COGNITIVE AND LINGUISTIC COMPONENTS OF READING ACQUISITION IN TURKISH: EVIDENCE FROM SECOND AND FOURTH GRADERS

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DECLARATION OF ORIGINALITY

I, Sezen Bektaş, certify that

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- this thesis contains no material that has been submitted or accepted for a degree or diploma in any other educational institution;
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ABSTRACT

Cognitive and Linguistic Components of Reading Acquisition in Turkish:

Evidence from Second and Fourth Graders

The present study investigated the role of cognitive and linguistic components of reading acquisition in Turkish, with special reference to phonological awareness (PA), rapid automatized naming (RAN), morphological awareness (MA) and phonological memory (PM) in predicting real word reading (WREAD) and non-word reading (NWREAD) abilities of Turkish-speaking children. In a cross-sectional study design, it explored the relationships between the respective reading components and measures with a special focus on grade-level differences. Besides, the relative importance of the variables in predicting word-level reading success was investigated through multiple hierarchical regression analyses across grades. A total of 87 Turkish-speaking children from Grade 2 and 4 participated in the study. Multiple instruments were used to collect the data. The results showed that the fourth graders performed significantly better than the second graders at all the measures, which pointed to a significant grade-level difference between the groups. When WREAD was the dependent variable, regression analyses revealed that RAN was a strong predictor of the WREAD ability at both grades. In addition, PA made a significant contribution to WREAD at Grade 2, whereas it did not account for significant amounts of variance in WREAD at Grade 4. As for NWREAD, none of the predictors made a significant contribution to NWREAD at Grade 2, while RAN appeared as the only significant predictor at Grade 4. The results highlighted that RAN remained as a strong predictor of both reading abilities as the grade level increased; however, the effect of PA tended to decrease over years.

ÖZET

Türkçede Okuma Ediniminin Bilişsel ve Dilbilimsel Bileşenleri:

2. ve 4. Sınıf Öğrencilerinden Elde Edilen Bulgular

Bu çalışma, fonolojik farkındalık (FF), fonolojik bellek (FB), hızlı otomatik isimlendirme (HOTI) ve morfolojik farkındalık (MF) gibi okuma edinimindeki bilişsel ve dilbilimsel bileşenlerin anadili Türkçe olan çocukların anlamlı ve anlamsız kelime okuma becerilerindeki belirleyici rolünü araştırmaktadır. Çalışmada, okuma bileşenleri ve okuma becerileri arasındaki ilişkiler, sınıflar arası farklılar bağlamında karşılaştırmalı olarak incelenmiştir. Ayrıca, söz konusu bileşenlerin anlamlı ve anlamsız kelime okuma becerisindeki belirleyici rolleri çoklu regresyon analizleri ile ele alınmıştır. Çalışmaya, ilkokul 2. ve 4. sınıf seviyesinde eğitim gören toplam 87 öğrenci katılmıştır. Çalışma verilerinin toplanmasında, çeşitli testler kullanılmıştır. Sonuçlar, 4. sınıf öğrencilerinin bütün testlerde 2. sınıf öğrencilerinden daha üstün performans sergilediğini göstermiş, ve sınıflar arası anlamlı bir gelişimsel farkın varlığına işaret etmiştir. Regresyon sonuçları, anlamlı kelime okuma becerisinin bağımlı değişken olduğu durumda, HOTI becerisinin her iki sınıf düzeyinde de en güçlü belirleyici etken olduğunu ortaya koymuştur. Bunun yanı sıra, FF'nin 2. sınıf öğrencilerinin anlamlı kelime okuma becerisini belirleyen bir ölçüt olduğu; ancak 4. sınıf öğrencilerinin bu becerisine katkıda bulunmadığı görülmüştür. Diğer yandan, 2. sınıflarda anlamsız kelime okuma başarısını belirleyen hiçbir ölçüt bulunmazken, 4. sınıflarda HOTI bu başarıyı belirleyici önemli bir rol üstlenmiştir. Bulgular, sınıf düzeyi arttıkça, HOTI'nin hem anlamlı hem de anlamsız kelime okuma başarısını belirlemede artan bir rol üstlendiğini, FF'nin etkisinin ise azaldığını göstermiştir.

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This thesis is dedicated to my father, Hüseyin Bektaş
who bequeathed me his eternal love and trust:
Your "sarı kedi" has grown up and done a good job
as you always believed.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

Reading is a fundamental skill which is acquired during the early stages of life, and is one of the determining factors which result in long-term life outcomes. In the 21st century society, reading has permeated essentially every aspect of our lives, and consequently a large body of research has been conducted in order to understand how people read and how they learn to read.

Being called an "unnatural act" (Gough & Hillinger, 1980), reading is sometimes achieved with considerable difficulty despite the child’s normal intellectual growth. Unlike the acquisition of oral skills in early childhood, learning to read requires a special effort and explicit teaching (Chall, 1983; Gillon, 2007; Liberman, Shankweiler, & Liberman, 1989). Although reading is simply referred to as the process of understanding the link between certain visual codes and sound units so as to grasp the meaning conveyed through the written material, a robust body of research in reading has documented that it is a complex skill involving various components and processes (Ziegler & Goswami, 2005). As such, the question of what reading encompasses is worth pursuing from a scientific perspective.

