LITERACY DEVELOPMENT IN TURKISH-ARABIC SPEAKING BILINGUAL CHILDREN

FERDA İLERTEN

BOĞAZİÇİ UNIVERSITY

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LITERACY DEVELOPMENT IN TURKISH-ARABIC SPEAKING BILINGUAL CHILDREN

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Ferda İlerten

Boğaziçi University

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ABSTRACT

Literacy Development in Turkish-Arabic speaking Bilingual Children

This study explored the role of cognitive and linguistic variables in the development of word reading and reading comprehension in Turkish-Arabic bilingual children. Ninety-two 2nd grade Turkish-Arabic simultaneous bilingual and thirty-five Turkish monolingual children participated in the study. The performance of both groups in phonological awareness (PA), phonological memory (PM), rapid automatized naming (RAN), morphosyntactic awareness (MA), morphological awareness test time (MATT), processing speed (PS) and vocabulary knowledge (VK) was examined and compared through independent samples t-test with bootstrapping function. Bilingual children outperformed monolingual children in PA and PS. The performance of both groups was similar in other tasks. The predictors of reading skills were investigated separately for both groups of participants through stepwise regression analyses. The results revealed that while MATT and RAN predicted word reading efficiency in the bilingual group, MATT and PA were the significant predictors of word reading in the Turkish monolingual group. As for reading comprehension, the groups displayed different patterns. While WRead, VK and PM were the most powerful indicators of comprehension in the Turkish-Arabic bilingual group, MA was the only significant precursor of reading comprehension in the Turkish monolingual children. These differences indicated that the reliance of the monolingual and bilingual children on linguistic and cognitive mechanisms ranged in word reading and reading comprehension.

ÖZET

Türkçe-Arapça Konuşan İkidilli Çocukların Okuma Gelişimi

Bu çalışmada Türkçe-Arapça ikidilli çocukların sözcük okuma ve okuduğunu anlama gelişimindeki bilişsel ve dilsel değişkenlerin rolü araştırılmıştır. Doksan iki Türkçe-Arapça eşzamanlı ikidilli ve otuz beş Türkçe tekdilli ilkokul 2.sınıf öğrencisi katılımcı olarak yer almıştır. Her iki grubun fonolojik farkındalık (FF), fonolojik bellek (FB), hızlı otomatik isimlendirme (HOTİ), morfosentaktik farkındalık (MF), morfolojik farkındalık test süresi (MFTS), işleme hızı (İH) ve sözcük dağarcığı (SD) performansı ölçülmüş ve sonuçlar yeniden önyükleme özellikli bağımsız değişken t-testi yöntemiyle karşılaştırılmıştır. İkidilli katılımcılar FF ve İH testlerinde tekdilli katılımcılara göre istatistiksel olarak anlamlı başarı göstermiştir. Okuma hızı ve okuduğunu anlama becerilerini yordayan değişkenler her iki katılımcı grubu için aşamalı regresyon analiziyle belirlenmiştir. Analiz sonuçlarına göre ikidilli grupta okuma hızını en güçlü oranda MFTS ve HOTI yordamıştır. Tekdilli grupta ise okuma MFTS ve FF anlamlı biçimde açıklamıştır. Katılımcılar okuduğunu anlama becerisinde de farklılık göstermiştir. Türkçe-Arapça ikidilli grupta okuduğunu anlama becerisini en güçlü biçimde okuma akıcılığı, SD ve FB yordarken, Türkçe tekdilli grupta okuduğunu anlama becerisini açıklayan tek anlamlı değişken MF'dir. Bu sonuçlar, kelime okuma ve okuduğunu anlama becerisinde tekdilli ve ikidilli çocukların dilsel ve bilişsel mekanizmalardan farklı oranda yararlandığını göstermiştir.

CURRICULUM VITAE

NAME: Ferda İlerten

DEGREES AWARDED:

PhD in English Language Education, 2021, Boğaziçi University
MA in English Language Education, 2010, Çukurova University
BA in English Language Education, 2006, Çukurova University

AREAS OF INTEREST

Bilingualism, literacy acquisition in L1 and L2, language acquition, cognitive and linguistic processes in language learning, reading development, language attrition

PROFESSIONAL EXPERIENCE

Lecturer, Department of Foreign Languages Education, Faculty of Education, Yıldız Technical University, 2011-present

Visiting Scholar, Graduate School of Education, Harvard University, Spring 2019

Fulbright Foreign Language Teaching Assistant, Center for Languages, Brown University, 2009-2010

Instructor, School of Foreign Languages, Çağ University, 2008-2009

English Language Teacher, 100. Yıl Secondary School, Spring 2007

AWARDS AND HONORS

Best Verbal Presentation Award, 8. International Language, Literature and Stylistics Conference, İzmir University of Economics, May 2008

Çukurova University Honors List, 2006

GRANTS

Inclusiveness Target Country (ITC) Conference Grant, 1st Literacy Summit, Portugal, 2018

Fulbright Foreign Language Assistantship, Brown University, USA, 2009-2010

EU Comenius Teaching Assistant Program, Protugal, 2006-2007

Erasmus Exchange Student Program, Kodolanyi Janos University, Szekesfehervar, Hungary, Fall 2006

PUBLICATIONS

Refereed Journal Articles

İlerten F., & Efeoğlu G. (2021).Utilization Focused Evaluation of an ELT Prep Program: A Longitudinal Approach. *Pegem Journal of Education and Instruction, 11*, 27-31 (ESCI).

Efeoğlu G. , İlerten F., & Başal A. (2018) A Utilization Focused Evaluation of the Preparatory School of an ELT Program. *International Online Journal of Educational Sciences, 4*(1), 149-163.

Conference Proceedings

Argıt C.E., & İlerten F. (2015). Building Teacher Identity And Enhancing Multi Cultural Interaction Through Peer Helping in Turkish as a Foreign Language Classrooms, 1.UluslararasıYabancı Dil Olarak Türkçe Öğretimi Kongresi, Frankfurt,Germany, pp.69-79

Çubukçu, H., İlerten F.& Eşme M (2010) Türkçe nin Sözvarlığı Cinsiyetçi midir?: TDK Türkçe Sözlükte Toplumsal Cinsiyet, *23.Ulusal DilbilimKurultayı Bildiri Kitabı,* Doğu Akdeniz Üniversitesi, KKTC, 75-89.

Çubukçu H., Eşme M. & İlerten F. (2008). Gender in Basic Turkish Dictionary How Sexism operates in the Basic Turkish Dictionary, *Communicatiom Interculturelle et Literature,* Romanya, *2*, 205-216.

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“Please enjoy all the amazing things life has to offer.”

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LIST OF ABBREVIATIONS

MA: Morphological Awareness

MATT: Morphological Awareness Test Time

PA: Phonological Awareness

PM: Phonological Memory

PS: Processing Speed

RAN: Rapid Automatized Naming

RCOMP: Reading Comprehension

VK: Vocabulary Knowledge

WREAD: Word Reading

CHAPTER 1

INTRODUCTION

The current study aims to explore the cognitive and linguistic variables in word reading and reading comprehension among Turkish-Arabic simultaneous bilingual and Turkish monolingual 2nd grade children. In order to provide a rationale for the research, first, the background and the significance of the study will be discussed. Then, operational definitions will be presented in this section.

1.1. Background of the Study

The acquisition of literacy skills is essential for academic and lifelong achievement in literate societies to the extent that high school drop-out rates are related to poor reading proficiency in primary school (Annie E. Casey Foundation [AECF], 2010). Among individuals who have experienced severe reading difficulties, college graduation rate is only four percent (Neuman & Dickinson, 2002). To this end, reading acquisition and development in childhood is not a footnote that could be overlooked when such significant consequences are considered.

Reading acquisition can be defined as constructing “a self-organizing mental network consisting of lexico-semantic, phonological and orthographic components” (Hsu, Ip, Arrendo, Tardif & Kovelman, 2019; p.1). Thus, gaining mastery in written language is a complicated process (Gillon, 2007). Basic social contact is not sufficient for the acquisition of reading. Attainment of literacy skills requires explicit instruction and effort. Moreover, metalinguistic and metacognitive abilities play a substantial role in reading and writing achievement (Koda & Zehler, 2008; Kuo & Anderson, 2006).

Reading development is regarded as “fundamentally metalinguistic” (Nagy & Anderson, 1995, p.2). Metalinguistic awareness here refers to the ability to attend specific language elements which is considered to be a prerequisite for the emergence of literacy skills (Koda and Zehler, 2008). In more specific terms, metalinguistic awareness involves knowledge and reflection upon the structural features of language such as phonology, morphology, semantics, orthography and syntax. Accordingly, literacy acquisition studies commonly investigate awareness in these structural features of languages as influencing factors or correlates of reading achievement. Moreover, general processing speed (Catts, Gillispie, Leonard, Kail, & Miller, 2002; Kail & Hall, 1994; Nicolson & Fawcett, 1994) and vocabulary (Babayiğit & Stainthorp, 2014; Duff, Tomblin, & Catts, 2015; Oulette, 2006; Snow, Burns, & Griffin, 1998) have been acknowledged as influential predictors of reading abilities. In parallel to the previous work in the literature the current study has employed phonological awareness (PA), phonological memory (PM), rapid automatized naming (RAN), morphosyntactic awareness (MA), morphosyntactic awareness test time (MATT), processing speed (PS) and vocabulary knowledge (VK) as independent variables.

PA is the ability to recognize and manipulate sounds in spoken language (Anthony & Francis, 2005; Elbro, 1998; Goswami, 2000). It is a multilevel skill of decomposing words into smaller units such as syllables, onset-rimes and phonemes (Høien, Lundberg, Stanovich, & Bjaalid, 1995; Muter, Hulme, Snowling & Taylor, 1997; Stahl & Murray, 1994; Ziegler & Goswami, 2015). Numerous studies demonstrated that good and poor readers could be differentiated through their PA skills (Adams, 1990; Scarborough, 1998; Wagner & Torgesen, 1987). PM refers to recoding phonological information in order to access lexicon and retrieve stored information (de Jong & van der Leij, 1999; Gathercole, Willis, & Baddeley, 1991; Georgiou, Parrila, & Kirby, 2006). Thus, this ability is of importance to the beginning reader for decoding and comprehension (Wagner, Torgesen & Rashotte, 1994). Forward/backward digit span and word/sentence repetition tasks are used to measure the efficiency of PM. While some researchers argue that it is weakly or indirectly related to reading (Dufva, Niemi, & Voeten, 2001; Geva & Siegel, 2000; Parrila, Kirby, & McQuarrie, 2004), others claim that PM has a direct contribution to word recognition (Alloway, Gathercole, Willis, & Adams, 2004; Kibby, Lee, & Dyer, 2014). RAN has also been acknowledged as a universal correlate and predictor of reading fluency (Georgiou, Parrila, & Papadopoulos, 2008). It represents the automaticity in which the names of a set of familiar visual stimuli can be pronounced (Wolf & Bowers, 1999). RAN is considered as an indicator of reading achievement in consistent and inconsistent alphabetic orthographies as well as non-alphabetic languages (Babayiğit & Stainthorp, 2010; de Jong & van der Leij; 1999; Cutting & Denckla; 2001; Georgiou et al., 2008; Gonzalez-Valenzuela, Díaz-Giráldez, & López-Montiel, 2016; Mann & Wimmer, 2002; Moll, Fussenegger, Willburger, & Landerl, 2009; Wimmer, Mayringer & Landerl, 2000). Another basic skill which has a strong influence on the reading process (Casalis & Louis-Alexandre, 2000) is MA. MA refers to individuals' ability to recognize, reflect and manipulate the smallest meaningful units in words (Carlisle, 1995; Kuo & Anderson, 2006). To put it differently, it consists of the explicit knowledge of roots, inflected/derived forms and word combinations with the objective of understanding the structure and meaning (Kieffer & Lesaux, 2008). It has been documented to be related to word reading

(Carlisle, 1995; Roman, Kirby, Parrila, Wade-Woolley & Deacon, 2009). Numerous studies have also provided evidence for its relation and contribution to reading comprehension (Carlisle, 1995, 2000; Casalis & Louis-Alexandre, 2000; Deacon & Kirby, 2004; Kieffer & Lesaux, 2008; Kuo & Anderson, 2006; Layes, Lalonde, & Rebaï, 2017; Nagy, Berninger, & Abbott, 2006; Singson, Mahony & Mann, 2000; Tong, Deacon, Kirby, Cain, & Parrila, 2011). PS shows the efficiency of cognitive processing during a mental activity. In PS tasks, individuals are required to use limited processing resource due to time limitation or in order to perform rapidly. It is claimed that the speed of information processing increases by age (Hale, Fry & Jessie, 1993; Kail, 1991). According to Kail and Hall (1994), PS is a precursor of naming speed; naming speed is correlated with word recognition and word recognition is linked to reading comprehension. Additionally, VK is recognized as a strong associate of reading accomplishment (Chall, Jacobs, & Baldwin, 1990; Sénéchal, Ouellette, & Rodney, 2006; Snow et. al., 1998). The development and reconsolidation of a phonological system is fostered by the growth of the vocabulary knowledge (Hoff, 2013). Several studies agree that in the course of literacy development, while PA is a pioneering precursor of achievement initially, in the middle elementary years, vocabulary becomes more important (e.g. Roth, Speece, & Cooper, 2002; Senechal et. al., 2006; Storch & Whitehurst, 2002). There is an abundance of investigation about the direct or indirect contribution of VK to reading comprehension (Catts, Adlof, & Weismer, 2006; de Jong & van der Leij, 2002; Ouellette, 2006; Protopapas, Sideridis, Mouzaki, & Simos, 2007; Seigneuric & Ehrlich, 2005; Senechal et al,, 2006; Stanovich, 1986; Torgesen, Wagner, Rashotte, Burgess, & Hecht, 1997).

In addition to the predictors of reading achievement, developmental trajectories of monolingual and bilingual children might display differences (Comeau, Cormier, Grandmaison, & Lacroix, 1999; D'anguilli, Siegel & Serra; 2001; Fleury & Avila, 2015; Özata, 2013). To exemplify, as a domain of cross-linguistic transfer, bilingual children who develop phonological skills in one language can transfer them to their second language (Durgunoğlu, 2002). In this way, bilingualism can affect the rate of reading development. Moreover, it enhances metalinguistic awareness and cognitive development (Adesope, Lavin, Thompson, & Ungerleider, 2010; Bialystok, 2001a). More specifically, bilingual children could selectively attend to the stimulus while inhibiting salient distractors better than their monolingual counterparts (Bialystok, 1986; Bialystok & Martin, 2004). Furthermore, bilingual children could discriminate form and meaning better than monolingual participants and show cognitive flexibility (Barac & Bialystok, 2012; Bialystok, 1999; Bialystok & Majumder, 1998). There is empirical evidence that bilingual children can transfer their metalinguistic skills from one language to the other even if the two languages are typologically distinct (Chow, McBride-Chang & Burgess, 2005; Saeigh-Haddad & Geva, 2008). On the other hand, VK and reading comprehension have been regarded as the most vulnerable skills in bilingual children (Lesaux & Siegel, 2003; Uccelli & Paez, 2007).

1.2. Purpose of the Study

The principal aim of the study is to explore the correlates and predictors (PA, PM, RAN, MA, MATT, PS, VK) of word reading fluency and reading comprehension in Turkish-Arabic simultaneous bilingual and Turkish monolingual 2nd grade children. Further, the study intends to investigate whether there are differences between bilingual and monolingual children in the cognitive and linguistic tasks which may lead to distinct developmental patterns in reading.

In broader terms, the purpose of the current study is to contribute to the reading development research in Turkish, which has received limited attention in the literature. Another general objective of the study is to examine the impact of simultaneous bilingualism on reading acquisition, which is another area of limited research not only in local but also in global terms.

Ninety-two simultaneous bilingual and thirty-five monolingual children participated in the research. The data were collected in a cross-sectional design. The correlates of word reading and reading comprehension were determined through Pearson product-moment correlation analyses. The influence of the independent variables on the dependent variables was analyzed through stepwise regression analyses. Moreover, the differences between the bilingual and monolingual children in the task performance were determined via Independent Samples t-tests with bootstrapping function.

1.3. Significance of the Study

Prior studies on reading development predominantly investigated the acquisition of literacy skills in English. The limitation of “Anglocentric” (Share, 2008) studies is that language-specific features of other languages may not be noticed or processes which are specific to English might be regarded as universal. Even though some languages have common alphabetical systems or similar typologies, variations in the depth of orthography could be observed. For instance, children who were learning to read in English decoded 70% of real words and 45% of pseudowords accurately (Frith, Wimmer & Landerl, 1998). On the other hand, the rate of accuracy in Italian children was 94% for words, 82% for nonwords at the end of grade 1 (Cossu, Gugliotta & Marshall, 1995). In such inquiries, grapheme-phoneme consistency of languages is an essential factor. Since English is an opaque language in terms of spelling and reading, accuracy scores of children are lower than those learning to read transparent languages such as Italian in the earlier stages. Therefore, research in other languages provides a broader understanding about universal and specific features of languages (David, 2013). Thus, the present research intends to expand the existing knowledge on Turkish reading development. Moreover, the study attempts to provide a grounded framework about the precursors (PA, PM, RAN, MA, MATT, PS, VK) of word reading efficiency and reading comprehension in Turkish which is a transparent language in terms of reading and spelling.

Furthermore, it is acknowledged that bilingualism influences cognitive and linguistic processes in several domains (Bialystok, 2001a; Bialystok, Majumder & Martin, 2003). Therefore, the current research will shed light on the understanding of bilingual reading development. Additionally, this study is of importance as it is one of the most comprehensive investigations on the reading development of simultaneous bilingual Turkish children, and the first study in terms of Arabic-Turkish bilingual vs. Turkish monolingual comparisons. The outcome of the study is of concern to parents, reading development researchers, practitioners, reading specialists, school administrators and policy makers.

1.4. Definition of Key Terms

Bilingualism: The systematic use of two different languages on a daily basis.

Decoding: The process of translating print into speech by rapidly matching a letter or combination of letters (graphemes) to their sounds (phonemes) and recognizing the patterns that make syllables and words.

Executive Function: A set of cognitive processes that are necessary for the cognitive control of behavior.

Grapheme: The smallest unit of a writing system

Morpheme: The smallest meaningful unit in a language

Morphological Awareness: Conscious awareness of the morphemic structure of words and (individuals') ability to reflect on and manipulate that structure

Morphological Awareness Test Time: The amount of time participants spent on the morphological awareness test

Phoneme: The smallest unit of sound in a word that makes a difference in its pronunciation, as well as its meaning, from another word.

Phonics: A method of teaching children to read by linking phonemes and the symbols that represents them (graphemes, or letter groups).

Phonological Awareness: The ability of recognizing, discriminating and manipulating the sounds in oral language

Phonological Memory: Coding information phonologically for temporary storage in working memory, verbal short term memory.

Processing Speed: The ability to identify, discriminate, integrate, make a decision about information, and to respond to visual and verbal information

Rapid Automatized Naming (RAN): The ability to access and pronounce visual items such as letters, digits, objects and colours as quickly as possible

Reading Comprehesion: The ability to process a text, understand its meaning, and integrate it with previous knowledge.

Sequential Bilingual: It occurs when a child learns a language other than his or her first language after three years of age.

Simultaneous Bilingual: It occurs when a child is exposed to and learns two languages from birth, usually before the age of three.

Vocabulary Knowledge: Knowledge of the meanings of words and how to use them in appropriate contexts.

Word Reading Accuracy: Reading words without mistakes, word recognition.

Word Reading Fluency: The ability to read words accurately and quickly. It is used interchangeably with word reading efficiency in the present study.

1.5. Summary

Acquiring reading skills is a lifelong activity which has socio-economic and cognitive outcomes. Hence, it is crucial to examine reading processes of children to discover the factors influencing their reading abilities. By means of the studies investigating the correlates and predictors of word reading and reading comprehension, the stakeholders could be informed at an early stage. Then, precautions could be taken in a timely manner before children experience academic and social problems. Furthermore, such studies broaden the perspectives of the researchers, practitioners and parents on the reading development of bilingual children. The pathway bilingual children follow might be different from monolingual children. Such differences do not mean that bilingualism causes disadvantages, rather positive effects of dealing with two language systems might be observed.

This chapter introduced the research topic, background and potential contribution of the study to the literature. Chapter 2 provides a review of literature on the theories of reading development and skilled reading, cognitive outcomes of bilingualism, predictors of reading and the Turkish educational system. Chapter 3 presents the methodology of the study. It involves the research design, research questions, hypotheses, participants, instruments, data collection procedures and data analysis methods. In Chapter 4, results of the study are presented in detail. The analyses include mean comparisons, correlation and regression. Lastly, Chapter 5 consists of the discussion and conclusion. They are followed by the implications of the study, limitations and suggestions for further research.

CHAPTER 2

REVIEW OF LITERATURE

This chapter is organized according to the questions addressed in the present study. The first part of this section includes the theoretical explanations of reading development, word recognition and reading comprehension. In the second part; approaches to cross-linguistic transfer in bilinguals and cognitive/linguistic outcomes of bilingualism are discussed. The second part is followed by a review of precursors of word reading and reading comprehension, namely PA, PM, RAN, MA, PS and VK. Each subsection regarding the precursors of reading includes the definition, use, relationship of the predictor with other constructs and a detailed review of previous research in bilingual readers. In the final part, the characteristics of Turkish language and literacy instruction in Turkey are briefly explained.

2.1. Theories of Reading

Reading can be defined as a complex, cognitive and social process (Bernhardt, 1993) of understanding and matching conventional visual symbols with sound units (Ziegler & Goswami, 2005) without having an innate biological mechanism to do it naturally (Norton & Wolf, 2012). Initially, each grapheme is mapped onto a speech sound which requires time and effort. According to Perfetti (1985), words and morphemes must be automatically connected to the phonological and semantic correspondents for skilled reading.

Accordingly, several theories aimed at explaining the pathways to reach skilled reading. For instance, stage theories of reading development (Ehri, 1995, 2005; Frith, 1985) account for how readers reach to the high level of automatization from a one-by-one decoding stage. Theories of word recognition (Coltheart, 1978; Ehri, 1992a, 1992b; Frost, Katz & Bentin, 1987; Ziegler & Goswami, 2005), on the other hand, consider the sub-skills involved in efficient word reading. Word recognition forms the basis for reading comprehension. Thus, theories of reading comprehension (Gough & Tunmer, 1986; LaBerge & Samuels, 1974; Perfetti & Lesgold, 1977) value word reading accuracy and fluency as significant constructs. In the following part, the theories regarding the development of reading, word recognition and reading comprehension are summarized.

2.2. Theories of Reading Development

In this section, some of the well-established theories on the development of reading will be presented. The models of reading development and structural models of skilled reading are closely associated with each other. Reciprocally, dominant strategies for accurate and fluent reading can be interpreted through these models. Another significance of the theories is that they provide a common terminology to describe the developmental levels of the reader. The main difference between the theories is that while some of the theories (Frith, 1985) proposed stage-based models, others (Ehri, 1995) had a transitional disposition.

Frith developed the *Stage Theory of Reading* (1985). In this model, children pass through three steps and passing each stage successfully is a prerequisite for the accomplishment of the following stage. Frith claimed that although new strategies were employed in each developmental stage, there were complex connections between the earlier and later phases. Respectively, readers progress through logographic, alphabetic and orthographic stages. During the logographic stage, children do not have any phonological awareness or knowledge of the alphabetic principle. They rely on salient visual features and contextual cues such as their names, common signs of shops (M for McDonalds) etc. In the alphabetic stage, children develop phonological awareness and the knowledge of phoneme-grapheme mapping. Readers also begin to develop word attack skills; they start reading unfamiliar words or pseudowords. Finally, at the orthographic stage, readers automatically recognize words and reach their meaning through the accumulated knowledge. This process is much faster than the phonological analysis stage as the repeated exposure lets children store whole-word grapheme sequences in an orthographic lexicon.

In contrast with Frith's stage model of reading, Ehri's *Phase Theory* (1995, 2005) proposed transitional phases rather than sharp boundaries between stages. For fluent reading skills, children go through a pre-alphabetic phase, a partial alphabetic phase, a full alphabetic phase and a consolidated alphabetic phase. In the first phase, pre-alphabetic, children rely on visual cues for word recognition, in the second phase, partial alphabetic, children have some (but not all) knowledge about letter-speech sound connections, they use contextual and phonetic cues to identify words. Then, in the third phase, full alphabetic, children decipher words with their existing phonological knowledge. Lastly, in the consolidated alphabetic phase full connections are formed among morphographic units, phonological units and their semantic counterparts.

Gillon (2007) argued that stage models and transitional views consider PA as the most critical issue in reading development. For instance, in Frith's theory, children cannot move to the orthographic stage if they have phonological processing inabilities. With poor phonological skills children will perform unsuccessfully in decoding and these lead to decreasing amount of reading attempts. In the following section, automatization of word reading and the theories in relation to skilled reading will be discussed.

2.3. Theories of Word Recognition and Skilled Reading

Word recognition theories explain how readers access to the meanings of words. Some of the most influential cognitive theories related to the present study are Coltheart's (1978) *Dual-Route Model of Reading* and Ehri's (1992) *Modified Dual-Route Theory*, Frost, Katz and Bentin's (1987) *Orthographic Depth Hypothesis* and Ziegler and Goswami's (2005) *Psycholinguistic Grain Size Theory*. In this section, the basic tenets of these theories will be mentioned.

According to Coltheart's Dual-Route Model, readers can follow two paths: phonological (non-lexical) and orthographic (lexical, visual) routes to reach the meaning of a word. The phonological route consists of decoding each grapheme-phoneme correspondence and the orthographic route involves the direct retrieval of words from the lexicon by the written, visual form. In consistent phoneme-grapheme correspondences, readers rely on the phonological route but in inconsistent mappings the orthographic route is resorted. The orthographic route is also used for irregular words, while the phonological route is taken for unfamiliar words and pseudo-words for efficient processing. Once the words are frequently encountered and become familiar, they could be processed through the visual route as well. Readers do not need to have PA any longer, as they use the orthographic route. Beginning readers depend on the phonological route, whereas skilled readers have flexibility to opt for the operative route.

Coltheart's view about the use of the visual route without phonological processing was criticized by Ehri (1992). In her Modified Dual-Route Theory, the visual route was changed to visual-phonological route since, as she pointed out, the most irregular words have some parts which follow sound-spelling correspondences and it is not possible to read each and every word from its orthographic shape as it places heavy demands on memory. Sight word reading should be backed up with phonological cues in words. According to the modified dual-route theory, any reading requires phonological skills. Therefore, poor PA skills cause difficulties in word recognition via phonological route and sight word reading. This deficit may become more apparent as texts get more complex and the retrieval of each word visually without phonological aid becomes insuperable.

Based on the word recognition theories, Frost, Katz & Bentin (1987) proposed a skilled reading theory, Orthographic Depth Hypothesis (ODH). ODH postulates that the demands of orthography influence the reliance of readers on phonological (nonlexical) or orthographic (lexical) pathways in reading. In transparent (shallow) orthographies, graphemes and phonemes correspond to each other. Therefore, the use of phonological decoding processes is encouraged. On the other hand, in opaque (deep) orthographies, because of the less systematic mappings between graphemes and phonemes, visual word recognition is supported for more accurate results. There are two versions of ODH. According to the strong version, individuals who read in consistent orthographies, naming involves phonological or prelexical analysis. On the contrary, retrieving pronunciation through direct mapping of visual input is not viable in such orthographies. However, Katz and Frost (1992) argued that the strong form of ODH is not tenable since pronunciation in a shallow orthography such as Serbo-Croatian requires reference to the lexically stored information for words greater than two syllables and the recognition of such words cannot be explained solely by the phonological pathway. Similarly, Katz and

Feldman (1983), Frost, Katz and Bentin (1987) supported the weak version of the ODH. Based on the weak version, prelexical letter-phonology correspondences and stored lexical phonology (memory) are processed both in deep and shallow orthographies. The degree of activation of the pathways depends on the requirements of languages. In other words, readers do not develop different psycholinguistic units in transparent and opaque orthographies, rather, readers adapt their reliance on lexical or nonlexical pathways.

