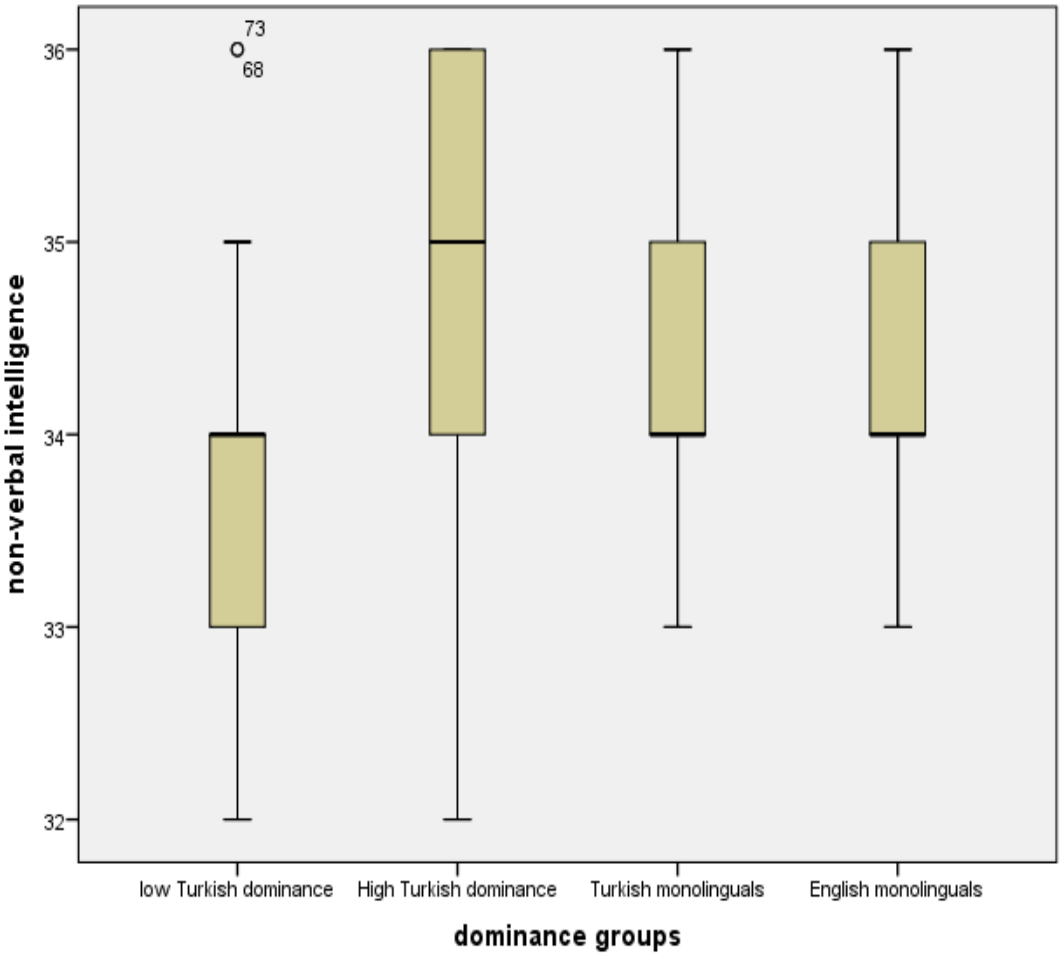

Figure 21. Nonverbal intelligence scores of bilingual sub-group (Low-High Turkish dominant), (adapted from Daller & Ongun, 2017, p.13)

Figure 21 shows that the sub-group with high Turkish dominant parents also showed higher nonverbal intelligence than the two monolingual groups. Comparing these two sub-groups (low and high Turkish dominant) with the monolingual groups in Turkish and English with ANOVA analysis with multiple comparison in post hoc Tukey analyses suggests that the only difference is between the high Turkish dominant sub-group and the monolingual groups, $F(3, 146) = 12.487$, $p < .001$; $\eta^2 = .217$). Bilinguals with high Turkish dominant parents have higher nonverbal intelligence scores than the two monolingual groups and the sub-group of low Turkish dominant.

The following figure (Figure 22, below) demonstrates the development of bilingual children's nonverbal intelligence scores in both high and low Turkish dominant groups by age (in months).

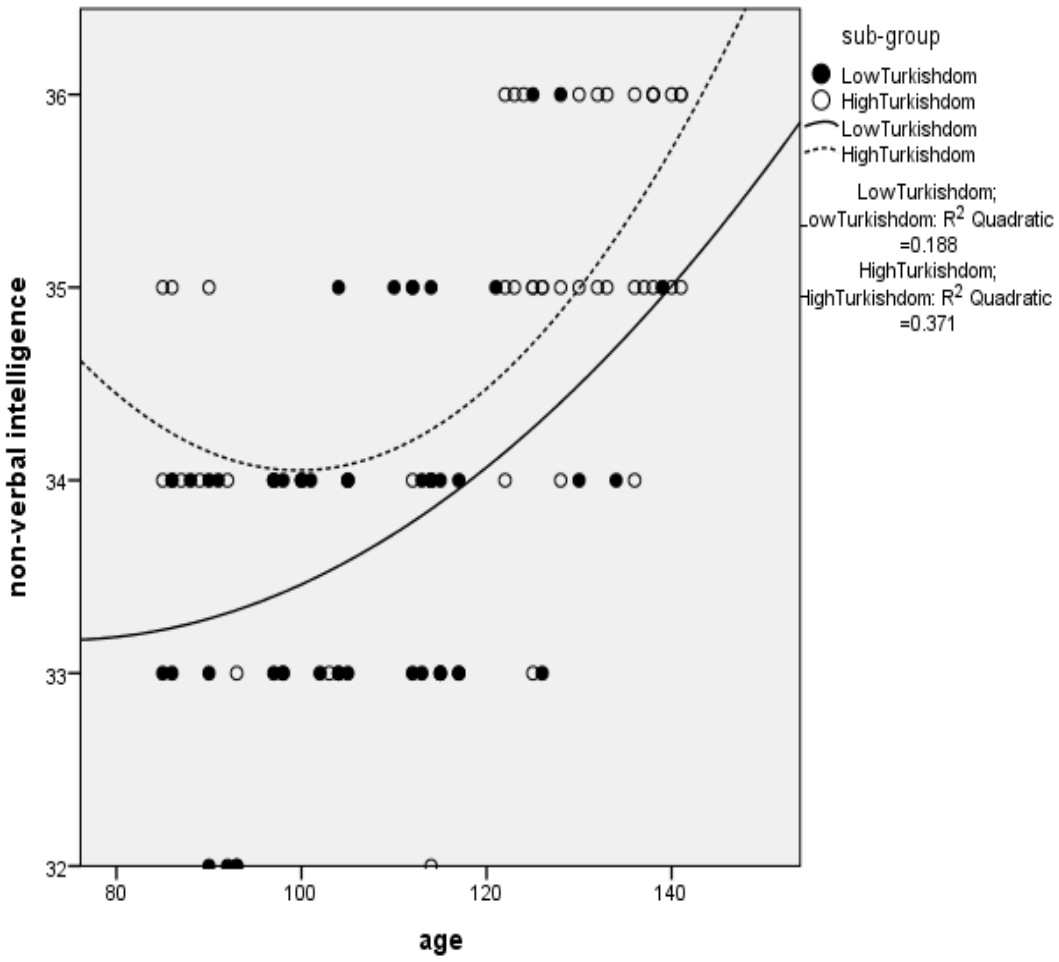

Figure 22. Correlation between parents' language dominance and nonverbal Intelligence scores of bilingual hildren (adapted from Daller & Ongun, 2017, p.14)

The findings shown in Figure 22 suggest that the development of bilingual children's nonverbal intelligence is faster in the high Turkish dominant sub-group than the low Turkish dominant sub-group. According to the independent T-test scores comparing the mean scores of the two sub-groups (Low and High Turkish dominant), there is a significant difference between the mean scores of the sub-groups (t = 6.3, df = 98, p < .001): bilinguals with higher Turkish dominant parents have higher nonverbal intelligence scores than bilinguals with lower Turkish dominant parents.

4.9.2 Comparison of Parental Home Language Use sub-group (More Turkish and more English) for Nonverbal intelligence scores

The effect of home language use on bilinguals' nonverbal intelligence scores has been also explored according to the aim of the fourth hypothesis of this study. With respect to the effect of home language use, the bilingual group was divided into two sub-groups: more Turkish use at home versus more English use at home to allow comparisons that determine the effect of parents' home language use on children's nonverbal intelligence scores.

The data analyses reported in Table 15 (below) demonstrates the mean scores on the nonverbal intelligence test of the sub-group of bilinguals (More Turkish/English use at home).

Table 15. Mean scores of nonverbal intelligence of the sub-group (more Turkish and more English use at home)

Groups	N	Mean	St. Dev.
More Turkish use at home	50	34.85	.967
More English use at home	50	33.69	.919

Table 15 shows that the 'more Turkish use at home' group scored slightly higher than the 'more English use at home' group, and according to an independent T-test, the difference is significant (t = 6.0, df = 98, p < .001). The mean difference is 1.18, which seems low, but there is a large effect of Cohen's d = 1.26 in the mean differences. The analysis suggests that bilingual children with parents who use Turkish more at home have significantly higher nonverbal intelligence scores than children whose parents use more English at home. The development of the two home language sub-groups of bilinguals is demonstrated in Figure 23 (below).

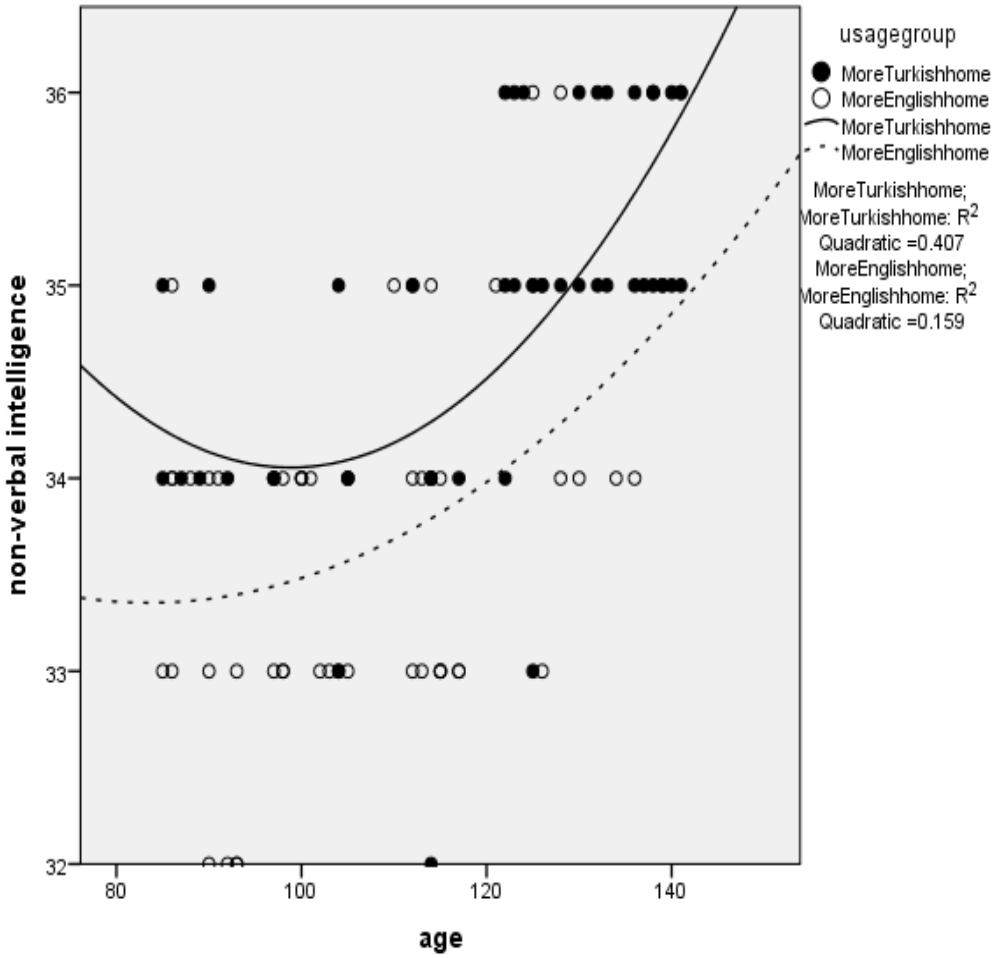

Figure 23. Correlation between parents' home language use and nonverbal intelligence scores of bilingual children

Figure 23 shows that the bilingual children in the 'more Turkish use' sub-group have higher nonverbal intelligence scores than those in the 'more English' sub-group, controlled for age.

The difference between these two sub-groups and the two monolingual groups in nonverbal intelligence scores are illustrated in Figure 24 (below).

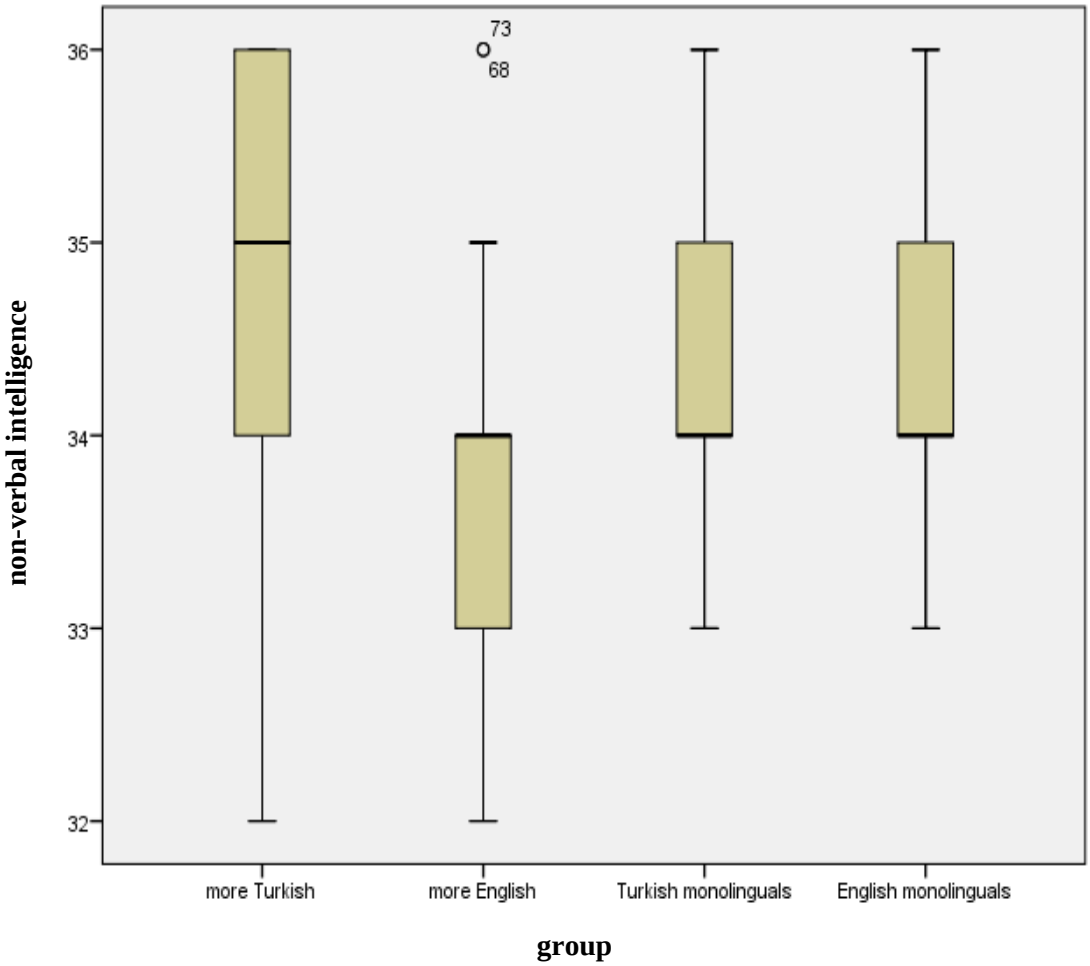

Figure 24. Box-plot of comparison of bilingual children's nonverbal intelligence scores between the sub-groups (more Turkish/ English use at home) and both monolingual groups

It can be seen in Figure 24 that those children with parents who use more Turkish at home have higher nonverbal intelligence scores than both those with parents who use more English at home and the two monolingual groups, demonstrating an advantage (detailed discussion can be found in the next chapter). In terms of the comparison between the two sub-groups (More Turkish and More English use) and the monolingual groups, Anova analysis with multiple comparison in post hoc Tukey analyses suggests the only difference is for the 'more Turkish use' sub-group (one-way ANOVA, F (3, 146) = 13.627, $p < .001$; $\eta^2 = .217$).