Among a variety of cognitive processes and social factors, *phonological awareness* (PA) has been found to be central to reading development by a great deal of research in the literature (Adams 1990; Anthony & Francis, 2005; Gillon, 2007; Wagner & Torgesen 1987; Ziegler & Goswami, 2005). PA is defined as “the ability to recognize, discriminate, and manipulate the sounds in one’s language, regardless of the size of the word unit” (Anthony & Francis, 2005, p. 256). In other words, it refers to the awareness of phonological units of a spoken word such as phonemes, rimes and syllables, including the ability to perceive, segment and explicitly manipulate these units. Burgeoning evidence exits that PA plays an essential role in both predicting and facilitating reading development across languages (e.g., Czech: Caravolas, Volin, & Hulme, 2005; Dutch: de Jong & van der Leij, 2002; English: Bradley & Bryant, 1983; Kirby, Parrila, & Pfeiffer, 2003; Wagner et al., 1997; Finnish: Müller & Brady, 2001; French: Demont & Gombert, 1996; Turkish: Babayiğit & Stainthorp, 2007; Öney & Durunoğlu, 1997). That is, the current line of research has demonstrated that children with poor PA are likely to have difficulty in learning to read and lag behind children with high PA through reading development (Pullen & Justice, 2003). The relation of PA to reading achievement is mostly explained via the vital role of PA in the understanding of letter-sound relations which is crucial in the initial stages of reading (Adams, 1990; Chall, 1983; Gibson, 1965; Ziegler & Goswami, 2005). Besides its relationship with reading, PA has been widely explored with regard to its development. In a great number of child literacy studies, PA appears to follow a developmental route throughout a child's reading acquisition, progressing from the awareness of larger units of sounds (i.e. words, syllables) to the awareness of smaller units (i.e. onset, rimes, phonemes) (Anthony & Francis, 2005; Cossu, Shankweiler, Liberman, Katz, & Tola, 1988; Denton, Hasbrouck, Weaver, & Riccio, 2000; Treiman & Zukowsky, 1991). Anthony et al. (2002) point out that the rate of progress in the development of PA skills and the knowledge acquired at each level vary among the speakers of different languages based on the language- specific properties.

Phonological memory, (PM) is also a cognitive component of reading ability which has been widely included in literacy research. It is mainly defined as the ability to store information coded in a sound-based representational mechanism only for a short time (Baddeley, 1982). In other words, it is the ability to use phonological segments to retain information for temporary storage. Wagner and Torgesen (1987) regard PM as a sub-component of phonological processing ability, along with phonological awareness and rapid naming. With regard to the relation of PM to reading ability, Wagner, Torgesen, and Rashotte (1994) stated that the ability to code phonological information efficiently should provide the beginning reader to maintain a precise representation of the phonemes related to letters or units of words as well as to employ the most of the potential cognitive resources in decoding and comprehension processes. In general, PM is assessed via the tasks which require repetitions of non-words or digits forward/backward.

Although PM has been extensively included in reading studies, there is no consensus on its role in predicting reading abilities. A great number of these studies have included PM as a control variable, and they have concluded that it had only a weak contribution to reading ability, especially considered together with other cognitive and linguistic components of reading (e.g., Babayiğit & Stainthorp, 2007; de Jong & van der Leij, 1999; Dufva, Niemi, & Voeten, 2001; Georgiou, Parrila, & Papadopoulus, 2008; Kirby et al., 2003; Parrila, Kirby, & McQuarrie, 2004).

In addition to PA having received the most attention in reading research and PM mostly included in the studies as a control variable, *rapid automatized naming* (RAN) has been also documented to be a significant precursor of reading achievement in a wide array of languages (Dutch: de Jong & van der Leij; 1999; English: Denckla & Cutting; 2001; Kirby et al., 2003; Kirby, et al., 2010; Parrila et al., 2004; Torgesen, et al., 1997; German: Moll, Fussenegger, Willburger, & Landerl, 2009; Greek: Georgiou et al., 2008; Spanish: González-Valenzuela, Díaz-Giráldez, &

López-Montiel; Turkish: Babayiğit & Stainthorp, 2010, 2011; Sönmez, 2015). RAN is simply defined as the ability to name a set of highly familiar visual stimuli such as colors, objects, digits, and letters as quickly as possible (Cutting & Denckla, 2001; Wolf & Bowers, 1999). There has been different theoretical views to explain the relation of naming speed to reading; however, all these explanations agree that RAN and reading share similar cognitive processes such as automatized recognition and the retrieval of phonological representations of visual stimuli from the long-term memory (Kirby et al., 2010). Overall, RAN is related to the achievement of accurate and fluent word reading, which is an essential component of literacy development.