Ziegler and Goswami (2005) put forward the Psycholinguistic Grain Size Theory (PGST) as an alternative interpretation to the reading strategies in transparent and opaque orthographies. Although ODH and PGST have commonalities, PGST suggests that the role of phonological processing is different in the two orthographies, as phonological processing is assumed to have a greater role in opaque languages than the transparent ones. In response to the demands of orthography, readers develop different recoding strategies and this process leads to variations in reading accuracy and fluency. Children who learn reading in shallow orthographies such as Italian, German or Turkish rely on grapheme-phoneme recoding strategies (small grain size), however in deep orthographies such as English grapheme-phoneme correspondences are not consistent, as a result they are obliged to develop strategies for larger units (larger grain size) as well. To put it differently, while developing phoneme-grapheme level strategies is sufficient for consistent orthographies, syllable, onset, rime or morpheme level strategies should be developed for deep orthographies and this process takes longer than developing a single recoding strategy.

Word recognition and skilled reading theories in this section provided an insight about how readers process printed material and the role of orthographies on the accuracy and fluency. The main difference between dual-route theory/modified dual-route theory and orthographic depth hypothesis/psycholinguistic grain-size theory is that in the latter view, there is a special emphasis on the strategies of readers across orthographies rather than the characteristics (regular/irregular, familiar/unfamiliar, word/nonword) of the words in print. In addition to word reading, reading comprehension is another important component of this dissertation. The following section explores some of the established theories on reading comprehension.

2.4. Theories of Reading Comprehension

Theoretical approaches to reading comprehension aim to explain how a coherent mental representation of a text is constructed as well as describing the cognitive/social factors in reaching the meaning of words and texts. A great majority of the theories in the literature associates decoding skills with comprehension. More specifically, lack of accuracy and fluency in reading the words of texts affects integrative processes and leads to poor comprehension (Shankweiler, 1989). In order to gain a more comprehensive picture of the phenomenon, the most widely covered theories in reading literature, *The Simple View of Reading* (Gough & Tunmer, 1986); *The Automaticity Theory* (LaBerge & Samuels, 1974) and *The Verbal Efficiency* (Perfetti & Lesgold, 1977; Perfetti & Roth, 1981) will be explained in this section.

One of the most prominent theories in reading comprehension is The Simple View of Reading (SVR) (Gough & Tunmer, 1986). According to SVR, reading comprehension (RC) is the product of word decoding (D) and linguistic comprehension skills (LC) (*D x LC=RC*). Word decoding involves fast/accurate word recognition and sounding out them; the broad term, linguistic comprehension skills include oral language skills. Based on the foundational framework, the two components have been widely investigated in reading research (Chen & Vellutino, 1997; Florit & Cain, 2011; Gough, Hoover, & Peterson, 1996). The scope of this framework extended to various alphabetic orthographies and reading disability research. Among these studies, Rispens (1990) and Stanovich (1991a, 1991b) claimed that word decoding skills are the main reasons for poor comprehension. Others (Chen & Vellutino, 1997; Gough & Tunmer, 1986; Hoover & Gough, 1990) argued that while decoding plays a dominant role in reading comprehension during the early stages, the amount of variance that linguistic/oral comprehension skills explain gradually increases and becomes the most powerful variable with age in opaque orthographies (English: Chen & Vellutino, 1997). In transparent orthographies (Finnish: Dufva et al., 2001), listening comprehension becomes the most powerful predictor even at the first and the second grade. Due to the dynamic pattern of the framework, SVR could be referred as a developmental account of reading comprehension (Gough et al., 1996).

Despite the attention SVR has drawn in the literature, it has been subject to criticism as well. Kirby and Savage (2008) questioned the framework for its limitation in considering additional cognitive and linguistic factors of reading comprehension. There is evidence that MA (Kirby et al., 2012), working memory (Cain, Oakhill & Bryant, 2004) and PA (indirectly) (Tunmer & Nesdale, 1985) have contributions to reading comprehension. Moreover, understanding a text is regarded as a multifaceted skill as background knowledge, instructional methods, inference making strategies, educational experiences, knowledge of text structure and vocabulary are all influential features. Thus, the multi-dimensional nature of reading comprehension makes the developmental process of theoretical models more complicated and challenging (Perfetti, Landi, & Oakhill, 2005).

Reading fluency has also been an area of scrutiny and theories such as The Automaticity (LaBerge & Samuels, 1974) and The Verbal Efficiency (Perfetti & Lesgold, 1977) focused on automaticity and accuracy in reading for higher levels of comprehension. According to these theories, fluency reduces the cognitive load and free the limited attentional resources for other processes such as inferencing and monitoring.

The theories of reading development, skilled reading and reading comprehension have not specifically focused on how reading processes take place in bilingual populations. The following section discusses the most acknowledged theories on bilingualism and its relationship to reading.

2.5. Approaches to Transfer in Bilinguals

This section summarizes how the ‘transfer’ phenomenon in bilingualism is explained in several hypotheses. Bilinguals have been exposed to two language systems; therefore, reading acquisition in bilingual and monolingual children displays some differences in terms of rate and developmental patterns. Prior investigations established the effects of bilingualism on certain literacy tasks (Bialystok, 1997; Chiappe & Siegel, 1999; Oller & Eilers, 2002; Verhoeven, 1994). Accordingly, reading theories on bilinguals focus on the interaction of languages, cross-linguistic transfer and profile effects (Cummins, 1979; Oller, Pearson & Cobo-Lewis, 2007; Oller & Jarmulowicz, 2007).

Several researchers (Grosjean, 1989; Jared & Kroll, 2001) assert that bilinguals, without lagging behind monolinguals, process two interactive systems where monolinguals use the same substrate for a single language (Genesee, Paradis & Crago, 2004; Paradis & Genesee, 1996). Correspondingly, in some theories the nature of interaction between languages and cross-linguistic transfer were examined:, *The Threshold Hypothesis* (Cummins, 1979, 1981) and *The Interdependence Hypothesis* (Cummins, 1979, 1991).

While The Threshold Hypothesis deals with the cognitive and academic outcome of varying degrees of bilingualism, The Interdependence Hypothesis is concerned with the functional and developmental relationship between L1 and L2.

Cummins based The Threshold Hypothesis on the findings of various studies (Bain, 1975; Ben-Zeev, 1977; Peal & Lambert, 1962; Swain, 1975) all of which support the view that access to multiple languages in early childhood has a facilitating effect on cognitive development. Especially, in additive bilingualism, where L1 of the child is not in the danger of replacement by L2, high levels of competence in both languages can be possible. The situation might be less promising in subtractive bilingualism for the two languages. It is assumed that, to avoid the cognitive deficits and benefit from the advantages of bilingualism a certain threshold level must be attained in both languages. If the threshold level of bilingual competence is low, then the quality of interaction in the educational context may be impaired. On the other hand, through a high threshold level in bilingual competence, children can develop high levels of L2 skills with their greater cognitive capacities. This hypothesis provides a framework to understand that linguistic competence levels of bilingual children influence their cognitive and academic development in varying degrees.

Extending the arguments of The Threshold Hypothesis, The Interdependence Hypothesis aims to account for how L1 and L2 skills are related and how school programs promote additive/subtractive bilingualism. It proposes that the language of instruction (first, second or both) and child's L1 competence prior to schooling are interrelated. High levels of L1 make similar levels of development in L2 possible. Cummins (1981) defines the hypothesis as:

> "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 (p.29)."

To Cummins, although languages have separate specific surface features (e.g. pronunciation, fluency etc.), all languages share a common underlying cognitive/academic proficiency. The underlying proficiency is a conceptual term and it is different from linguistic proficiency. When languages are dissimilar, only conceptual and cognitive elements can be transferred to L2, but if they are similar both surface (linguistic) structures and conceptual structures can be transferred. As literacy-related proficiency is a construct of underlying cognitive proficiency, such skills can also be transferred across languages. About literacy-related knowledge, the transfer of PA to the second languages has been widely investigated (Durgunoğlu & Verhoeven, 1998, Geva & Wang, 2001).

Genesee, Geva, Dressler and Kamil (2006) examined the theories in several aspects. The researchers argued that it was not entirely clear how Cummins define common underlying proficiency in The Interdependence Hypothesis and the proficiency level required for cross-linguistic transfer in The Threshold Hypothesis.

In line with the approaches mentioned in this part, metalinguistic/ metacognitive domains which could be transferred to the other language will be explained in the following section.

2.6. Domains of Transfer in Bilinguals

Cross-language transfer of literacy-related processes has gained much importance in recent years (Cisero & Royer, 1995; Durgunoğlu & IYOP Team, 2012; Jimenez, 2000; Verhoeven, 1994). Durgunoğlu (2002) highlighted that unlike language-specific concepts such as orthographic patterns, language-independent metalinguistic/metacognitive processes could be transferred across languages. In addition, she stressed that transfer to L2 could be expected if certain skills are strong in L1, however, if such skills have not been observed in L2 yet, it may not necessarily mean that the individual has language disabilities. Rather, it may be a sign of lack of proficiency in the L2. In other words, if skills that could be transferred to L2 are existent in the L1, they will be available in L2 with increasing proficiency, so L1 can facilitate the acquisition of L2 literacy skills. She listed these transferable skills as phonological awareness, syntactic awareness, functional awareness, decoding, use of formal definitions, decontextualized language, knowledge of writing conventions, story grammar, meaning making strategies in reading comprehension.

The transfer of phonological skills has been investigated in Durgunoğlu, Nagy and Hancin-Bhatt (1993). L1 Spanish children who were learning English as an L2 participated in their study. The children's phonological awareness and word recognition levels in their L1 predicted their word recognition in English. Similar results were found in other examinations. Comeau and colleagues' (1999) longitudinal study showed that L1 PA was strongly correlated with L1 word decoding and L2 PA skills. Likewise, L2 PA was strongly correlated with L2 word decoding and L1 PA skills in English speaking children who were in French immersion program. Such studies indicate that once concepts of PA are established in a language, these skills can be transferred to the other language. In a similar vein, once children become aware of the concepts about print (Clay, 1979), why it is used and how it conveys the meaning in one language, they do not need to learn such concepts for the second language from the beginning. Durgunoğlu, Mir and Arino-Marti (2002) showed how syntactic skills are correlated in Spanish-English bilingual children. They concluded that children who could correct sentences with morphological and syntactic errors (a common metalinguistic awareness was used for the English and Spanish tasks) in one language performed similarly in the other language.

Decoding skills require awareness about the recurring statistical patterns in the written and oral language. Having an understanding about the patterns in one language facilitates sensitivity in the other language as well. Knowledge of writing conventions, how information is organized in different styles, use of formal definitions can also be transferred cross-linguistically (Durgunoğlu, Peynircioğlu & Mir, 2002). Finally, if individuals use reading strategies such as monitoring, inferencing, background knowledge and comparison of it with new information, they can develop these proficiencies in L2 as their competence in L2 increases. In the following section positive and negative outcomes of bilingualism will be explained.

2.7. Cognitive and Linguistic Outcomes of Bilingualism

Although there was a negative attitude towards bilingualism until the second half of the 20^{th} century various studies showed that bilinguals display better performance both in nonverbal and verbal tests. The bilingual advantage is observed in symbol manipulation, mental reorganization and flexibility. Findings from various disciplines such as education, psychology, neural processes and psycholinguistics have documented several positive outcomes of bilingualism (Bain, 1974; Bialystok, Craik & Luk, 2012; Ricciardelli, 1992). Components of executive functions (inhibition, selective attention, self control, mental flexibility, switching), conflict monitoring, problem solving and knowledge transfer are some of the fundamental areas where the effects of bilingualism are profoundly encountered.

Executive control (function) refers to a set of mental processes which are employed during tasks that require concentration and attention (Diamond, 2013; Miyake et al., 2000). There is a positive correlation between the performance in executive function tasks and classroom success, academic achievement, long term health and wellbeing (Best, Miller, & Naglieri, 2011; Blair, 2002; Duncan, Ziol-Guest, & Kalil, 2010; Yoshida, 2008). Behavioural and cognitive inhibition (such as self-control, selective attention etc.), working memory, cognitive flexibility (mental set shifting) are the three main executive functions. As bilinguals shift between two languages, they constantly inhibit one language when using the other language, so they develop advanced competence in inhibition as they become more proficient in two languages. There are numerous studies validating that bilinguals show advantage over monolinguals that require executive control (Adesope et al., 2010; Bialystok, 1999; Hilchey & Klein, 2011; Zelazo & Frye, 1998). For instance, Bialystok (1999) used Dimension Change Card Sort (DCCS) task in which children were expected to sort cards into boxes according to the given dimension (shape, colour). Preschool children were asked to switch from one dimension (shape) to another (color). It was observed that bilingual children performed better than monolingual children in task switching. The DCCS task measured inhibition (of the prior rule in the task) and flexibility to adapt to new circumstances. In Bialystok and Majumder (1998), eight-year old bilingual children solved nonverbal problems, some of which included perceptual distractions. Bilingual children were better at conflict tasks since they required inhibition but their performance was similar in other tasks.

The transfer of knowledge from one language to the other can also be considered as an advantage. Phonemic awareness, word recognition strategies, use of cognates, conceptual knowledge and intellectual skills are among the positive outcomes of bilingualism. Children need to develop them only once in one language. In maths, for instance, they do not need to learn how to do addition in the second language once they learned how to add numbers in their home language (Yoshida, 2008).

The effects of bilingualism were observed in the studies examining creativity and problem solving, as well (Kessler & Quinn 1980, 1987). The researchers hypothesized that bilinguals would realize different aspects of problems since their experience in two languages and cultures would lead to them to see the problem from different perspectives.

Despite the advantages briefly summarized in this section, bilinguals do not differ from monolinguals in intelligence (Bialystok, 2001a, 2001b). Main differences between the two groups are in the cognitive processes and selective attention. In the case of linguistic tasks, bilingual children are less successful than their monolingual counterparts in vocabulary (Bialystok, Luk, Peets, & Yang, 2010; Oller, Pearson, Cobo-Lewis, 2007). However, in metalinguistic awareness assessments, bilingual children exhibit better performance (Barac & Bialystok, 2012; Bialystok, 1986; Ricciardelli, 1992). Barac and Bialystok (2012)'s comprehensive study investigated the verbal and nonverbal outcomes of bilingualism with respect to language similarity, culture and educational experience. Six year old English monolingual, Chinese-English, French-English and Spanish-English bilingual children participated in the study. Chinese is different from other languages phonologically and the writing system is logographic. French, English and Spanish share cognate words and they use an alphabetic system. The performance of four groups of participants was examined in language tasks such as English vocabulary, grammar, metalinguistic tasks and nonverbal executive control task measuring task switching. The language of instruction was French in the French-English bilingual group, the other groups were instructed in English. All bilingual groups performed better than monolingual children in task switching. This means that language similarity and cultural background did not have a contribution on executive control beyond bilingualism. In contrast, language similarity and language of schooling influenced the scores in verbal tasks. The Spanish bilingual children outperformed French and Chinese bilingual children. The results showed that bilingualism itself influences executive functioning (no effect of language similarity or language of instruction was observed); on the other hand, educational experience, language of schooling, similar phonology and writing systems have an effect on the varying performance on verbal tasks among bilinguals.

Bilingual children are less likely to interlock words with properties of their referents compared to monolinguals. In this manner, they can keep form and meaning separate to selectively attend to form and ignore meaning. In Bialystok (1997), two aspects of symbolic function of written language were assessed through moving word and word size tasks. In the moving word task, children were expected to understand that the meaning is encoded in the text; what is written gives the information needed (not other distracting information). All bilingual children in her study, Chinese-English and French-English, were more advanced than monolingual children in understanding this representational principle. In the word size task where children match pictures and written names of objects in congruent (in the pair *dinosaur* and *nut*, the longer word names the larger object) and incongruent situations (in the pair *train* and *caterpillar,* the longer word names the smaller object), monolingual children and French-English bilingual children performed similarly. Younger (four-year-old) Chinese-English bilingual children performed lower than all of the other children. However, older (five-year-old) Chinese-English bilingual children were better than all groups in the study. The experience of working through representational rules in two different writing systems clarified the rule for older Chinese-English bilingual children. They could differentiate the form and meaning. This study showed that bilingual differences cannot be expressed positively at all times. There might be an initial stage of confusion for young bilinguals during the acquisition of two writing systems. When the confusion is resolved, they can benefit from the richer experience to apply the knowledge to both languages. For Bialystok, Craik and Luk (2012), nature and degree of bilingualism is an important factor in determining performance outcomes in such studies.

As stated in Bialystok (2001a, 2001b), simultaneous bilingualism facilitates the development of PA as children are exposed to two sound systems at the same time. In sequential bilingualism, the stronger or the first language can form the foundation for the development of the sound structure in the weaker or second language. In Bialystok, Majumder and Martin (2003), Spanish-English bilinguals benefited from language similarity and language transparency (transparent orthography of Spanish) in English PA tasks; they performed better than monolinguals and Chinese-English bilinguals. Cross-linguistic transfer of PA skills appears as another positive outcome of bilingualism in this study. Such positive transfers were observed in other languages: English-French bilinguals (Comeau et.

al., 1999), English-Cantonese bilinguals (Luk & Bialystok, 2008), Turkish-English successive bilingual children (Özata, Babür & Haznedar, 2016) and English Spanish bilinguals (Lindsey, Manis & Bailey, 2003).

In sum, cognitive outcomes of bilingualism can be observed in tasks that require executive functioning, selective attention, inhibition, self-control, task switching and monitoring. The situation is different for linguistic tasks. Different groups of bilinguals perform differently depending on the language of testing, writing systems, the depth of orthographies, language of schooling, home-languages, proficiency etc. In the next section, the predictors of reading and related research will be explained.

2.8. Predictors of Reading

In this section, the predictors of the reading skill will be reviewed exhaustively. The studies of reading development focused on the linguistic and cognitive factors which influence word reading, fluent reading and reading comprehension. Among these factors, PA, PM, RAN, MA, PS and VK are some of the main constructs which have been investigated in previous studies on literacy development. The tasks measuring these skills are the independent variables of the present study, as well. Therefore, a review on the predictors of reading is essential to our discussion in order to have a better understanding of the variables responsible for reading success and to apprehend the universal and specific features in reading.

2.8.1. Phonological Awareness (PA)

This subsection includes the definition, developmental stages and tasks employed in the assessment of PA skills. Its association with orthography will be summarized as well. Moreover, it involves the relationship between PA and other predictors of reading and studies with monolingual and bilingual participants.

PA refers to one's ability of recognizing, discriminating and manipulating the sounds in oral language regardless of the word size (Anthony & Francis, 2005). It is considered as a construct of phonological processing abilities which involve the utilization of phonological information during the processing of spoken and written language (Wagner & Torgesen, 1987). Other constructs are coding sound-based information in working memory (phonological memory) and phonological access to lexical storage (retrieving phonological codes from long term memory). PA is also a construct of metalinguistic awareness which involves the ability to think about and reflect upon the structural features of language. Once the reader masters in basic decoding and encoding skills; other aspects of metalinguistic awareness (semantic, syntactic, pragmatic and morphological) become important in relation to reading and writing. Gillon (2007) illustrated PA as the intersection of phonological processing abilities and metalinguistic awareness as follows:

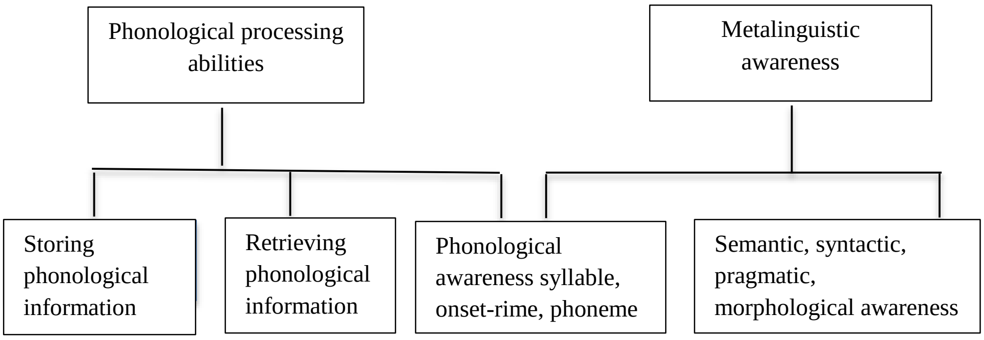

Figure 1. Phonological awareness as a shared subcomponent

Phonological development begins with the perception of speech sounds during infancy at an unconscious level. In childhood, the implicit knowledge children have in phonology allows them to make judgements whether a particular word exists in their native language or not. They can self-correct speech errors and distinguish between acceptable and unacceptable variations of a spoken word (Yavaş, 1998). However, to be able to read, an explicit awareness about the phonological structure is necessary to make connections between the spoken and the written forms.

It has been reported that PA development follows a universal pattern across languages; from word awareness to syllable awareness, syllable awareness to phonemic awareness (Anthony & Francis, 2005; Ziegler & Goswami, 2005). That is, children become sensitive to smaller units as they grow older. They can recognize and cope with syllables before intrasyllabic units (onset-rime) and intrasyllabic units before phonemes. One of the earliest studies that evidenced developmental progression in PA is Liberman and colleagues (1974). In their research, it was hypothesized that the performance of children in segmentation task at the syllable level would have been better compared to the phoneme level. They recruited English speaking children at the nursery, kindergarten and first grade classes and they were divided into two groups. In the first group, children were asked to tap out the number of phonemes while the second group of children tapped out the number of syllables in words. The results showed that at the nursery level, 46% of the children could segment the syllables, none of them could segment the phonemes. Among the first graders, 90% correctly tapped out the syllables, 70% completed the phoneme task successfully. This investigation demonstrated the order of progression robustly and it was corroborated by subsequent research (Caravolas & Bruck, 1993; Tibi, 2010).

According to Gillon (2007), the awareness in phonology could be evaluated at three subword levels; syllable awareness, onset-rime awareness and phonemic awareness. At the phonemic awareness level, several tasks can be employed. These are phoneme detection/categorization/alliteration (e.g. Which word has a different first sound? *bed, bus, chair, ball?*), phoneme matching (e.g. Which word begins with the same sound as *bat*: *horn, bed, cup*), phoneme isolation (e.g. “Tell me the sound you hear at the beginning of the word *food*?), phoneme completion (e.g.Here is a picture of a watch. Finish the word for me: *wa*___?), phoneme blending with words/nonwords (e.g.What words do these sounds make: *m...oo…n*?”), phoneme deletion (e.g.Say *coat*. Now say it again without saying /k/”), phoneme segmentation with words/non-words (e.g.“Say *it*. Now say *it* one sound at a time.”), phoneme reversal (e.g. Say *na* (as in *nap*). Now say *na* backwards”__*an*) and phoneme manipulation (e.g. Say dash. Now say it again, but instead of /æ/ say /ı/”__ *dish*). Adams (1990) claimed that phoneme manipulation and phoneme segmentation tasks are strongly correlared with reading achievement. Likewise, phonemic awareness is regarded as the most correlated construct of phonological processing with literacy and it has been acknowledged as the best single predictor of word reading performance by a wealth of data (Lonigan, Burgess, & Anthony, 2000; Muter, Hulme, Snowling & Stevenson, 2004; Shankweiler, 1989; Wagner et.al., 1994, 1997).

Wagner and colleagues' studies in 1994 and 1997 are among the well-established longitudinal studies in the literature. They followed the phonological awareness and word reading skills of children from kindergarten to the second grade (Wagner et al., 1994). The results showed that PA influenced word reading development from the beginning of literacy instruction until the second grade and letter-name knowledge influenced subsequent PA and serial naming. Moreover, the influences of phonological memory and naming were redundant with that of PA and an effect of word level reading on phonological processing was not found (possibly due to the floor level effects on word-level reading measures). The goal of their follow-up study in 1997 was to investigate whether there were changes in the individual differences in phonological processing abilities and word reading from kindergarten to the 4th grade. Each year, they measured PA both at the analysis and synthesis levels, phonological memory, serial naming, word reading and verbal aptitude of 216 English speaking children. The results showed that PA was strongly correlated with word reading in each level and until the 4th grade. Moreover, serial naming and vocabulary were initially correlated with word reading but the relation diminished across years.

Following Wagner and colleagues' (1997) research, de Jong and van der Leij (1999) conducted a 2 year longitudinal study with 166 Dutch children. They observed children's phonological abilities, nonverbal intelligence, vocabulary and letter knowledge in kindergarten and 1st grade. This study differed from Wagner and colleagues' investigation in several domains: Dutch has a transparent orthography, and the literacy instruction method in the study was based on phonics. The findings showed that the abilities in phonology and reading depend on the time that the assessment took place. After the reading instruction began, PA and verbal working memory contributed to reading within a short time. During the first year, the effects of phonological abilities on reading increased. However, after the 1st grade, such effect disappeared. Rhyme awareness explained 22.4%, 11.6%, and 3.1% additional variance in reading achievement in the fall of Grade 1, at the end of Grade 1 and at the end of Grade 2, respectively. The effects of rapid naming and PA on reading were independent (and specific to reading). The findings supported an interactive view of relationship between PA and reading (they develop simultaneously). The researchers concluded that although the predictive power of phonological abilities diminishes, these skills are crucial for children to acquire especially in the first few months of schooling.

In transparent orthographic systems such as Turkish, German, Dutch and Italian, the straightforward correspondence between phonemes and graphemes facilitates the development of both reading accuracy and PA skills (Durgunoglu & Öney, 1999). The shallow nature of the spelling system promotes reading accuracy to such an extent that the performance of children reaches ceiling levels by the end of a year of instruction and it becomes redundant in predicting future performance (Babayigit & Stainthorp, 2007; Verhagen, Aarnoutse, & Van Leeuwe, 2008; Wimmer & Mayringer, 2002). Thus, reading fluency rather than reading accuracy becomes a more significant criterion of reading skills in transparent orthographies (Wimmer, Landerl, Linortner, & Hummer, 1991). However, in opaque systems such as English, reading accuracy can be used as an index of reading abilities for a longer term (Babayigit & Stainthorp, 2007). In deep orthographic systems, phoneme level awareness is sometimes never fully acquired leading to permanent deficiencies in PA and word decoding accuracy (Bruck, 1992). For this reason, unlike transparent languages, PA development remains as a major limiting factor in accurate reading in opaque languages (Aro & Wimmer, 2003).

The development of reading in different orthographies and the effect of instruction types were demonstrated more sharply in cross-linguistic designs. For instance, Mann and Wimmer (2002) compared kindergarten, 1st and 2nd grade American and German children who were exposed to two different pedagogical approaches. In the US, literacy instruction is an eclectic blend of whole word and phonics-based approaches and children are taught letters and sounds in kindergarten. On the other hand, in Germany, there is no instruction of letters until the 1st grade and the instruction approach is intensive synthetic phonics only. Along with PA tests, digit span and RAN were given to 100 German and 60 American children. In the kindergarten level, American children overachieved in phoneme judgement and deletion tasks as opposed to German children. Nevertheless, at the end of the 1st grade German children exhibited a better letter knowledge, they performed phonemic awareness tests as well as American children and they excelled American children in accurate/fluent decoding of pseudowords by the end of 2nd grade. As reported by the researchers, phonics instruction and the shallow orthography of German were the possible agents of excellent decoding and decreased correlation with PA in German speaking children.