4.9.3 Correlations between Parental Language Dominance and Bilingual children's Vocabulary size and Nonverbal intelligence

The further analysis now focuses on exploring the partial correlations between parents' language dominance and the vocabulary size of the bilinguals (receptive, productive and conceptual vocabulary) in both languages. Partial correlation analysis will also be carried out for parental language dominance and nonverbal intelligence scores of the bilinguals. Firstly, the correlation between parental language dominance and vocabulary size of bilingual children is shown in Table 16 (below).

Table 16. Partial correlations between parental language dominance and bilingual children's vocabulary size in both languages (controlled for age), (adapted from Daller & Ongun, 2017, p.14)

Parents	Receptive Turkish	Receptive English	Productive Turkish	Productive English	Conceptual Vocabulary
Language dominance	.716**	.303*	.405**	.422**	.389**

* p < .01; ** p < .001

Table 16 shows that language dominance of the parents is highly and significantly correlated with children's vocabulary size scores in both languages.

Figures 25 and 26 illustrate the correlations between parents' language dominance and children's receptive vocabulary size scores with a strong correlation for Receptive Turkish and weak correlation for Receptive English. Productive vocabulary showed moderate correlations for both Turkish and English, and conceptual vocabulary separately with a weak correlation.

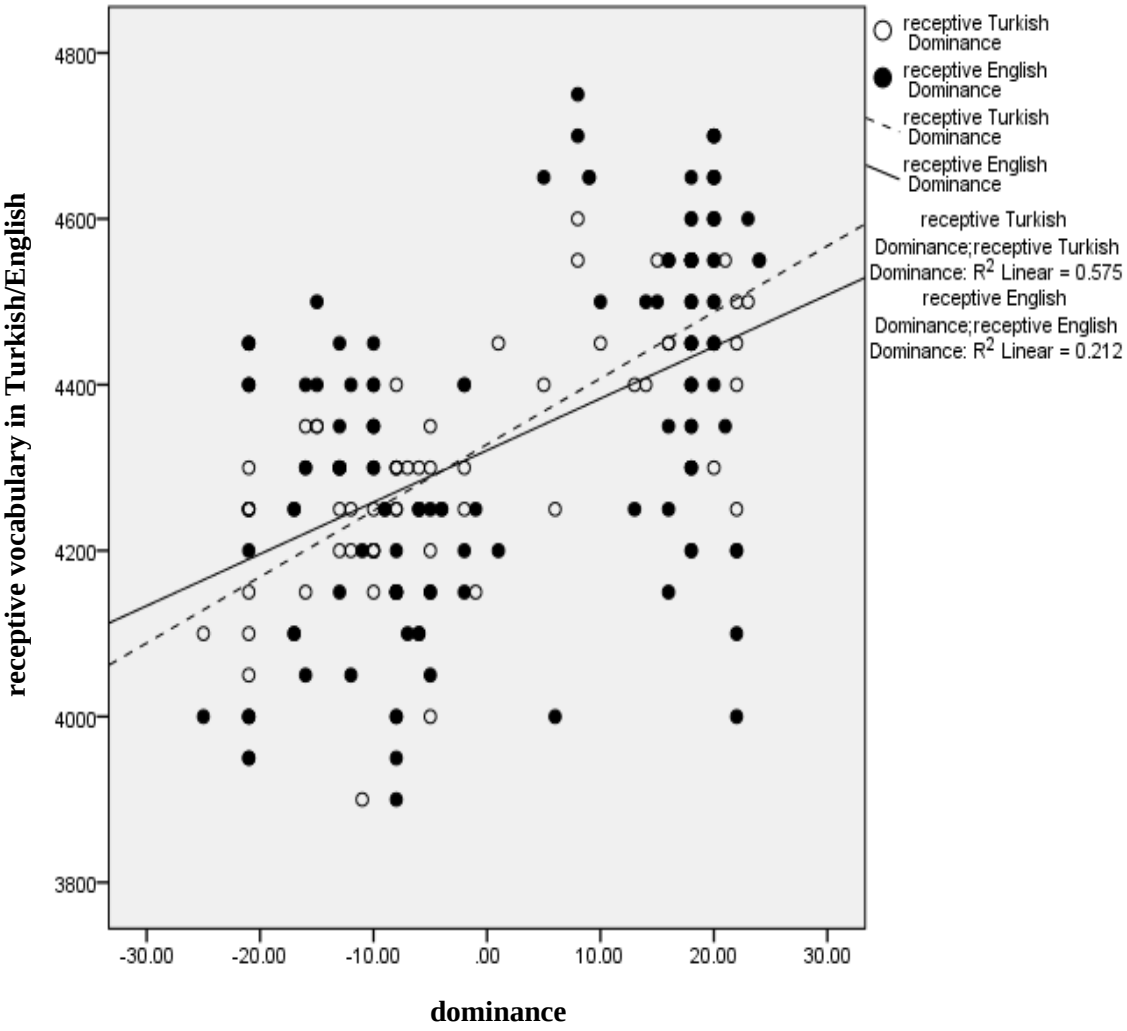

Figure 25. Correlations between language dominance of parents and receptive vocabulary size of bilingual children (Turkish/English) (-30.00 = less Turkish dom., +30.00 = more Turkish dom.)

Figure 25 shows that the receptive Turkish vocabulary accounts for 57% of the total variance in dominance (R^2 = .557); this means that 43% of the variation in the dominance is not accounted by the receptive Turkish. The receptive English explains 21% of the dominance (R^2 = .212). This may be due to the nature of the tests or other unknown factors.

The findings suggest that bilinguals with high Turkish-dominant parents have a higher receptive vocabulary size in both Turkish and English, but the development of both languages increases more strongly with Turkish-dominant parents. This could be explained with Cummins' Interdependence Hypothesis that posits the idea that L1 support is important for beneficial transfer of L1 proficiency to L2 (see Chapter 5 for further discussion).

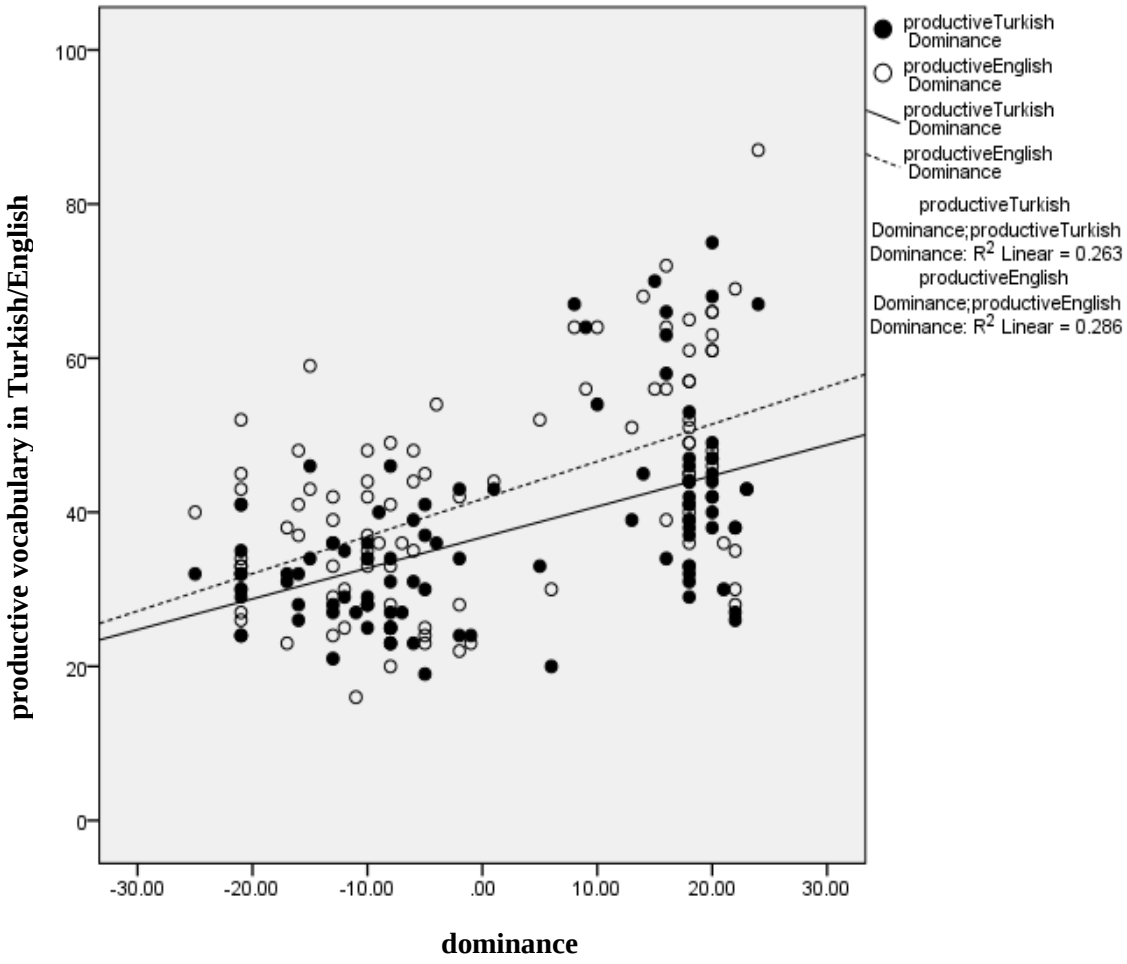

Figure 26. Correlations between language dominance of parents and productive vocabulary size of bilingual children

The scatter-gram in Figure 26 clearly indicates that bilinguals with higher Turkish dominant parents have higher productive vocabulary size scores in both languages than bilinguals with lower Turkish dominant parents.

Figure 26 also shows that the productive Turkish vocabulary accounts for 26% of the total variance in dominance (R^2 = .263); this means that 74% of the variation in the dominance is not accounted by the productive Turkish. The productive English explains 20% of the dominance (R^2 = .206) without explaining 80% of the variance. This may be due to the variables or inherent variability factors.

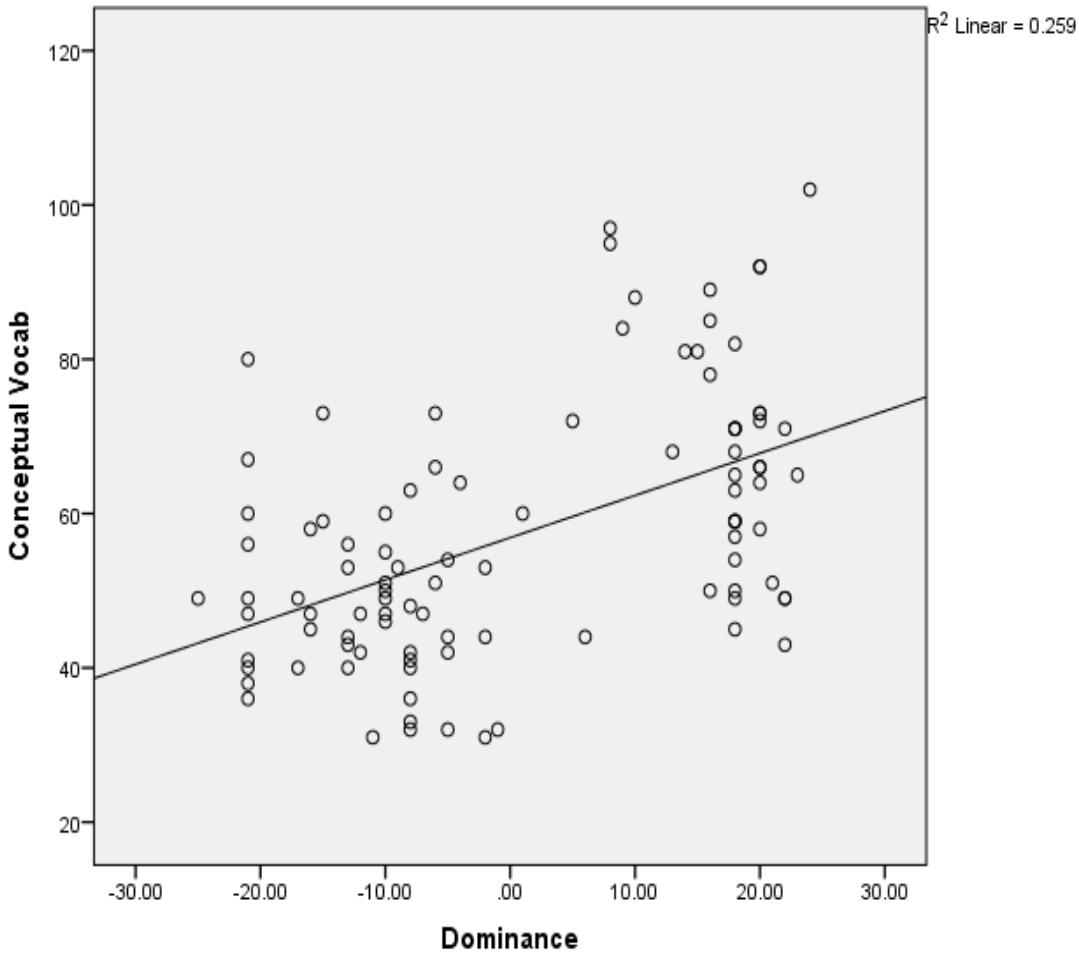

Figure 27. Correlations between parents' language dominance and conceptual vocabulary size of bilingual children

Figure 27 indicates similar findings to those shown in Figures 25 and 26 (above). Children with more Turkish dominant parents scored higher in conceptual vocabulary testing than the children with lower Turkish dominant parents.

To sum up, overall results from the correlations with vocabulary size of bilingual children in both languages and parents' language dominance indicate that bilingual children with more Turkish dominant parents have higher vocabulary size scores in receptive, productive and conceptual vocabulary in both Turkish and English than the bilingual children with lower Turkish dominant parents. The overall findings suggest that parents who are more dominant in Turkish have children with higher vocabulary size scores. Parental Turkish

dominance therefore seems to have a positive effect on children's vocabulary size in both languages.

Separate statistical analysis has been carried out to discern the correlation between parental language dominance and the nonverbal intelligence scores of the bilingual children. The correlation between language dominance of the parents and nonverbal intelligence scores of the bilingual children is significant (r = .433, p < .001), with a moderate correlation. Nonverbal intelligence explains 29% of variance in the dominance, thus failing to explain 71% of the variance (R^2 = .293). The findings are provided in Figure 28 (below).

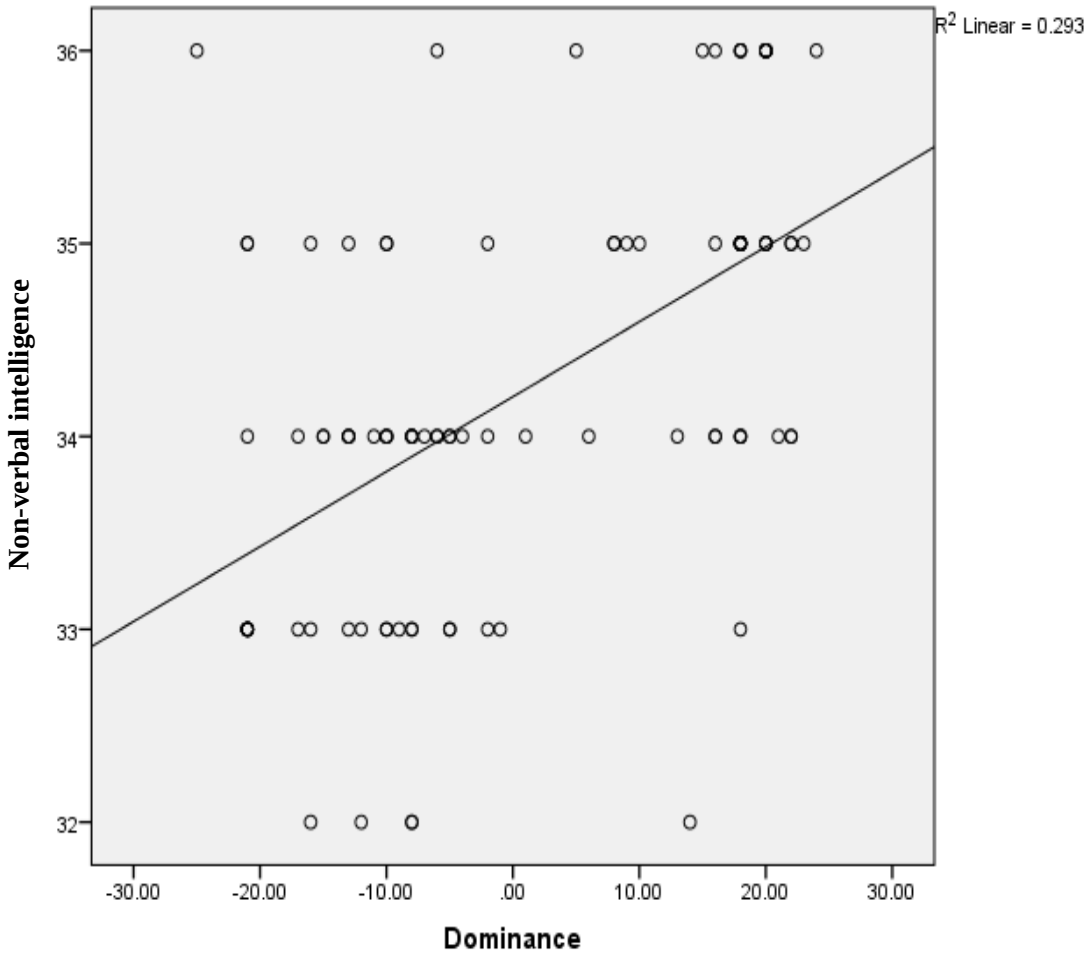

Figure 28. Correlation between parents' language dominance and bilingual children's nonverbal intelligence (positive scores represent Turkish dominant parents, negative scores represent low Turkish dominant parents (maximum Turkish dominance = 30.00, minimum Turkish dominance = -30.00)

Figure 28 suggests parents who are more dominant in Turkish have children with higher nonverbal intelligence scores than parents with low Turkish dominance.

4.9.4 Correlations between Parental Home Language Use and Bilingual children's Vocabulary size and Nonverbal intelligence

The correlations between parents' home language and children's vocabulary size and nonverbal intelligence scores are explored and presented separately in the following Tables and Figures.

Table 17. Partial correlations between parental language use at home and bilingual children's vocabulary size in both languages (controlled by age), (adapted from Daller & Ongun, 2017, p.14)

Parents	Receptive Turkish	Receptive English	Productive Turkish	Productive English	Conceptual Vocabulary
Language use at home	.361**	.368**	.367**	.437**	.381**

* p < .01; ** p < .001

Similar to the findings of parental language dominance, parental home language is moderately correlated with bilinguals' vocabulary size scores in both languages in terms of receptive, productive and conceptual vocabulary.

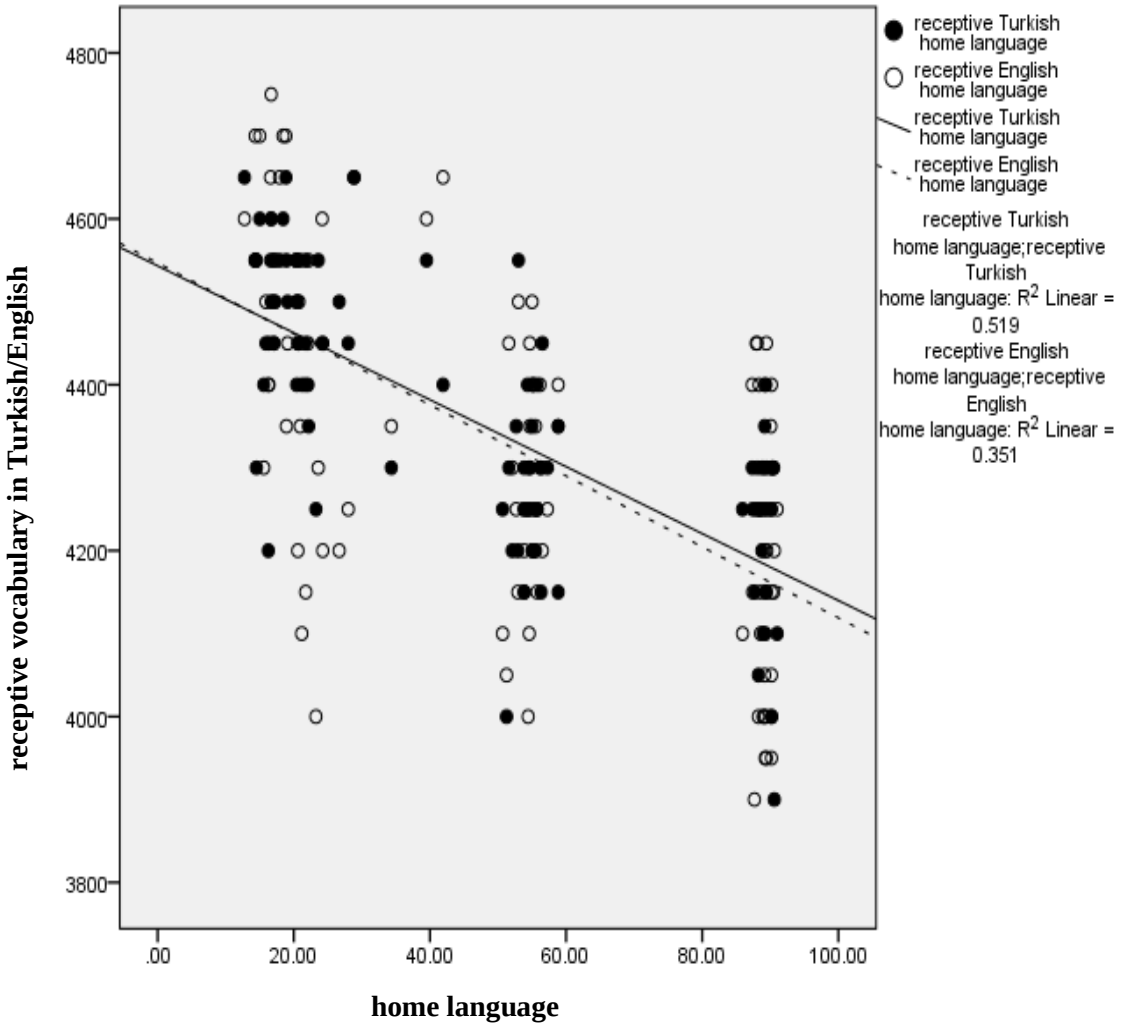

Figure 29. Correlations between bilingual children's receptive vocabulary size and parents' home language use (.00 = more Turkish use at home, 100 = more English use at home)

As seen in Figure 29, there is a strong positive correlation between parents' home language use and the receptive vocabulary size of children in both languages (Turkish receptive, r =.361, $p < .001$; English receptive, r = 368, $p < .001$). Both English and Turkish receptive vocabulary size is correlated with parents' home language use in parallel. The receptive Turkish explains 51% of the home language (R^2 = .519), and the receptive English explains 35 % of the home language (R^2 = .351). The findings demonstrate that parents using more Turkish at home have children with a higher receptive vocabulary size in both Turkish and English.

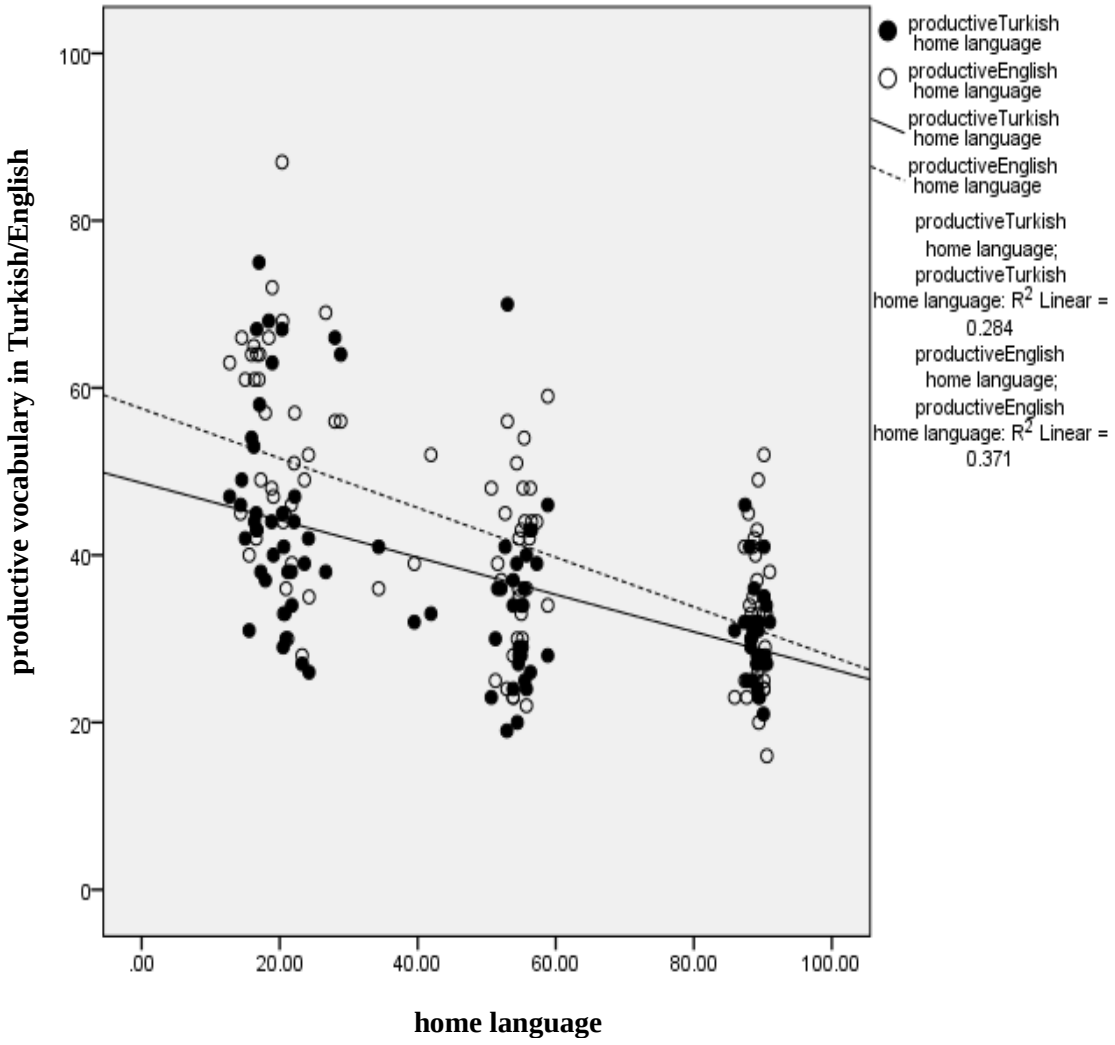

Figure 30. Correlation between bilingual children's productive vocabulary sizes and parents' home language (.00 = more Turkish use at home, 100 = more English use at home)

Figure 30 (above) shows the correlation between parents' home language use and children's productive vocabulary size in both languages is highly significant (Turkish productive, r =.367, $p < .001$; English productive, r =.437, $p < .001$). The productive Turkish explains 28% of the home language without explaining 72% variance (R^2 = .284) and the productive English explains 37% of the home language (R^2 = .371).

Parents who use Turkish more at home have children with a higher productive vocabulary size in both languages (Turkish/English), similar to the findings to do with receptive vocabulary size.

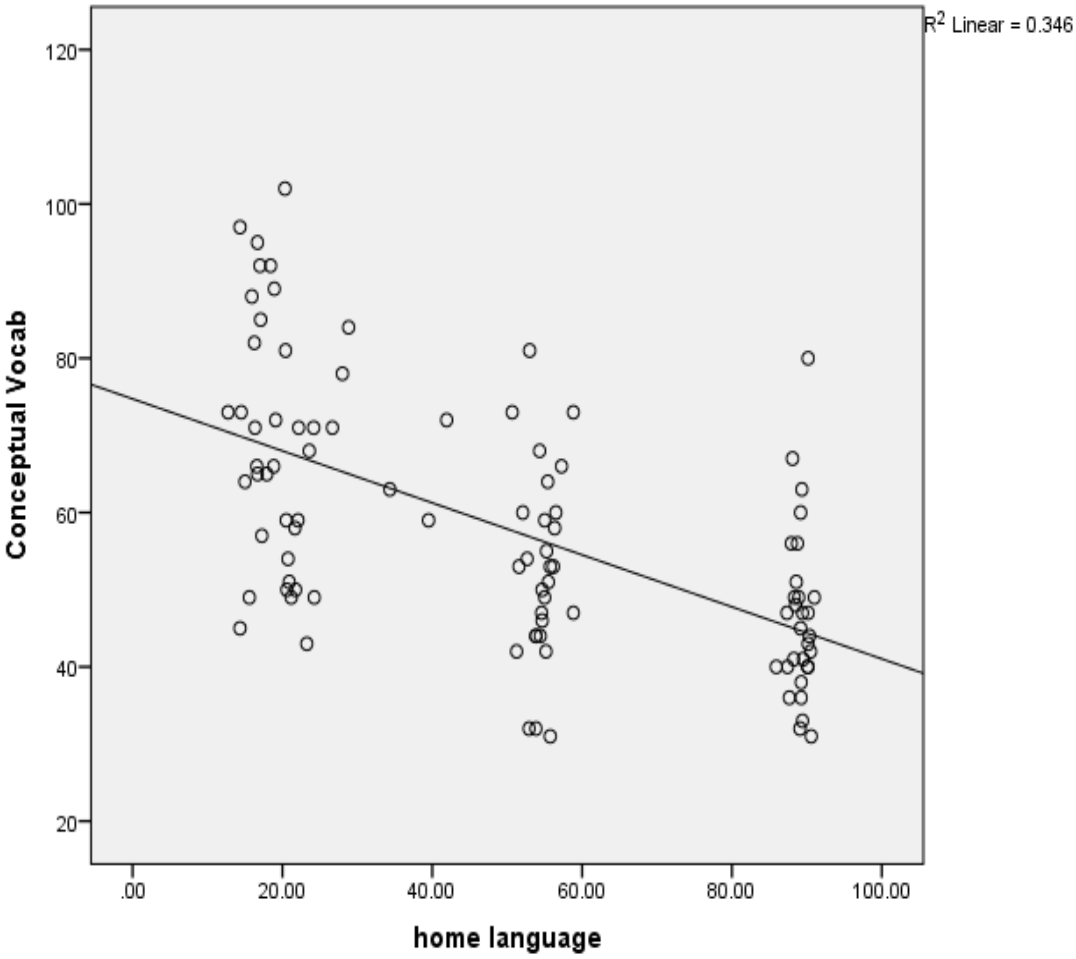

Figure 31. Correlation between bilingual children's total conceptual vocabulary size and parents' home language use (.00 = more Turkish use at home, 100 = more English use at home)

The correlation between parental home language use and the conceptual vocabulary of bilingual children is also significant, like the results for the receptive and productive vocabulary size of children (r = .381, p < .001). The conceptual vocabulary explains 34% of the home language (R^2 = .346), meaning 66% of the variation in home language is not accounted for by this.

To sum up, the correlations between bilingual children's receptive, productive and conceptual vocabulary size and parents' home language use are highly significant. Parents using more Turkish at home have children with higher receptive, productive and conceptual vocabulary scores in both languages, meaning parental Turkish home language use has a

positive effect on children's vocabulary size in both languages. It was expected that more Turkish home use has a positive effect on children's Turkish vocabulary size, but it is surprising that parental Turkish use at home also correlates positively with the children's English vocabulary size. The partial correlation between parental home language and bilinguals' nonverbal intelligence has been analysed, and the findings are provided in Figure 32 (below).