In another cross-linguistic study, Durgunoğlu and Öney (1999) compared 138 monolingual Turkish and English kindergarten-1st grade children in terms of their PA and reading skills. The research had two main foci: the effects of the spoken language on PA development and the influence of orthographic variation on PA and word recognition in both languages. Durgunoğlu and Öney predicted that the simple syllable structure, vowel harmony and complex morphemic structure of Turkish would lead to higher levels of PA in Turkish children. Their decoding proficiency would also develop faster than English speaking children due to the consistent grapheme-phoneme correspondences in Turkish. They also measured children's ability to manipulate rhyming nonwords in order to determine the relationship between the spoken language and PA development (English has more rhyming neighbours compared to Turkish). The participants were given a letter recognition task, letter usage task, decoding task and PA tasks of syllable tapping, phoneme tapping, initial phoneme deletion and final phoneme deletion. The findings demonstrated that as children became literate their PA levels increased. The data supported the predictions of the researchers and reflected a pattern in line with the spoken languages.

The developmental process of PA showed similarities across other transparent orthographies such as Greek, Finnish, German and Turkish. Rothou, Padeliadu and Sideridis (2013) investigated the effect of phonological processing skills on word reading in Greek. 120 1st and 123 2nd grade monolingual Greek children participated in the study. Structural equation modelling analysis showed that PA was the only predictor of reading in the 1st grade. Contrarily, none of the predictors in the research explained word reading among 2nd graders. The researchers discussed that although Greek is a phonologically shallow language, PA played a central role for one year (during the 1st grade). The study supported the view that in transparent languages the predictive power of PA is transient (de Jong & van der Leij, 2002; Landerl & Wimmer, 2000).

The transient effect of PA was observed in Erdoğan (2012), as well. The researcher investigated the relationship between PA and reading skills of 126 Turkish

1st grade students. PA and reading skills were measured at the beginning of the first semester. Then, she evaluated students' reading and reading comprehension skills in the middle and at the end of the fall semester and in the middle of the spring semester. The analysis showed that PA measures predicted reading skills in the middle of the first semester. However, the results were insignificant for the end of the fall and at the beginning of the second semesters. PA abilities were not indicative of reading comprehension in any evaluation period. Upon the results, she discussed that PA was not a sufficient condition for comprehension skills as comprehension required more than vocalization of sounds. Similar evidence was found in her research on the relationship between PA and writing skills (Erdoğan, 2011). PA skills of children at the beginning of the first grade predicted their writing skills in the middle of the first semester, but such relationship was not found at the end of the first semester or at the beginning of the second.

The relationship between PA and reading achievement has not been widely investigated in the Turkish context longitudinally. The only longitudinal research which tested 85 kindergarten and 1st grade children's word/nonword reading and reading comprehension abilities in connection with PA was Güldenoğlu, Kargın and Ergül's investigation in 2016. They measured children's phonological abilities in kindergarten. In the 1st grade, their reading and reading comprehension skills were assessed. The data were analyzed in three dimensions; word reading accuracy, text reading speed/accuracy and reading comprehension skills were compared individually with PA skills. The results showed that children with good and poor skills performed similarly in accuracy measures. However, their fluency and reading comprehension scores differed significantly. The researchers discussed that children who were proficient in PA were more experienced in word recognition and they were able to apply certain skills to recognize faster which let them comprehend reading texts more efficiently.

In a larger scale inquiry, Ziegler and colleagues (2010) investigated the role of PA, memory, vocabulary, rapid naming and nonverbal intelligence in the reading performance of 2nd grade children in five European languages, namely Finnish, Hungarian, Dutch, Portuguese and French. These languages range in their levels of transparency. While English stands at one end of the continuum as the most opaque language, Finnish stands at the other end as the most transparent one. One of the aims of the study was to reevaluate whether the role of PA was overestimated because of the excessive English-based research in the field (Share, 2008). Data were collected from 1265 children and the results showed that PA was the key component in reading acquisition; however the impact of PA was stronger in less transparent alphabetic orthographies. Finnish was the only language that PA was not the most important correlate of reading.

In addition to the influence of orthographic system on PA development, oral language affects the course of progression. Various features of languages such as saliency, vowel-consonant harmony, the position of phonemes within words, complexity of word structures and articulatory factors specify the way in which development will be facilitated (Anthony & Francis, 2005). When languages have simple and salient syllable structures with clear boundaries, then children who speak these languages develop syllable awareness earlier. For instance, in Turkish, syllables could be segmented in certain types: V (o - he/she/it), VC (ev-house), VCC (ört - (to) cover - üst-top), CV (su- water), CV (ya-is that so), CVC (kuş-bird), CVCC (dört-four). Turkish words do not begin with consonant clusters and for the syllabification of multisyllabic words onset first principle is applied (Taylan, 2015).

In addition to Turkish, Greek and Italian children attain syllable awareness quicker than English or French speaking children (Cossu, Shankweiler, Liberman, Katz, & Tola, 1988; Demont & Gombert, 1996; Durgunoğlu & Öney, 1999) because of their simple and consistent syllable pattern.

Another characteristic that has an effect upon the development of PA is vowel harmony. It is a left to right operating process that suffixation, thus pronunciation, depends on the characteristics (front/back, high/low, rounded/unrounded) of the preceding vowel in the word root or the suffix used before it. To illustrate, in Turkish, in order to say "adam (man)" in the plural form, ler/lar are the possible morphophonemic variations. According to the vowel harmony, if the last vowel in the word root is a back vowel, then the plural marker should also include a back vowel. In that case, "adam-lar" (men) is the correct use. In order to add any suffix to "adamlar" vowel harmony should be noticed once again. In such case, "to the men" would be "adamlar-a" as the dative case in Turkish suggests two options (-e/-a). Moreover, inflection of words may cause final phoneme deletion or alteration in word stems. Turkish is an agglutinative language and suffixes mark voice, aspect, modality, mood, person and number in nouns while they mark derivation, negation, tense, person, etc. in verbs. Therefore, such constant monitoring and manipulation of subword units, accelerate the development of phonemic awareness in Turkish (Durgunoğlu & Öney, 1999).

Initial phonemes in English can be easily manipulated by English speaking children as compared to medial and final phonemes (Stage & Wagner 1992; Treiman, Berch & Weatherston, 1993). When Czech and English speaking preliterate children were contrasted in terms of their ability to isolate singleton onsets (onsets with one consonant) and cluster onsets (onsets with more than one consonant), it was noticed that English speaking children were better than Czech speaking children in isolating singleton onsets, whereas Czech speaking children were better at cluster onset isolation (Caravolas & Bruck, 1993). The frequency of consonant cluster onsets in Czech is higher than English. As a consequence, the frequency of exposure to onset types influences the sensitivity to particular sub-syllabic units. The researchers also discovered that once formal literacy instruction began, Czech children improved in PA compared to English children due to the transparent orthography of Czech language.

Having a large number of phonological neighbours is yet another index of salient linguistic feature (Anthony & Francis, 2005). English has more rime neighbours in comparison to body neighbours. To clarify, onset is any consonant that precedes the vowel and rime includes the vowel and the following consonants in syllables (e.g. ‘tr-’ is the onset, ‘-ust’ is the rime in ‘trust’). On the other hand, body includes the initial consonant and the vowel and coda is the consonant(s) that follow the vowel (e.g. ‘tru-’ is the body, ‘-st’ is the coda in ‘trust’) (Murray, Brabham, Villaume, & Veal, 2008). According to Ziegler and Goswami (2005), English, French, Dutch and German children can segment the syllables into onset-rime before body-coda. Conversely, Japanese children attain body-coda awareness (morae corresponding to body) earlier than onset-rime awareness (Inagaki, Hatano, & Otake, 2000).

This section presented the definition and the predictive power of PA in orthographically transparent and deep orthographies. Previous research on the relationship between PA and reading in bilingual populations will be presented in the following section.

2.8.1.1. Previous Research on PA and Reading in Bilingual Children

The studies on the role of PA in reading development of bilingual children focus on the interaction and transfer of skills between languages. In this subsection, investigations on the PA skills of Spanish-English, Italian-English, English-French, Turkish-English and Chinese/Malay/Tamil-English bilingual readers will be mentioned.

Cross-linguistic transfer of PA abilities and the role of oral language skills in second-language word identification were investigated by Durgunoğlu and her colleagues (1993). Participants in the study were 31 1^{st} grade Spanish (dominant language)-English bilingual beginning readers. PA was measured at syllable, onset-rime, phoneme levels in Spanish. As well as PA, listening comprehension, vocabulary and language production in Spanish were assessed to observe their relationship with English word recognition. The results showed that Spanish PA was correlated with Spanish word recognition. There was also a relationship between Spanish word recognition, Spanish PA and English word recognition. Children who had better PA skills in Spanish were also better at reading English words and English-like pseudowords. In short, PA was found to be a significant predictor of word recognition within and across the languages. The development of this skill in one language is likely to facilitate the development of reading skills in the second language. Conversely, the oral language predictors in the research did not have any significant correlations with word recognition or PA measures. The insignificant correlations between oral language and word recognition were also found in Verhoeven (1990). In his research, reading comprehension, rather than word recognition was predicted by oral language in Turkish-Dutch bilingual children.

Another study which examined the hypothesis that exposure to a predictable phonological system would benefit reading skills in an opaque system is D'angiulli, and colleagues (2001). 81, 9-13 year old Italian (home language)-English bilingual children and their monolingual counterparts were tested in Italian and English phonological, reading, spelling, syntactic and working memory tasks. The researchers tested their predictions combining the two theoretical frameworks, namely the script dependent hypothesis (Liberman et al., 1974; Lindgren, DeRenzi, & Richman, 1985) and the interdependence hypothesis (Cummins, 1979). In brief, the script-dependency hypothesis supported the view that orthographic structure and transparency of phonology influence the skills in one language. On the other hand, the interdependence hypothesis postulated that the languages/language problems are strongly intercorrelated. Through combining the two theories, the predictions in the study were as follows: there would be a positive correlation between English and Italian tests, especially in PA as a language-general metalinguistic ability. They also predicted that the cognitive locus of reading performance would be similar in both languages and exposure to Italian would result in positive transfer compared to monolingual English speakers. The results revealed that in all phonological tasks Italian and English were correlated. Such a relationship was minimal in syntactic awareness and absent in working memory. In conclusion, it was observed that the most interdependent domain was phonological processing between languages and there was a positive transfer from Italian to English.

The transfer of PA skills between languages was also observed in immersion classes (Comeau et al., 1999). The researchers investigated the relationship between phonological processing skills (phonological awareness, rapid naming, working memory) and word decoding skills of English speaking children in L2 French. They tested three hypotheses: there would be a symmetrical cross-language transfer of PA, PA would be the most important concurrent and longitudinal predictor of word decoding ability and during the 2nd year of the study, the relation between PA and word decoding would be significant even when taking into account the influence of the relationship between PA and word decoding at Time 1. Canadian children were tested in the 1st, 3rd and 5th grade; they were re-tested one year later in the 2nd, 4th and 6th grade respectively. It was discovered that cross-language transfer occurred for PA and word decoding. PA in English was strongly related to L1 English and L2 French word decoding. Similarly, PA in French was as strongly related to L1 and L2 word reading achievement. These relations remained significant after partialling out the influences of speeded naming and pseudoword repetition. The transfer of PA skills cross-linguistically conformed to Cisero and Royer (1995) and Durgunoğlu and colleagues (1993).

Özata, Babür and Haznedar (2016) investigated the relationship between PA and word reading in 50 Turkish-English successive bilingual and 16 English monolingual children. The grade level of the children ranged from 1 to 5. PA and word recognition data were obtained in both languages. The results showed that PA skills developed from larger to smaller units. Also, there was a strong relationship between PA and word reading efficiency in both languages. Similarly, PA skills predicted word reading in Turkish (it explained 55% of unique variance) and PA skills in English predicted word reading performance in English (it explained 53% of unique variance). Besides, the error analyses showed that the biggest proportion of errors was observed in phoneme deletion. Bilingual children transferred from Turkish phonology to English as they came across with unfamiliar words or pseudowords. When the two languages were compared, it was observed that the children had stronger PA skills in Turkish, however their word reading performance was similar in both languages. They transferred their PA skills in Turkish to word reading in English. The study supported the view that PA is a universal skill and could be transfered across languages.

The significance of PA and its effects on the other language were demonstrated in non-alphabetic languages as well. For instance, Chow and colleagues (2005) provided longitudinal data from Chinese-English bilingual children. In their 9-month study, the relationship between Chinese (L1) phonological processing skills (phonological awareness, rapid automatized naming, and verbal short-term memory) and word reading abilities in both L1 Chinese and L2 English were investigated. 227 kindergarten children were tested twice with a nine month interval. The findings showed that Chinese syllable deletion and speeded number naming significantly predicted concurrent Chinese and English word reading. However, only Chinese syllable deletion uniquely contributed to concurrent and longitudinal Chinese and English word reading. Among three phonological processing tasks RAN only had concurrent contributions to Chinese and English word reading. In agreement with several previous studies in Chinese (Chan & Siegel, 2001; Ho & Bryant, 1997; Hu & Catts, 1998), it was concluded that, PA is not only essential for alphabetic languages but also for Chinese literacy development.

From a different perspective, O'Brian, Mohamed, Yussof and Ng (2018) compared three simultaneous biliterate groups, Chinese-English, Malay-English and Tamil-English in order to observe cross linguistic effects of the ethnic languages on English reading. They aimed to find out how the salient features of languages influence reading in the other language. The study was conducted in Singapore where English is the main medium of instruction and ethnic language instruction also takes place. They specifically focused on PA (in English), oral language experience and vocabulary. Based on The Grain Size Theory (GST) (Ziegler & Goswami, 2005), they measured children's sensitivity in syllable and subsyllable units. 612 kindergarten children in the study received similar literacy instructions in English. However, in Chinese, characters represent syllables and teaching focused on syllables; in Malay, Roman letters are used and the instruction emphasized syllables; in Tamil instruction, on the other hand, phonemes were emphasized. The study had a longitudinal design and children were tested three times: at the beginning of the 1st year, at the end of the 1st year and in the middle of the 2nd year of kindergarten. In line with the method of instruction, the researches predicted that Chinese-English children would have greater syllable awareness than phoneme awareness while Tamil-English children would exhibit the opposite. For Malay- English children either phoneme awareness (due to consistency and accessibility) or syllable awareness (due to accessibility in GST) would be more prominent. The results showed that in all language groups, children had syllable-level awareness; phoneme level awareness appeared in the second year of kindergarten which supported a universal progression pattern in PA. As expected, Tamil-English children performed highest levels of phonemic awareness at the earliest time. Chinese-English and Malay-English children demonstrated a similar pattern over time. Syllable awareness was the most accessible one in both groups. This research proved that the salient features of additional languages have an influence on the phonological development of the other language.

2.8.1.2. Summary

In this section, the definition, development and assessment of PA skills were presented. Various investigations on the predictive power of PA in transparent and opaque languages were addressed. Moreover, the role of PA in reading development of monolingual and bilingual children was discussed.

Overall, it was argued that PA, as an index of reading accuracy, followed a universal development pattern across languages regardless of the consistency of orthography; that is, children become more sensitive to phonologically smaller parts as the grow older (Anthony & Francis, 2005; Ziegler & Goswami, 2005). The pace of development depends on the type of instruction (whole word vs. phonics), orthography (deep vs. transparent) and the salient features of the oral language (vowel harmony, consonant clusters).

A wealth of data showed that PA is the best predictor of word reading (Lonigan et al., 2000; Muter et al., 2004; Shankweiler, 1989; Wagner et.al., 1997). Yet, the orthography has a prominent role in the development and predictive role of PA. For instance, in shallow orthographies, reading accuracy is promoted in such a way that the performance of children reaches to a ceiling level by the end of a year of literacy instruction (Dutch: de Jong & van der Leij, 1999; German: Wimmer et al., 1994; Turkish: Durgunoğlu and Öney, 1999). On the other hand, PA can be used as a precursor of reading achievement for a longer period in deep orthographies (Babayigit & Stainthorp, 2007). PA development stands as a primary factor in reading accuracy.

PA development of bilingual children show dissimilarities with monolingual children but PA skills can be transferred across languages which provides an advantage over monolingual children (Durgunoğlu et al., 1993). Studies which investigate the role of bilingualism in reading achievement provide evidence to script-dependency hypothesis and ınterdependence hypothesis which were mentioned previously in this chapter.

In the following section, PM which is regarded as one of the influential predictors in reading development will be explained.

2.8.2. Phonological Memory (PM)

This section introduces basic concepts related to PM, the development of phonological memory abilities, its relationship with the components of reading and other predictors. The section is followed by a review of previous studies with monolingual and bilingual populations.

In the 1950s and 1960s, a two-way componential memory system, namely long term memory (LTM) and short term memory (STM) was proposed (Atkinson & Shiffrin, 1968; Peterson & Peterson, 1959). LTM involves durable changes in the nervous system, while STM serves as “an antechamber” to LTM and a rapid loss of information can be observed in STM if the information is too complicated or not rehearsed. The differentiation of the two systems was favoured by the studies investigating patients with neuropsychological disorders (Baddeley & Warrington, 1979; Shallice & Warrington, 1970).

When complex tasks such as reasoning, comprehension, attentional control etc. are performed in the temporary system, working memory (WM) serves as a workspace. WM can be conceptualized as an online information processing system which integrates multiple sources with a limited capacity (Baddeley & Logie, 1999; Engle, Tuholski, Laughlin, & Conway, 1999; Just & Carpenter, 1992). Baddeley and Hitch (1974), Baddeley (1986) divided the unitary WM into subcomponents which work together to perform complex tasks. The first subcomponent, "central executive" is an attentional system supervising and coordinating information between STM and LTM with limited capacity. Second component, "visuospatial sketchpad", processes and maintains information based on their spatial characteristics. Third component, "episodic buffer" which was recently added to the model, functions as an integrator of memory representations across different memory domains and systems (Baddeley, 2000a). The final component is the "phonological loop". It involves short-term verbal processing and storage of information.

For novice readers, PM skills are essential for storing individual sounds temporarily before blending the phonemes into words (Baddeley 1982; Wagner & Torgesen 1987). Maintenance of information in the phonological loop depends on several factors such as subvocal rehearsal, word length, sequencing of the input, complexity etc. Children's decoding ability was found to be related to their capacity to hold orally presented codes and repeat them back shortly after their presentation (Adams & Gathercole, 2000; Bowey & Hansen, 1994; Gathercole & Baddeley, 1989; Mann, Liberman & Shankweiler, 1980; Siegel & Ryan, 1989). It was also evidenced that children who were good at repeating non-words and digits in their native language (Bowey, 2001; Gathercole & Baddeley, 1989; Gathercole, Service, Hitch, Adams, & Martin, 1999; Gathercole, Willis, Emslie, & Baddeley, 1992) and in the second language (Dufva & Voeten, 1999; Service, 1992; Service & Kohonen, 1995) had a greater knowledge in vocabulary compared to those with poor nonword repetition skills.

Beginning from the age four, PM abilities develop substantially. Their phonological knowledge, vocabulary and the information that could be retained in STM increase (Alloway, Gathercole & Pickering, 2006; Gathercole, 1998).

Moreover, links between PM and word learning extends to adults (Papagno, Valentine, & Baddeley, 1991) and special populations such as SLI patients (Bishop, North, & Donlan, 1996; Bishop et al., 1999) or children with Down's syndrome (Hulme & Mackenzie, 1992; Jarrold, Baddeley, & Hewes, 2000).

Most examinations on the efficiency of PM simultaneously measure related components such as short-term memory, long term phonological knowledge (phonotactic frequency) and memory for serial order (Nithart et al., 2011). The tasks, nonword repetition, digit span, recall of new word/description, listening span etc. are reinforced by these components and processes at varying levels. For instance, the sensitivity of nonword repetition and digit span tasks in measuring phonological capacity was discussed by researchers (Baddeley & Della Sala, 1996; Gathercole, Willis, Baddeley, & Emslie, 1994; Gathercole, Hitch, & Martin, 1997). It was argued whether nonword repetition was a purer measure of children's phonological memory abilities since no traces of phonological representations could be observed in the mental lexicon and it could only be subserved by the phonological loop. On the other hand, digit span tasks involve familiar 'numbers' which already exist in the long term memory and LTM can back up the immediate memory processes in the phonological loop. Conversely, Snowling, Chiat and Hulme (1991) asserted that in studies which investigate the relationship between vocabulary knowledge and PM, performance in nonword repetition tasks might be influenced by the stimuli with familiar phonological and prosodic features; repetition accuracy might be linked to 'wordlikeness'. From a different standpoint, Babayiğit and Stainthorp (2014) underlined the level of complexity in tasks that could be used in young and older children. They claimed that listening span tasks, where children judge a series of sentences as true/false (e.g. rabbits have wheels; the sky is blue) and recall the final words in sentences, are too complex for children below the age of six. For that reason, for young children simple verbal working memory such as serial recall of digits/words are used to measure a passive storage of information (Gathercole, Pickering, Ambridge & Wearing, 2004).

Phonological memory was largely investigated in reading development, word recognition, reading comprehension and vocabulary development studies (Smith, Mann & Shankweiler, 1986; Wagner & Torgesen, 1987). Baddeley, Papagno & Vallar (1988) were the first to demonstrate a direct link between phonological memory and word learning. They conducted a neuropsychological case study with an Italian speaking patient PV who had a left hemisphere damage and poor memory span for digits and nonwords. Although she did not exhibit a general learning problem by learning phonologically familiar word-word pairs, she was unable to associate word-nonword combinations. Her selective deficit in learning unfamiliar items reflected her inability to hold new phonological materials in memory. A similar case was observed by Baddeley (1993) in a graduate student SR who had phonological loop impairment. SR's inadequacy to repeat digits and nonwords was accompanied by poor word learning, signalling a causal link between phonological memory and vocabulary.

The studies investigating the relationship between PM and reading performance yielded inconsistent findings. While some studies displayed a direct/causal relationship between PM and the components of reading (decoding and fluency), some presented indirect, weak or no relationship. In word decoding, beginning readers need to synthesize the smallest units by keeping information in the WM. Thus, individual differences in the reading rate might be observed based on the memory skills (Perfetti, 1992; Wolf & Katzir-Cohen, 2001). Asadi and Khateb

(2017) found that PM contributed to decoding but not fluency in Arabic. Their conclusion was supported by more data in Arabic (Abu-Rabia, Share, & Mansour, 2003; Al-Mannai & Everatt, 2005) and Hebrew (Shatil & Share, 2003). On the other hand, Dufva and colleagues (2001) evidenced that preschool PM had an indirect effect on 1st grade word recognition through its weak effect on PA. In the 2nd grade, PM had a weak direct effect and they observed a stable development of PM from preschool to the end of 2nd grade. Their results were parallel with Näslund and Schneider (1991), Wagner and colleagues (1994, 1997), Parrila and colleagues (2004), Babayigit and Stainthorp (2014) and Georgiou and colleagues (2008) that PM did not have a predictive role of word recognition at the beginning stages of reading acquisition. Similarly, in Norwegian and Swedish (Høien-Tengesdal & Tønnessen, 2011) verbal short term memory (V-STM) explained 0.7% of the variance among normal decoders which was only marginally significant. It could be assumed that variability in the findings could be observed when tasks which tap onto PA skills and phonological representations are used together with PM measures in the same design (Asadi & Khateb, 2017, Dufva et al. 2001).

A different argumentation in the reading literature is about the interconnection between PM and PA. Since most PA tasks have verbal memory load (Alloway et al., 2004) and verbal memory tasks require phonological coding (Gathercole, Alloway,Willis & Adams, 2006), the association between PM and PA is not unanticipated. Nithart and colleagues (2011) listed three main hypotheses which emphasized commonality (1st), complete distinction (2nd) or partial distinction (3rd) of PM and PA. According to the first hypothesis, PA and PM use a common phonological substrate (Dufva et al., 2001; Griffiths & Snowling, 2002). In the second hypothesis (complete distinction), it was claimed that PA relies on the phonological structure while PM is dependent on the phonological representations (Windfuhr & Snowling, 2001). According to the third hypothesis, PA and PM are both restricted by phonological processing but they differ in their utilization of phonological knowledge and loop (Alloway et al., 2004; de Jong & Van der Leij, 1999; Gathercole et al., 2005; Gathercole et al., 2006). In their attempt to find out the relationship between the two, Nithart and colleagues (2011) observed a qualitative progression across years; reading skills were predicted by PA in kindergarten stage and later on by PM at the end of the 1st grade. Their data were in line with the studies suggesting that they were independent domains of phonological processing though highly related (de Jong & van der Leij, 1999; Gathercole et al., 2005). Similarly, Passenger, Stuart and Terrell (2000) indicated that PM and PA made significant yet distinctive contributions to reading. Early PA predicted subsequent single-word reading, whereas PM played an important role in later decoding strategies. Alternatively, Dufva and colleagues (2001), asserted that there is ‘no room left’ for PM as an indicator of word recognition and reading comprehension once PA and listening comprehension are included in the research design.

In order to evaluate young children’s reading comprehension, oral language processing and PM tasks are used as a starting point since they have limited metacognitive abilities, background knowledge and experience (Babayigit & Stainthorp, 2014). However, the predictive role of PM on reading comprehension (Rcomp) is controversial. The results of the studies vary depending on the target groups, texts and tasks employed. While some studies found an increasing relationship between PM and Rcomp within years (Seigneuric & Ehrlich, 2005), in some studies an indirect relationship was found (Babayigit & Stainthorp, 2014; Dufva et al., 2001; Näslund & Schneider, 1991). According to Seigneuric and

Ehrlich (2005), 1st grade working memory was not associated with 2nd grade reading comprehension. However, 2nd grade WM accounted for 4% of variance in Rcomp. It was discussed that because of the complexity of PM tasks the performance of younger children reduced. In addition, Torppa and colleagues (2007) affirmed that 8 year-old children who were having Rcomp difficulties had low verbal short term memories at the of 5-6. Contrarily, Dufva and colleagues' (2001) longitudinal study with Finnish preschooler-2nd grade children showed that PM did not directly predict Rcomp. A (stable) strong indirect effect via listening comprehension was observed. Such indirect effects were detected in Turkish (Babayigit & Stainthorp, 2014) and in German (Näslund & Schneider, 1991), all of which have transparent orthographies. It could be inferred from the findings that in transparent orthographies word decoding skills reach to a ceiling level in a short time and listening comprehension becomes a better predictor of Rcomp.

In this section, the role of PM in reading and its relationship with other constructs were emphasized. Moreover, its association with word learning, word reading and reading comprehension were mentioned. The following subsection includes a review of literature in bilingual readers.

2.8.2.1. Previous Research on PM and Reading in Bilingual Children

This subsection involves studies which focused on the relationship between PM and word learning in foreign language (FL) (Dufva & Voeten, 1999; Hu, 2003; Service 1992). These studies were conducted based on the idea that having accurate phonological representations in the new language is essential for vocabulary learning and without it neither comprehension nor production in FL could be possible (Service, 1992). Furthermore, other studies mentioned here concentrated on the role of bilingualism on PM skills (Pierce, Genesee, Delcenserie, & Morgan, 2017; Delcenseri & Genesee, 2016, Blom, Küntay, Messer, Verhagen & Leseman, 2014).

In Service (1992), English word learning process of Finnish children was followed for three years. It was maintained by the researcher that all new words are initially unfamiliar non-words, the difficulties in creating sufficient and durable traces in the phonological store might impede long term learning. With the aim of finding out the relationship between the ability to form phonological representations in WM and FL learning in a classroom setting, she evaluated their pseudoword repetition and pseudoword copying abilities as well as metalinguistic skills. The data revealed that repetition, copying accuracy and syntactic-semantic comparison abilities predicted English learning. These skills were only related to language learning, but not mathematics grades. The structural comparison task was equally related to mathematics and foreign language. It was concluded that representing unfamiliar sounding materials in WM formed the basis of learning new vocabulary in the FL.