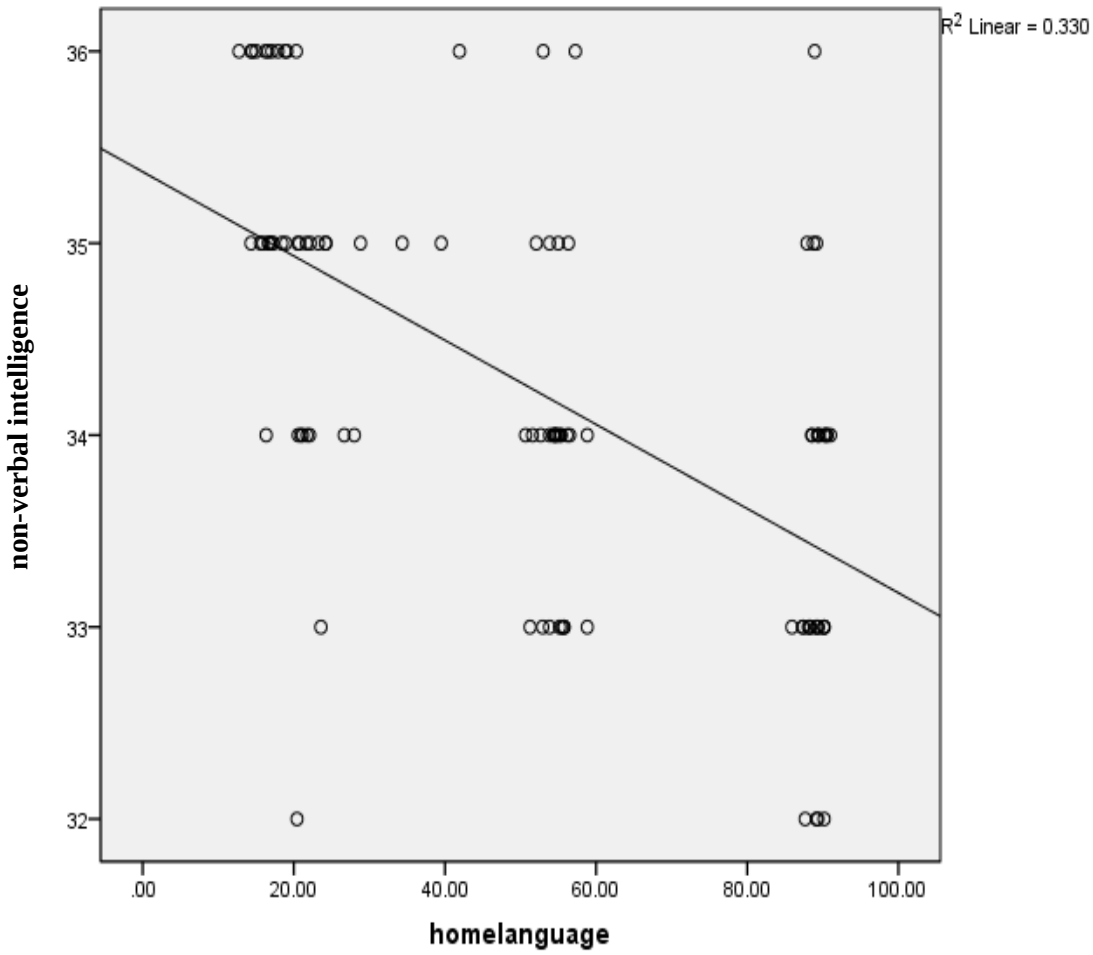

Figure 32. Correlation between parents' home language use (.00 = more Turkish use at home, 100 = more English use at home) and bilingual children's nonverbal intelligence scores

Figure 32 illustrates the correlation between parents' language use at home and children's nonverbal intelligence scores. The lowest score (.00), represents maximum parental Turkish use at home, and the highest (100) represents maximum parental English use at home.

The findings reveal a positive correlation (r =.398, p < .001) between parents' home language use and bilingual children's nonverbal intelligence scores: parents using more Turkish at home have children with higher nonverbal intelligence scores, whereas parents using more English at home have children with lower nonverbal intelligence scores. This suggests that more Turkish use at home has a positive effect on children's nonverbal intelligence (as well as on their vocabulary size in both languages, as shown earlier).

These results demonstrate that parental language dominance and language use at home are highly related with bilingual children's vocabulary size in both languages and nonverbal intelligence. The correlation between home language use and language dominance of the parents is not surprisingly highly significant (r = .901, p < .001). Parents with higher dominance in Turkish / more Turkish use at home have children with higher vocabulary size and nonverbal intelligence scores.

Chapter five

DISCUSSION

The main aim of this study is to investigate the relationship between bilingual children's vocabulary size in both of their languages in relation their nonverbal intelligence, the effects of parental language dominance and their home language use. The current study has four hypotheses, as explained previously (see section 1.2 & 1.3 in Chapter 1). The first hypothesis relates to a positive relationship between the vocabulary sizes of Turkish-English bilingual children in both their languages. The second one posits that bilingual children have a lower receptive and productive vocabulary size than monolingual children in both languages when both languages of the bilinguals are measured separately, but when their total conceptual vocabulary (TCV) is counted, there is no bilingual disadvantage. The vocabulary 'gap' disappears and the TCV size of the bilinguals is no smaller than that of the monolinguals. The third hypothesis proposes a positive relationship between the vocabulary size of bilingual children in both languages and their nonverbal intelligence scores, and the final hypothesis relates to the effect of parental L1 language dominance L1 use at home on children's vocabulary size (both receptive and productive) in both of their languages, and their nonverbal intelligence scores. Data collection methods and the study's procedure can be found in Chapter 3, and the findings from the statistical analyses in Chapter 4.

This chapter is dedicated to discussion of the results obtained from the statistical analyses in respect to the sequence of the hypotheses, in the light of the main aim of this study, incorporating the literature in this area (previously reviewed in Chapter 2). The discussion in this current chapter will be presented in the form of the main headings of the hypotheses.

5.1 Relationship between the Vocabulary sizes of bilingual children in Turkish and English

The first hypothesis focuses on the relationship between the vocabulary sizes of bilingual children in their L1 and L2, supposing that the relationship between the vocabulary sizes of Turkish-English bilingual children in both languages is positive. As explained in Chapter 3, bilinguals were tested with the X-Lex receptive vocabulary size test (Meara & Milton, 2003) in English and a Turkish version (Turkish X-Lex) created for this study. The bilingual children were also tested with the Verbal Fluency Test (semantic category fluency test) in both of their languages. The findings of the current study in regard to the first hypothesis provided clear evidence of a positive correlation between the vocabulary sizes of bilingual children in both languages (Turkish/English), with a strong significant correlation between them in terms of both receptive (r = .611, p < .001) and productive vocabulary size (r = .732, p < .001). In this study, vocabulary size develops in parallel in both languages even though L2 development seems to increase with age, which can be explained by reference to the fact that English is the children's language of education. The findings in this study demonstrate that bilinguals with a larger vocabulary size in Turkish also have a larger vocabulary size in English in terms of both receptive and productive vocabulary. The findings of the current study suggest a clear link between the bilingual children's L1 and L2 vocabulary size in both receptive and productive vocabulary. These findings clearly support the idea of the Interdependence hypothesis (Cummins, 1979, 1984) in terms of vocabulary knowledge, which posits that the development of L2 is partly dependent on the development already achieved in L1, and that there is a relationship between the language proficiency of bilinguals in their two languages. High level development in L1 proficiency allows similar development in L2 proficiency, so L1 and L2 competence can be said to be linked in bilingual settings. That these findings support the idea of the Interdependence hypothesis is important, as previous studies have provided evidence of such a bilingual L1 and L2 relationship for

reading comprehension, literacy and spelling skills, phonological awareness and writing performance (Lanauze & Snow, 1989; Verhoeven, 1991a, 1991b, 1994, 2000, 2007), but, as shown in the review of the literature, previous studies which have directly provided evidence for the relationship between L1 and L2 vocabulary size in respect to Cummins' Interdependence hypothesis are very scarce. There are in fact only three previous studies which partly investigate the relationship between L1 and L2 vocabulary size (Henriksen, 2008; Masrai & Milton, 2015; Sparks et al., 2009) in different language pairs (Danish-English, Arabic- English), and the current study supports the findings of these more clearly and directly than previous studies.

The findings of the current study also support the theory of Cummins' Common Underlying Proficiency (CUP) in terms of the vocabulary knowledge of bilinguals in both languages. As explained in Chapter 2, the CUP theory (Cummins, 1980) refers to the idea that even if a bilingual's two languages seem to be separate on the surface, there is a common area where bilinguals can transfer their existing L1 knowledge to their L2 knowledge and vice versa. The current study also provides important results in the field of vocabulary size research, contributing to narrowing the gap in the area of research around the relationship between L1 and L2 vocabulary size.

The findings of the positive relationship between the L1 and L2 vocabulary sizes of bilingual children in the current study may also have important implications for studies on bilingual mental lexicon representations, storage and interrelationship, and supports the Revised Hierharchical Model (RHM, Kroll, 1993; Kroll & Stewart, 1994) in terms of the relationship between bilingual L1 and L2 lexical knowledge representations and translations between two languages. According to RHM, although lexical storage is separate for each language, conceptual storage connects both L1 and L2 lexical knowledge, but the lexical transfer from L1 to L2 can be stronger than the transfer from L2 to L1, or vice versa, so the link between

the lexicons and concepts in the two languages show differences in terms of strength, based on different domains. For example, at the various stages of L2 learning, most words with the same concepts and meanings can be transferred from L1 to L2. Lexical concepts are first developed in L1 and these acquired concepts are transferred from L1 to L2; children use the already achieved concepts in L1 to develop L2 lexical knowledge by learning labels in L2 for the same concepts (Kroll, 1993; Kroll & Stewart, 1994). It may be possible for those participants who are sequential bilinguals who first learn Turkish in a family setting and then English at the age of 3 (or school age) to transfer their existing L1 lexical knowledge and concepts to their L2 lexical storage, and L1concept translation may develop their L2 lexical knowledge. As Wolter (2006) points out, L1 lexical and conceptual knowledge has an important effect on the development of L2 lexical knowledge. Children can develop their L2 lexical knowledge at the highest level when their L1 is acquired sufficiently (Umbel et al., 1992).

One explanation could be that the lexical connection or transfer from L2 to L1 may be stronger than that from L1 to L2. In the present study, the bilingual participants may also transfer their developing L2 lexical knowledge to L1 lexical knowledge, as the bilingual participants in the current study have a formal, systematic education in English in a school setting, whereas their Turkish is learned and spoken in an informal family setting. It is also possible that the bilingual participants both transfer from L1 to L2 and vice versa to develop their lexical knowledge in each language, and the conceptual lexical translation links their lexical knowledge between L1 and L2, as mentioned in RHM (Kroll, 1993), at the level of lexical and conceptual storage and representation. With regard to the link described in this model, the current findings support the link between L1 and L2 vocabulary in two languages in accordance with the aim of the first hypothesis. This finding also supports RHM in terms of the strong asymmetrical connection between L1 and L2 bilingual lexical processing, therefore

bilingual children with higher L1 vocabulary size also have a higher L2 vocabulary size in the current study.

The findings of the first hypothesis also have some supportive implications for the integrated bilingual lexicon framework, which has been supported by previous studies (De Groot et al., 2000; Paradis, 2001), rather than two seperate lexical representations. As Paradis (2001) states, there is only one conceptual representation linked to both languages, and two lexical representations are integrated with each other.

Additionally, according to the findings regarding the first hypothesis, the receptive and productive vocabulary sizes of the bilingual children in each language are significantly correlated. There is a strong positive correlation between the receptive and productive vocabulary size of bilinguals within their two languages (Turkish receptive / productive vocabulary size: $n = 99$, $r = .782$, $p < .001$; English receptive / productive vocabulary size: $n = 100$, $r = .437$, $p < .001$), in line with previous studies (Laufer, 1998; Laufer & Goldstein, 2004; Laufer & Patribakht, 1998) which suggests a link between the receptive and productive vocabulary size of bilinguals in each of their languages. Bilinguals with a larger receptive vocabulary in Turkish and English also have a larger productive vocabulary. It is also possible to say that the receptive vocabulary size of bilinguals can be a good predictor for the productive vocabulary size of bilinguals in both languages (L1 & L2).

This empirical study is also important for exploring the vocabulary size relationship between Turkish and English, and to our knowledge, there is no previous study which investigates the link between the Turkish and English vocabulary size of Turkish-English bilingual children specifically.

5.2 Comparison of Vocabulary sizes between Bilingual and Monolingual children with Total Conceptual Vocabulary (TCV)

The first point of the second hypothesis proposes that bilinguals have a smaller vocabulary size in each language than monolinguals. Bilingual children were tested in each language separately, for receptive (X-Lex in English and Turkish, Turkish X-Lex) and productive (verbal fluency test in English and Turkish) vocabulary size, and monolinguals were tested in their respective languages with the same tests (Turkish monolinguals = X-Lex in Turkish for receptive vocabulary and Verbal Fluency Test in Turkish; English monolinguals = X-Lex in English for receptive vocabulary and Verbal Fluency test in English). The results show that bilingual children have significantly lower scores than Turkish monolingual children in receptive tests and productive ones. Similar results were found when bilingual children were compared with their age-matched English monolingual children. However, this narrows with age in English, possibly explained by the children's school education in L2 (English).

The comparison between bilingual and monolingual vocabulary sizes supports the idea that bilingual children have a significantly lower vocabulary size than their monolingual counterparts in each language separately for both receptive and productive vocabulary, with respect to the second hypothesis of the current study. These findings are in line with expectations and the findings of previous studies, which have shown that bilingual children have a lower vocabulary size than monolinguals (Bialystok, 1988; Bialystok et al., 2010; Bialystok & Feng, 2009; Bialystok & Martin, 2004; Oller & Pearson, 2002). One possible interpretation that can be drawn from the findings is that when the vocabulary sizes of bilingual children are measured in two languages separately, bilingual children use their existing L1 or L2 lexical knowledge in each language. When they are compared with their monolingual counterparts in one language assessment, for example L1, even if they know the meaning of a word in the test, they may not remember or pronounce the word in L1, but remember that word in L2, so the number of words they 'know' is reduced, and this affects the

total score of the test. However, this situation does not exist for monolinguals, as they do not have two options or two separate lexical storages: they simply use the word they know.

Another interpretation may be the conceptual differences of words according to L1 and L2 use in different domains. For example, the concept words could be about school or kitchen items. If a bilingual is tested with words about stationery, more English (L1) words than Turkish (L2) are expected because stationery terms are predominantly used in school, where they entirely use English. If the bilingual is asked about kitchen vocabulary, the opposite is true: more words in Turkish are expected because the kitchen and its items are more likely to be discussed in L1 if the parents speak Turkish at home. Again, this is not the case for monolingual children, because all of the concepts they know are in the same language.

The second point of the second hypothesis assumes that there is no bilingual disadvantage in comparison with monolinguals when both languages of the bilingual children are considered together and measured with Total Conceptual Vocabulary (TCV). The findings of this study show that the TCV of the bilingual children in both languages is not lower than the vocabulary of the monolingual children. Even if the bilinguals have not achieved higher vocabulary size scores than the monolinguals, this is still considered an advantage for bilinguals who have consistently lower vocabulary size scores than monolinguals. As mentioned in Chapter 3, the conceptual vocabulary assessment was carried out for the productive vocabulary of the bilinguals only. The productive vocabulary sizes of bilingual children in each language were counted as a total conceptual vocabulary, which brought the productive vocabulary scores in both languages (L1 = Turkish, L2 = English) together. The TCV size of the bilingual children was compared with the monolingual children`s productive vocabulary. When the TCV is taken into account, there is no significant difference between the vocabulary scores of the bilingual and the two monolingual groups in both languages (Turkish, English). No vocabulary gap was identified in the total conceptual vocabulary size

of the participants, as it was when the bilinguals' two languages were measured separately. The mean scores of the bilingual and monolinguals groups are close (Mean score of Turkish/English bilingual children = 57.50; Turkish monolingual children = 63.68; English monolingual children = 62.84), and there is no significant difference between the groups of bilinguals and monolinguals. As expected, the findings suggest that bilingual children have no disadvantage in comparison with their monolingual counterparts when TCV is taken into account, which is in line with expectations and supports previous findings (Umbel et al., 1992; Pearson et al., 1993; Bedore et al., 2005). This indicates that measuring the conceptual vocabulary of bilinguals provides a more realistic estimate of their overall vocabulary size. The findings also support Cummins' Common Underlying Proficiency (CUP), which underlies the positive effect of development in L1 on L2, as both of the bilinguals' vocabulary sizes were taken into account. The development of concepts in L1 affect the development of concepts in L2, so they can be easily transferred between the languages: higher development in L1 concepts makes for similar development in L2 concepts. The findings of the current study are important, as there are no previous studies exploring TCV in Turkish-English bilinguals.

The findings also have some important implications for the mental lexicon framework of the Revised Hierarchical Model (RHM; Kroll et al, 2010; Kroll & Stewart, 1994) in terms of the stronger link between L1 lexical knowledge and conceptual representation than that of L2. Bilingual participants may use the stronger conceptual connection between L1 lexical knowledge and conceptual storage in TCV assessment, but when they compared with monolinguals without conceptual vocabulary assessment, they have no chance to use this strong link between their L1 lexical knowledge and conceptual vocabulary storage. When L1 knowledge is ignored for bilinguals in a vocabulary assessment, they may be only partly using their conceptual storage so they are unlikely to demonstrate their total vocabulary knowledge capacity. Therefore, in TCV assessment, bilinguals may use their all vocabulary knowledge in

L1 and L2 vocabulary, using the strong L1 lexical knowledge link to conceptual vocabulary knowledge, so the gap between monolinguals may exist.

Additionally, bilingual conceptual representation and storage are classified in Henriksen's lexical storage model (2008) as a link between lexical entries and conceptual and semantic knowledge. When we consider bilingual conceptual knowledge, all these levels and the link between them are important for bilinguals to develop and process their lexical knowledge across two languages. For example, according to the level of lexical representation, all lexical entries are categorized according to both formal and semantic knowledge. The semantic knowledge of a word is used to connect other words in the same semantic category, and in this way one word leads to the learn or recalling of other relevant words within the same semantic category, so the bilingual can produce or understand more words in this semantic category. If the bilingual cannot use conceptual knowledge to store a word with its form and semantic meaning, the link between the words is closed and this reduces the bilingual's total measured lexical knowledge. Therefore, bilinguals can make more lexical semantic connections with conceptual knowledge and produce their existing lexical knowledge more accurately without restrictions. It could be important to point out that different conceptual categories would be used in the productive test to support more diverse vocabulary that may provide larger vocabulary size. In this study, four categories (foods, body parts, clothes and colours) were included in the productive vocabulary test, but a greater number of more diverse categories may help the children to demonstrate their vocabulary knowledge more intensively. In the current study, bilinguals were able to demonstrate their overall lexical knowledge in TCV assessment to use the link between conceptual knowledge, lexical knowledge and all the relevant semantic connections of their lexical knowledge, so the gap between bilinguals' and monolinguals' lexical knowledge disappeared.

5.3 Relationship between Bilingual children's Vocabulary sizes and Nonverbal intelligence

The third hypothesis assumes a positive correlation with regard to the relationship between the vocabulary size and nonverbal intelligence scores of bilingual children. Bilingual children were tested in both languages in terms of receptive and productive vocabulary, and with a nonverbal intelligence test (RCPM; see Chapter 3) to determine any correlation between vocabulary size and nonverbal intelligence. Statistical analyses reveal a positive correlation between the receptive vocabulary size of bilinguals in both languages (Turkish/English) and their non-verbal intelligence scores. These findings support the third hypothesis and suggest that there is a positive correlation between bilinguals' vocabulary size and non-verbal intelligence. The findings of the current study are important for understanding the relationship between vocabulary knowledge and non-verbal intelligence in terms of general intelligence (*g*) theory (Spearman, 1909). Therefore, the relationship between vocabulary size and intelligence can be explained by reference to the mechanism of general intelligence, which is only one common psychological trait underlying all mental verbal or non-verbal abilities, so vocabulary knowledge may be directly linked to general intelligence.

In another assumption, vocabulary knowledge is first linked to long-term memory, which is a sub-component of crystallized intelligence. This is linked to general intelligence, as Cattell and Horn (1966) divided general intelligence into 'fluid' and 'crystallized' intelligence, the latter of which is related to long-term memory, including vocabulary and previously acquired general and cultural knowledge. Baddeley (2000) explains that verbal working memory is related to both lexical and general linguistic ability, and verbal working memory is considered an important factor for lexical processing abilities. The positive relationship between vocabulary knowledge and non-verbal intelligence may be explained with the link from, first, vocabulary knowledge to long-term memory, then to crystallized intelligence and finally to general intelligence.

This correlation between the receptive vocabulary scores and nonverbal intelligence scores is, however, higher than the correlation between the productive vocabulary scores of bilingual children in both languages and their nonverbal intelligence scores. The correlation between the receptive vocabulary size scores and non-verbal intelligence scores is significant, but the correlation between the productive vocabulary scores and non-verbal intelligence scores only approaches significance. One explanation for this may be that receptive vocabulary size might be a better predictor of non-verbal intelligence scores than productive vocabulary size, or that non-verbal intelligence affects receptive vocabulary knowledge more obviously than productive vocabulary knowledge. According to Cattell-Horn Theory (Cattell, 1963), vocabulary learning and storage is related to crystallized intelligence, which includes long-term memory that consists of previously acquired knowledge. When the findings of the current study are considered, bilingual receptive vocabulary knowledge can be more closely linked to long-term memory than productive vocabulary knowledge, and bilingual children can use their existing vocabulary knowledge in receptive vocabulary tests more effectively than productive ones. One possible reason for this could be that in productive tests, the participants need to use other mental or memory skills including short-term memory, and there are other factors bearing on accurate scores, such as processing speed, decision or reaction time and fast track speaking skills or the mental conceptual framework to produce a word in a certain time limit. Productive vocabulary assessment is related to simultaneous use of all these mental abilities. In receptive vocabulary tests, by contrast, only word recognition and decision-making skills are required other than speaking skills.

The receptive and productive tests are necessarily different. In the productive test, the participants need to produce the relevant words for the given concepts in a limited time as the procedure of the semantic fluency task is 2 minutes for each concept. Speaking and producing words in a limited time could be more related with speaking skills, but in the receptive tests, the participants only need to remember the words that they see and decide whether they know

the words or not. Therefore, the difference between the test procedures could be a reason for the differences between the correlations of receptive and productive vocabulary scores and nonverbal intelligence scores.

Next, receptive vocabulary size is larger than that of productive vocabulary (Laufer, 1998; Laufer & Goldstein, 2004; Laufer & Patribakht, 1998), so the difference between the size of receptive and productive vocabulary knowledge can also affect the link between the vocabulary sizes and nonverbal intelligence scores of bilinguals. Larger lexical knowledge can strengthen the link between receptive vocabulary knowledge and nonverbal intelligence.

The overall findings of this hypothesis clearly support the idea that bilinguals with higher vocabulary scores also have higher nonverbal intelligence scores, in line with Cummins' Threshold hypothesis (see 2.2.7 section in Chapter 2), which posits that bilingual cognitive advantage can only be seen after a certain language proficiency achievement in both languages, and a bilingual cognitive advantage is possible if bilinguals attain sufficient proficiency in both languages. If bilinguals have a lower language proficiency in both languages, or high proficiency in one language and low in the other, no bilingual cognitive advantage is likely to exist. Parental L1 support is important for the development of L1 proficiency, and adequate L2 education and schooling are important for the development of L2 proficiency. Bilinguals need not only parental L1 support but also schooling support in L2 for achieving possible bilingual cognitive advantage with a high level proficiency in both languages. In this study, the vocabulary size scores of the bilingual children were regarded as language proficiency and nonverbal intelligence scores were regarded as general cognitive development. The findings around this hypothesis support very early studies on the relationship between vocabulary size and intelligence and nonverbal intelligence scores (e.g. Terman et al., 1918; Miner, 1961), as well as more recent studies (e.g Grzegorzewska, 2015), and the previous studies (e.g Adesope et al., 2010; Barac & Bialystok, 2011; Bialystok, 1997;

Bialystok, 2010; Bialystok, et al., 2005; Bialystok & Majumder, 1998; Bialystok & Viswanathan, 2009; Goetz, 2003) demonstrating bilingual cognitive advantage in different cognitive abilities.

5.4 Effects of Parental Language Dominance and Home Language Use on Bilingual Vocabulary sizes and Nonverbal Intelligence

The fourth and final hypothesis proposes that parental language dominance and home language use have a positive effect on bilingual children's vocabulary sizes in both languages and nonverbal intelligence scores. Statistical analysis was carried out with all participants to compare the nonverbal intelligence scores of the bilingual and monolingual children, revealing no significant difference between these groups in terms of nonverbal intelligence scores.

As described in Chapters 3 and 4, the bilingual children were divided into two sub-groups, the first of which was High and Low Turkish dominant based on the medians of parental language dominance. A comparison was also carried out for the two bilingual sub-groups and both monolingual groups in non-verbal intelligence scores. The findings show that bilinguals with more Turkish dominant parents have significantly higher non-verbal intelligence scores than the bilinguals with less Turkish dominant parents and both monolingual groups (Turkish and English). This suggests that bilingual children with L1 dominant parents outperform monolingual children and bilingual children with low L1 dominance parents in these non-verbal intelligence tests. One of the important assumptions drawn from this finding is that parental L1 support may be an important factor for the development of the link between L1 and cognitive development of bilingual children. A large vocabulary size in L1 may make a positive contribution to bilingual cognitive development. Bilinguals may develop cognitive skills and abilities with the support of L1 development, and high parental L1 support may increase the positive effects of this on bilingual cognitive

development. For example, more parental verbal input may develop bilingual cognitive mechanisms and lead to their using and developing their existing cognitive abilities to learn and code L1 more effectively. Considering the current study, parental L1 support is an effective factor on the cognitive development of their bilingual children. Another consequence of parental L1 support could be the use of working memory capacity to learn new L1 input produced by parents, and the production of more words of varied type: explaining the meaning of a word or giving examples of its use from different word types can develop bilinguals' short- and long-term memory. The development of working memory as a sub-component of non-verbal intelligence may link to the development of non-verbal intelligence, and parental L1 support could have a positive effect for both the development of working memory and non-verbal intelligence, and for the strength of the links between these two important cognitive components.

Parental Turkish (L1) dominance can be said therefore to have a positive effect on the cognitive development of the bilingual children (nonverbal intelligence in this case), and that Cummins' Threshold hypothesis may need a revision in terms of the positive effects of parental L1 support on children's cognitive development. Although the findings regarding the third hypothesis (above) were in line with the Threshold hypothesis, the findings around the fourth hypothesis suggest that parental L1 support should be taken into account when studying bilingual cognitive advantages, as it has a positive effect on the development of bilingual children's nonverbal intelligence (cognitive development).

There was a positive correlation between the parental language dominance and children's nonverbal intelligence scores. These findings support and replicate those of previous studies (Dickinson & Tabors, 2001; Hart & Risley, 1995; Huttenlocher et al., 1991; Pan et al., 2005). There is, however, no known previous study exploring the relationship

between parental L1 language dominance and bilinguals' nonverbal intelligence scores, so this empirical study is important to contribute to this area of research.

The second of the bilingual sub-group divisions was around the language use of parents at home: Turkish vs. English (one bilingual group with parents using more Turkish at home, the other with parents using more English at home). A statistical analysis was carried out to compare these sub-groups to each other and to the monolingual groups in terms of non-verbal intelligence scores. The findings demonstrate significant differences between the groups. The bilingual sub-group with parents using more Turkish at home showed significantly higher non-verbal intelligence scores than the bilingual sub-group with parents using more English at home. The correlation between parental home language use and non-verbal intelligence scores is positively significant, so it can be said that children with parents using more Turkish at home have higher non-verbal intelligence scores than children with parents using less Turkish at home.

The findings also suggest that parental home language affects bilinguals' cognitive development, similar to the findings with the effect of parental language dominance, and comparable assumptions can be drawn. More L1 use at home may have a direct link to the non-verbal intelligence of the bilingual children in terms of the development of cognitive abilities and strategies, by speaking and learning L1 more effectively with L1 home language support. More L1 use at home may be the first important way to use the cognitive abilities of bilingual children, and L1 home language use may be the first link to working memory capacity development: the link between working memory and non-verbal intelligence is considered crucial to the development of all these cognitive abilities asymmetrically. A highly developed L1 also makes a similarly high development of working memory possible, and this leads to high development of non-verbal intelligence. Whether more L1 use at home is directly linked to non-verbal intelligence development or not, the process of the development

seems to begin with the development of L1 and continues with the components of cognitive development. Therefore, parental L1 use at home, which is important for bilingual L1 development, is an essential factor in the process of bilingual cognitive development.

These results also support the Threshold hypothesis in terms of the effect of higher language proficiency in both languages on cognitive development, but this hypothesis may require revision regarding the positive effect of parental L1 dominance and L1 home use on bilinguals' cognitive development.

In the light of the fourth hypothesis, correlations between bilinguals' vocabulary size, parental language dominance and home language use were analysed statistically to discern the relationship between them, and to explore the effect of parental language dominance and home language use on bilinguals' vocabulary size in both languages. As explained in Chapter 4, a positive significant correlation was found between the language dominance of the parents and the vocabulary size of their bilingual children. The children with more Turkish dominant parents achieved higher vocabulary scores in both languages than children with more English dominant parents. One possible explanation is that, as mentioned before, L1 and L2 vocabulary size development are related, and the link between L1 and L2 vocabulary size is explained with the implications of mental lexical theories: the findings support the idea that development in L1 vocabulary size leads to a similar development of L2. At this point, it is very important to consider the positive effects on the vocabulary size development of bilingual children in L1 and L2 of parental L1 support in terms of the parental language dominance preferences. Parental L1 support may strengthen the link between L1 and L2 vocabulary because parental L1 support leads to the development of the L1 vocabulary size of bilingual children and that of the L2 in parallel. More L1 vocabulary input with parental support may also lead to more vocabulary uptake in L2 due to greater conceptual transference from L1 to L2. As mentioned earlier, L1 lexical knowledge and concept representations are

linked, so concepts are first developed in L1 and possible transference occurs from L1 to L2 lexical knowledge (Kroll, 1993; Kroll & Stewart, 1994; Wolter, 2006). Parental L1 support makes L1 lexical and conceptual knowledge larger and this leads to similar developments in L2 lexical knowledge, with conceptual transference from L1 to L2 (see Chapter 2, the bilingual mental lexicon section). Therefore, parental L1 support seems to have a positive effect on both L1 and L2 in the process of the vocabulary knowledge development of bilingual children.

The parents' home language use has a similarly positive effect on bilingual children's vocabulary size in both languages. According to the findings from the statistical analysis, the correlation between parents' home language and bilinguals' vocabulary size is positively significant. This finding suggests that children with parents using more Turkish at home achieve higher vocabulary size scores in both languages than bilingual children of parents using less Turkish. This finding can be explained by reference to the positive effects of parental L1 use on the development of the L1 vocabulary of bilingual children and, later, on L2 vocabulary development. Parental L1 home language use may not directly affect the development of the L2 vocabulary of bilingual children, and the link may exist due to the relationship between bilingual L1 and L2 development. As development in L1 leads to similar developments in L2, and lexical and conceptual transference is from L1 to L2 vocabulary knowledge, the positive effects of parental L1 home use on the L1 vocabulary knowledge of bilingual children can also positively affect vocabulary development in L2.

Findings from the correlations between nonverbal intelligence and vocabulary size scores of bilingual children and parental language dominance and parental home language use are similar, and the correlation between parental home language use and language dominance is highly significant. One reason for the similarity between these correlations may be because those parents who report greater dominance in Turkish also tended to report higher Turkish

use at home, or parents with more Turkish dominance simply prefer to use their dominant language at home. Parents who are more dominant in Turkish also prefer to use more Turkish at home, so the parallel results between the correlations are expected.