Hu (2003) administered a similar study with 58 Chinese speaking children across two years in Taiwan. The researcher asserted that initial lexical items in the FL are more important in the phonological terms than the semantic aspect. Regarding the basic vocabulary such as objects (e.g. fruit names, basic animal names) and body parts (e.g. face, eyes, nose), this view seemed plausible. The new sound patterns are mapped onto old concepts. For this reason, the role of PM and PA on word learning in English as a FL was examined in the beginner level learners. The data were collected in 4 time periods and foreign language word learning was assessed in the T3 (time 3) of data collection. Their ability to relearn the words was assessed in the final period T4. It was observed that PM, but not PA, was related to FL word learning at T3. On the other hand, PA became the most significant predictor of relearning the words at T4. The finding suggested that PM supported the learning of unfamiliar words. This finding corroborated with Baddeley, Gathercole and Papagno (1998). However, PA played a more essential role, once previously learned words are practised again. Also, PM supported vocabulary acquisition rather than vice versa. It was derived from the findings that phonological processing skills in the native language play significant roles in the recall and pronunciation-learning ability in the FL.

Alternatively, Dufva and Voeten (1999) stated that previous studies which analyzed the relationship between phonological memory and FL learning might have drawbacks since they did not control the effects of native language literacy skills on foreign language learning. Both PM and native language literacy skills have the potential to tap into phonological processing skills. For this reason, they examined the role of native language (NL) literacy skills and PM on the learning of English language skills such as listening comprehension, communication abilities etc. They followed 160 Finnish from 1st grade to the 3rd grade. Their NL word recognition, listening comprehension skills were measured in the 1st grade. In the 2nd grade, word recognition, reading comprehension and PM were assessed. English instruction began in the 3rd grade. Therefore, FL skills such as communicative skills, vocabulary and listening comprehension were examined in the final assessment. The results showed that PM and NL literacy skills explained 58% of the variance in English skills. Moreover, word recognition level in Finnish in the 2nd grade strongly predicted English skills at the end of the third grade. Unlike other studies which did not include the role of NL skills (Service, 1992; Service & Kohonen, 1995) PM alone was not the strongest predictor. NL comprehension skills influenced FL listening and reading comprehension positively, though it was not a strong predictor as word recognition. In conclusion, the researchers suggested that promoting literacy skills in the mother tongue and FL phonology training could be useful ways to promote foreign language learning.

PM development may display a different course in simultaneous bilingualism. Simultaneous bilingualism is regarded as one of the cases of enriched language because children are exposed to two phonological systems from very early on. Although they have reduced exposure to each language compared to monolinguals, they experience an advantage in executive functions and verbal working memory (Blom et al, 2014; Delcenserie & Genesee, 2016; Parra, Hoff & Core, 2011). Parra and colleagues (2011) investigated Spanish-English simultaneous bilingual children who were 22-month old. Their data showed that the amount of English spoken at home was positively associated with their English-like nonword repetition accuracy but not Spanish-like stimuli. More comprehensively, Delcenserie and Genesee (2016) compared Spanish-English simultaneous and sequential bilingual children on their PM and nonverbal memory abilities. They further divided sequential bilingual children as early and late (after six years old) acquirers. The results showed that all bilingual children performed better than monolingual children in both of the memory tasks. Strikingly, simultaneous bilingual children were more successful than both sequential bilingual groups. In sequential bilingual children, Blom and colleagues (2014) observed a bilingual advantage in visuospatial and PM tasks. They monitored five-six year old Turkish-Dutch emerging bilingual children whose home language is Turkish. These children had lower Dutch receptive language scores and SES backgrounds. However, they outperformed monolingual children on visuospatial working memory task and backward digit span task which is a measure of executive control. The results contributed to the research showing that bilingual cognitive advantage could be observed in low SES background (Calvo & Bialystok, 2014) and in emerging bilinguals.

2.8.2.2. Summary

In this section, the definition, development and assessment of PM were presented. Its relationship with PA, word learning and Rcomp were emphasized. In addition, studies on the effect of PM on reading development of bilingual children were discussed.

According to the previous investigations, PM skills are important for storing sounds in a short period before blending the sounds into words (Baddeley 1982; Wagner & Torgesen 1987). Children who performed well in repeating nonwords and digits were better at vocabulary learning compared to children with poorer skills (Bowey, 2001). However, studies had inconsistent findings with regard to the role of PM in the development of literacy skills. Whereas some studies demonstrated a direct/causal relationship between phonological memory and the components of reading (decoding and fluency), some presented indirect, weak or no relationship.

Furthermore, the substrate that PA and PM use were discussed in the literature. While some researchers claimed that they use a common phonological substrate (Dufva et al., 2001; Griffiths & Snowling, 2002), some argued that PA and PM were completely distinct from each other (Windfuhr & Snowling, 2001). Others asserted that PA and PM were both restricted by phonological processing, but they were different in their use of phonological information (Alloway et al., 2004). Noteworthy, it was mentioned that when PA and listening comprehension are used in the same research design with PM, it is not possible for PM to explain more variance in word reading or reading comprehension (Dufva et al., 2001).

The studies on the relationship between PM and word learning focused on the direction of relationship. According to Gathercole and colleagues (1992), the accounts of relationships are; PM influences vocabulary directly; PM is dependent on vocabulary knowledge; there is a reciprocal, simultaneous relationship between the two; and lastly, there is a reciprocal, dynamic relationship between PM and vocabulary. In the dynamic relationship the role of PM diminishes across years while the prominence of vocabulary knowledge increases. Longitudinal studies (Gathercole & Baddeley, 1989; Gathercole et al., 1992) provided evidence to the dynamic nature of the two constructs.

With regard to the relationship between PM and Rcomp, some studies found an increasing association between PM and Rcomp across years (Seigneuric & Ehrlich, 2005). Alternatively, some studies showed an indirect relationship between them (Dufva et al., 2001; Babayigit & Stainthorp, 2014; Näslund & Schneider, 1991). For instance, in Turkish Babayigit and Stainthorp (2014), in German Näslund and Schneider (1991) established that PM indirectly influenced Rcomp via listening comprehension.

Simultaneous bilingual children perform better than monolingual children in PM as they experience an advantage of executive functions and verbal working memory (Blom et al., 2014; Delcenserie and Genesee, 2016; Parra et al., 2011). Bilingual cognitive advantages could also be observed in low SES background (Calvo & Bialystok, 2014) and in emerging bilinguals.

The following section involves a comprehensive description of RAN and its association with reading.

2.8.3. Rapid Automatized Naming (RAN)

This section aims to introduce RAN and its relationship to reading. First, the definition of RAN is given, which is followed by the assessment of rapid naming ability, its predictive nature and association with other precursors of reading.

RAN refers to the ability to access and pronounce visual items such as letters, digits, objects and colours as quickly as possible (Bowers, 1993; Tibi & Kirby, 2018; Wolf & Denckla, 2003). Naming tests were developed as a result of Geschwind's (1965) interest in explaining colour naming difficulties of patients. He devised a timed measure of 50 coloured squares in five rows in order to investigate the possibility of the loss of visual-auditory connections. In 1976, Rudel and Denckla revised the speeded naming task and developed three more variations: letter, object and number naming. These tasks measure the automaticity of the linguistic processes in the naming circuit. For instance, in letter naming tasks, the efficiency of converting orthographic information into phonological knowledge is assessed. Wolf and Bowers (1999) termed rapid naming as a "microcosm" of reading since in both reading and RAN tasks the reader needs to attend the stimuli, process the information visually, integrate visual information with the orthographic and phonological representation, access and retrieve the lexical information and organize the articulatory output.

Some researchers recognize RAN as one of the strongest predictors of reading across languages and orthographies (Araujo, Reis, Petersson & Faisca, 2015; Georgiou, Parrila & Papadopoulos, 2008; Norton & Wolf, 2012; Tan, Spinks, Eden, Perfetti & Siok, 2005). According to a meta-analysis of 137 studies, RAN performance and reading ability showed a significant correlation (r _ .43) (Araujo et al., 2015). The magnitude of the correlation with RAN was the highest in real word reading and reading comprehension. Moreover, Arnell, Joanisse, Klein, Busseri and Tannock (2009) evidenced that RAN explained 10% and 17% of the variance in reading comprehension and reading fluency respectively. Likewise, in Schatschneider, Fletcher, Francis, Carlson and Foorman's (2004) longitudinal study, the correlation between kindergarten RAN and PA scores were similar in untimed passage comprehension in the 2^{nd} grade. However, the association between RAN and timed word/nonword reading in 2^{nd} grade was stronger than PA.

Previous research showed that naming speed contributes to reading in word/text reading fluency rather than accuracy which is generally measured by PA tasks (Bowers & Wolf, 1993; Compton, Defries, & Olson, 2001; Georgiou, Parrila, & Papadopoulos, 2008; Georgiou, Parrila & Kirby, 2009; Young & Bowers, 1995; Wolf & Bowers, 1999). Data from Turkish speaking children confirmed that RAN strongly predicted reading fluency, whereas PA was the best predictor in spelling (Babayiğit & Stainthorp, 2010; Candan, Babür, Haznedar & Erçetin, 2020).

The developmental relationship between RAN and reading was investigated by Torgesen and colleagues (1997). It was determined that the association between RAN and accuracy decreases while its relationship with reading fluency does not. Alternatively, Kirby, Parrila and Pfeiffer (2003) found an increasing relationship between RAN and accuracy over time. Araujo and colleagues (2015) stated that grade level of the participants is highly influential in identifying RAN and reading accuracy interdependence. Although studies in English speaking populations focused on accuracy and PA, fluency measures are of importance in transparent orthographies. Araujo and colleagues (2015) showed that RAN and fluency relationship is *($r=.49$)*, while RAN and accuracy relationship is *($r=.42$)*. Wolf and Bowers (1999) further argued that since they contribute to different types of reading outcomes, the use of RAN is accentuated in consistent orthographic systems when PA is accentuated in inconsistent systems. On the whole, Norton and Wolf (2012) established that as word decoding reaches to a ceiling level RAN becomes a more important predictor than PA. The timing of the shift to fluency measures is dependent on the orthographic depth of languages; in transparent languages the shift occur earlier (Vaessen et al., 2010).

Recent research has documented that naming speed and reading are related both in transparent (e.g. Turkish, Finnish) and opaque (e.g. English, French) orthographies (Seymour et al., 2003; Ziegler & Goswami, 2005). Yet, some studies showed that shallow orthographies have stronger associations with RAN (Aro & Wimmer, 2003; de Jong & van der Leij, 1999; Gonzalez-Valenzula et al., 2016; Mann & Wimmer, 2002; Wimmer et al., 2000). For instance in González-Valenzuela and colleagues (2016), the contribution of phonemic awareness, phonological memory and alphanumeric/non-alphanumeric rapid naming on word/nonword reading accuracy, efficiency and speed was examined. The results showed that object naming had no explanatory role in word or pseudoword reading. Instead, alphanumeric rapid naming strongly explained word reading speed, efficiency and pseudoword reading accuracy, speed and efficiency. Their study suggested that reading is dependent upon multiple cognitive variables. That is children who are good at naming letters and digits will perform faster in reading tasks.

Likewise, Babayiğit and Stainthorp (2010) purported that RAN was the strongest predictor of reading speed among Turkish speaking children. In Özata (2018), RAN and orthographic knowledge were the strongest predictors of Turkish reading fluency both in the 2nd and 4th grades. Ziegler and colleagues (2010) reported that in five orthographies (Dutch, Finnish, French, German and Hungarian) phonological awareness was not as strong and consistent as naming speed in transparent systems.

Caravolas and colleagues (2012) investigated English which is an opaque language and Spanish, Czech and Slovak which are relatively consistent languages. Their longitudinal research revealed that apart from phonemic awareness and letter sound knowledge RAN was also one of the strongest predictors of reading development. The cross-linguistic investigation of Moll and colleagues (2014) indicated that phonological processing skill and naming speed both accounted for significant variance in all languages, naming speed was the best predictor of reading speed while phonological processing explained reading accuracy and spelling best and the predictive pattern was strongest in English compared to other languages. On the contrary, Landerl and colleagues (2013) demonstrated a stronger relationship in opaque languages.

In addition to the orthographic transparency, task types- alphanumeric (letters and digits) and non alphanumeric (colors and objects) rapid naming- also impacted on the results. According to Norton and Wolf (2012), preschoolers or five to six year old children can name non alphanumeric stimuli more quickly. However, through practice and exposure to letters and numbers, alphanumeric tasks become more automatic and correlated to reading (Lervåg & Hulme, 2009; Wolf et al, 1986). Additionally, it was discussed that since non-alphanumeric tasks do not involve orthography, they may not have a direct causal relationship with orthographic knowledge (Cutting & Denckla, 2001). Wolf (1984) investigated the relationship between naming measures and reading. The participants were followed from kindergarten to second grade. The tasks involved variety of naming tasks: colors, digits, letters, objects, alternating digits and letters (e.g. 2 a 6 s) and alternating digits, letters and colors. The results showed that letters were more related than colours. Moreover, grade levels of the participants and reading abilities were also effective.

The structure of naming tests influences the scores in rapid serial naming (RSN) as well. That is, naming items discretely or serially affects the cognitive demand of the task. Serial naming increases cognitive load and its continuous nature makes it a better predictor of reading (Bowers & Swanson, 1991; Norton & Wolf, 2012). It was also found that discrete naming and serial naming are only moderately correlated *($r=0.5$)* (Logan, Schatschneider & Wagner, 2011). Stanovich (1985) reported that discrete naming tasks disclose smaller differences between groups in comparison to continuous naming tasks. On the other hand, Lorsbach and Gray (1985) argued that if two groups are considerably distinct from each other, then discrete naming tasks are reliable predictors of reading abilities.

Rapid naming involves several functions which makes it more difficult to explain its predictive nature. Wolf and Bowers (1999) listed the processes involved in the naming visual stimuli as a) attention to stimulus, b) bihemispheric, visual processes that are responsible for initial feature detection, visual discrimination, and letter and letter-pattern identification, c) integration of visual feature and pattern information with stored orthographic representations, d) integration of visual information with stored phonological representations, e) access and retrieval of phonological labels, f) activation and integration of semantic and conceptual information, and g) motoric activation leading to articulation (p. 418). Due to these complex processes, the predictive nature and the mechanisms of RAN are not clear (Araujo et al., 2015; Cutting & Denckla, 2001). According to Cutting and Denckla (2001), the main hypotheses about Rapid Serial/Automatized Naming and reading relationship are: 1) Rapid naming is a component of phonological processing (Wagner, Torgesen, Laughon, Simmons & Rashotte, 1993; Wagner et al., 1994). 2) Rapid naming is a component of orthographic knowledge (Bowers, 1997; Manis, Doi & Bhada 2000; Sunseth & Bowers 1997; Wolf & Bowers 1999), 3) Rapid naming is essential in memory span (Bowers, Golden, Kennedy & Young, 1994; Spring & Capps 1974; Spring & Perry 1983). Although these topics have been widely discussed, there are also hypotheses about the relationship between rapid naming and general processing (Kail & Hall, 1994) and other domain general processes (Altani, Protopapas & Georgiou, 2016; Savage, Pillay & Melidona, 2007; Swanson, Orosco, Lussier, Gerber & Guzman-Orth, 2011).

Wagner and his colleagues (1993) put forward that similar to phonological awareness and short-term memory span, RSN is a subcomponent of phonological processing. On the other hand, Bowers and her colleagues (1994) argued against the phonological nature of rapid naming and claimed that RSN measures the efficiency of how orthographic stimuli are processed. They asserted that a child's difficulty in extracting regularities from the orthography and inability to get automatized in word reading might be because of slow access and retrieval of codes due to restricted reading experience. Their view is based on the dual- route theories (Ehri, 1992b; Perfetti, 1992) which proposed that, although words are recognized through phonological recoding initially, repeated exposure to the identical orthographic patterns lead to orthographic processing. According to the researchers, reading disabilities might be caused either by poor recoding skills or underdeveloped orthographic knowledge.

Unlike Bowers and colleagues (1994), Torgesen and colleagues (1997) demonstrated the *growth* of the orthographic skills in their longitudinal study. Rapid naming scores of 2nd and 3rd grade normal and poor readers did not account for their orthographic knowledge in the following years when they took autoregressive effects into account. Alternatively, Manis, Seidenberg and Doi (1999) found that rapid naming contributed to orthographic knowledge in the second grade even when first grade reading skills are included.

Manis and colleagues (2000) study provided further evidence to Bowers and colleagues (1994) and Bowers and Wolf (1993). Their findings indicated that rapid naming for letters predicted orthographic knowledge after vocabulary and phonological awareness task performance was partialled out. Similar findings were found in Sunseth and Bowers (2002) that children with naming deficits showed orthographic processing problems compared to children with no deficit.

On the other hand, some researchers exhibited that the effects of RAN are over and above orthographic processing (Araujo et al., 2015; Cutting & Denckla, 2001; Georgiou et al., 2008). For instance, Araujo and colleagues (2015) revealed in their meta-analysis that RAN was a better correlate of word and text reading (*r_.45),* and a significant correlate of non-word reading (*r_.40)* which is a measure of phonological processing. In a similar vein, Cutting and Denckla (2001) reported that no single variable could fully explain rapid naming.

There is conflicting evidence about the relationship between RAN and memory span (Bowers, Steffy & Tate, 1988; Cornwall, 1992; Felton & Brown, 1990; Spring & Capps, 1974; Spring & Perry, 1983). Spring and Perry (1983) discussed that rapid naming was reflective of high speed phonetic coding and in poor readers deficiency in this process affected short-term memory span. On the other hand, Cutting and Denckla (2001) reported that studies which found a relationship between RAN and memory span (Spring & Capps, 1974; Spring & Perry, 1983) were only correlational and they did not denote causality. Likewise, Wagner et al. (1993) found no correlations between letter and digit naming with digit span in the second grade. Cornwall’s (1992) findings supported the idea that RSN and memory span were not associated. Her analyses showed insignificant correlation (*r_0.18)* between sentence memory and speeded naming. Alternatively, Amtmann, Abbott, and Berninger (2007) discussed that RAN could be a measure of phonological loop because it involves time sensitive sub/lexical orthographic and phonological representations and articulation of unrelated letters which were stored in the episodic buffer.

This section provided a detailed overview of the concepts related to RAN, its relationship to the components of reading. Moreover, divergent views on the predictive nature of RAN and its existence as a separate construct in reading research were discussed. The next subsection involves previous research on RAN as a precursor of reading achievement in bilingual groups.

2.8.3.1. Previous Research on RAN and Reading in Bilingual Children

Studies on RAN and reading relationship in bilingual participants involve children from diverse backgrounds such as dual language learners, successive bilinguals and heritage language learners. In this subsection, studies on these language groups will be summarized.

Wood, Bustamante, Fitton, Brown, and Petscher (2017) conducted a preliminary study to investigate the relationship between RAN and other literacy assessments in Spanish-English speaking dual language learners (DLLs). Data were collected from kindergarten and first grade children. Overall findings indicated that RAN was a feasible measure for the majority of young DLLs. Kindergarten children performed better in color and object naming, while first graders were better in letter and number naming. Although it was claimed that bilingual performance in lexical retrieval may be slower in naming low frequency items (Edmonds & Donovan, 2012; Gollan, Montoya, Fennema-Notestine, & Morris, 2005) or because of the inhibition of the other language in object naming (Kohnert, Bates, & Hernandez, 1999), DLL children in the current study performed within the typical range on RAN. With the total sample, RAN was correlated with English and Spanish receptive vocabulary and letter identification. It also had a small positive correlation with English sentence repetition and nonverbal intelligence. Yet, RAN was not associated with English PA.

In Gholomain and Geva (1999), “script dependent hypothesis” which links the pace of reading development to orthographic depth of languages and “central processing hypothesis” which proposes a common underlying cognitive factor influencing reading development in all languages were examined. The authors also researched the relative role of working memory, letter naming speed and L2 oral reading proficiency in word recognition and word attack skills. Elementary school children (grades 1-5) who spoke English as an L1 and Persian as a heritage language participated in the study. Similar to Arabic, Persian is written from right to left, it has one-to-many correspondence in sound symbols and ambiguities are resolved within context. This makes syntactic and semantic skills essential to compensate for word level deficiencies. Still, learning to read in Persian is simpler than English which has a less consistent sound to symbol correspondence. The findings were congruent with both hypotheses and they functioned as complementary frameworks in the literature. Students who performed better in reading and cognitive skills in their first language were also better in the second language. Furthermore, the same constructs explained significant variance in L1 and L2. These results were in parallel with the central processing hypothesis. The evidence to script dependent hypothesis came from word decoding performance in Persian. Although, children did not have the same level of exposure to Persian, once they were taught letters in Persian they could decode words as accurately as in English. Additionally, letter naming speed in L1 and L2 predicted word recognition and decoding skills within and across languages.

Another example to common underlying mechanism across languages was Morfidi, van Der Leij, de Jong, Scheltinga, and Bekebrede (2007) research in L1 Dutch and L2 English. The participants were secondary school students. There were 26 poor readers and 26 average readers. Poor readers had a weaker L2 letter knowledge compared to normal readers. The findings, in general, were in line with the cross-linguistic universality view of reading skills. In other words, deficits in the first language were encountered in the second language. It was demonstrated in the study that the performance in rapid naming was slow in both languages but it predicted speeded word reading in both languages and L2 text reading accuracy. In addition, L2 phoneme awareness and orthographic skills accounted for unique variance in L2 text reading accuracy. Moreover, speeded word reading in L1 predicted speeded L2 word reading and vice versa. Serial rapid naming, the most consistent cross-linguistic predictor, explained additional variance in the prediction of L2 from L1.

Fleury and Avila (2015) compared the performance of bilingual and monolingual Brazilian children in reading fluency, verbal short term memory and rapid naming. The participants were 3rd to 5th grade elementary school children, bilingual participants in the study were exposed to English in the school setting. The researchers reported that the bilingual group performed better in rapid naming and pseudoword repetition task which was a phonological memory task. The monolingual group, on the other hand, had a better reading fluency in Portuguese. It was concluded that as well as rapid naming skills bilingualism enhanced reading rate and accuracy of individuals.

Lastly, Özata (2013) investigated the predictors of word reading in Turkish and English among Turkish-English successive bilingual and English monolingual children. She employed PM, PA and rapid naming tasks in order to examine their relationship with word recognition and cross-linguistic transfer of PA. The results indicated that alphanumeric rapid naming PA were the most powerful predictors in both languages. The amount of variance explained by rapid naming was 70% in Turkish and 63% in English for bilingual children. In monolingual English speakers RAN explained 70% of the variance. Furthermore, Turkish PM did not predict Turkish word reading although it was related to PA. Turkish PA was associated with English word recognition.

2.8.3.2. Summary

This section provided a comprehensive review of RAN, various views on the nature of it. Its predictive power in transparent and deep orthographies in monolingual and bilingual participants was mentioned.

On the whole, RAN is regarded as one of the strongest precursors of reading achieivement across languages and spelling systems (Araujo et al., 2015; Georgiou et al., 2008; Norton & Wolf, 2012). According to the meta-analysis of Araujo and colleagues (2015), RAN was strongly correlated with real word reading and reading comprehension. The association of RAN and reading fluency was stronger than the relationship between RAN and reading accuracy (Compton et al., 2001; Georgiou et al., 2008; Georgiou et al., 2009). Thus, while RAN is empahsized in consistent orthographies, PA is more eminent in opaque languages (Wolf & Bowers, 1999).

That is, transparent languages have stronger interrelations with RAN (Aro & Wimmer, 2003; Babayiğit and Stainthorp, 2010; de Jong & van Der Leij, 1999; Mann & Wimmer, 2002; Wimmer et al., 2000).

The predictive nature of RAN is controversial. Although Wagner and his colleagues (1993) claim that RSN is a subcomponent of phonological processing, Bowers and her colleagues (1994) argued that RAN measured the efficiency of orthographic processing. On the other hand, some researchers exhibited that no single variable could fully explain rapid naming (Cutting & Denckla, 2001).

There is also conflicting evidence about the relationship between RAN and memory span. For instance, Spring and Perry (1983) discussed that rapid naming was reflective of high speed phonetic coding. Conversely, Cutting and Denckla (2001) claimed that studies which found a relationship between RAN and memory span were only correlational. Additionally, some scholars associated general processing speed with rapid naming as they both rely on efficient operation of underlying cognitive processes (Kail & Hall, 1994).

The studies investigating the role of RAN and reading in Turkish monolingual children showed that RAN was the best predictor of reading fluency with an increasing prominence across years (Babayiğit & Stainthorp, 2011; Özata, 2018). Further, Özata (2013) demonstrated that RAN was the most powerful precursor of reading fluency in Turkish-English bilingual children as well.

The following section includes an overview on MA which has been widely investigated in reading research.

2.8.4. Morphological Awareness (MA)

This section involves the definition of MA, its development, predictive nature and relationship with reading. It also includes the assessment of MA skills and examples from crosslinguistic studies. Subsequently, previous studies on MA and reading development of bilingual children will be mentioned.

MA is another variable which has been studied in reading development research in recent years (Kuo and Anderson, 2006). It is the ability to reflect on and manipulate the morphemic structure in words (Carlisle, 1995, p. 194). In other words, MA can be defined as one's conscious awareness of the morphemic structure of words. It is an analytical skill which allows individuals to make inferences about the word structure and meaning (Anglin, Miller & Wakefield, 1993; Nagy & Anderson, 1984). Similar to phonemic awareness, it facilitates decoding written words and this skill becomes more critical in reading and comprehension in the subsequent years of elementary school (Carlisle, 2003). Different from PA, MA has an association with meaning, structure, orthography, syntactic and phonological properties of words (Carlisle, 1995; 2003).

The relationship between MA and reading was first studied by Brittain (1970). In a sentence completion test, he investigated the relationship between first and second graders' inflectional awareness and word reading and reading comprehension. He found a stronger correlation for the second graders. Other studies supported the finding that the contribution of MA to reading increased with age.

Casalis and Louis-Alexandre (2000) maintained that MA explained decoding significantly among 2^{nd} grade French speaking children but not in 1^{st} graders. Anglin and colleagues (1993) compared the 1^{st}, 3^{rd} and 5^{th} graders in their ability to define and select the root in morphologically complex words. The 5^{th} graders' better performance was regarded as a sign of “morphological problem solving”. In Carlisle and Fleming (2003), 1st and 3rd graders analysed words in terms of their complexity. In the analysis of morphologically complex words (i.e. Is there a little word in *robber* that means something like *robber*?) and morphologically simple words (i.e. Is there a smaller word in *corner* that means something like *corner*?) 1st graders answered 57% of the pairs correctly while 3rd graders accuracy rate was 72%. Carlisle (2003) discussed that the limited performance of 1st graders in derivations meant that their morphological awareness abilities were emerging and these skills would become more distinct in time. Children lay the foundation for analytic reasoning about words in the 1st grade.

In a similar vein, Wolter, Wood, and D’zatko (2009) examined the relationship between MA in 1st grade and its effect on word reading and spelling. The results revealed that the effect of derivational awareness was also significant on spelling. This study established that not only inflectional but also derivational morphological development could be observed in the 1st grade.

Several other studies further demonstrated that the contribution of MA to decoding and reading comprehension increases with age (Bektaş, 2017; Carlisle, 1995; Layes et al., 2017; Mahony et al., 2000; Nagy et al., 2006). In the 2nd and 3rd grade, children have a better performance in naming frequent transparent words compared to mono-morphemic words matched for spelling and frequency (Carlisle, 2003). A similar condition continues in the 4th and 6th grades. These results could be interpreted as the advantage of morphological recognition in words. When the accuracy and speed of decoding complex words measured among 3rd and 5th graders, syllable length was the most significant variable in 3rd graders while for 5th graders both syllable length and base frequency explain their performance. That is, children become more automatic in morphemic parsing over time and they are able to use morphological cues in complex words (Carlisle & Stone, 2005).