Finally, the results of the statistical analyses suggest that both parental L1 dominance and parental L1 home language use have a positive effect on the development of bilinguals' vocabulary size in both languages and nonverbal intelligence scores. As mentioned earlier, the Threshold hypothesis posits that a high level of proficiency in L1 and L2 leads to advantage in cognitive development, and this is supported by the findings of the current study. However, in regard to the positive effect of parental L1 dominance and home language use on bilinguals' vocabulary size and nonverbal intelligence, the Threshold hypothesis may need to be revised to take into account the parental L1 support effect on bilingual children's vocabulary size and nonverbal intelligence scores, as parental L1 use and support had a positive effect on bilinguals' language proficiency and cognitive development in the current study.

5.5 Chapter summary

With respect to the main aim of this study and its four hypotheses, the findings show a positive correlation between the vocabulary sizes of bilingual children in both languages (Turkish/English), and that children with a higher Turkish vocabulary size also tend to display a higher vocabulary size in English, both receptively and productively. These findings support Cummins' Interdependence hypothesis and CUP theory in terms of the relationship between L1 and L2 vocabulary size development. This has not been precisely explored in the literature, and these findings should help address the gap in research on vocabulary size relationships in a bilingual setting.

The findings support the idea that receptive vocabulary size is a good predictor of productive vocabulary size, and, indeed, a strong positive correlation between receptive and

productive vocabulary sizes were found in each language separately. This study offers an important example of the link between the receptive and productive vocabulary sizes of bilingual children in two structurally distant languages, Turkish and English. Comparing the bilingual and both monolingual groups in terms of vocabulary size in each language separately, bilinguals demonstrated a lower vocabulary size than their monolingual counterparts, but this gap disappears when bilinguals' Total Conceptual Vocabulary (TCV) is taken into account in productive vocabulary size assessment, so conceptual vocabulary assessment is considered an advantage for bilinguals' vocabulary size in comparison with monolinguals.

The findings of the current study support the idea that there is a strong positive correlation between the vocabulary size of bilinguals in their languages and their nonverbal intelligence scores, but the correlation for receptive vocabulary is higher than that for productive vocabulary, and this may be explained by reference to the fact that receptive vocabulary size might be a better predictor of nonverbal intelligence scores than productive vocabulary size. This supports Cummins' Threshold hypothesis in terms of the effect of high language proficiency in both languages on the cognitive development of bilingual children.

Finally, the findings of the current study provide evidence stating that parental language dominance in Turkish and parent's use of Turkish at home have a positive effect on bilingual children's vocabulary size in both languages and nonverbal intelligence scores: bilinguals have no advantage in nonverbal intelligence scores over monolinguals in general. When the bilingual children were divided into two groups in terms of parental language dominance preference and language use at home, the findings clearly support the idea that the sub-group of bilingual children with parents of high Turkish dominance and more Turkish use at home have higher nonverbal intelligence scores than both monolingual groups as well as the sub-group of bilinguals with low Turkish dominant parents and those whose parents use

more English at home. The language dominance of parents and their home language use are significantly correlated with children's vocabulary size in both languages and their nonverbal intelligence scores. Children with high L1 dominant parents and parents who use more Turkish at home have a higher vocabulary size in both languages and higher nonverbal intelligence scores than the children with low Turkish dominant parents and parents who use more English at home. The findings suggest that Cummins' Threshold hypothesis needs to be revised regarding the positive effect of parental L1 use and support on bilinguals' language proficiency (vocabulary size in this case) and cognitive development (nonverbal intelligence in this case), as it posits the idea that high language proficiency of bilinguals in both languages leads to high cognitive development and that bilingual cognitive advantage can only be observed in bilinguals with sufficient language proficiency in both languages. However, the findings of this study clearly demonstrate the positive effects of parental L1 support on bilinguals' cognitive development, but there is no parental notion in this hypothesis.

These findings also support the findings of previous studies (Dickinson and Tabors, 2001; Pan et al., 2005), demonstrating that parental language input and use have a positive effect on bilinguals' vocabulary development in both languages.

Chapter six

CONCLUSION

6.1 Introduction

In this final chapter, the general conclusions of this study will be summarised in the following section, followed by an examination of the study's acknowledged limitations and suggestions for further research in this field. This chapter goes on to describe the study's implications for both parents with bilingual children living in a bilingual setting and policy makers who organise and conduct bilingual educational programmes, and, in the final section, the contributions of this study to the field of bilingualism, bilingual cognitive development and vocabulary will be provided.

6.2 General conclusion

The main aim of this study was to explore the relationship between the vocabulary sizes of bilingual children in relation to their nonverbal intelligence scores, with the effect of parental language dominance and home language use taken into account. With respect to this aim, four hypotheses have been proposed: the first requires exploring the relationship between the vocabulary size scores of bilingual children in terms of both receptive and productive vocabulary; the second is that bilinguals have a lower vocabulary size in each language separately in comparison with their monolingual counterparts but that when total conceptual vocabulary is taken into account, there is no difference between the bilingual and monolingual groups; the third is that there is a positive relationship between the bilinguals' vocabulary size in both languages and their nonverbal intelligence scores; and the fourth proposes that parental language dominance and home language use has a positive effect on bilinguals' vocabulary sizes in both languages and their nonverbal intelligence scores.

The findings indicate a positive relationship between the two vocabulary sizes of Turkish-English bilingual children in terms of both receptive and productive vocabulary (Turkish/English): bilinguals with a higher Turkish receptive vocabulary size also have a higher receptive vocabulary size in English, and bilinguals with a higher Turkish productive vocabulary size also have a higher productive vocabulary size in English. Parallel development of both receptive and productive vocabulary size in both languages was found, supporting Cummins' Interdependence hypothesis and CUP theory (Cummins, 1979, 1984).

The findings also confirm a positive relationship between the receptive and productive vocabulary size of the bilingual children in each language (Turkish & English) separately: bilinguals with a higher Turkish receptive vocabulary size also demonstrate a higher Turkish productive vocabulary size and so with English.

This thesis provides evidence of the positive findings of the bilinguals' total conceptual vocabulary size in comparison with their monolingual counterparts. The findings suggest that bilinguals have a lower vocabulary size (receptive and productive) than monolinguals when each language is taken separately, forming a vocabulary 'gap' between bilinguals and monolinguals tested in this way. However, one of the key findings of this study is that when bilinguals' productive vocabulary size is compared with monolinguals' and the total conceptual vocabulary taken into account, the vocabulary gap is no longer evident, and there is no bilingual disadvantage with regard to vocabulary size. Total conceptual vocabulary is counted only in productive vocabulary size assessment, so this can only apply to productive vocabulary size testing. It is clear that assessment of total conceptual vocabulary affects the vocabulary gap between bilinguals and monolinguals. The results also demonstrate that the total conceptual vocabulary size of bilingual children in Turkish is positively correlated with

their total conceptual vocabulary scores in English, similar to the correlation found between their receptive vocabulary sizes.

The findings reveal a positive relationship between the vocabulary sizes of bilinguals in both languages and their nonverbal intelligence scores, supporting the idea that the receptive and productive vocabulary sizes of bilinguals in both languages are positively related to their nonverbal intelligence scores, giving support to Cummins' Threshold hypothesis (Cummins, 1976). However, correlations between the receptive vocabulary sizes of bilinguals in both languages are higher than those between the productive vocabulary sizes of bilinguals in both languages and nonverbal intelligence scores (see Chapter 5 for discussion).

Finally, the findings of the current study demonstrate that a nonverbal intelligence scores comparison between the bilingual and monolingual groups demonstrate no difference, but when the bilingual group is split into two sub-groups according to their parents' language dominance (high and low Turkish dominant), the results show that bilinguals with more Turkish dominant parents scored higher on nonverbal intelligence scores than both monolingual groups and the sub-group of low Turkish dominant parents. Similarly, when the bilinguals are split into two sub-groups in terms of home language use of parents (high and low Turkish use at home), the results demonstrate that those whose parents have a high use of Turkish at home scored significantly higher in nonverbal intelligence than both monolingual groups and the bilinguals with parents who use little Turkish at home. These findings clearly demonstrate that parents' L1 language dominance and L1 home language use have a positive effect on their children's nonverbal intelligence scores, and there is a bilingual advantage with regard to nonverbal intelligence.

When the vocabulary sizes of the bilingual children in both languages are compared with parental language dominance and home language use, the same results appear. Bilinguals

with more Turkish dominant parents and those with parents who use more Turkish at home achieved higher vocabulary size scores than the bilinguals with low Turkish dominant parents and more English use at home, so the L1 dominance of parents and L1 home language use also have a positive effect on bilingual children's vocabulary sizes in both languages (Turkish and English) in terms of receptive and total conceptual vocabulary. Language dominance of parents and home language use are significantly correlated with children's vocabulary sizes in both languages and nonverbal intelligence scores. The findings clearly suggest that parents with more Turkish dominance and more Turkish use at home have children with higher vocabulary sizes in both languages and nonverbal intelligence.

The overall conclusions drawn from this study demonstrate a strong positive relationship between the vocabulary sizes of Turkish-English bilingual children in both languages in receptive and productive vocabulary (TCV), and may contribute to the understanding of the relationship between bilinguals' vocabulary sizes in both languages and nonverbal intelligence, as well as the positive effect of parental L1 language dominance and L1 home language use on children's vocabulary sizes and nonverbal intelligence.

6.3 Contributions of the study

This study contributes to the area of bilingualism and linguistics research, and is the first of its kind to explore the vocabulary size and nonverbal intelligence of bilingual children with Turkish as a minority language and English as a majority language.

Second, the development of the Turkish version of the receptive vocabulary size test (X-Lex; Meara & Milton, 2003) is an important contribution of this study. The Turkish X-Lex provided a reliable measure for comparison between the vocabulary sizes of bilingual children. To our knowledge, this is the first study to make such a comprehensive comparison in bilingual vocabulary in terms of Turkish-English language pairs and analysing the receptive, productive and conceptual vocabulary size of bilingual children. It is noteworthy

that this test was developed for the aim of this current study and used here for the first time (so it is not a standardized test). This could make vocabulary size comparisons from minority languages that currently lack standardized vocabulary measures possible.

Third, this study contributes to the area of vocabulary studies by assisting understanding the link between L1 and L2 vocabulary size across Turkish and English bilingual vocabulary knowledge in children. To our knowledge, this study is the first to explore the relationship between the Turkish and English vocabulary size of bilingual children living in the UK. By measuring both receptive and productive vocabulary sizes and comparing with monolinguals, the vocabulary development of Turkish-English bilingual children was explored in a detailed and comprehensive way. Additionally, this study is the first of its kind to examine the total conceptual vocabulary sizes of Turkish-English bilingual children in terms of Turkish-English language pairs for conceptual vocabulary assessment, although previous studies have been carried out in languages related to English (e.g. Spanish).

Next, exploring the relationship between the vocabulary sizes of both languages and the nonverbal intelligence of Turkish–English bilingual children constitutes an important contribution to understanding the cognitive advantages of bilingualism in terms of nonverbal intelligence, a topic not directly explored in recent studies. This study demonstrates the strong correlation between the vocabulary size of bilingual children and their nonverbal intelligence scores, which, as discussed, might form an important contribution to understanding the link between vocabulary knowledge and cognitive development in the field of study relating to the cognitive advantages of bilingualism.

This study contributes to the areas of sociolinguistics and psychology in terms of studying both parents and children in immigrant families. The findings clearly show that parental L1 dominance and L1 home language use have a positve role on bilingual children's vocabulary size and cognitive development, so this study contributes to an understanding of

the positive effect of parental L1 language dominance and L1 home language use on bilinguals' language and cognitive profiles in the Turkish-English bilingual setting (a setting not previously explored), although previous studies have explored this in other settings. This study brings parental language dominance and home language use together in the same study to contribute to an understanding of the area of parental L1 support in bilingualism research.

As this study provides findings from school-age bilingual children, the findings can also contribute to bilingual education research, specifically in terms of understanding the linguistic and cognitive development of school-aged bilingual children.

To sum up, the current study contributes to the areas of bilingualism, cognition and linguistics, psycholinguistics, socio-linguistics and education in terms of studying the vocabulary size and nonverbal intelligence of school-aged bilingual children in an immigrant setting. The current study provides findings not previously explored (Turkish-English language pairing) and the participant profile (Turkish-English bilingual children between 7 and 11 years old from middle-class families) has not been studied previously in linguistic and cognitive research.

6.4 Implications for parents

The findings of the current study suggest several implications for parents responsible for bringing up bilingual children. This study and previous studies support the idea that parental language dominance and L1 language input (Turkish in this case) have a positive effect on children's language proficiency (Hoff et al., 2012; Mancilla- Martinez & Lesaux, 2011; Roberts, 2008) and vocabulary knowledge development (Cobo-Lewis et al., 2002a, 2002b), and specifically support the idea that parental language dominance and home language use have a positive effect on children's vocabulary sizes in both languages and their nonverbal intelligence scores. The simplest way for parents to help their children's vocabulary size development and nonverbal intelligence scores, therefore, is to speak their first language. One

of the possible suggestions drawn from the findings of the study is that parents should use their first language as much as possible to ensure sufficient language input and encourage their children to speak their first language. There are plenty of ways parents can do this: reading a book in Turkish, listening to music in Turkish, or watching Turkish TV channels and programs, such cartoons and documentaries. If the child asks about the meaning of a word, it should be answered as fully as possible, and children's questions all considered seriously. If the child makes mistakes in Turkish, parents should correct them by encouraging accurate speech production. In family conversations when the whole family is together, for example, parents should speak their minority languages and hold conversations with their children in Turkish. All of this does not mean banning or refusing to speak English, of course, but simply to support and encourage use of the minority language.

Due to common misconceptions, parents (in the context of this study) often consider English to be their child's most important language as it is the language of their children's education and future. The anxiety they feel over this is understandable, but the current study shows that children with a higher Turkish vocabulary size also show a higher English vocabulary size, and the vocabulary size of children and their nonverbal intelligence scores are closely related. Children with higher Turkish vocabulary knowledge also have higher nonverbal intelligence scores. The findings clearly suggest that if parents support their children's first language, they will support their English vocabulary size by doing so, as well as their cognitive development. Supporting their children's use of Turkish (in this case) is therefore beneficial to their English and their cognitive development.

Besides the findings of the current study, the literature on this topic suggests that speaking (producing sufficient language input) and literacy are vital to develop the vocabulary knowledge of bilingual children, and frequency of reading has been well correlated with vocabulary knowledge (Kalia & Reese, 2009; Scheele, Leseman, & Mayo, 2010). Parents

should therefore tell their children stories, read to them at bedtime and do reading activities with their children in their minority language.

Parents, especially main carer, should strive to develop their own language proficiency in their minority language, as maternal language proficiency has a positive effect on the development of children's language proficiency in both languages (Hammer et al., 2012). Social activities with friends or relatives can also support bilingual children's minority language (Rowe, 2008) so parents should be social with their ethnic society as much as they can so the children can come together to speak their minority language, which in turn supports their vocabulary development. Finally, even though it is more related to a specific SES, parents can travel more often to their native country (Turkey in this case) to involve their children in social activities with their relatives, friends and neighbours.

To sum up, in regard to the findings of the current study, developing L1 vocabulary size is also related with L2 vocabulary size of bilingual children, and vocabulary size development in both languages is related with cognitive development (nonverbal intelligence in this case). Parental L1 support has a critical effect on bilingual children's vocabulary knowledge and cognitive development, so parents should always be aware that they are the main source of a minority language for children. Their behaviour with regard to their first language (Turkish in this case), like speaking more Turkish or using more Turkish at home, is crucial in supporting their children's vocabulary knowledge development in both languages and their cognitive development. Parents' L1 dominance and use at home are beneficial for the development of bilinguals' linguistic and cognitive development, so the current study highly recommends parents use their L1 languages daily to support their bilingual children.

6.5 Implications for policy makers and education specialists

This study has emphasized the linguistic and cognitive advantages of using bilinguals' L1 (Turkish in this case) in terms of vocabulary knowledge and nonverbal intelligence. As the

findings demonstrate that supporting the L1 (Turkish) vocabulary of bilinguals is beneficial for their L2 (English) vocabulary and cognitive development, implications can be drawn for policy makers and education specialists. The findings presented in this thesis lead to the idea that bilingual children cannot be evaluated as monolinguals or as students with special educational needs. As mentioned before, Cummins' Interdependence hypothesis (1979, 1984) is supported by these findings, and in the literature there is a broad area of research on bilingual education programmes (e.g. Baker, 2001; Cummins, 2001) related to the Interdependence hypothesis which supports the importance of bilingual programs in terms of interrelationship and transfer of language and academic achievement across languages. Well-considered design of education or immersion programmes and a suitable curriculum which supports bilinguals' languages can be of great help in providing bilingual children with more learning opportunities and linguistic development. Instead of ignoring their ethnic language, bilingual children should be firmly supported to develop their first language and their cognitive development.

However, bilingual programs are not supported sufficiently (Cummins, 2001), and there is a set of major constraints that need to be overcome in the UK. Schools only provide English support programmes for bilingual children in the early years of schooling, and the main concern is to teach English to develop the bilinguals` majority language. The lack of emphasis on minority languages discourages bilingual immersion programmes (Cummins, 2001). Such immersion programmes should, however, be supported for the benefit of the bilingual children's L1, L2 and cognitive development (Baker, 2001): bilingual children should learn their L1 in a school setting. Even though parental language dominance and L1 home language has a positive effect on children's language and cognitive development, L1 learning and teaching should be considered an important aspect of a systematic school-based education, and policy makers and education specialists should be aware of the positive effects

of L1 on bilinguals' L2 and cognitive development. With this in mind, it would be beneficial to take into account and support both languages of bilinguals in education.

6.6 Suggestions for further research

Future studies are needed to deepen our understanding of the relationship between bilinguals' vocabulary sizes across their languages and their nonverbal intelligence, with the effect of parental L1 language dominance and L1 home language support taken into account. From the findings of this current study, several directions emerge for further study.

First, longitudinal studies should be designed to include a wider age range, which can be more helpful in further identifying patterns in the relationship between L1 and L2 vocabulary size development. These kinds of longitudinal studies provide a more comprehensive picture of bilingual vocabulary size development across languages. Additionally, it would be useful to follow-up on the bilinguals in this study to examine their vocabulary size development across time. This would provide more accurate information on vocabulary size development across two languages among bilinguals, and enhance our knowledge of the factors related to the vocabulary size development of bilingual children.

Second, the findings in this study provide bilingual total conceptual vocabulary comparisons with monolinguals in productive vocabulary size assessment with semantic categories, so further studies may further explore the total conceptual vocabulary of bilinguals in terms of both semantic and phonemic fluency tasks to draw a wider picture of total conceptual vocabulary size measurements.

Third, considering the strong relationship between the vocabulary size of bilinguals and their nonverbal intelligence scores in the findings of this study, future studies are needed to focus on the relationship between the vocabulary size and other aspects of nonverbal intelligence of bilinguals, with more detailed investigation related to bilingual cognitive advantage or disadvantage. According to the findings of this study, the relationship between

the receptive vocabulary size and nonverbal intelligence of bilingual children is stronger than the relationship between the productive vocabulary size and nonverbal intelligence scores. The recommendation for further research might be to analyse the link between receptive vocabulary size and nonverbal intelligence, and to clarify why receptive vocabulary size is more related with nonverbal intelligence than productive vocabulary. This would contribute greatly to the areas of both vocabulary and cognition.

Next, future studies are needed to investigate the effects of parental language dominance and home language use on bilinguals' linguistic and cognitive profile in terms of different aspects, such as short- and long-term memory, verbal intelligence etc. The findings of this study clearly support the idea that parental language dominance and home language have a positive effect on bilinguals' vocabulary knowledge and nonverbal intelligence development, so further studies could analyse parental dominance preferences and their effects on various aspects of bilinguals' language proficiency and cognitive development. Further studies could also investigate other possible cognitive advantages of parental L1 dominance and L1 use at home specifically.

As this study concerned Turkish-English bilinguals, further studies might explore vocabulary size relationships in different language pairs, as well as cases where Turkish is the minority language and a language other than English is the majority language. In terms of linguistics, examination of the relationship between different vocabulary aspects like word type identification, word difficulty, semantics and word associations, etc. across Turkish and English might be a worthwhile aspect for further research.

Finally, regarding the findings of the current study, parental language support might be analysed in future studies in terms of their language input and parental first language support in a longitudinal study to provide more comprehensive long-term findings. Parents from different SES, such as low- or high-class families, and different educational

backgrounds (low or very high education) might be compared in terms of their language input and L1 support specifically to understand the effect of SES and education on parental language support in bilingual settings. Parents might also be analysed in terms of their own language proficiency in both languages, and compared with their children, so the effect of parental language support might be explored regarding language use and support.

To sum up, the findings of the current study suggest further studies in bilingualism, cognition and linguistics. Further studies also may explore the vocabulary size relationship across different languages or age groups of bilingual children or adults, and various bilingual settings in other countries might be explored with respect to the relationship between bilinguals' vocabulary sizes across languages, nonverbal intelligence and parental L1 support, and the relationship between different language domains might be explored for better understanding of the bilingual L1 and L2 relationship in a Turkish-English language setting. Parental language support could be analysed to discern the effect of language proficiency and parental language support on children's language and cognitive development in bilingual settings.

6.7 General limitations of the study

One of the primary limitations of this study pertains to the overall representativeness of the bilingual participants. The participants are Turkish-English bilingual children between 7 and 11 years old, so the findings cannot be generalized to all bilingual children, and can only be considered for bilingual children in the Turkish and English languages. Additionally, these bilingual children received no Turkish lessons or immersion programs, having learned Turkish only from their parents in family settings and using Turkish only with their Turkish friends in social settings. As mentioned in Chapter 3, these bilinguals' education language is English, and they all attend government schools taught in English, which must be borne in mind when evaluating these findings. The bilingual participants are from middle-class

families, so again the results cannot be generalized to families of other SES, and the parents of the children have attained a high level of education (at least one parent of each bilingual child holds a university or higher educational degree), so the results cannot be generalized to bilingual children whose parents have different educational backgrounds. The findings of this study may be due to the specificities of the participants' parents' SES and higher educational background (Cobo-Lewis et al., 2002a, 2002b; Hart & Risley, 1995; Hoff, 2003a).

A further limitation pertains to the sample size: the study includes 100 Turkish-English bilingual children, 25 Turkish and 25 English monolingual children. Although this is a limited scale study, the group comparisons between bilinguals and monolinguals were analysed with the T-test including equal variances not assumed (the assumption of homogeneity of variance is not met) and the (η^2) values were provided with all of the T-test results.

In addition, the Turkish monolingual group lives in Turkey but the bilingual group lives in the UK, so there may be differences in terms of cultural context, education systems or the way Turkish is spoken in Turkey and in the UK. However, this limitation is beyond the responsibility of the current research as it is in the nature of being a monolingual or a bilingual.

Findings from the group comparisons of nonverbal intelligence and vocabulary size scores reveal that the standard deviations of the bilingual group are always higher than those of the monolingual groups, indicating that even if there is no difference between the groups in terms of nonverbal intelligence or conceptual vocabulary testing, some individual bilingual scores are lower than those of the monolingual control groups. Furthermore, the receptive vocabulary size measurements when comparing Turkish and English might need to be considered with caution, as the receptive vocabulary size tests used in this study are not standardized tests (X-Lex English & X-Lex Turkish), particularly that used for the Turkish participants, which was developed for this study and employed here for the first time. Despite

the fact that in the pilot study, the reliability of the test proved high, its validity is not provided, and even if the procedure of the Turkish X-Lex is identical to the English X-Lex, the features of Turkish words are different to English: Turkish words are highly derived and inflected, so one word in the Turkish X-Lex can give more word knowledge coverage than a single word in the English X-Lex. Comparing the vocabulary of two distant languages (Turkish and English in this case) is complex, so the tests cannot be assumed to be equally valid.

The final limitation of this study is to do with the conceptual vocabulary assessment, used for only measuring the productive vocabulary size of the bilingual participants beyond the control of the current study. The total conceptual vocabulary assessment is unavailable for the receptive vocabulary size tests because there is no existing vocabulary test which follows the frequency bands and is associated with the measurement of the same concepts in both languages, as the words in each language are not matched in the same frequency band and included in the same concept in terms of receptive vocabulary. This is why, in this study, total conceptual vocabulary is only measured in the productive vocabulary size tests, for which the items share a similar conceptual match.

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APPENDICES

Appendix A

X-Lex Vocabulary Size Test

Please look at these words. Some of these words are real English words and some are invented but are made to look like real words. Please tick the words that you know or can use. Here is an example.

Dog....✓

Thank you for your help.

that	both	cliff	sandy	lessen	darrock
with	century	stream	military	oak	waygood
before	cup	normal	impress	antique	kennard
person	discuss	everywhere	staircase	chart	gazard
feel	park	deny	daily	limp	fishlock
round	path	shot	essential	permission	cantileen
early	tower	refer	associate	headlong	gillen
table	weather	independent	conduct	violent	pardoe
question	wheel	feeling	relative	fade	frequid
effect	whole	bullet	upward	rake	hobrow
market	perform	juice	publish	trunk	candlin
woman	pity	nod	insult	mercy	litholect
stand	probable	gentle	cardboard	anxious	gumm
believe	signal	slip	humble	pedestrian	alden
fine	dish	diamond	contract	arrow	treadaway
instead	earn	press	mount	feeble	sumption
produce	sweat	provide	tube	sorrow	horozone
group	trick	drum	moreover	brighten	hyslop
arrive	manage	reasonable	crisis	dam	manomize
difficult	mud	boil	jug	outlet	horobin

Appendix B

Turkish X-Lex Vocabulary Size Test

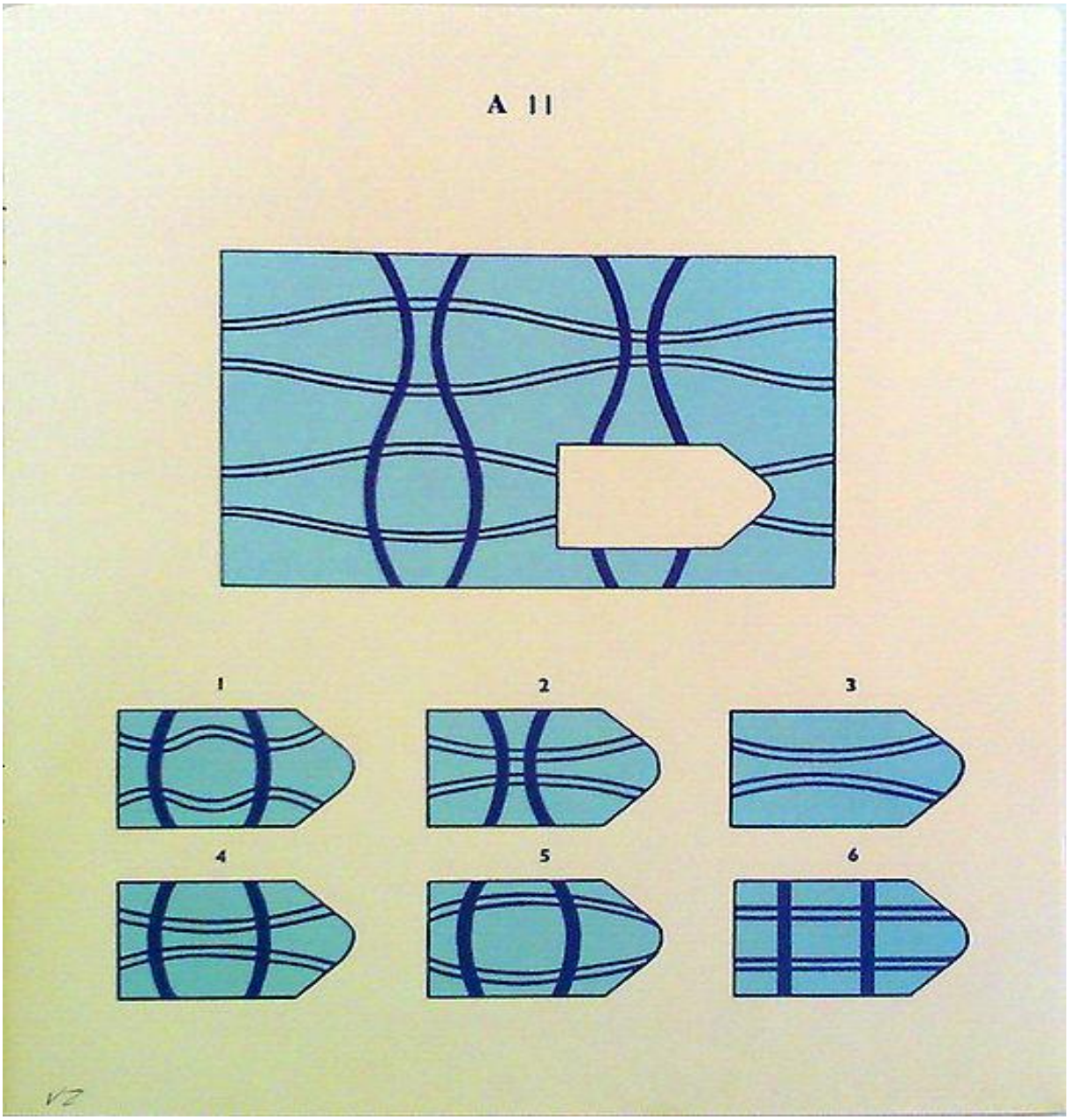
Lütfen aşağıdaki kelimere bakınız. Bazı kelimerler gerçek Türkçe kelimelerdir ve bazıları gerçek olmayan kelimelerdir. Lütfen bildiğiniz yada kullanabildığiniz kelimere tik koyunuz. Örneğe bakın. **sevgi…**✓ Yardımınız için Teşekkürler.

ve	yumurta	dikkatli	mısır	kıvılcım	saneli
çocuk	kemik	utanmak	posta	üçgen	bilik
iç	iş	bal	tatmak	yazlık	selul
yine	kapalı	halı	yanık	unutma	kuveli
işte	dikmek	misafir	heyecanlı	nazar	ültemek
ayak	komşu	elma	kemer	kayak	menilmek
deniz	bayram	uzay	saçlı	bulma	sorkın
dinlemek	patlamak	patates	zayıflamak	kek	foluk
dışarı	gül	üzüntü	bahane	sıcak olmak	fızlamak
yanlış	mevsim	vapur	fena	şahsen	üsli
kelime	gölge	sevilmek	gergin	devretmek	ansen
kesmek	yangın	pilav	haşlanmak	muhalif	tillemek
uyumak	kavga	pembe	uyanık	ayıklamak	fıta
mektup	lezzet	yüzük	boyamak	ilerleme	araka
top	yıkanmak	kirli	katılma	şirin	küne
otobüs	oyuncak	olur	haberci	mağara	serün
yeşil	zararlı	yavaşça	kova	nişan	valı
burun	dilim	çatal	yazdırmak	uçuş	selmek
yıldız	gözlük	şapka	kase	gereklilik	tulalı

çay	düğme	soyunmak	ilkbahar	iletken	bellime

Appendix C

Raven's Coloured Progressive Matrices (example question)



Appendix D

The Twelve Bilingual Dominance Scale questions and the scoring procedure

Questions 1 and 2: At what age did you first learn Turkish _____ English _____?