An awareness of morphemic structure provides advantage in many domains such as word reading, pseudoword reading, reading fluency, reading comprehension, vocabulary and the organization of mental grammar (Carlisle, 2003, 1995; Deacon, 2012; Deacon & Kirby, 2004; Green, 2009; Green et al., 2003; Kuo & Anderson, 2006; Layes et al., 2017; Mahony et al., 2000; Moats, 1994). Textbooks consist of a high percentage of morphologically complex unfamiliar words. Approximately 60% of words school age children acquire are transparently structured morphologically complex words (Anglin et al., 1993; Baumann et al., 2002; Nagy & Anderson, 1984). Readers who are aware of the morphemic structure can be more successful in decoding and inferring the meaning of unfamiliar words (Carlisle, 2003). For instance, MA enables children to identify morpheme boundaries allowing them to pronounce *uninform* and *uniform* correctly (Deacon, 2012).

Similar to reading unfamiliar words, reading pseudowords which seemingly have affixes could be decoded accurately. For example, the nonword *lagician* could be interpreted as a multimorphemic word: *lagic*-root and *ian*- agentive suffix (Deacon & Kirby, 2004). Furthermore, MA supports fluency and reading comprehension since children can analyze the structure of the words and decode them quickly and accurately (Green, 2009). Green illustrated that although the word *sleeplessness* looks complicated at a first glance, decomposition of it into familiar morphemic parts facilitates recognition and comprehension.

The relationship between reading and MA has received less attention compared to PA (Apel, 2014; Carlisle, 1995; Kuo & Anderson, 2006; Mahony et al., 2000). Mahony and colleagues claimed that the role of MA is less well understood due to its complex nature. According to Carlisle (1995), it is not well known whether MA has a different relationship with early reading since this skill involves semantic, syntactic and phonological knowledge.

There is also controversy about the independence of MA from other constructs such as phonological and orthographic processing (Deacon, 2012; Deacon & Kirby, 2004; Kuo & Anderson, 2006; Mahony et al., 2000; Windsor, 2000). Windsor (2000) claimed that PA is a more important skill than MA in reading among older children. She evidenced that derived words which are phonologically complex *(e.g. heal, health*) are better predictors of reading compared to phonologically transparent derived forms *(e.g. enjoy, enjoyment)*. In a similar vein, Kuo and Anderson (2006) suggested that there is a noteworthy overlap between MA and phonological processing and the development of MA depends on phonological development in the early stages of elementary school. In contrast, some researchers criticized that the morphological tasks which require phonological processing (e.g. oral tasks) naturally found strong relationship between MA and PA (Carlisle, 2003). According to Carlisle, morphological learning and PA are intertwined but the complexities in morphology are not only phonological.

Deacon (2012) investigated the contribution of PA, MA and orthographic processing to reading. She found that each construct accounted for unique variance in real and pseudoword reading when age and vocabulary considered. The predictive power of the three variables changed across grades 1-3. MA uniquely contributed 1-2% of the variance which is a smaller percentage than the range of 5% in previous studies (Mahony et al., 2000; Roman et al., 2009). Further, it was observed that the interaction between PA and MA showed that children with lower PA might have used their MA skills for compensation. These findings are compatible with Bryant, Nunes, and Bindman (1998) that children used alternative reading strategies in their first reading attempts. The researchers proposed that MA should be recognized as an independent contributor in reading research. Likewise, Deacon and Kirby (2004) highlighted that morphological awareness is not a “more phonological” skill.

The independent contribution of MA to reading was investigated among various age groups. Nagy and colleagues (2006) found a unique contribution of MA to reading comprehension beyond phonological processing in grades 4-9. Carlisle and Nomanbhoy (1993) assessed MA through judgement and production tasks in 6-year-old children. The morphological production task uniquely explained 4% of variance while PA accounted for 37% of single word reading. In Singson and colleagues (2000), MA contributed 4% to pseudoword and real word reading between the 3rd and 6th grades. In Carlisle (1995)’s longitudinal study, children were followed from kindergarten to 2nd grade. Although there was no relationship between kindergarten MA and reading, the results were different for the following grades. In grade 1, MA accounted for 10% of the variance in reading after PA. It was further observed that MA was more predictive of reading comprehension than nonword reading. A similar investigation by Deacon and Kirby (2004) showed that MA had an individual, significant contribution to reading. Yet, the effect of MA on reading is rather small. Correspondingly, Mahony and colleagues (2000, Experiment 2) probed the contribution of MA in reading beyond vocabulary and phonological abilities. The findings showed that PA explained 13% of reading ability, while the contribution of MA was around 5%. The researchers emphasized that there was disparity between MA, PA and vocabulary skills. Although the size of variance explained by MA is small, it made a consistent and significant contribution. Kirby and colleagues (2012) examined the independent role of MA on various reading skills such as word/nonword reading accuracy and fluency, text reading speed and reading comprehension. The data analysis indicated that MA explained the above mentioned variables significantly. Moreover, MA accounted for reading comprehension beyond word reading.

The number of cross-linguistic studies on the role of MA in reading has increased in recent years (Fowler, Feldman, Andjelkovic, & Öney, 2003; Ku & Anderson, 2003; Mc-Bride Chang et al., 2005). According to Verhoeven and Perfetti (2011) morphological processing may show language-specific features and the significance of morphology varies based on the depth of orthography and morphological richness. Indeed, in Bektaş (2017) MA was a more powerful and reliable variable than PA due to the rich morphology of Turkish. Oflazer and colleagues (2003) likened the morphemes in Turkish to the "beads on a string" since morphemes are attached to base morphemes or other morphemes (p.262). Fowler and colleagues (2003) compared MA development of Serbian and Turkish monolingual children. Serbian and Turkish differ in terms of phonological predictability of derived and inflected forms. Derivational patterns are less consistent than inflected forms in Serbian while both derived and inflected forms are equivalent in Turkish. The findings showed that phoneme deletion accounted for phonologically nontransparent derivational items in Serbian whereas in Turkish phoneme deletion explained derivational and inflected forms equally.

The role of MA in Chinese reading has been extensively explored presumably because morphology is more eminent in the writing system than phonology. For instance, Ku and Anderson (2003) investigated derivational and compound awareness in second, 4th and 6th grader Mandarin and English speaking monolingual children. Both group demonstrated that morphological awareness was a significant predictor of reading comprehension beyond vocabulary. Yet, the data weakly proved that Mandarin speaking children were advantageous in morphology than English speaking children.

McBride and colleagues' (2005) well recognized research among Chinese, Korean and English speaking second graders showed that MA but not PA predicted word reading in Chinese beyond vocabulary and speeded naming. As for the Korean group, both MA and PA were significant in word reading. Lastly, in the English-speaking children PA was a more significant construct than MA in letter recognition and word decoding. Similarly, there is growing evidence that MA is more essential in reading comprehension than PA, vocabulary and word reading in Chinese (Ho et al., 2012; Shu, McBride-Chang, Wu, & Liu, 2006; Tong, McBride-Chang, Shu, & Wong, 2009).

The research on the components of MA and reading achievement in bilingual children will be mentioned in detail in the following part.

2.8.4.1. Previous Research on MA and Reading in Bilingual Children

As previously mentioned in Section 2.6., reading related skills could be transferred from one language to the other in simultaneous or early bilingualism (Cummins 2012; D'angiulli et al., 2001; Geva & Wang, 2001). Especially when the features are salient or shared by two languages, the transfer is more likely to happen (Bialystok et al., 2003; Kuo, Uchikoshi, Kim, & Yang, 2016). However, in language specific units and different writing systems such transfers may not be automatic (Bialystok, 2005; Durgunoğlu, 2002). According to Luo, Chen, and Geva (2014), MA is a language specific construct, thus transfer between morphologically distant languages may not be common. Still, a number of studies identified cross-linguistic transfer in the morphological domain. In this subsection, some of these investigations are presented.

Pasquerella, Chen, Lam, Luo, and Ramirez, (2011) examined the transfer of morphological skills between English and Mandarin Chinese. They conducted the study on Mandarin speaking Canadian children in the elementary school. The participants ranged from 1st to 4th grades. It was established that English compound awareness predicted Chinese vocabulary and reading comprehension. However, it did not have an effect on Chinese character reading.

Similar to Pasquerella and colleagues, Hsu and colleagues (2019) delved into the interaction between English and Chinese, the two typologically different languages. The researchers compared the reading acquisition of Chinese-English bilingual and English monolingual children. The age of children ranged from 6 to 12. Unlike English, compound morphology and morpheme to print mapping are salient features of Chinese. On the other hand, derivations are more dominant features in English and they are more predictive of reading. Apart from MA skills, the authors explored whether Chinese- English bilingual children had more developed skills in building meaning to print association than English monolinguals. The findings revealed that Chinese English bilingual children had a lower performance in forming sound-to-print association than sound-to-meaning association. To recapitulate, the nature of Chinese language impacted bilingual children’s reading acquisition path, since in English monolinguals sound-to-print association is more prominent. Further, a group of participants completed fMRI MA measures and they exhibited a stronger activation in the left middle temporal gyrus which is related to lexico-semantic processing. These findings unveiled that bilingualism affected the neuro-cognitive architecture of bilingual individuals because Chinese reading dominantly involves lexico-semantic processing. Moreover, the performance of both monolingual and bilingual children was similar in PA. Although the bilingual children had limited Chinese literacy instruction, their experience with English alphabet strengthened bilingual children's PA abilities in Chinese.

Another example to the cross-linguistic transfer of literacy skills in Chinese-English bilinguals is Luo and colleagues' study (2014) which examines the interconnection between phonological and morphological skills in Chinese and English. In order to discover the effects of cross-linguistic transfer, kindergarten children were tracked through the 1st grade. The participants attended English public schools and received Chinese instruction for 2,5 hours a week. PA, compound awareness and word reading abilities were measured in both languages in the first year. In the second year word reading abilities were measured again. Concurrent and longitudinal transfer of skills was examined. The data analysis revealed that PA and MA skills transferred at the construct level. Chinese PA predicted 45% of the variance in English PA after controlling for other variables. Similarly, English PA predicted 27% of the variance in Chinese PA. Likewise, English compound awareness accounted for 21% of Chinese compound awareness and Chinese compound awareness explained 18% of the variance in English compound awareness. Additionally, Chinese PA skills impacted concurrent reading in the other language, however such an effect was not observed in the other direction. English PA did not affect Chinese character reading. Since PA has a more important role in English reading, skills in Chinese PA are transferred to support English word reading. There was no direct effect of MA on English and Chinese word reading longitudinally. These results indicate that MA is a language specific construct.

Little research has been conducted to show the relationship between reading and MA in bilingual Turkish children. To the best of our knowledge, the only research in this area was conducted by Aydın (2014). Aydın compared a 7-year-old English-Turkish bilingual child with a Turkish monolingual child in morphological processing and reading comprehension. The bilingual child had Turkish parents and had been living in Turkey for 3 years at the time of testing. The children completed a derivational and decomposition task as well as a reading comprehension task in Turkish. The researcher investigated whether there was a bilingual advantage in the morphological and comprehension tasks. It was observed that both children were more successful in processing high-frequency words. The bilingual child was less successful than the monolingual child in all tasks probably due to the limited exposure to Turkish and smaller vocabulary. The monolingual child performed better than the bilingual child in the reading comprehension task as well. Overall, these findings suggest that the advantages of bilingualism could be observed in cases where children attain high levels of proficiency (Cummins, 1976). In addition, compatible with the previous studies (Carlisle and Fleming, 2003; Carlisle, 2000; Ku & Anderson, 2003), MA skills were predictive of the performance in reading comprehension in the word and text levels.

2.8.4.2. Summary

This section introduced MA as a predictor of reading in various reading groups. Its development, predictive nature and relationship with reading were mentioned.

Overall, previous studies showed that MA has a significant role in real word reading, pseudoword reading, reading fluency, reading comprehension, vocabulary and the organization of mental grammar (Carlisle, 2003, 1995; Deacon, 2012;

Deacon & Kirby, 2004; Green, 2009; Green et al., 2003; Ku & Anderson, 2006; Layes et al., 2017; Mahony et al., 2000; Moats, 1994). The contribution of MA to reading increases with age (Bektaş, 2017; Carlisle, 1995; Layes et al., 2017; Mahony, Singson & Mann, 2000; Nagy et al., 2006).

Moreover, morphological knowledge fosters vocabulary development (Green, 2009). It has an influence on parsing, which is associated with comprehension. Readers with good MA skills can be more successful in decoding and inferring the meaning of unfamiliar words (Carlisle, 2003).

In morphologically rich languages, such as Turkish, MA is a more powerful predictor of reading compared to PA (Bektaş, 2017). Yet, its effect on Rcomp was indirect via vocabulary at times (Özata, 2018).

The following section introduces PS as another influential predictor of reading.

2.8.5. Processing Speed (PS)

This section includes the definition of PS and its association with the components of reading.

Processing speed, as investigated in motor, visual, auditory and linguistic processing studies, has been documented as one of the influential factors of individual differences in reading (Catts et al., 2002; Nicolson & Fawcett, 1994; Wolff, Michel, & Ovrut, 1990).

As reported in Kail and Hall (1994), the pace of processing increases as children grow older. While 4-year-old children are three times slower than adults, 8-year-olds process information two times slower than the grown-ups. Further, Kail and Hall stated that some changes in the global mechanism occur with age which allows an increasing performance in tasks which requires to be completed in a limited time. To recapitulate, in addition to the effects of age on tasks PS is related to the achievement of activities when there is time restriction. The researchers discussed that global processing is the predictor of the execution of any task that necessitate rapidness. They attributed this view to the relationship between PS and memory span. Age-related development in memory span is positively associated with articulation rate, an index of efficiency of the articulatory rehearsal loop in working memory (Hitch, Woodin, & Baker 1989).

In an alternative and more simplistic view, increased PS enables rapid articulation, thus a more accurate retention. In line with Kail and Hall (1994), Kail (1992) and Kail and Park (1994) investigated the relationship between articulation rate, memory and PS. The findings corroborated with the consideration that age had a relationship with increased speed of processing, which also had relationship with articulation rate and memory span.

According to Catts and colleagues (2002), although poor readers display poor performance in PS, the nature of the deficit is not unequivocal. Kail and Hall (1994) maintained that global change in PS could be measured through rapid naming of digits, letters, colours and objects. To them, global mechanism is responsible for retrieval speed not automaticity. Kail and Hall investigated the associations among age, word recognition and composite measures of global processing and rapid naming. Their data from 144 children aged 8-13 years showed that global processing affected word recognition through naming speed. Moreover, age had an impact on naming speed via global processing speed. In similar vein, Kail and colleagues (1999) established that age-related processing accounted for naming speed. However, processing time did not explain reading.

In contrast, Bowey, Storey, and Ferguson (2004) examined global processing speed, serial naming speed and word reading skills of 4-6th graders. Their results showed that after age and non-symbol processing speed controlled, alphanumeric processing speed accounted for 13% variation in word reading. The results supported the view that some characteristics of alphanumeric processing is strongly related to word reading.

In their attempts to conceptualize naming speed deficits, Wagner and colleagues (1993) defined naming speed as a subcomponent of phonological processing as such deficits appear as an inability to access phonological codes in memory. Bowey and colleagues (2005) substantiated that the strong association between rapid naming of alphanumeric stimuli and reading ability in fourth grade children was mediated by phonological processing ability. Alternatively, Wolf and colleagues (2000) contended that naming speed has a complex nature and it cannot be fully explained by phonological processing. The scholars argued the possibility that a neurological time deficit could influence naming speed in poor readers.

Likewise, in Catts and colleagues (2002), poor readers had slower response time than good readers in linguistic and nonlinguistic domains. Conversely, Stringer and Stanovich (2000) showed that response time did not account for a significant variance when phonological awareness and IQ were partialled out. Thus, they did not consider general processing speed as a core deficit of reading.

The following subsection includes the findings of a number of studies on PS and its role in reading.

2.8.5.1. Previous Studies on Processing Speed and Reading

In this subsection, previous research on the nature of processing speed will be discussed. While some researchers defined it as a domain general skill (Kail & Hall, 1994; Catts et al., 2002), others discussed that rapid naming in relation to processing speed is a construct of phonological processing (Bowey et al., 2005). On the other hand, Cutting and Denckla (2001) claimed that rapid naming and phonological processing were separate constructs. Moreover, some studies investigated the relationship with PS and word reading fluency (Papadopoulos et al., 2016; Özata, 2018).

Kail and Hall (1994) examined naming speed in relation to the automaticity of access to familiar items and changes in global mechanism with age. They employed measures of naming speed, reading skill and processing time. The participants were 144 8-13 year old children. The path analyses and structural equation modelling (SEM) revealed that naming speed was associated with processing speed. However, naming time was not related to age. There was an age-related change in speed of processing. Besides, naming time and age were related to reading recognition and reading recognition was connected to reading comprehension. The findings supported that since naming time and age were not related, automaticity was not the foundation for the rapid naming of digits, letters and colours. Rather, these findings are compatible with the view that naming time is determined by a global mechanism. In general, the researchers argued that these results provided evidence to processing speed as a vehicle of developmental change. However, the global mechanism cannot be directly associated with performance in particular domains.

Likewise, Catts and colleagues (2002) scrutinized the role of rapid naming, PA and PS on reading. The study combined data from two projects. The first project assessed PA and rapid naming skills of 2nd and 4th graders (Catts & Fey, 1995). In the second project, 3rd graders completed motor, visual, lexical, grammatical and phonological processing speed tasks (Leonard, Kail, & Ellis Weismer, 1995). The findings demonstrated that poor readers were slower than good readers in response time (RT) and rapid naming of object. These results were interpreted as a general deficit in processing speed. Furthermore, processing speed explained unique variance (8.3% in reading comprehension and 18.1% in word recognition) when IQ and phonological awareness were considered. The researchers concluded that processing speed deficit might be “extra-phonological” or domain-general in some reading problems.

Alternative to Kail and Hall (1994) and Catts and colleagues’ (2002) findings, Bowey and colleagues (2005) investigated the relationship between serial naming speed, word reading, global processing speed, alphanumeric symbol processing efficiency and phonological processing in 65 Australian English speaking 4th grade children. The results exhibited that alphanumeric naming speed and reading was strongly mediated by phonological processing. Phonological processing and word reading shared 61% of the total variance. Alphanumeric and non-alphanumeric naming speed exhibited different patterns. Alphanumeric stimuli were relatively stronger measure of word reading ability in children who already passed the earlier stages of literacy acquisition. Moreover processing speed explained 13% of variance in word reading. Global processing speed mediated the interrelation between non-symbol naming speed and word reading, yet, it was not a mediator in the association between word reading and alphanumeric naming speed. When processing speed was considered, alphanumeric naming speed still explained 12% of variance. The findings provided further data on the phonological processing account of word reading deficits.

From a different perspective, Cutting and Denckla (2001) followed 1st grade children until the 3rd grade to examine whether PS and articulation were responsible for the performance in rapid naming. The path analysis showed that rapid naming and PA were separate constructs. Noteworthy, without PS rapid naming had a minimal effect on orthographic knowledge. The amount of variance explained by PS was 11% while rapid naming added only 2% to orthographic knowledge. Even though PS was an important mediator between rapid naming and orthographic knowledge, it was not sufficient to explain total association with rapid naming and word reading.

The relationship between word reading fluency and naming speed was investigated by Papadopoulos and colleagues (2016). The researchers tracked 286 Greek children for one year from 1st to 2nd grade. The results demonstrated that rapid naming directly and indirectly influenced reading fluency. PA and orthographic awareness mediated the relationship of rapid naming with reading. When rapid naming was excluded, speed of processing was a strong predictor of oral reading fluency. Moreover, PS had a longitudinal effect on silent reading. The results further showed a developmental change in the significance of processes. While PA was more significant initially, orthographic knowledge took over its role in the following stages.

In her in-depth study, Özata (2018) probed the predictors of word reading fluency and reading comprehension in 2nd and 4th grade Turkish children. Her findings exhibited that rapid naming and orthographic knowledge were the strongest predictors of word reading fluency. There was a high correlation between PS and word reading fluency in the 2nd grade (r= .*54*) and 4th grade (r= .*66*). In the 2nd grade, PA and PS influenced reading fluency via orthographic knowledge. On the other hand, in the 4th grade, PS but not PA influenced word recognition fluency indirectly. Compatible with Bowey and colleagues (2005), Özata's findings showed that, alphanumeric rapid naming was influential on word reading fluency beyond general processing speed. PS did not have an independent contribution when other predictors were taken into account. However when the other predictors such as orthographic knowledge and rapid naming were excluded from the analysis it explained a significant amount of unique variance in word reading fluency in the 2nd grade (29%) and in the 4th grade (44%). Moreover, PS contributed to orthographic knowledge in both grades (11% in 2nd grade and 33% in 4th grade). Based on the correlation among PS, orthographic knowledge and alphanumeric rapid naming, the researcher concluded that speed was an important factor in the development of reading and reading-related skills.

2.8.5.2. Summary

This section included a synopsis of PS as a precursor of reading achievement. Its predictive nature and relationship to other constructs were discussed.

On the whole, PS is regarded as one of the influential factors of individual differences in reading (Catts et al., 2002; Nicolson & Fawcett, 1994; Wolff, Michel, & Ovrut, 1990). PS performance of children increases with age (Kail and Hall, 1994).

PS is related to articulation rate and memory span (Kail and Park, 1994). Poor readers have slower response time than good readers in linguistic and nonlinguistic domains (Catts et al., 2002).

Some studies focused on the relationship betweeen PS and rapid naming. According to Cutting and Denckla (2001), rapid naming had a small contribution to orthographic knowledge (OK) without the contribution of PS. Moreover, Papadopoulos and colleagues (2016) demonstrated that when rapid naming was excluded PS was a strong precursor of reading fluency in Greek. Similarly, Özata (2018) evidenced that in Turkish, PS was significant when RAN and OK were excluded from the analysis.

In the following section, findings of the previous studies on the relationship between VK and reading development will be reported.

2.8.6. Vocabulary Knowledge (VK)

This section includes a brief introduction of vocabulary skill, its components, developmental pattern, and hypotheses on its role in reading. Afterwards, previous studies investigating VK and reading in bilingual children will be presented.

As "reading is partly about words" (Perfetti & Hart, 2002; p. 189), vocabulary development has a pivotal role in school success and child growth (Verhoeven & Perfetti, 2011). In the earlier stages of reading, words that children encounter are predominantly present in their lexical inventory. Word reading and decoding are adequate skills for comprehension at this stage (Duff et al., 2015). Despite the significant role of oral language initially, a transition occurs as children become proficient in reading and start confronting more words which are predominantly accessible in print materials (Duff et al., 2015).

In parallel, previous research indicated that the expansion of lexical inventory largely depends on written language exposure (Cunningham, Perry & Stanovich, 2001; Nagy, Herman & Anderson, 1985). Children learn approximately 2000 word meanings every year and reach to a vocabulary size of 15000 words at the end of the elementary school (Nation, 1993). Conversely, an average 4th grader can recognize 3000 words from print (Chall, 1987; Snow et al., 1998). According to Biemiller (2005), from the 3rd grade, 95% of children are able to read more words than they can define. The gap between oral and reading vocabulary depends on the extent of children's reading (Joshi, 2005). At this stage, individual differences can be observed as readers' ability to extract word meanings from context varies (Cain, Oakhill & Elbro, 2003). Therefore, investigations on the associations between vocabulary and reading skills are necessary to disclose individual differences in reading, skilled reading, literacy instruction and reading research (Oulette, 2006).

Individual differences in VK or the relationship between VK and the amount of reading has been discussed in studies investigating the phenomenon known as *the Matthew Effect* (Stanovich, 1986). According to *the Matthew Effect*, there is a positive correlation between the level of reading skill, vocabulary knowledge and the volume of reading. This condition is frequently recapitulated as "the rich get richer" (Stanovich, 1986; p.380). Since poor readers are likely to read less and simpler print materials than good readers, they have a low-speed development and a smaller vocabulary (Joshi, 2005). On the other hand, children who read more, acquire more abstract and complex vocabulary which can improve their comprehension. Empirical evidence supports *the Matthew Effect* (Allington, 1983; Carver, 1994; Duff et al., 2015; Juel, 1988). As reported by Allington (1983), strong readers in the 1st grade can read approximately three times as many words than weak readers. Conforming to

Allington, Juel (1988) stated that average and strong readers spent more time in a week for pleasure reading than weak readers. Accordingly, Duff and colleagues (2015) established that 4th grade word reading ability was related to the vocabulary growth in the 10th grade. Above average readers in the study exhibited a better development in vocabulary than the average readers.

Words carry meaning and as an index of semantic knowledge, they are closely related to reading comprehension and knowledge construction (Verhoeven & Perfetti, 2011). There is a direct and indirect relationship between vocabulary and reading comprehension (Babayiğit & Stainthorp, 2014; Biemiller & Boote, 2006; Muter et al., 2004; Oulette & Shaw, 2014). The direct effect of vocabulary on reading comprehension can be observed in semantic processing of texts and indirect effects through its facilitating role on word recognition. Several theories were put forward to explain the direct and indirect effects of word knowledge on Rcomp.

One of the well-recognized theories, *The Simple View of Reading (SVR)* (Gough & Tunmer, 1986) acknowledges the components of oral language skills and associates them with reading comprehension. According to SVR, reading comprehension is the product of word decoding and oral language skills. That is, if any of the multiplier is zero, then reading comprehension does not occur. Alternatively, Joshi (2005) discussed that *The Componential Model of Reading* (Joshi & Aaron, 2000) adds *fluency* as an additional component to SVR. The formula of Reading Comprehension is proposed as RC= Decoding x Oral (Listening) Comprehension + Fluency. In both models, vocabulary plays a causal role in reading comprehension. Although the association with spoken language comprehension is small in the early stages of reading development, by high school the correlations increase and level out (Sticht & James, 1984). According to Gernsbacher (1990), the association between reading comprehension and listening comprehension in college students is strong (*r=.90*). Anderson and Freebody (1981) argued that such a relationship is found in all grades and languages.

The role of vocabulary in reading comprehension was also stressed in *The Lexical Quality Hypothesis* (Perfetti & Hart, 2002). Perfetti and Hart stated that reading comprehension is mostly dependent on word knowledge. The quality of codes (parts of stored linguistic symbols) influences reading and comprehension. When "..retrieval is effortful and the retrieved codes are low in quality, processing is inefficient (Perfetti, 1985; p.118). On the other hand, "..a high-quality representation has a specified orthographic representation (a spelling) and redundant phonological representations (one from spoken language and one recoverable from orthographic-to-phonological mappings)" (Perfetti & Hart, 2002; p.190). High quality representations allow for fast and efficient retrieval. Repeated exposure to words and having high quality representations enable the recognition of the words as a whole rather than their parts which may also be parts of other words. When a word is frequently encountered then confusion is minimized. Perfetti and Hart points out that even skilled readers have low quality representations for many words, however they have foundational resources and can add new information to a weak representation. To summarize, reading comprehension relies on robust orthographic, phonological and semantic representations. Moreover, the size of vocabulary affects comprehension and retrieval of texts (Perfetti et al., 2005).

A meta-analysis on vocabulary research (Stahl & Fairbanks, 1986) showed that vocabulary played a causal role in comprehension. The relationship between reading comprehension and vocabulary was also investigated in concurrent and longitudinal studies (Babayiğit & Stainthorp, 2014; Muter et. al., 2004; Oulette, 2006; Roth et al., 2002). For instance, Babayiğit and Stainthorp (2014) followed kindergarten children until the 2nd grade. Their findings manifested that listening comprehension with vocabulary, grammar and verbal short-term memory in kindergarten explained reading comprehension in the early reading. In another longitudinal study, Cunningham and Stanovich (1997) evidenced that vocabulary skills in the 1st grade accounted for 30% of the variance in reading comprehension in the 11th grade.