Scoring: 0–5 yrs=+5, 6–9 yrs=+3, 10–15 yrs=+1, 16 and up=+0

Questions 3 and 4: At what age did you feel comfortable speaking this language? (If you still do not feel comfortable, please write "not yet.") Turkish _____ English _____

Scoring: 0–5 yrs=+5, 6–9 yrs=+3, 10–15 yrs=+1, 16 and up=+0, "not yet"=+0

Question 5: Which language do you predominately use at home? Turkish _____ English _____ Both _____ Scoring: if one language used at home, +5 for that language; if both used at home, +3 for each language

Question 6: When doing math in your head (such as multiplying 243×5), which language do you calculate the numbers in? _____

Scoring: +3 for language used for math; +0 if both

Question 7: If you have a foreign accent, which language(s) is it in? _____

Scoring: if one language is listed, add +5 to the opposite language of the one listed; if both languages are listed, add +3 to both languages; if no language is listed, add nothing

Question 8: If you had to choose which language to use for the rest of your life, which language would it be? _____ Scoring: +2 for language chosen for retention

Questions 9 and 10: How many years of schooling (primary school through university) did you have in: Turkish _____ English _____ Scoring: 1–6 yrs=+1, 7 and more yrs=+2

Question 11: Do you feel that you have lost any fluency in a particular language? _____If yes, which one? _____ At what age? _____ Scoring: −3 in language with fluency loss; −0 if neither has lost fluency

Question 12: What country/region do you currently live in? _____ Scoring: +4 for predominant language of country/ region of residence

Appendix E

Name:

Surname:

Age:

Language Usage Questionnaire

1. Which language do you prefer to speak with your partner?

   Mainly Turkish …….1……..2…….3……4……..5…….Mainly English

2. Which language do you prefer to speak with your child?

   Mainly Turkish …….1……..2…….3……4……..5…….Mainly English

3. Which language is used between your children? (If you have one child, please ignore this question.)

   Mainly Turkish …….1……..2…….3……4……..5…….Mainly English

4. Which language do you mainly use when you read a book to your child? T/E

   Mainly Turkish …….1……..2…….3……4……..5…….Mainly English

5. Which language do your children prefer to use when they meet their Turkish friends?

   Mainly Turkish …….1……..2…….3……4……..5…….Mainly English

6. At which age did your children start to learn English?

7. How long have you been living in the UK?

8. How long have you been married?

9. Have you got any plan to go back to Turkey? If yes, when do you go back to Turkey?

Thank you

Appendix F

Language, Social and Background Questionnaire (LSBQ) (UK is used instead of Canada)

1. Subject ID: _____ 2. Today's date:_____

3. Sex: M F 4. Hand: L R 5. Date of birth:_____

6. On average, how many hours do you spend on working on a computer every day? _____

7a. Do you play video games? Yes No
b. If yes, how many hours do you play in a week? _____

8. Do you speak any languages in addition to English? If yes, please specify the language(s)

_____

9. Do you need to speak/read/write in the non-English language everyday? Yes No

10. Have you ever lived in a place where the non-English language is the dominant communicating language? Yes No

11. If yes, where and for how long? _____

12. Were you born in Canada? Yes No (If yes, skip Q. 13)

13a. If No, where were you born? _____

b. when did you first move to Canada? _____

14. What is the first language that you have acquired? _____

15. What is the second language that you have acquired? _____

16. What is your dominant language for the last 5 years?_____

17a. Do you speak any other language(s)? Yes No

b. If yes, what are the language(s)?_____

18. Where did you learn your second language? Home School Community

19a. At what age did you first start **learning** your second language **informally at home**? _____

19b. At what age did you first start **learning** your second language **formally at school**? _____

19c. At what age did you first start **using** your second language actively?_____ ___

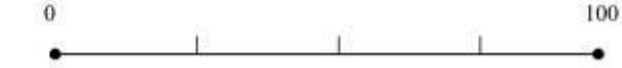
In each of the scales below, indicate the proportion of use for English and your other language in **daily life**. These scales are set up for different activities at home or at school/work. On one end of the scale, you have 100 which indicates that the particular activity in that environment is carried out in ALL ENGLISH. On the other end, you have 0 which indicates that you do not use English at all to carry out the activity.

At Home

20a. Speaking

No English All English

20b. Listening

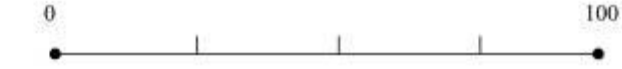


No English All English

20c. Reading

No English All English

20d. Writing

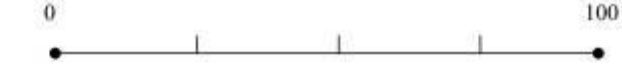


No English All English

20e. Watching TV

N/A No English All English

20f. Listening to radio



N/A No English All English

Relative to a native speaker's performance, rate your proficiency level in a scale of 0 – 100 for the following activities conducted in your first and second language.

Language # 1: _____ (please indicate)

22a. Speaking

22b. Understanding (Comprehension)

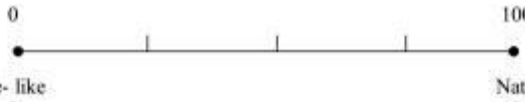
22c. Reading

22d. Writing

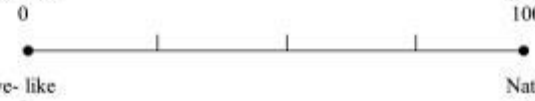
Language # 2: _____ (please indicate)

23a. Speaking

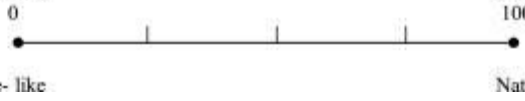
23b. Understanding (Comprehension)



23c. Reading



23d. Writing



Appendix G Consent Forms

PARENTAL CONSENT FORM FOR CHILD PARTICIPATION IN RESEARCH

CONSENT FORM FOR PARTICIPATION IN RESEARCH

(testing, veli Kabul onay formu)

Testing vocabulary knowledge and nonverbal intelligence, kelime bilgisi ve bilissel gelisim testi

The data will be collected by Mrs. Zehra Ongun (Doctoral research student, Arts and humanities, Applied Linguistics, Swansea University, e-mail: 680478@swansea.ac.uk.) and this study is conducted by Dr. Michael Daller, Swansea University, e-mail: m.h.daller@swansea.ac.uk). Data toplama Zehra Ongun tarafindan yapilacaktir, Bu calisma Dr. Michael Daller tarafindan yonetilmektedir.

I consent to my child .....participating, as requested, for the research project on vocabulary size in Turkish and English. Cocugumun bu calismada yer almasini kabul ediyorum.

1. I have read the information provided. Zehra Ongun explained the aims of this study in detail. Bilgileri okudum. Zehra Ongun bu calismanin amaclarini detayli bir sekilde anlatti.
2. I am aware that I should retain a copy of the Information Sheet and Consent Form for future reference. Gelecekte referans olarak kullanilacagindan haberim vardir.
3. I understand that: Anladim ki:
   - My child may not directly benefit from taking part in this research. Cocugum direk olarak bu calismadan fayda gormeyebilir.
   - My child is free to withdraw from the project at any time and is free to decline to answer particular questions. Cocugum istedigi zaman bu arastirma projesinden cekilebilir yada istedigi soruya yanit vermeyebilir.
   - While the information gained in this study will be published as explained, my child will not be identified, and individual information will remain confidential.Cocugun bireysel bilgileri sakli kalacak ve direk paylasilmayacaktir.
   - Whether my child participates or not, or withdraws after participating, will have no effect on any treatment or service that is being provided to him/her. Cocugun geri cekilmesi ona negative bir yaptirim saglamayacaktir.
   - Whether my child participates or not, or withdraws after participating, will have no effect on his/her progress in his/her course of study, or results gained. Cocugun geri cekilmesi onun calismasina bir etki etmeyecektir.
   - My child may ask that the recording/observation be stopped at any time, and he/she may withdraw at any time from the session or the research without disadvantage. Cocugum istedigi zaman ses kaydi yada gozlemden geri cekilebilir.
   - The responses will be recorded by a voice recorder or a relevant device. These records will be only used for counting the number of the words for each concept.

   Cevaplar ses kayidi ve testlerle yazili olarak toplanacaktir. Bu kayitlar sadece kelime sayisi toplamak icin yapilacaktir.

I certify that I have explained the study to the volunteer and consider that she/he understands what is involved and freely consents to participation. Onayliyorumki bu calisma gonullu ve isteyerek katilimci olan kisilerden yurutulecektir.

Researcher's name……Zehra Ongun signature Date……10/03/2014…
Arastirmacinin adi imza tarih

4. I, the parent whose signature appears below, have read a transcript of my child participation and agree to its use by the researcher as explained. Ben veli olarak cocugumun bu calismada yer almasini onayliyorum.

Parent`s signature……Date……...

Veli imza tarih

5. I, the parent whose signature appears below, have read the researchers report and agree to the publication of my child information as reported. Ben veli olarak cocugumun biligilerinin basilamsini onayliyorum.

Parent`s signature……Date……...

AKADEMIK CALISMAYA KATILAN COCUKLARIN VELILERININ KABUL FORMU

(veli Kabul onay formu)

,kelime bilgisi ve bilissel gelisim testi

Calismadaki datalar Mrs. Zehra Ongun (Doctora ogrencisi, Dil bilimi bolumu, Swansea Universitesi, e-mail: 680478@swansea.ac.uk.) tarafindan toplanacaktir. Bu calisma Dr. Michael Daller, Swansea University, e-mail: m.h.daller@swansea.ac.uk) tarafindan yonetilmektedir.

Cocugum.....in bu calismada yer almasini kabul ediyorum.

1. Bilgileri okudum. Zehra Ongun bu calismanin amaclarini detayli bir sekilde anlatti.
2. Gelecekte referans olarak kullanilacagindan haberim vardir.
3. Anladim ki:
    - Zehra Ongun calismanin amaclarini ve neden yapildigini detayli bir sekilde anlatmistir.
    - Cocugum direk olarak bu calismadan fayda gormeyebilir.
    - Cocugum istedigi zaman bu arastirma projesinden cekilebilir yada istedigi soruya yanit vermeyebilir.
    - Cocugun bireysel bilgileri sakli kalacak ve direk paylasilmayacaktir.
    - Cocugun geri cekilmesi ona negative bir yaptirim saglamayacaktir.
    - Cocugun geri cekilmesi onun calismasina bir etki etmeyecektir.
    - Cocugum istedigi zaman ses kaydi yada gozlemden geri cekilebilir.
    - Cevaplar ses kayidi ve testlerle yazili olarak toplanacaktir. Bu kayitlar sadece kelime sayisi toplamak icin yapilacaktir.

Onayliyorumki bu calisma gonullu ve isteyerek katilimci olan kisilerden yurutulecektir.

Arastirmacinin adi ……Zehra Ongun imza
tarih……20/08/2014…

4. Ben veli olarak cocugumun bu calismada yer almasini onayliyorum.

Veli imzasi ……
tarih……

5. Ben veli olarak cocugumun biligilerinin basilamsini onayliyorum.

Veli imza……
tarih……...

PARENTAL CONSENT FORM FOR CHILD PARTICIPATION IN RESEARCH

CONSENT FORM FOR PARTICIPATION IN RESEARCH

(testing)

Vocabulary test in English

This research study is aimed to get knowledge on monolingual students` vocabulary knowledge. The vocabulary test is aimed to test the receptive vocabulary knowledge of the students.

The test has six columns in total, and it will take ten minutes maximum. Each column has 20 words from the frequency band and each word represents 50 word knowledge.

This research study will be conducted by Mrs. Zehra Ongun (Doctoral research student, Arts and humanities, Applied Linguistics, Swansea University, e-mail: 680478@swansea.ac.uk.).

I consent to my child .....participating, as requested, for the research project on productive vocabulary knowledge in English.

1 I have read the information provided.

2 I am aware that I should retain a copy of the Information Sheet and Consent Form for future reference.

3 I understand that:

My child may not directly benefit from taking part in this research.

- My child is free to withdraw from the project at any time and is free to decline to answer particular questions.
- While the information gained in this study will be published as explained, my child will not be identified, and individual information will remain confidential.
- Whether my child participates or not, or withdraws after participating, will have no effect on any treatment or service that is being provided to him/her.
- Whether my child participates or not, or withdraws after participating, will have no effect on his/her progress in his/her course of study, or results gained.
- My child may ask that the recording/observation be stopped at any time, and he/she may withdraw at any time from the session or the research without disadvantage.
- The responses will be recorded by a voice recorder or a relevant device. These records will be only used for counting the number of the words for each concept.

I certify that I have explained the study to the volunteer and consider that she/he understands what is involved and freely consents to participation.

Researcher's name…….Zehra Ongun signature Date……15/06/2014…

4. I, the parent whose signature appears below, have read a transcript of my child participation and agree to its use by the researcher as explained.

Parent`s signature……Date……...

5. I, the parent whose signature appears below, have read the researchers report and agree to the publication of my child information as reported.

Parent`s signature……Date……..…..

PARENTAL CONSENT FORM FOR CHILD PARTICIPATION IN RESEARCH

CONSENT FORM FOR PARTICIPATION IN RESEARCH

(testing)

Productive vocabulary concept test in English

This research study is aimed to get knowledge on monolingual students` productive vocabulary knowledge in concept base. The vocabulary test is aimed to test the conceptual vocabulary knowledge of the students.

There are four main concepts which are COLOURS, BODY PARTS, CLOTHES and FOODS. These concepts will be simply asked, and the students will be expected to produce relevant words for each concept.

This research study will be conducted by Mrs. Zehra Ongun (Doctoral research student, Arts and humanities, Applied Linguistics, Swansea University, e-mail: 680478@swansea.ac.uk.).

I consent to my child .....participating, as requested, for the research project on productive vocabulary knowledge in English.

1. I have read the information provided.
2. I am aware that I should retain a copy of the Information Sheet and Consent Form for future reference.
3. I understand that:
    - My child may not directly benefit from taking part in this research.
    - My child is free to withdraw from the project at any time and is free to decline to answer particular questions.
    - While the information gained in this study will be published as explained, my child will not be identified, and individual information will remain confidential.
    - Whether my child participates or not, or withdraws after participating, will have no effect on any treatment or service that is being provided to him/her.
    - Whether my child participates or not, or withdraws after participating, will have no effect on his/her progress in his/her course of study, or results gained.
    - My child may ask that the recording/observation be stopped at any time, and he/she may withdraw at any time from the session or the research without disadvantage.
    - The responses will be recorded by a voice recorder or a relevant device. These records will be only used for counting the number of the words for each concept.

I certify that I have explained the study to the volunteer and consider that she/he understands what is involved and freely consents to participation.

Researcher's name……Zehra Ongun signature Date……12/02/2015…

4. I, the parent whose signature appears below, have read a transcript of my child participation and agree to its use by the researcher as explained.

Parent`s signature……Date……...

5. I, the parent whose signature appears below, have read the researchers report and agree to the publication of my child information as reported.

Parent`s signature……Date……...

PARENTAL CONSENT FORM FOR CHILD PARTICIPATION IN RESEARCH

CONSENT FORM FOR PARTICIPATION IN RESEARCH

(testing)

Nonverbal intelligence testing

This research study is aimed to get knowledge on monolingual students' nonverbal intelligence. The test is aimed to measure the nonverbal intelligence scores of the students.

This research study will be conducted by Mrs. Zehra Ongun (Doctoral research student, Arts and humanities, Applied Linguistics, Swansea University, e-mail: 680478@swansea.ac.uk.).

I consent to my child .....participating, as requested, for the research project on productive vocabulary knowledge in English.

I. I have read the information provided.

2. I am aware that I should retain a copy of the Information Sheet and Consent Form for future reference.

3. I understand that:

- My child may not directly benefit from taking part in this research.
- My child is free to withdraw from the project at any time and is free to decline to answer particular questions.
- While the information gained in this study will be published as explained, my child will not be identified, and individual information will remain confidential.
- Whether my child participates or not, or withdraws after participating, will have no effect on any treatment or service that is being provided to him/her.
- Whether my child participates or not, or withdraws after participating, will have no effect on his/her progress in his/her course of study, or results gained.
- My child may ask that the recording/observation be stopped at any time, and he/she may withdraw at any time from the session or the research without disadvantage.
- The responses will be recorded by a voice recorder or a relevant device. These records will be only used for counting the number of the words for each concept.

I certify that I have explained the study to the volunteer and consider that she/he understands what is involved and freely consents to participation.

Researcher's name……Zehra Ongun signature Date……22/06/2014…

4. I, the parent whose signature appears below, have read a transcript of my child participation and agree to its use by the researcher as explained.

Parent`s signature……Date……...

5. I, the parent whose signature appears below, have read the researchers report and agree to the publication of my child information as reported.

Parent`s signature……Date……...