Some researchers further pointed out a reciprocal connection between reading comprehension and vocabulary (Beck, Perfetti & McKeown, 1982; Verhoeven, van Leeuwe & Vermeer, 2011; Verhoeven & Perfetti, 2011). Reading enables readers to learn more words, in turn, broader vocabulary allows for extensive reading and comprehension. According to Adams, Bell, and Perfetti (1995), another advantage of vocabulary is that readers can use their word knowledge to compensate for their weaknesses in other domains which might affect comprehension. To recap, reading comprehension is possible when word forms are automatically identified and lexical representations are accessed (Verhoeven & Perfetti, 2011).

In several studies, the difference between the number of entries in the lexicon (breadth) and the depth of semantic representation were discussed (Oulette, 2006; Oulette & Shaw, 2014; Proctor, Uccelli, Dalton, & Snow, 2009). The differentiation of the breadth and depth of vocabulary knowledge allowed researchers to explain the relationship between oral vocabulary and reading comprehension more comprehensively (Oulette & Beers, 2010). The breadth of vocabulary can be measured through one word picture identification and naming tasks, while the depth of word knowledge can be measured via oral definitions (Ouellette, 2006; Proctor et al., 2009). Both breadth and depth of vocabulary explained reading comprehension

(Ouellette, 2006; Ouellette & Beers, 2010; Protopapas et al., 2007). The breadth of vocabulary explained word reading in English (Oulette, 2006; Mitchell & Brady, 2013) and in more regular languages such as Greek (Protopapas et al., 2007). Moreover, it predicted irregular and non-word reading (Ouellette, 2006; Tunmer & Chapman, 2013). As reported in Oulette and Beers (2010), vocabulary depth explained unique variance in irregular word reading.

This section introduced the development of VK, its relationship with reading comprehension and word reading, the meaning of breadth and depth of vocabulary,. In the following section previous studies on the relationship between reading development and vocabulary knowledge in bilingual children will be mentioned.

2.8.6.1. Previous Research on VK and Reading in Bilingual Children

Monolingual and bilingual children demonstrate different patterns in vocabulary development. As reported in Tabors and colleagues (2003) English L2 learners during preschool and kindergarten years lagged behind monolingual children both in expressive and receptive vocabulary. Depending on individual differences and environmental factors, the divergence persists (Carlo et al., 2004). On the other hand, studies which focused on the distinction between the breadth and depth of vocabulary knowledge manifested that although differences could be observed between monolingual and bilingual children in the breadth of vocabulary knowledge, bilingual/biliterate children showed a positive relationship in the depth of vocabulary (Ordonez et al., 2002; Wang, Cheng, & Chen, 2006). Similarly, Pearson, Fernandez, and Oller (1995) discussed that bilingual children have a larger conceptual vocabulary than monolingual children. This argument points out that in language assessments, bilingual individuals should be examined in both languages (Cobo-Lewis, Pearson, Eilers, & Umbel, 2002; Uccelli & Paez, 2007).

Reading comprehension has also been regarded as one of the most vulnerable skills in bilingual children (Lesaux & Siegel, 2003; Verhoeven, 2000). Verhoeven (2000) showed that among monolingual Dutch speaking children and Turkish, Moroccan immigrant children who were instructed in Dutch, immigrant bilingual children performed worse than monolingual children in vocabulary and reading comprehension skills although they had similar decoding skills. Limited oral vocabulary has an important role in the comprehension of texts (Rothou & Tsimpli, 2017). According to Pearson (2002), bilingual children need to acquire more complex language related skills than monolingual children, thus the rate of development in both groups may exhibit differences.

Rothou and Tsimpli (2017) compared 3rd-6th grade monoliterate Albanian-Greek, biliterate Albanian-Greek and monolingual Greek children. The study consisted of two experiments. In the first measurement, the effect of biliteracy on Greek word recognition and its relationship with expressive vocabulary was examined. The scores in visual word recognition revealed that oral proficiency in the second language played a significant role in word reading in L2. Monoliterate bilingual children did not differ from monolingual children in word recognition skills. The instruction they received in Greek allowed them to perform akin to the monolingual peers. However, biliterate bilingual children were outperformed by the two groups. This finding might be due to the interference of the strong first language skills. In the second experiment, reading comprehension skills were measured. The monoliterate bilingual participants performed similar to monolingual peers. On the other hand, biliterate bilingual children were outperformed by monolinguals. These findings might be observed due to the breadth of oral Greek vocabulary. The limited vocabulary of biliterate bilingual children affected their performance in reading comprehension. The authors highlighted that proficiency in the second language has an essential role in second language word reading when other cognitive abilities are controlled.

Uccelli and Paez (2007) studied the association between oral vocabulary and narrative skills of 24 Spanish-English bilingual children in a longitudinal design. The data were collected through standardized vocabulary tests and narrative elicitation tasks for kindergarten and 1st t grade children. The analysis showed a developmental pattern from kindergarten to first grade in English. Despite a steady development in vocabulary, the scores of bilingual children were behind monolinguals in the 1st grade. Kindergarten Spanish story narrative scores predicted their English narrative quality in the first grade. On the other hand, Spanish narrative skills were predicted by Spanish vocabulary. The researchers underlined the necessity of early assessment of vocabulary and oral narrative skills in bilingual children as well as the importance of promoting first language skills for the development of the second.

2.8.6.2. Summary

This section consisted of the components of VK , its developmental pattern, and hypotheses on its role in reading. They were followed by previous studies investigating the association with VK and reading in monolingual and bilingual children.

The studies mentioned above exhibited that vocabulary develops dramatically through exposure to written language. Children read more words than they can define or use in daily language. Poor readers read less and simpler materials which cause a slow development in their lexical inventory. On the other hand, reading abstract and complex language has a positive effect on vocabulary and reading comprehension.

Some researchers found a causal connection between vocabulary and reading comprehension (Stahl & Fairbanks, 1986), some showed a reciprocal connection between the two (Verhoeven et al., 2011; Verhoeven & Perfetti, 2011).

Monolingual and bilingual children are different in vocabulary development. During preschool and kindergarten years, bilingual children lag behind monolingual children both in expressive and receptive vocabulary (Tabors et al., 2003). On the other hand, bilingual children possess a larger conceptual vocabulary than their monolingual counterparts (Pearson, Fernandez & Oller, 1995).

Prior to moving onto the methodology chapter of the current study, it will be useful to review briefly some basic characteristics of Turkish morphology and phonology. This subsection is then followed by a short discussion of literacy education in Turkey.

2.9. Characteristics of Turkish Language and Literacy Instruction in Turkey

The Turkish language has more than 80 million speakers around the world and it is predominantly spoken in Turkey, the Balkans, Middle East and Europe (Durgunoğlu, 2017). The Latin alphabet was adopted in 1928 after the foundation of the modern Turkish Republic (Kılıç, 1991). The Turkish alphabet is comprised of 29 letters-21 consonants and 8 vowels.

Although the canonical word order is Subject-Object-Verb (SOV), all six permutations (SOV, SVO, VSO, VOS, OVS, OSV) of a transitive sentence can be used in proper discourse situation (Hoffman, 1995. p.253). Based on the pragmatic functions, word order may change. For instance, the sentence-initial position is where topicalization takes place, the focus is the preverbal position and background information is provided in the postverbal position (Taylan, 1984). Slobin and Bever (1982) reported that in a corpus of 500 naturally sentences in Turkish, 48% of the sentences were SOV, 25% of the sentences were SVO, 13% of them were OVS and 8% were in an OSV order.

Phonological and morphological acquisition of Turkish is relatively effortless due to the vowel harmony and suffixation system (Durgunoğlu, 2017). In parallel, Turkish children make few developmental errors during the acquisition of morphophonological forms (Aksu-Koç & Slobin, 1986). In terms of reading development the consistent phoneme-to-grapheme and grapheme-to-phoneme conversion in Turkish enables an efficient and easier beginning reading process (Öney & Durgunoğlu, 1997). Knowledge of the letter entails the knowledge of the sound it represents. Accordingly, Öney and Goldman (1984) evidenced that Turkish children acquired competency in decoding more rapidly than American beginning readers. Unlike opaque languages, PA develops earlier in Turkish and decoding process reaches to a ceiling level by second grade (Babayiğit & Stainthorp, 2007; Erdoğan, 2012).

2.9.1 Turkish Phonology

Turkish language is composed of twenty-three consonant phonemes and eight short contrastive vowels (Taylan, 2015). In general, each phoneme is represented by one symbol in the standard orthography, (Topbaş, 1997). In terms of manner of articulation, the consonants are classified as *plosives, affricates, fricativesi nasals, tap, lateral approximant, glides.* The consonants are also classified based on the place of articulation: *bilabial, labia-dental, dental, alveolar, alveo-palatal, palatal, velar, glottal*.

Obstruents (oral stops, affricates, fricatives) are contrastive with each other in their voicing features and point of articulation (coronal/non-coronal, anterior/non-anterior, labial/non-labial) (Taylan, 2015, p.23). Some examples to distinctive features in Turkish obstruents are: continuant/non-continuants (i.e. +continuants: *f, v, s, z, ʃ, Ʒ, Ɣ, h*), strident/non-stridents (i.e. +stridents: *tʃʰ, dʒ, f, v, s,z, ʃ, Ʒ*), voiced/voiceless (i.e. +voiced: *b, d, ɟ, g, dʒ, v, z, Ʒ, Ɣ*), labial/non-labials (i.e. +labials: *pʰ, b, f, v*). All of the Turkish sonorants (m, n, ɫ, ʎ, ɾ, j) are voiced. The phoneme /r/ is also treated as liquid in general due to its allophonic variations not specified phonetically in Turkish (Topbaş, 1997, p. 380). Noteworthy, while voicing is a distinctive feature in Turkish, aspiration is non-distinctive (Taylan, 2015, p.24).

Word-final consonant clusters can be used only when they are limited to fricative/sonorant + non-continuant (stop, affricate) (i.e. rk, rt, rp, rc, nk, nt, ns, sk, st, lk, lp, lç) (Topbaş, 1997). On the other hand, word-initial clusters are not allowed, except for the loan words. Word final clusters, the consonants /*p, t , tʃ, k*/ are subject to final voicing rule before vowels during suffixation where they alternate to /b, d, d3, g/.

The eight short contrative vowels in Turkish are /i, e, y, Ø, ɯ, a, u, o/. The vowels are contrasted in their height, frontness/backness and rounding features (Taylan, 2015, p. 33). Although all vowels in Turkish are lax vowels (except for the loanwords), they can be lengthened by adding *soft g* (ğ) right after the vowel (i.e. yağmur *rain*). According to Göksel and Kerslake (2006), /*o*/ and / *Ø* / can be used in the initial syllable except for the imperfective suffix *–iyor*.

According to Öney and Durgunoğlu (1997), syllables are the basic units of articulation in Turkish. The syllables are salient and they govern boundaries. There are six syllable structure patterns: V, VC, VCC, CV, CVC and C‘VCC; the first three occurring word-initially and the last three in any position (Topbaş, 1997, p.380).

Word roots in Turkish are made up of four syllables maximum (Topbaş, 1997). Yet, as an agglutinative language, morphemes which are attached to word stems may form long syllabled words. Oflazer and associates (2003) likened the morpheme to morpheme attachment in Turkish to “beads on a string” (p, 2.).

The most salient characteristics of Turkish phonology is the vowel harmony. Vowel harmony is a left-to-right process along syllables (Durgunoğlu, 2017, p.440). That is, any Turkish vowels can be used in the first syllable of a word, yet the following syllables in the word root and suffixes are shaped based on the frontness/backness feature of the first vowel in the word. For instance, the plural markers in Turkish are *ler/lar*. In order to make the word “*araba (car)”* plural, the first syllable in “*a-ra-ba”* conditions the plural marker as *lar* as the vowel has a backness feature. Exceptionally, some loanwords may violate the vowel harmony (e.g. *kitap-kitaplar book-books*).

Although the development of phonological skills pursues a universal pattern, phonological development of Turkish children involves certain language-specific characteristics (Topbaş, 1997). The transparent orthography, salient features such as syllables and vowel harmony, saliency and invariance of syllable boundaries allow for a rapid and straightforward phonological development and sound awareness.

2.9.2 Turkish Morphology

Turkish is an agglutinative language with a transparent and rich morphology. That is, free and bound morphemes which constitute words can easily be segmented and recognized. Taylan (2015) exemplified the agglutination in Turkish as follows:

the word *gerçekleştirdiklerimizden* (from those that we have actualized) is made up of;

gerçek	'real/reality' (root)
-*leş*	'suffix deriving verbs from nominals/substantives'
-*tir*	'causative suffix'
-*dik*	'nominalizing suffix'
-*ler*	'plural suffix'
-*imiz*	'1st person plural possessive/nominal agreement suffix'
-*den*	'ablative case suffix' (p., 103)

As illustrated above, there is a one-to-one relationship between the form and meaning. The morpheme order is not random, derivational suffixes are used before the inflectional markers.

Turkish does not have any infixes. Suffixation is the main type of affixation. Although there is prefixation as well, most of them are loan prefixes (e.g. *na-tamam* incomplete, *anti-sosyal* antisocial). The suffixes in Turkish have allomorphs which correspond to vowel and consonant harmony (Taylan, 2015). For example, the allomorphs *-gin, -gın, -gun, -kin, -kın, -kün, -kun* are determined based on the consonant harmony (by suppyling the voicing feature of the suffix initial plosive) and vowel harmony (supplying the frontness-backness and rounding features of the suffix vowel) (p.107).

Turkish nominals receive three types of inflectional marking: case, number and, possessive. In addition, they receive tense-aspect-modality as well as subject-verb agreement markers (Ketrez & Aksu-Koç, 2009; p. 15). The case markers in Turkish are: nominative (NOM), accusative (ACC), dative (DAT), genitive (GEN), locative (LOC) and ablative (ABL). Except for the nominative case, all cases have distinct markers which are stem based and transformed based on vowel and consonant harmony. Ketrez and Aksu-Koç (2009) exhibited the case marking in Turkish as follows:

Lemma	kedi 'cat'	ben 'I'
NOM Ø	kedi	ben
ACC -(y)I [(y)i/ı/u/ü]	kedi-yi	ben-i
DAT -(y)A [(y)e/a]	kedi-ye	ban-a
GEN -(n)IN [(n)ın/in/un/ün/im]	kedi-nin	ben-im
LOC -DA [de/da/te/ta]	kedi-de	ben-de
ABL -DAN [den/dan/ten/tan]	kedi-den	ben-den
INSTR/COM -(y)la [(y)le/la]	kedi-yle	ben-imle (p.16)

Derivational suffixes change the class of words, they create nouns, adjectives, verbs and adverbs from any type of words. According to Durgunoğlu (2017), the derivations were used to enhance Turkish vocabulary. Similar to inflectional suffixes, derivational suffixes follow the rules of vowel and consonant harmony.

Due to the regular and transparent morphology, Turkish children acquire morphophonological forms with ease and by making fewer errors (Aksu-Koç & Slobin, 1986). By 24 months of age, nominal inflections and most verbal inflections are present in their oral productions (Aksu-Koç & Slobin, 1986). The first acquired nominal inflection is the accusative case, while the past tense is the first appearing verbal inflection (Durgunoğlu, 2017).

2.9.3. Literacy Instruction in Turkey

Literacy education policy in Turkey is centralized (Durgunoğlu, 2017), it is designed and implemented by the Ministry of National Education (MONE). From 1968 to 2004, the Sentence Method-SM (holistic instructional approach) was the primary instructional approach (Baydık & Kudret, 2012). In 2005, Sound Based Sentence

Method-SBSM (phonics approach) has replaced SM (MEB, 2005). Reading and writing instruction are provided simultaneously. Children are encouraged to develop reading and writing skills together. Based on the SBSM approach, reading-spelling education begins with sounds. The sounds are taught based on a fixed order: the first group of phonemes are *e, l, a, n* , the second group of phonemes are *i, n, o, r, m*, the third group of phonemes are *u, k, ı, y, s, d*, the fourth group of phonemes are *ö, b, ü, ş, z, ç*, the fifth group of phonemes are *c, p, h* and the sixth group of phonemes are *ğ, f, v, j* (Canbulat, 2013; Alver & Sancak, 2016). SBSM instruction involves the introduction of phonemes and phoneme blending which is followed by the activities in the syllable, word and sentence level. In other words, literacy education advances from easier units to the more difficult ones.

There is a controversy about the implementation of SBSM approach in Turkey. Baydık and Kudret (2012) stated that the adoption of SBSM approach facilitated the acquisition of reading since each phoneme is represented by a grapheme in Turkish spelling. In addition, Güneş (2006) reported that SBSM method contributed to the creativity and productivity of children. However, Polat (2017) reported that syllable based instruction would be a more appropriate approach due to the saliency of syllables in Turkish.

This brief subsection aimed at providing overall information about the features of the Turkish language and the educational system so that the readers have a better insight into the linguistic components of the current study. In the following chapter, the methodology, research questions, the participants and instruments of the present study are introduced.

CHAPTER 3

METHODOLOGY

This chapter consists of three main parts. Firstly, research design of the present study, research questions and participants will be presented. Then, hypotheses in the study will be introduced in detail. The third section is composed of the instruments and data collection procedure.

3.1. Research Design and Research Questions

The aim of the current study is to examine the contribution of PA, PM, RAN, MA, MATT, PS and VK to word reading and reading comprehension in Turkish-Arabic simultaneous bilingual and Turkish monolingual children. Moreover, the developmental pathway of bilingual and monolingual children will be compared. In other terms, the influence of exposure to two languages from birth on literacy development will be investigated. In order to measure multiple variables at a time, a cross-sectional design was employed in the study.

In line with the aims of the study, the following research questions were addressed:

1. Is there a significant difference between Turkish-Arabic simultaneous bilingual and Turkish monolingual children in PA, PM, RAN, MA, MATT, PS, VK, WRead and Rcomp performance?
2. How do the variables; PA, PM, RAN, MA, MATT, PS and VK explain variance in word reading fluency (WRead) in Turkish-Arabic simultaneous bilingual and Turkish monolingual children?

3. How do the variables; PA, PM, RAN, MA, MATT, PS, VK and Wread explain variance in reading comprehension (Rcomp) in Turkish-Arabic bilingual and Turkish monolingual children?

3.2. Participants

The data of the current study were collected in April 2017 upon the formal approval of Hatay Provincial Directorate for National Education. 138 students participated in the study; 100 of them constituted the Turkish-Arabic simultaneous bilingual group while 38 children formed the Turkish monolingual control group. 54 children were male, 84 of them were female. The participants had no reported diagnosis of developmental or cognitive impairment. All 2nd grade students in each school whose language and social profile matched with the aims of the study were included in the study regardless of their academic achievement. The age range was 7-8. The data were collected from students of five primary schools in the counties, Samandağ (3), Antakya (1) and Defne (1).

Hatay province in Turkey, which is located on the border of Syria was chosen for data collection since a large Arabic speaking community resides in the area. Noteworthy, the bilingual participants in the study were not immigrants from an Arabic speaking country, the ancestors of them were also born in Hatay. In other words, the children were born to Turkish-Arabic speaking parents and exposed to these two languages from birth. According to the parents' statements, the number of bilingual speakers in the region has decreased across generations since families do not want their children to have an Arabic accent. They believe that their children would not be excluded from society and they can find better jobs if they speak Turkish without an Arabic accent.

Primary schools in the region were selected under the guidance of the Hatay Directorate for National Education. School administrators and teachers were informed about the research. Written consents and demographic forms were received from the parents. Demographic forms involved information about the age, language background, education level and occupation of the family members. Maternal education level ranged from primary to secondary school. Only seven mothers were university graduates and worked in the region as teachers. Except for them, all mothers were homemakers. Similarly, paternal education level ranged from primary to secondary school. Six of the fathers were university graduates and they were teachers or merchants. In general, they came from lower-middle socioeconomic backgrounds. The average number of siblings at home was three.

The participants were included in the study based on the statements of the teachers and parents. In the bilingual group, all participants could comprehend and speak Arabic. While at least one of the parents prefered speaking Arabic in the family, siblings prefered Turkish in their conversations. Arabic language proficiency tests were not given to the bilingual children since there were no tests available to measure reading skills in the dialect spoken in Hatay. Moreover, they received literacy instruction only in Turkish.

In Hatay, except for the official language Turkish, a dialect of Arabic is spoken. No written form of the dialect exists. Although there are similarities, Modern Standard Arabic and Vernacular Arabic differ in the domains of vocabulary, morphology, phonology etc. Modern Standard Arabic is used in formal contexts and children learn it at school. Thus, neither parents nor children had access to the written form and could only use the colloquial Arabic in Hatay unless they received private instruction. The following table illustrates the demographic profile of the participants in the study:

Table 1. Participant Demographics

Language	Gender / N (%)		Age (year) X	SD
Bilingual	Male	40 (40%)	7.87	.463
	Female	60 (60%)		
	Total	100		
Monolingual	Male	14 (37%)	7,76	.430
	Female	24 (63 %)		
	Total	38		

3.3. Hypotheses

The hypotheses in relation to the research questions of the study are explained as follows:

1. *Is there a significant difference between Turkish-Arabic simultaneous bilingual and Turkish monolingual children in PA, PM, RAN, MA, MATT, PS, VK, WRead and Rcomp performance?*

It was hypothesized that the main differences between monolingual and bilingual children would be in PA, PS and VK. Since the positive effect of bilingualism on PA (Bialystok, 2001a, 2001b; Durgunoğlu, 2002) and PS (Kroll & Bialystok, 2013) was established in previous studies, it was predicted that bilingual children would have a better performance than monolingual children in PA and PS measurements.

On the other hand, it was expected that the number of words known by the bilingual children would be less than their monolingual peers (Bialystok et al. 2010;

Oller, Pearson, Cobo-Lewis, 2007). Yet, the difference between the two groups in VK would not be significant since the bilingual children were exposed to both languages simultaneously and had sufficient language exposure.It was also predicted that there would be no significant differences in the other variables.

2. *How do the variables; PA, PM, RAN, MA, MATT, PS and VK explain variance in word reading fluency (WRead) in Turkish-Arabic simultaneous bilingual and Turkish monolingual children?*

It was hypothesized that PA would not have a significant contribution to word reading fluency in bilingual children, yet a small amount of contribution of PA was expected in monolingual children. In transparent languages like Turkish, the consistency between the phonemes and graphemes facilitates the development of accuracy and PA skills (Durgunoğlu & Öney, 1999). The performance of children in PA tasks reaches to a ceiling level by the end of the first grade in such languages (Babayigit & Stainthorp, 2007; Verhagen et al., 2008; Wimmer & Mayringer, 2002). Therefore, reading fluency becomes a better predictor of reading than accuracy (Wimmer et al., 1991). Moreover, as Bialystok (2001) mentioned phonological awareness develops faster in simultaneous bilingual children than monolingual children. Therefore, their reliance on PA will be less than monolingual children in Wread.

Additionally, PM would have an insignificant effect on WRead in monolingual and bilingual children, since PM predicts word decoding but not fluency (Arabic: Abu-Rabia et al., 2003; Asadi et al., 2017; Hebrew: Shatil & Share, 2003). According to Dufva and colleagues (2001) when PA and PM are assessed together, there is no room left for PM to explain more variance.

On the other hand, RAN, MATT and PS would have significant effects on WRead in both groups. Babayiğit and Stainthorp (2011), Özata (2018) and Sönmez (2015) reported that RAN was the best predictor of reading fluency in Turkish after the first grade. MA tasks was not expected to be influential in reading fluency tasks. MATT, the time children spent on the MA tasks, was also predicted to be a powerful precursor of Wread.

Finally, no effect of VK on Wread was expected due to the task type. As the VK task requires object naming and no activation of orthographic representations takes place, it would not be influential in word reading.

3. *How do the variables; PA, PM, RAN, MA, MATT, PS, VK and Wread explain variance in reading comprehension (Rcomp) in Turkish-Arabic bilingual and Turkish monolingual children?*

It was hypothesized that the contribution of Wread, MA and VK would be strongest in Rcomp in both language groups. The main differences between the two groups might be observed in the predictive role of VK. As VK is known as a weakness of bilingual children, it might be influential in explaining Rcomp.

3.4. Procedure

The tests were administered in quiet classrooms at the selected schools in April 2017. The data were collected during school hours. Exceptionally, some parents volunteered to wait for their children at school until the tests are completed after the school hours.

One dataset included PA, PM, RAN, MA, PS, VK, WRead and Rcomp tests. The implementation of all tests to a single student took 1-1.5 hours depending on the pace of the participant by giving breaks when necessary. The tests were given in a random order to each participant to avoid fatigue effects.

The same test instructions were given to all participants and the researcher applied the tests to one participant at a time. The responses, scores and test durations of each student were recorded.

3.5. Data Collection Instruments

In order to determine the predictors and correlates of reading in Turkish by Turkish-Arabic simultaneous children and Turkish monolingual children, the following tests were implemented. The tests in this study were developed considering the characteristics of Turkish language.

3.5.1. PA Tasks

In order to measure the phonological awareness levels of the students, Turkish Comprehensive Test of Phonological Processing (*KFFT*: Kapsamlı Fonolojik Farkındalık Testi, Babür, Haznedar, Erçetin, Özerman & Erdat, 2013[1]) was used.

Phonological awareness skills are measured through two core tests: elision and blending words. Supplemental subtests for phonological awareness are blending non-words, segmenting non-words, phoneme reversal and segmenting words. All core and supplemental subtests of phonological awareness were given to the participants in the current study.

In all subtests of KFFT, when the participant makes three errors in a row, the researcher stops the current subtest and continues with the next subtest. In the initial

[1] KFFT was developed as part of the *Development of Turkish Reading Achievement Tests for the Identification of Developmental Dyslexia among Turkish Children* Project (Bogazici University Scientific Research Foundation; Project Number 05D101)

questions, the examiner can provide feedback. Additionally, before each section, there are practice items to make sure that the examinee has understood the test instructions. Each correct answer is scored as “1”, wrong answer is scored as “0”. The total score of each subtest is recorded. The implementation method of KFFT subtests are as follows:

Elision (ses atma): In this 17-item subtest, participants are expected to eliminate one phoneme in the words given. The length of words ranges from 3 to 6 phonemes. At the beginning, initial and final phonemes are removed, later on participants are expected to remove the phonemes in the middle of the words. (e.g. The word is “elma” [apple]. Now say “elma”. This time say it without /m/. What is left? The correct answer is “ela”[hazel].) In this task, after the removal of the given phoneme, the remaining part becomes a different meaningful word in Turkish.

Blending Words (sesleri birleştirme): In the initial items, syllables and in the following items, phonemes are synthesized to generate words. This subtest has 20 items. (e.g. The participant listens to two syllables such as “el-ma” or the phonemes /e//l//m//a/. Then, what is heard is combined. The correct answer is “elma” [apple]). *Phoneme Reversal (sesleri tersine çevirme):* The participant listens to a word which has no meaning. Then, the experimenter asks them to reverse it. When the word is reversed the word becomes meaningful. In this 18-item subtest, the participant has 10 seconds to give an answer. (e.g. Say “amle”. “Amle” has no meaning. What is the word you get when you reverse it? The correct answer is “elma” [apple]).*Blending Nonwords (anlamsız sesleri birleştirme):* The participant listens to the syllables or phonemes of pseudowords. Then, they are asked to synthesize these syllables and phonemes. This subtest has 18 items. (e.g. Listen to the syllables “em-la” or the phonemes /e//m//l//a/. Now, combine the sounds you heard. The correct answer is “emla”.*Segmenting Words (ses ayırma):* In this subtest, the examinee listens to meaningful words and segments them into phonemes. The length of the words ranges from two to eight phonemes. This subtest has 20 items. (e.g. Repeat the word “elma” [apple] after me. Now, say each sound you heard in order. The correct answer is /e//l//m//a/ - 4 phonemes.) *Segmenting Nonwords (anlamsız sözcükleri/sesleri ayırma):* The participant listens to unmeaningful words and segments them into phonemes. The length of words ranges from two to eight phonemes. This subtest has 20 items. (e.g. Repeat the unmeaningful word “emla”. Now, say each sound you heard in order. The correct answer is /e//m//l//a/ - 4 phonemes)

3.5.2. PM Tasks

Phonological memory tests include two core subtests: memory for digits and non-word repetition. The implementation methods of PM tasks are as follows:

Memory for Digits (sayı tekrarı): Digit span test has two subtests: forward and backward. In the forward digit span test, the examinee is given a set of numbers in increasing length through items. In each item, there are two trials. Then the numbers are repeated by the test taker in the same order. If they commit two errors in the same trials of an item, the test is recorded as the ceiling level. Each correct trial item is scored as 1 point. In the backward span test, the numbers are repeated in a reversed order. (e.g. Listen to the numbers "6-5-3". Repeat the numbers you heard in order. The correct answer for the forward digit span test is "6-5-3" and for the backward digit span test is "3-5-6"). *Non-word Repetition (anlamsız ses tekrarı)*: In this 18-item subtest of phonological processing, a nonexistent word is repeated by the participant after it is heard. The length of words increases from 3 to 15 phonemes. (e.g. Listen to the unmeaningful word "alme". Now, repeat what you heard.)

3.5.3. Rapid Automatized Naming Tasks (RAN)

Turkish Test of Rapid Automatized Naming (*HOTIT*: Hızlı Otomatik İsimlendirme Testi, Bakır & Babür, 2009, 2018) was employed in this study. In rapid naming tests, alphanumeric (letters, numbers) or non-alphanumeric (colours, objects) stimuli are presented in five lines; in each line there are ten items. Each subtest of HOTIT includes five stimuli, and they are presented in different order in each presentation.

In all subtests of HOTIT, the participant names the items in all lines from left to right as quickly as possible. The experimenter records the amount of time spent during naming, the number of wrong answers and corrections. The time spent for naming is recorded as the score of the participant. There is an inverse proportion between the test duration and the score.

For the 2nd graders, alpha-numeric subtests were employed as letters and digits are better predictors of reading after literacy instruction begins (Wolf, 1984). Before each test implementation, the same instructions were given and practice test items were presented. The tester started a stopwatch as the child started naming the letters/digits and stopped it as they finished. The child was expected to name each stimulus one by one until the end of the test and was not allowed to stop or ask questions once the stopwatch started.

3.5.4. Morphosyntactic Awareness Tasks (MA)

Three tests were employed in this study to measure the morphosyntactic awareness skills of the participants. The first test was the adapted version of Woodcock-Johnson morphological awareness test (Haznedar, Babür & Ercetin, 2015). It was composed of 30 sentences, the children were asked to read the sentences and mark them as grammatically correct or incorrect. The tests included violations in the use of inflectional and derivational morphemes. Before the implementation, the participants read the practice items aloud to make sure that they comprehended the instructions or do not have any decoding problems. They read the test items silently, judged the accuracy of the sentence while the experimenter kept time. The experimenter started the stopwatch as the child started reading the sentences and stopped it as they finished. The number of correct judgements was noted as the MA score of the test taker. The duration of the test was also recorded (*MATT*; Morphological Awareness Test Time).

The second test measured the awareness about the inflectional morphology in Turkish and its reflections in the sentence level (Kuzucu Örge, 2018). Since Turkish is a morphologically rich language, morphological awareness is of vital importance in text comprehension (Durgunoğlu, 2017). This test has 26 items and it has the same implementation as the first morphosyntactic awareness task. Unlike the forementioned tests, the awareness in derivational morphology was measured through a multiple choice test (Kuzucu Örge, 2018); the participants chose one of the two options. They read the given situations in which non-words were used as the verbs or nouns and they selected the derivationally correct answer to the questions (e.g. *Ayşe makal yemeyi çok seviyor. Makal pişiren kişiye ne denir? a. Makalcı b. Makalsız* Ayşe loves eating makal [non-word]. What do you call the person who cooks makal? a.Makal + der. mor-occupation. b. Makal + der.mor.-without / correct answer is a). The derivational test included ten questions and just as the other two morphosyntactic awareness tests, this test was timed and the items were read silently.

3.5.5. Processing Speed (PS) Task

In order to measure the speed processing, the adapted version of Woodcock-Johnson processing speed test (Haznedar, Babür, & Erçetin, 2015) was employed. This test had 40 items and the participant was expected to match two similar or related images among seven objects as fast as possible. The experimenter started a stopwatch as the participant began matching the objects and she stopped it as they finished. The number of correct matches in 3 minutes was the score of the test taker. Before the implementation of the test, the examinee gets accustomed to the test through the practice items. Processing speed test was conducted individually.

3.5.6. Vocabulary Knowledge (VK) Task

Adapted version of Woodcock-Johnson vocabulary test (Erçetin, Babür & Haznedar, 2015) was utilized for expressive vocabulary. This task was untimed. The experimenter showed images to the participant and asked what they were called. There were 44 coloured images with increasing difficulty. When the participant comitted six errors in a row, the final correct answer was regarded as the ceiling score and the test was stopped. Also, if the child could not answer six questions correctly within their grade range, more images were shown to find the base level.

3.5.7. Word Reading Tasks

In the current study, Turkish Test of Word Reading Efficiency (*KOBIT*; Babür et al., 2013) was employed. KOBIT was developed with the aim of monitoring and assessing word reading development of primary school children. The test can be applied to individuls within 6-11 age range. It involves two lists of subtests: word reading and non-word reading, both of which were designed in parallel to the morphological and phonological features of Turkish. The items in the lists increase in length and difficulty. Real word list has 104, non-word list has 63 items. The meaningful word list does not require phonetic coding; instead, it measures an automatic reading process. On the other hand, non-word reading list requires the examinee to decode non existent words phonetically.

Both subtests of KOBIT, word reading which measures sight word efficiency and non-word reading which measures phonemic decoding efficiency, have the same implementation procedure. The participants took the tests individually, they were expected to decode the items aloud in the given word list in 60 seconds. Before the administration of the test, practice items and the instructions were presented. The number of correctly decoded words in 60 seconds was noted as the score of the test taker.

3.5.8. Text Comprehension (Rcomp)

In order to assess reading comprehension, Boğaziçi Test of Reading Comprehension (Erçetin, Babür & Haznedar, 2015) was given. In this test, the students read texts with increasing length and difficulty and answered the comprehension questions. While they read the texts silently, their answers were given aloud. Similar to the vocabulary test, the last correct answer before six consecutive wrong answers was the ceiling level of the student. If the student could not give six answers correctly, the experimenter presented more items to find the base level. This test was untimed and implemented individually. The following chart illustrates the tasks employed in the current study:

Skills Assessed (Test)	Measures
PA (KFFT)	• Elision • Phoneme Reversal • Blending Nonwords • Segmenting Words • Segmenting Nonwords
PM (KFFT)	• Nonword Repetition • Memory for Digits (Forward/Backward)
RAN (HOTIT)	• Letters • Digits
MA	• Inflection • Derivation • Inflection + Derivation
PS	• Object Matching
VK	• Expressive Vocabulary
WREAD (KOBIT)	• Real Word Reading Fluency • Pseudoword Reading Fluency
RCOMP	• Text Reading Comprehension

Figure 2. Tasks employed in the study

3.6. Statistical Analysis

The quantitative data of PA, PM, RAN, MA, MATT, PS, VK, WREAD, RCOMP tests were analyzed by using SPSS (Statistical Package for Social Sciences) for Windows 22.0. So as not to miss out noteworthy relationships, a more liberal alpha value .10 was adopted in all statistical tests (Babür, 2003). Although the data were collected from 138 children, 11 of them were unable to complete all tasks. After the exclusion of these children, the number of participants decreased to 127 (92 bilingual, 35 monolingual).

Preliminary analyses were conducted in order to check the assumptions in the data set (N=127). Kolmogorov Smirnov test was utilized for the normality check. The results indicated that PM, RAN, MA, MATT, VK were not normally distributed, while PA, PS, Real Wread and Pseudo Wread were normal. Therefore, in order to obtain robust findings, Independent samples t-tests with bootstrapping function were employed. In bootstrapping, the sample data in the study are treated as a population. From the population thousands of smaller samples are drawn and their sampling distribution, standard deviation and standard error are estimated. Confidence interval and significance are determined from the standard error (Field, 2009). Through employing thousands of bootstrapped samples, the accuracy of CI is improved. Put differently, this function allows the researchers to eliminate the potential risk of low statistical power and Type II error which might occur due to small sample size. Moreover, compared to its parametric equivalents, bootstrapping allows for accurate and powerful estimation when the data are not normally distributed (LaFlair, Egbert, & Plonsky, 2015).

Additionally, Pearson r analysis was conducted separately for monolingual and bilingual participants to show correlations among predictors. Stepwise regression analyses were conducted to find out the contributions of each variable to word reading and reading comprehension. In the stepwise method, the program searches for the best variables which best predict the dependent variable by removing the least useful predictor from the analysis. For the regression analyses, the assumptions; *autocorrelation* - the existence of correlation between the adjacent residuals (Durbin-Watson), *multicollinearity* – examining whether two or more predictors are correlated too highly (Tolerance and VIF values), *outliers* (Mahalonobis' Distance), *the undue influence of cases on models* (Cook's Distance), *normality, linearity* and *homoscedasticity* (residual and scatter plots) were checked and the assumptions were all satisfied.

CHAPTER 4

RESULTS

This chapter consists of the descriptive analysis of the data, interrelations among the variables, comparison of the test scores in monolingual and bilingual participants and regression analyses.

Descriptive statistics for monolingual and bilingual participants are presented in the table below. The table includes information on the language groups, number of participants (n), standard deviation (SD), minimum, maximum and mean scores (M) of each group.

Table 2. Descriptive Statistics for Monolingual and Bilingual Participants

	Monolingual (n=35)				Bilingual (n=92)			
Tasks	Min	Max	M	SD	Min	Max	M	SD
PA (composite)	19	100	58.37	23.60	22	114	74.52	20.89
PM (composite)	17	33	23.51	3,61	17	34	24.78	3.55
RAN (composite)	41.4	86.6	62.09	8,89	40,90	98	60.43	11.83
MA (composite)	33	60	48.51	7,4	32	223	50.90	19.56
MATT (composite)	361	1038	655.94	205.13	318	2015	672.18	250.07
PS	13	33	20.94	4.48	15	39	23.01	4.19
VK	15	25	19.91	2.62	11	30	19.96	3.02
Real Wread	17	85	42.74	14.04	10	67	40.32	13.53
Pseudo Wread	10	47	26.17	7.91	2	45	24.60	7.56
WRead-Composite	27	129	68.91	20.02	12	108	64.91	20.05
Rcomp	15	25	20.74	2.07	14	29	20.98	2.96

Note. PA= Phonological Awareness (Composite), PM= Phonological Memory (Composite), RAN= Rapid Automatized Naming (Composite), MA= Morphological Awareness (Composite), MATT= Morphological Awareness Test Time (Composite), PS= Processing Speed, VK= Vocabulary Knowledge, Real Wread= Real Word Reading Fluency, Pseudo Wread= Pseudoword Reading Fluency, WRead- composite= Word Reading Fluency (Composite), Rcomp= Reading Comprehension

Table 2. shows the scores in PS, Real Wread, Pseudo Wread, Rcomp and composite scores for PA, PM, RAN, MA, MATT and WRead. The composite scores

were calculated by adding up the scores in the subtests. For instance, RAN consists of two subtests; letters and digits. The sum of the scores in the two subtests composed the RAN composite score.

4.1. Presentation of the Research Findings

In this section, the findings with respect to each research question will be presented:

Research Question 1: Is there a significant difference between Turkish-Arabic simultaneous bilingual and Turkish monolingual children in PA, PM, RAN, MA, MATT, PS, VK, WRead and Rcomp performance?

The descriptive statistics above showed the differences between monolingual and bilingual participants. In order to explore whether the differences in the mean scores were statistically significant, Independent Samples t-tests with bootstrapping function were run. As mentioned earlier, bootstrapping method is used when the independent variables are not normally distributed and the sample size is small. Since only PA, PS, Real Wread and Pseudo WRead were normally distributed and other independent variables were skewed, simple bootstrapping was employed for resampling the data multiple times (bootstrap results are based on 1000 bootstrap samples). The following table (Table.3) summarizes Independent Samples t-test results.

Table 3. Independent Samples T-Test Results

					Bootstrap		BCs 95% CI	
		x̅	*t*	*df*	SE	p	lower	upper
PA	M	58.3	-3.754	125	4.6	.00	-25.5	-.61
	B	74.5						
PM	M	23.5	-1.792	125	.70	.07	-2.5	.14
	B	24.7						
RAN	M	62	.854	81.4	1.9	.38	-1.7	5.3
	B	60.4						
MA	M	48.5	-.702	125	2.42	.40	-8.2	1.8
	B	50.9						
MATT	M	655.9	-.343	125	42.3	.69	-101	63
	B	672.1						
PS	M	20.9	-2.438	125	.86	.02	-3.7	-3.4
	B	23						
VK	M	19.9	-.073	125	.50	.93	-1.0	1.1
	B	19.9						
WREAD	M	68.9	1.005	125	3.89	.31	-3.6	12.3
	B	64.9						
RCOMP	M	20.7	-.451	125	.47	.59	-1.1	.75
	B	20.9						

Note: M: monolingual, B: bilingual

The results of Independent Samples t-test with bootstrapping indicated that the bilingual children (*M=75, SE=2.17*) performed better than monolingual children (*M=58, SE=4*) in PA. The difference between the two groups, -16.15, bias correlated and accelerated (BCa) 95% confidence interval (CI) [-26, -6.2] was significant $t(125)=-3.754$, $p<.01$.

With regards to PM, the bilingual group (*M=25, SE=0.37*) was more successful than the monolingual children (*M=24, SE=0.6*). However, the mean difference between them, -1.27, BCa 95% CI [-2.53, -.019] was not statistically significant $t(125)= -1.8$, $p>.05$.

According to the mean comparison in RAN, the bilingual children (*M=60, SE=1.2*) did not achieve better results than the monolingual children (*M=62, SE=1.5*). Because, the mean difference between the two groups, 1.66, BCa 95% CI [-1.99, 5.35] was insignificant $t(81)=.854$, $p>.05$.

In MA, the bilingual children (*M=51, SE=2.04*) and bilingual children (*M=49, SE=1.25*) obtained similar results. The mean difference between the two language groups, -2.39, BCa 95% CI [-8.9, 2.2] was not meaningful $t(125)=-.702$, $p > .05$.

The performance of bilingual children (*M=672, SE=26*) and monolingual children (*M=656, SE=35*) in MATT was comparable. The difference between their means, -16.24, BCa 95% CI [-102, 63] was not statistically significant $t(125)=-.343$, $p>.05$.

When mean scores of the bilingual (*M=23, SE=0.44*) and monolingual (*M=21, SE=.76*) children were compared in PS, the mean difference between the two groups, -2.07, BCa 95% [-3.8, -.326] was significant $t(125)=-2.44$, $p<.05$.

The bilingual children (*M=19.95, SE=0.32*) were slightly better than the monolingual children (*M=19.91, SE=0.44*) in VK. However, the difference, -.042, BCa 95% [-1.09, .95] was not statistically meaningful $t(125)=-.073$, $p>.05$.

WRead performance of the bilingual children (*M=65, SE=2.1*) and monolingual children (*M=69, SE=3.4*) was not statistically significant $t(125)=1.0$, $p<.05$. Their mean difference was 4.0, BCa 95% [-3.92, 12,4]. The results were also insignificant in Real Wread and Pseudo Wread.

The t-test results for Rcomp showed that the mean score of bilingual children (*M=21, SE=0.31*) was higher than monolingual children (*M=21, SE=0.35*), the mean difference, -.25, BCa 95% [-1.17, 0.76] was not significant $t(125)=-.45$, $p>.05$.

To recapitulate, although differences were noticed in the raw scores, the Independent Samples t-test with bootstrapping revealed that Turkish-Arabic simultaneous bilingual children significantly outperformed Turkish monolingual children in PA and PS. The differences in the other tests (PM, RAN, MA, VK, MATT, Real Wread, Pseudo WRead and Rcomp) were not significant.

Research Question 2: How do the variables PA, PM, RAN, MA, MATT, PS and VK explain variance in word reading efficiency (Wread) in Turkish-Arabic simultaneous bilingual and Turkish monolingual children?

As the initial step of the regression analysis, Pearson product-correlation coefficients were calculated for each language group in order to demonstrate the interrelations among the independent (PA, PM, RAN, MA, MATT, PS, VK) and dependent variables (Real Wread, Pseudo Wread, Rcomp). Table 4 represents the correlation matrixes for bilingual participants and Table 5 represents the correlation matrixes for monolingual participants:

Table 4. Correlation Matrix of the Variables – Bilingual Participants (n=92)

	1	2	3	4	5	6	7	8	9
1. PA (Composite)	-								
2. PM (Composite)	.541**	-							
3. RAN (Composite)	-.348**	-.160	-						
4. MA (Composite)	.215*	.185	-.145	-					
5. MATT (Composite)	-.371**	-.183	.491**	-.004	-				
6. PS	.214*	.142	-.385**	.021	-.353**	-			
7. VK	.239*	.283**	-.131	.148	-.277**	.345**	-		
8. Wread (Composite)	.261*	.187	-.558**	.104	-.657**	.380**	.295**	-	
9. Rcomp	.390**	.383**	-.388**	.263*	-.334**	.410**	.481**	.515**	-

Note.* p <.05, ** p <.01

PA= Phonological Awareness (Composite), PM= Phonological Memory (Composite), RAN= Rapid Automatized Naming (Composite), MA= Morphological Awareness (Composite), MATT= Morphological Awareness Test Time (Composite), PS= Processing Speed, VK= Vocabulary Knowledge, Wread (Composite)= Word Reading Fluency (Composite), Rcomp= Reading Comprehension

The correlation matrix of varibles for the bilingual children showed interrelations among variables. Yet, not all of the variables were correlated with one another. The strongest correlations were observed in MATT and Wread *(r= -.66, p<.01)* which was followed by the relationship between RAN and Wread *(r= -.56, p<.01)*. Noteworthy, Wread and PA were only moderately correlated *(r= .26, p<.01)*. The strongest correlates of Rcomp were Wread and VK *(r= .51, p<.01; r= .48, p<.01* respectively*)*.

The following table shows the interrelations among the variables for monolingual participants:

Table 5. Correlation Matrix of Interrelations Among Variables – Monolingual Participants (n=35)

	1	2	3	4	5	6	7	8	9
1. PA (Composite)	-								
2. PM (Composite)	,714**	-							
3 RAN (Composite)	-,404*	-,288	-						
4. MA (Composite)	,588**	,545**	-,011	-					
5. MATT (Composite)	-,341*	-,281	,367*	-,326	-				
6. PS	,592**	,420*	-,298	,516**	-,297	-			
7. VK	,055	,182	,257	,162	-,053	,077	-		
8. Wread (Composite)	,538**	,493**	-,426*	,496**	-,668**	,340*	,088	-	
9. Rcomp	,363*	,375*	-,092	,520**	-,348*	,339*	,147	,374*	-

Note.* p <.05, ** p <.01
PA= Phonological Awareness (Composite), PM= Phonological Memory (Composite), RAN= Rapid Automatized Naming (Composite), MA= Morphological Awareness (Composite), MATT= Morphological Awareness Test Time (Composite), PS= Processing Speed, VK= Vocabulary Knowledge, Wread (Composite)= Word Reading Fluency (Composite), Rcomp= Reading Comprehension

The strongest correlations among variables in monolingual children were observed in PA and PM *(r= .71, p<.01)* which were followed by the relationship between Wread and MATT *(r= -.67, p<.01).*Wread was also strongly correlated with PA *(r= .54, p<.01).* The strongest correlate of Rcomp was MA *(r= .52, p<.0)*

The correlation analysis for both monolingual and bilingual participants showed that there was a powerful relationship among the fluency measures. That is MATT was the strongest correlate of Wread both in monolingual and bilingual participants. Strikingly, phonological measures were still among the strongest associates of word reading in monolingual children.

While MA was the strongest correlate of Rcomp in monolingual children, Wread and VK were the strongly correlated with Rcomp in bilingual children.

Although correlation analysis provides an overall picture about the potential roles of the variables in Wread and Rcomp, it is not sufficient to explain the contributions of each construct to the dependent variables.

In order to examine the influence of the independent variables on Wread, stepwise regression analyses were utilized. For the regression analyses, the criterion level was selected as .10. The tables include unstandardized regression coefficients (*B*), standardized regression coefficients (β), squared semi-partial correlations, *t* value and significance level for each unstandardized coefficient. Also R value, R Square and R Square-Adjusted values for each model are presented. Each analysis was conducted separately for bilingual and monolingual participants.

The following table summarized the regression analysis for WRead in bilingual participants:

Table 6. Summary of Stepwise Regression Analysis for Variables predicting Word Reading in Turkish for Bilinguals (n=92)

Dependent Variable	Independent Variable	*B*	*β*	Squared Semi-Partial Correlation	*t-value*	*p*
Step 1						
WRead	MATT	-.053	-.66	.43	-.8.3	.00*
Note. R=.657, R^2= .431, R^2 adj= .425, F(1, 90)= 68.257, p<.01						
Step 2						
Wread	MATT	-.040	-.505	.194	-5.893	.00*
	RAN	-.525	-.310	.073	-3.621	.00*
Note. R= .710, R^2= .504, R^2 adj= .493, F(2, 89)= 45.275, p<.01						

*Note.**p<.05, **p<.01

Based on the regression analysis, the final model explained 49% of the variance in word reading among bilingual children. MATT and RAN were the only significant predictors in the models. The most correlated variable, MATT [t(89)= -5.893, p< .01, β= -.505], was also the best predictor of word reading. Squared semi partial correlations showed that the unique variance explained by MATT 19%.

RAN [t(89)= -3.621, p< .01, β= -.310] was the second best predictor of Wread in bilingual children. The unique variance explained by RAN was 7%. Other predictors (PA, PM, MA, PS and VK) in the study were excluded from the models since they did not have significant contributions.

The following table summarized the regression analysis for WRead in monolingual participants:

Table 7. Summary of Stepwise Regression Analysis for Variables predicting Word Reading in Turkish for Monolinguals (n=35)

Dependent Variable	Independent Variable	*B*	*β*	Squared Semi-Partial Correlation	*t-value*	*P*
Step 1						
WRead	MATT	-.065	-.668	0.45	-.5.163	.00*
Note. R=.668, R^2= .447, R^2 adj= .43, F(1, 33)= 26.652, p<.01						
Step 2						
Wread	MATT	-.056	-.549	0.27	-4.379	.00*
	PA	.297	.351	0.11	2.796	.01*
Note. R= .745, R^2= .555, R^2 adj= .528, F(2, 32)= 19.989, p<.01						

*Note.**p<.05, **p<.01

The regression analyses revealed that, MATT [t (32) =-4.379, p< .01, β= -.549] was the best predictor of word reading in Turkish monolingual children. In the last model MATT explained 27% of unique variance. PA was also a significant predictor in Wread among the monolingual children [t (32) =2.796, p< .01, β= .351]. It explained 11% of unique variance. Other predictors (PM, RAN, MA, PS and VK) in the study were excluded from the models since they did not have significant contributions.

The regression analyses revealed two different patterns for the two language groups. While word reading was supported by MATT and RAN in 2nd Grade Turkish-Arabic simultaneous bilingual children, monolingual word reading was supported by MATT and PA.

Research Question 3: How do these variables (2a-2h) explain variance in reading comprehension in Turkish-Arabic simultaneous bilingual and Turkish monolingual children?

In order to examine the contributions of the constructs on reading comprehension, stepwise regression analyses were conducted. The influences of the independent variable on Rcomp were investigated in monolingual and bilingual groups separately. The following regression analyses tables include unstandardized regression coefficients (*B*), standardized regression coefficients (β), squared semi-partial correlations, *t* value, and significance level for each unstandardized coefficient. Also R value, R Square and R Square-Adjusted values for each model are presented. The following table summarized the regression analysis for Rcomp in bilingual participants:

Table 8. Summary of Stepwise Regression Analysis for Variables predicting Reading Comprehension in Turkish for Bilinguals (n=92)

Dependent Variable	Independent Variable	*B*	β	Squared Semi-Partial Correlation	*t-value*	*p*
Step 1						
RComp	WRead	.076	.515	0.27	5.696	.00*
Note. R=.515, R^2= .265, R^2 adj= .257, F(1, 90)= 32.439, p<.01						
Step 2						
RComp	WRead	.060	.409	0.15	4.692	.00*
	VK	.353	.360	0.12	4.139	.00*
Note. R= .619, R^2= .384, R^2 adj= .370, F(2, 89)= 27.694, p<.01						
Step 3						
RComp	WRead	.057	.383	0.13	4.517	.00*
	VK	.298	.304	0.08	3.504	.00*
	PM	.118	.226	0.05	2.671	.01*
Note. R= .656, R^2= .430, R^2 adj= .410, F(3, 88)= 22.114, p<.01						

*Note.**p<.05, **p<.01

The final model which included three variables in the study explained 41% of variance in reading comprehension. The strongest predictor of reading comprehension in bilingual groups was WRead [t(88)= 4.517, p< .01, β= .38]. It was followed by VK [t(88)=3.504, p< .01, β=.304] and PM [t(88)= 2.671, p< .01, β= .23]. WRead explained 13% of unique variance in the final step where VK and PM were included in the analysis. The amount of unique variance VK explained was 8% while PM explained 5% of unique variance. Other predictors (PA, RAN, MA, MATT and PS) in the study were excluded from the models since they did not have significant contributions.

The following table summarized the regression analysis for Rcomp in monolingual participants:

Table 9. Summary of Stepwise Regression Analysis for Variables predicting Reading Comprehension in Turkish for Monolinguals (n=35)

Dependent Variable	Independent Variable	*B*	*β*	Squared Semi-Partial Correlation	*t-value*	*p*
Step 1						
RComp	MA	.15	.520	0.27	3.496	.00*
Note. R=.520, R^2= .270, R^2 adj= .248, F(1, 33)= 12.225, p<.01						

*Note.**p<.05, **p<.01

According to the analysis, only MA [t(33)=3.496, p< .01, β=.520] significantly explained RComp in monolingual children. The unique variance it explained was 27%. . Other predictors (PA, RAN, MATT, PS, VK and WRead) in the study were excluded from the analysis since they did not have significant contributions.

To summarize, RComp was predicted by different variables in the monolingual and bilingual children. In the bilingual group, reading comprehension was significantly explained by WRead, VK and PM. On the other hand, in the monolingual group, the only significant independent variable was MA.

CHAPTER 5

DISCUSSION AND CONCLUSION

The current research focused on the role of PA, PM, RAN, MA, MATT, PS and VK on Turkish word reading efficiency and reading comprehension in normally developing Turkish monolingual and Turkish-Arabic simultaneous bilingual 2nd grade children. The associations among the predictors and their influences on reading achievement were examined. Moreover, developmental trajectories of monolingual and bilingual children in reading were compared. The cross-sectional data were statistically analyzed through correlation, mean comparison and regression analyses. Correspondingly, this chapter provides a discussion on the findings of the current study with a reference to the previous literature. It consists of two main parts; findings on word reading and reading comprehension.

5.1. Turkish Word Reading in Monolingual and Bilingual Children

In the present study, Turkish word reading efficiency was measured through two tests: sight word reading (real word reading) and non-word reading. Sight word reading test measured an automatic reading process while non-word reading required phonetic decoding.

The results showed that the number of correctly decoded words was higher in sight word reading test compare to the non-word reading test in both groups. When the performance of monolingual and bilingual children was compared in sight word reading (Real Wread) and non-word reading (Pseudo Wread), it was observed that monolingual children surpassed bilingual children in Real Wread (M=42.74 vs. M=40.32) and Pseudo Wread (M=26.17 vs. M=24.60). However, the difference between the two groups was not statistically significant. That is, Turkish-Arabic simultaneous bilingual children were similar to monolingual children in Turkish word reading. According to the stepwise regression analyses, MATT and RAN explained 49.3% of total variance in word reading in the bilingual group, while MATT and PA explained 52.8% of variance in the monolingual children.

5.2. Turkish Reading Comprehension in Monolingual and Bilingual Children

The bilingual and monolingual children performed similarly in the reading comprehension test. Reading comprehension scores of bilingual children were moderately correlated with word reading (r=.52) and vocabulary knowledge (r=.48). On the other hand, the strongest correlates of reading comprehension in the monolingual groups were morphological awareness (r=.52), PM (r=.38) and word reading (r=.37). Based on the stepwise regression analyses, the independent variables WRead, VK and PM explained 41% of total variance in reading comprehension in the bilingual group. On the other hand, MA explained 25% of total variance in the monolingual group. These results indicate different strategies that bilingual and monolingual children employ in the comprehension of texts. Accordingly, the following subsections include the influence of the independent variables on word reading fluency and reading comprehension in both groups.

5.3. The Influence of PA on Word-Reading Efficiency and Reading Comprehension

As an index of word reading accuracy, PA tasks assessed children’s ability to recognize and manipulate sound based information. In the current study, PA skills were measured through six subtests: elision, real word blending, nonword blending, phoneme reversal, word segmenting and nonword segmenting. The results showed that bilingual children surpassed monolingual children in PA tasks.

According to the the correlation analysis, PA was weakly correlated with word reading (r=.26) in bilingual children. On the other hand, in the monolingual group there was a stronger correlation between PA and word reading (r=.54). In the same vein, regression analyses revealed that PA did not have a significant contribution to Turkish word reading fluency in 2nd grade Turkish-Arabic simultaneous bilingual children. However, in the monolingual group PA significantly contributed to word reading. It explained 11% of unique variance in reading fluency. In line with the studies reporting the long-standing effect of PA on word reading (Güldenoğlu et al., 2016, Hoien et al., 1995, Torgesen et al., 1997; Wagner et al., 1994, 1997), the current study manifested that the facilitative effect of PA on word reading was evident in the monolingual group. However, such an effect was not observed in the bilingual group. These results are consistent with the hypotheses. As Bialystok (2001a, b) pointed out, simultaneous bilingualism fosters PA development since constant exposure to two phonological systems concurrently refines their sensitivity to verbal sounds. The performance of children in PA tasks reaches to a ceiling level in a shorter period and other variables such as RAN become better predictors of word reading efficiency.

These findings further revealed that in the 2nd grade, word reading of Turkish-Arabic bilingual children moves beyond the phonological stages which were mentioned in the stage and phase theories of reading development (Ehri, 1995; Frith, 1985). As Gillon (2007) discussed, PA development is a prerequisite to reach to the orthographic level in these theories. Based on the analyses of the current data, children come to this level with relative ease and PA ceases to be a significant indicator of reading as early as the 2nd year. Apart from dealing with the phonological sytem of two languages, the straightforward correspondence between phonemes and graphemes in Turkish stimulates the development of PA skills. The facilitating role of transparent orthographic system was evidenced in previous research as well (Turkish-Babayiğit & Stainthorp, 2007, Bektaş, 2017; Özata, 2018; Dutch-deJong & van der Leij, 1999; Turkish, English-Durgunoğlu & Öney, 1999; German, English- Mann & Wimmer, 2002; Finnish-Müller & Brady, 2001).

The influence of PA on RComp was investigated in both groups. However, the results showed that there was not a significant influence of PA skills on RComp. The results are similar to Erdoğan (2012)'s research on 1st grade Turkish children. In her investigation, PA skills did not predict RComp skills from the beginning of literacy instruction. Yet, Güldenoğlu and colleagues (2016) obtained conflicting results. The participants who had good PA skills performed better in reading fluency and reading comprehension in their study. In the present research, accurate decoding did not guarantee better performance in reading comprehension in any groups.

5.4. The Influence of PM on Word Reading Efficiency and Reading Comprehension

PM skills were measured through forward and backward digit span and non-word repetition tasks in both groups. The findings revealed that the difference between bilingual children monolinguals in PM assessments was insignificant.

Compatible with the predictions, the results of the stepwise regression analyses showed that PM did not influence word reading in either group. Unlike Nithart and colleagues (2011) and Passenger and colleagues (2000), PM did not supersede PA skills nor PA was a significant predictor of Wread. Moreover, the results of the present study are incompatible with Dufva and colleagues (2001) where

PM had a direct weak effect on word recognition in the 2nd grade and an indirect effect via PA in the 1st grade. Similar to the findings of the present study, some scholars highlighted that PM was not influential in word recognition (Babayiğit and Stainthorp, 2014; Georgiou et al., 2008). Moreover, Asadi and Khateb (2017) mentioned that PM contributed to word decoding but not fluency. The current study focused on reading fluency since word reading accuracy scores of Turkish children reaches to a ceiling level by the end of 1st grade (Durgunoğlu & Öney, 1999), thus, the effect of PM on word reading was not significant. It was also discussed that when tasks which tap onto PA and phonological representations in the same research design, PM becomes redundant (Asadi & Khateb, 2017; Dufva et al., 2001).

While the effect of PM on RComp was insignificant in the monolingual group, it explained 5% of unique variance in the bilingual group. For the bilingual group, these results were partly congruent with previous studies which found an increasing role of PM on RComp (Seigneuric & Ehrlich, 2005) and indirect relationship between PM and RComp (Babayiğit & Stainthorp, 2014; Dufva et al., 2001; Näslund & Schneider, 1991). The present study did not demonstrate an indirect or increasing tinfluence of PM, as its influence was smaller compared to WRead and VK. The indirect influence in these studies was found via listening comprehension. In line with the Simple View of Reading, transparent orthographic systems allow for a rapid development in decoding skills, listening comprehension becomes a better predictor of RComp. Yet, in the current study, listening comprehension skills were not assessed and an indirect effect of PM could not be observed.

5.5. The Influence of RAN on Word Reading Efficiency and Reading Comprehension

RAN tests were employed in order to assess the automaticity of converting orthographic information into phonological output. Previous studies in Turkish consistently found a strong connection between RAN and reading (Babayiğit & Stainthorp, 2011; Bektaş, 2017; Özata, 2018; Sönmez, 2015). Thus, RAN was anticipated to be a strong correlate and indicator of word-level reading in 2nd grade Turkish children. Congruent with the predictions, RAN was strongly correlated with word reading and reading comprehension in the bilingual children. These findings were compatible with previous studies in opaque and transparent languages (Araujo et al., 2015; Georgiou et al., 2008; Norton & Wolf, 2012; Papadopoulos et al. 2016; Tan et al., 2005). Nevertheless, such associations were not as strong in monolinguals. In the monolingual children there was a moderate association between RAN and real/non-word reading. Further, no associations were found between RAN and reading comprehension in monolingual children. The decreasing relationship in monolinguals in the present study might have resulted from the paucity of participants.

The performance of bilingual and monolingual children in the RAN tasks was not significantly different. That is, the speed of naming letters and numbers was similar in both groups. These findings were incompatible with Fleury and Avila (2015) in which bilingual children had better rapid naming, verbal short term memory and accuracy compared to monolinguals. In the present study, although bilingual children had superior VSTM skills, simultaneous bilingualism did not provide an advantage or disadvantage in the pace of processing linguistic input in the naming circuit.

According to the regression analysis, RAN was the second strongest predictor of word reading following MATT in bilingual children. 7.3% of the unique variance in word reading was explained by RAN when both variables were included in the analysis. These findings corroborated with the previous studies in Turkish (Babayiğit & Stainthorp, 2010, 2011; Bektaş, 2017; Özata, 2013, 2018; Sönmez, 2015) that RAN emerges as one of the best predictors of word-level reading fluency once PA, the index of accuracy, becomes redundant. These results indicated that Turkish-Arabic bilingual children moved beyond the phonological stages which were mentioned in the models of Ehri (1995) and Frith (1985). Similar findings were obtained in other languages as well (Bowers & Wolf, 1993; Cutting & Denckla, 2001; Georgiou et al., 2016; Gonzalez-Valenzuela, 2016; Manis et al., 2000; Papadopoulos et al. 2016). Although the results were significant for bilingual children, RAN did not have a predictive role in monolingual children. The diminishing effect of RAN in monolinguals was not expected. These results might have been obtained due to the relatively less number of participants in the monolingual group.

The association between RAN and RComp was moderate in bilingual participants (r=.39) while there was not a significant correlation in monolingual children. According to the regression analyses, RAN did not have a significant influence on RComp in any groups. These findings are incongruent with the Automaticity (LaBerge & Samuels, 1974) and Verbal Efficiency (Perfetti & Lesgold, 1977) models. In these theories, reading fluency allowed for the reduction of the cognitive load and the limited attentional resources could be directed to comprehension skills such as inferencing and monitoring. However, the findings in the current study did not support their hypotheses.

5.6. The Influence of MA/MATT on Word Reading Efficiency and Reading Comprehension

In the present study, MA tasks measured the participants’ conscious awareness and their ability to manipulate the morphemic structure in words (Carlisle, 1995). The participants completed one inflectional, one derivational and one inflectional-derivational task. The time they spent on these tasks was noted as their MATT performance.

The correlation analyses in bilingual participants showed that MA was only correlated with RComp (r=.26). On the other hand, in monolingual participants MA had strong connections with RComp (r=.52) and word reading (r=.50). The associations with MATT were different. MATT was the strongest correlate of word reading (r=-.66) in bilingual children. It was also moderately correlated with RComp (r=.-.33) and PS (r=.35). Similarly, MATT was the strongest correlate of word reading (r=.67) among the independent variables in monolingual children. As in bilingual group, RComp had moderate correlation with MATT (r=-.35). These results indicated that fluency measures -MATT and word reading fluency- shared common underlying mechanisms. As MA measures the accuracy and sensitivity to structural units in words, its associations were stronger in RComp in both groups.

The monolingual and bilingual children were similar in MA and MATT scores. This may indicate that bilingualism does not provide an advantage in morphemic awareness or in the fluency to complete morphological tasks.

The current study failed to show an effect of MA on sight word reading and pseudoword reading, which contrasted with Singson and colleagues (2000) who found significant contributions in real and nonword reading. Yet, these results were congruent with earlier studies which investigated the influence of MA on word reading in Turkish (Bektaş, 2017; Özata, 2018). In these studies, the researchers discussed that other predictors in the analyses might have made MA redundant. For the current research, the results might have been obtained since word reading performance was measured through a fluency task. The results could have been different in an accuracy task.

MATT was the strongest predictor of Wread both in monolingual and bilingual children. The unique variance explained by MATT was 19.4% in bilingual and 27% in monolingual children when it was included in the analyses with other independent variables. Although the participants completed MA tests at their own speed, the time they spent on the MA tasks (MATT) predicted their word reading performance. These findings may further indicate that morphological fluency rather than morphological accuracy is a strong predictor of word reading among 2nd grade Turkish children.

The role of MA on RComp was examined in both groups. In the bilingual group, MA did not significantly predict RComp. However in the monolingual group, MA explained 27% of the unique variance in RComp. Also, MA was the only significant predictor of RComp in the monolingual group. The results for the monolingual group are in line with previous studies (Deacon et al., 2014; Green, 2009). However, these results are incompatible with Özata (2018). In her study, MA did not explain reading comprehension in the 2nd or 4th grades among Turkish children.

The findings on MA and MATT showed that while MA, as an index of morpemic sensitivity and accuracy predicted RComp in monolingual children, MATT, the index of morphological fluency or automaticity, predicted WRead in 2nd grade monolingual and bilingual children.

5.7.The Influence of PS on Word Reading Efficiency and Reading Comprehension

PS has been acknowledged as an influential factor in reading achievement (Catts et al., 2002; Kail & Hall, 1994; Nicolson & Fawcett, 1994; Wolff et al., 1990). In the current study, an object matching task was employed in order to measure the efficiency of cognitive processes during a mental activity. Since the task was timed, the participants were required to use limited processing resources to perform rapidly. Based on the literature, it was hypothesized that PS would have significant associations with the components of reading.

In consonance with the hypotheses, the correlation analyses revealed that PS was significantly correlated with word reading (r=.38) and reading comprehension (r=.41) in bilingual children. On the other hand, the significance of relationship decreased in monolinguals. The relationship with PS and word reading (r=.34), and reading comprehension (r=.34) were significant with a less stringent p value.

The comparison between monolingual and bilingual participants in PS performance exhibited that bilingual children had superior abilities to accomplish a task when there is time restriction. PS was one of the two tasks that bilingual children significantly outperformed monolingual children. Further, the task involved a matching activity with distracting information which meant that the children were also expected to inhibit unnecessary information and focus to select two related items from the pictures. Bilingual children successfully completed the task through selectively attending to the stimulus while ignoring the distractors. These findigs are congruent with previous studies which highlighted the advantage of bilingualism in the components of executive function such as inhibition, selective attention, mental flexibility etc. (Barac & Bialystok, 2012; Bialystok, 1999; Bialystok et al., 2012; Kroll & Bialystok, 2013).

The regression analysis showed that PS did not predict WRead or RComp in the monolingual or bilingual groups significantly. The results might have been different, if the indirect effect of PS was investigated.

5.8.The Influence of VK on Word Reading Efficiency and Reading Comprehension

Vocabulary size has been regarded as a strong associate of reading achievement (Chall et al., 1990; Snow et al., 1998). Several studies confirmed that in the course of literacy development, vocabulary becomes a stronger precursor of the reading skills over years (Roth et al., 2002; Senechal et al., 2006). Thus, in the current research, it was assumed that VK would be associated with reading components, particularly with reading comprehension. Based on the correlational analyses, VK was significantly correlated with word reading (r=.30) and reading comprehension (r=.48) in the bilingual group. Yet, none of the dependent variables were significantly correlated with VK probably due to the lack of participants in the monolingual group. The results of the correlational analyses indicated that vocabulary plays an important role in the components of reading among bilinguals.

The comparison of monolingual and bilingual children in VK did not demonstrate any significant differences between the two groups. These results are incompatible with previous studies which evidenced a lower performance in bilingual children (Pearson, 2002; Rothou & Tsimpli, 2017; Tabors et al., 2003; Verhoeven, 2000; Uccelli & Paez, 2007). The lack of difference between the two groups may be explained in two ways. First, the bilingual children were simultaneous Turkish-Arabic speakers and exposed to two languages from birth. Since Arabic is the home language only, the bilingual children had sufficient language experience in Turkish to improve their vocabulary at school and with their friends. Second, as the demographic data showed, the parents of bilingual children encourage their children to read in Turkish. Thus, neither their word reading nor reading comprehension skills were negatively influenced because of a smaller vocabulary size.

In the regression analyses, the effect of VK on Wread was investigated. The results did not yield significant results for either group. These results were incompatible with earlier studies (Duff et al., 2015; Oulette, 2006; Verhoeven et al., 2011). The results might have been different if a word reading accuracy task was utilized instead of a fluency task.

Previous studies also evidenced direct and indirect influence of VK on RComp (Babayiğit & Stainthorp, 2014; Biemiller & Boote, 2006; Oulette & Shaw, 2014; Verhoeven & Perfetti, 2011). The contribution of VK on RComp was observed directly in the current study. The only significant influence of VK was observed in reading comprehension in the bilingual children. VK explained 8% of unique variance in reading comprehension when other predictors were included in the analysis. The results for the bilingual group corroborated with the Matthew Effect (Stanovich, 1986) since children who received higher scores in the vocabulary task had acquired more abstract and complex vocabulary which allowed for a superior performance in reading comprehension.

The essential role of VK on RComp further supported the Lexical Quality Hypothesis (Perfetti & Hart, 2002). According to this view, reading comprehension is dependent upon the quality of lexical codes which ultimately influence decoding and comprehension. High quality representations (robust orthographic, phonological and semantic representations) allow for reading comprehension and retrieval of texts.

On the other hand, the results were insignificant for monolingual children. The reason for the lack of influence of VK might be due to the paucity of monolingual participants in the study. The results for the monolingual group are incompatible with previous studies which evidenced a significant role of VK in reading comprehension in early reading (Babayiğit & Stainthorp, 2014; Cunningham & Stanovich, 1997).

5.9. The Influence of Word Reading Efficiency on Reading Comprehension

Previous studies highlighted the essential role of fluent word recognition on reading comprehension among various age groups and backgrounds (de Jong & van der Leij, 2002; Perfetti, 2007; Protopapas et al., 2007). Thus it was hypothesized that word reading would have a significant effect on Turkish reading comprehension in 2nd grade children. In the present study, the difference between the monolingual and bilingual children in word reading and reading comprehension was not significant.

The correlational analyses indicated that reading comprehension was significantly linked to word reading ($r=.52$) in the bilingual children. In the monolingual group, there was not a significant relationship between word reading fluency and reading comprehension.

The regression analyses revealed a similar picture to the correlational analyses. Wread was the most powerful predictor of reading comprehension among the bilingual readers. Wread explained 13% of unique variance in reading comprehension. On the other hand, Wread was not a significant factor in reading comprehension in the monolingual children. The lack of a significant effect might be due to the number of participants or other perdictors in the equation. The findings for the bilingual group were compatible with previous which emphasized the prominence of fluent reading in comprehension (Kirby et al., 2010; Norton & Wolf, 2012; Parrila et al. 2004).

The results for the bilingual group further supported Automaticity Theory (LaBerge & Samuels, 1974) and Verbal Efficiency Theory (Perfetti, 1985). Based on these theories, reading fluency reduces the cognitive load and readers can focus on other processes for comprehension. The attentional resources could be used for inferencing or monitoring while reading. Additionaly, these results are partly congruent with Lexical Quality Hypothesis (Perfetti & Hart, 2002). When the readers have knowledge on the word forms and their meaning, they are processed more efficiently which eeventually allows for reading comprehension.

Furthermore, the significant role of fluency in reading comprehension in the bilingual group supports the Componential Model of Reading (Joshi & Aaron, 2000). This model counts fluency as an additional component to SVR (Gough & Tunmer, 1986). Thus the formula of reading comprehension is RC=Decoding x Oral (Listening) Comprehension + Fluency. Based on the formula, fluency plays a causal role in reading comprehension.

5.10. Conclusion

In the current study, the predictors of word reading efficiency and reading comprehension among 2nd grade Turkish monolingual and Turkish-Arabic simultaneous bilingual children were investigated. The results manifested different developmental trajectories for each group of participants although there were some commonalities. The bilingual participants significantly outperformed monolinguals in PA and PS. On the other hand, their performance was not statistically different in PM, RAN, MA, MATT, VK, Real Wread, Pseudo Wread and RComp. In other words, the bilingual children did not lag behing monolingual children in any tested cognitive or linguistic domains. Even though vocabulary and reading comprehension have been widely regarded as vulnerable skills in bilingual children, such results were not obtained in the present study. The reason for the similar performance of the bilingual children to the monolingual participants might be due to the simultaneous acquisition of Turkish and Arabic. The children might have received sufficient input and had compatible language experience in Turkish. As stated in the Threshold Hypothesis (Cummins, 1979), high levels of competence in both languages can be possible especially in the cases which L1 is not in danger of replacement by L2. Moreover, overachievement in PA and PS skills was expected in the bilingual group. Since bilingual children deal with two distinct phonological systems, their sensitivity to detect and manipulate syllabic and subsyllabic units develop faster than monolingual children. Also, positive outcomes of bilingualism have been observed in tasks that require executive functioning. Particularly in cognitive tasks, bilingualism itself causes advantage irrespective of other variables.

With regard to the predictors, although PA explained significant variance in the monolingual group, no significant role of PA on word reading was observed in the bilingual group in the present study. As expected, simultaneous bilingualism promoted the development of PA skills and the bilingual children performed at the ceiling level. Therefore, PA became redundant and could not explain word reading fluency in the bilingual children. Another finding of the study is that PM did not predict fluent reading. As Turkish has a consistent phoneme-to-grapheme, grapheme-to-phoneme conversion rules, decoding does not place high cognitive demands which makes PM a superfluous variable in the 2nd grade. When word decoding accuracy is maintained, it is acknowledged that RAN becomes a more prominent predictor of reading achievement. Especially in transparent orthographies, reading fluency emerges as an indicator of successful reading. As previous research showed, RAN consistently predicts word reading fluency. In the present study, RAN was the second strongest predictor of word reading in the bilingual group. The results for the predictive power of RAN were insignificant in the monolingual group due to the paucity of participants and the continuing effect of PA. The findings further indicated that MATT was the strongest indicator of word reading efficiency both in monolingual and bilingual children. That is, morphological fluency strongly influenced word reading speed in Turkish irrespective of the language background of the participants. Presumably, the automaticity of morphological processing allows for fluent reading both in monolingual and bilingual children in Turkish, which is an agglutinative language. Further, due to the rich and transparent morphemic structure, Turkish children acquire morpho-phonological units easily with less errors (Aksu-Koç & Slobin, 1986). The facilitative role of Turkish morphology supports accurate morphological productions at an early level. Thus, one of the possible reasons for the robust role of MATT on word reading might be that the automatization of the morphological skills becomes more prominent than accuracy in the 2nd year of schooling. In both groups, MA did not predict word reading. The lack of the contribution of MA on word reading might be the focus of the MA tasks. The results could have been different if the word reading skills were measured through an accuracy task. Similarly, PS did not contribute to word reading directly in any groups. In addition, expressive vocabulary did not predict word reading in any group of participants. Both real word reading and pseudoword reading tasks in the study were prepared regarding the phonological and orthographic characteristics of

Turkish. Thus, due to the regularity of Turkish orthography, vocabulary knowledge did not influence the fluency measures.

With reference to reading comprehension, word reading was the most powerful indicator in the bilingual group. The findings confirmed the arguments of the Componential Model of Reading (Joshi & Aaron, 2000), Automaticity Theory (LaBerge & Samuels, 1974) , Verbal Efficiency Theory (Perfetti, 1985) and Lexical Quality Hypothesis (Perfetti & Hart, 2002). In sum, efficient recognition of words and fluent reading might have enabled accurate comprehension of texts. Yet, word reading did not predict reading comprehension among monolingual children. Furthermore, as hypothesized, PA and RAN did not affect reading comprehension either in bilingual or monolingual children. PM had a relatively small influence on comprehension in the bilingual group compared to word reading and vocabulary. Additionally, whereas MA did not contribute to reading comprehension in the bilingual group, it was the only significant predictor of reading comprehension in the monolingual group. Due to the rich morphology of Turkish, the role of MA was expected to be stronger in both groups. However, the effect of MA was only evident in the monolingual group. Additionally, VK was the second strongest predictor of reading comprehension in bilingual children. Congruent with the persistent literature (Oulette, 2006; Oulette & Shaw, 2014), vocabulary size or the breadth of vocabulary affected the performance in comprehension in bilingual children. VK did not explain significant variance in reading comprehension among monolingual children.

All in all, the current study evidenced that various predictors contribute to word reading and reading comprehension. In some domains, monolingual and bilingual children displayed similarities, yet their reliance on these variables ranged. These findings supported the view that reading is a multilayered skill which involves linguistic and general processing abilities. Thus, it is essential to consider multiple factors in the assessment of literacy skills.

5.11. Pedagogical Implications of the Study

The present study evidenced that the skills which require speed were the best predictors of word reading efficiency in Turkish. These findings highlight that in the instructional settings, practitioners should focus on activities to facilitate word reading speed once accuracy has been maintained. The research further showed that reading comprehension skills are strongly affected by word reading fluency and vocabulary knowledge in bilingual children. For the monolingual children, morphological awareness plays a substantial part in reading comprehension. Therefore, teachers should incorporate fluency and vocabulary activities in their classes for better comprehension. Regarding the rich and transparent morphology of Turkish, educators could focus on activities that promote the recognition and manipulation of morphemes to ensure comprehension particularly in monolingual children. Additionally, morphological awareness and morphological fluency tasks could be employed in the assessment of reading achievement in 2nd grade Turkish readers. As the study evidenced, they predict reading fluency and comprehension stonger than phonological awareness tasks.

Based on the results of the current dissertation, it is advised that the differences between monolingual and bilingual children in literacy development should be considered. Instructors should be cautious about the cognitive and linguistic strengths and weaknesses of bilingual children in their classes. In the present study, the bilingual children were superior in phonological awareness (an index of word recognition accuracy) and processing speed (variable that indicates the time spent on the completion of a task in a limited time) than monolingual children. Although, bilingual children are widely regarded as vulnerable in vocabulary and reading comprehension, the present study was unable to confirm these views. The bilingual children performed similar to monolingual children in these skills probably because the participants were simultaneous bilinguals. Therefore, teachers should also be informed about their students' linguistic backgrounds. As discussed in the Interdependence Hypothesis (Cummins, 1979) and Durgunoğlu (2002), linguistic and cognitive difficulties in one language may persist in the other language. Further, when learners cannot reflect their knowledge in one language, it does not necessarily mean that they have reading difficulties. Instead, the initial step to take should be evaluating that particular knowledge in the stronger language. The skill may not have been acquired in the weak language yet. Thus, it is essential to assess students in both languages if measures are available.

5.12. Limitations of the Study

The study has a number of limitations that needs to be mentioned. First of all, the research has a cross-sectional design. That particular design was selected in order to measure various variables at a time. However, the developmental process of monolingual and bilingual children in reading could have been tracked more transparently in a longitudinal design. Second, the tasks were conducted only in Turkish. To gain a better insight about the reading development and the domains of transfer in the bilingual participants, the data could have been collected in Arabic language as well. Yet, in Hatay province, Vernacular Arabic which shows substantial phonological and morphological differences from the Standard Arabic is spoken. Vernacular Arabic does not have a written form. Also, there are no tests available in the vernacular Arabic to make comparisons with the scores in Turkish. For this reason, it was not possible to observe whether the bilingual children transfered language-independent metalinguistic or metacognitive skills to the other language. Third, the number of monolingual children should have been equal to the number of bilingual children. Due to time limitations, the researcher could not reach the expected number of participants. Further, although the role of MATT was powerful in the research, it is not known whether orthographic awareness has a significant effect on this skill. Thus, instruments which specifically measure morphological processing or fluency such as masked prime tasks could have been employed. Last but not least, the measures in Turkish should have been standardized and tests should have been suitable for the grade and skill levels of students. Specifically, in MA assessments, tests should be designed considering the morphological structure of Turkish. The inflectional and derivational tasks should be standardized.

5.13. Recommendations for Further Research

The research focused on the role of PA, PM, RAN, MA, MATT, PS and VK in word reading and reading comprehension in the 2nd grade Turkish-Arabic simultaneous bilingual and Turkish monolingual children. Further research can include more independent variables such as socioeconomic background, home literacy environment, intelligence and orthographic awareness. Furthermore, MATT can be measured in a timed MA test. Several reading skills can be tested in Arabic as well. Additionally, a longitudinal study may provide a better understanding about the literacy development of Turkish-Arabic simultaneous bilingual and Turkish monolingual children. In further studies, the number of participants in both groups should be increased in order to do stronger analyses and generate path models.

Lastly, there is a need for standardized Turkish tests in order to conduct more studies in reading development with various groups.

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