Last but not least, *morphological awareness*, (MA) constitutes another facet of metalinguistic awareness which has been vigorously investigated in the field of reading for the last decades. MA is referred to as an individual's "conscious awareness of the morphemic structure of words and their ability to reflect on and manipulate that structure" (Carlisle, 1995, p. 194). A growing body of research has indicated that it is a strong correlate of reading achievement in a variety of languages, after controlling the effects of other variables such as PA, PM, RAN, vocabulary, intelligence, and prior reading ability across languages (e.g., Arabic: Layes, Lalonde & Rebai, 2017; Chinese: McBride-Chang, Shu, Zhou, Wat, & Wagner, 2003; Dutch: Rispense, McBride-Chang, & Reitsma, 2008; English: Brittain, 1970; Carlisle, 1995; Carlisle & Nomanbhoy, 1993; Deacon & Kirby, 2004; Mahony, Singson, & Mann, 2000; Singson, Mahony, & Mann, 2000; French: Casalis & Louis-Alexandre, 2000; Plaza & Cohen, 2003, 2004; Turkish: Babayiğit & Stainthorp, 2011). According to this line of research, the ability to reflect on and manipulate *morphemes*, which are the smallest linguistic units with semantic information, helps children make the connections between sound, meaning, and function. Although PA, which indicates an awareness of the internal structure of words, has a strong link to reading success especially in the early stages, it remains limited to explain subsequent reading performance of children when they require the understanding of the syntactic and semantic formation of words (Carlisle & Nomanbhoy, 1993; Deacon & Kirby, 2004). Thus, MA has been suggested to provide a more comprehensive index of reading ability since it entails the knowledge and awareness of various aspects of linguistic sensitivity, including syntactic and semantic as well as phonological knowledge.

Taken together, reading is a very complex, multi-componential skill which encompasses various cognitive and linguistic abilities. As stated above, phonological awareness (PA), phonological memory (PM), rapid automatized naming (RAN) and morphological awareness (MA) are among the most extensively studied components of reading acquisition in literacy research. Although the studies conducted with English- speaking populations held sway over reading research in the past, a cross-linguistic perspective has been adopted in reading research for the last decades (Aro & Wimmer, 2003; Harris & Hatano, 1999). More importantly, the studies conducted in other languages, particularly the ones with transparent orthographies, have portrayed a different picture of reading development than English which has an exceptionally irregular orthography for literacy (Seymour, Aro, & Erskine, 2003). It is, therefore, highly significant to conduct studies in the languages which have not been extensively studied. In this regard, the main purpose of the present study is to provide new insights into the development of reading skills through a very consistent orthography, Turkish.

More specifically, the present study aims to investigate the role of cognitive and linguistic components of reading acquisition in Turkish, with special reference to phonological awareness (PA), phonological memory (PM), rapid automatized naming (RAN), and morphological awareness (MA) in predicting word-level reading abilities of Turkish- speaking children attending Grade 2 and 4. Through its phonologically transparent orthography and very rich morphology, the Turkish language presents an appropriate context for investigating the role of these components in reading development (Babayiğit & Stainthorp, 2007; Öney & Durgunoğlu, 1997). In a limited but increasing number, there are significant studies which investigated how some of these reading components function in such a transparent language (Babayiğit & Stainthorp, 2007, 2010, 2011; Öney & Durgunoğlu, 1997; Sönmez, 2015). The present study extends this line of research, including the crucial cognitive and linguistic components of reading ability within the scope of a cross-sectional study. It seeks to investigate both the interplay among them and their relative roles in predicting reading ability of Turkish children in two different grade levels. Also, the results of the present study contribute to the cross-linguistic research on reading acquisition as reflecting the phonological, morphological and orthographic characteristics of the Turkish language.

This chapter has provided a brief introduction with regard to the primary concerns of the present study. The following chapter presents a comprehensive review of the literature regarding the theoretical background of reading development and the respective reading components. Chapter 3 provides information about the characteristics of Turkish phonology and morphology. Chapter 4 presents the methodology of the present study with a reference to the study design, participants, instruments, procedure and data analysis. Following the methodology, Chapter 5 provides the results of the present study. Lastly, Chapter 6 mainly provides the discussion of the results. Also, it addresses the pedagogical implications and suggestions for further research as well as acknowledging the methodological limitations.

CHAPTER 2

LITERATURE REVIEW

This chapter consists mainly of two sections. In the first section, a theoretical discussion on the reading ability is provided. This is followed by a detailed discussion on various scientific approaches and models to explain its development. Then, in the second section, the key cognitive processes and abilities underlying reading achievement, are presented. These are: phonological awareness (PA), phonological memory (PM), rapid automatized naming (RAN), and morphological awareness (MA). In addition, the second section provides a comprehensive review of the previous research which explored the role of these variables in reading success across languages.

2.1 Theoretical and scientific approaches to reading development

Considering its vital role in the information era, reading has remained central to theoretical discussions and scientific research in the field of literacy. It is fundamentally described as the ability to understand the link between visual symbols and sound units so as to attain meaning through the written material (Ziegler & Goswami, 2005). Although this is an effortless activity for a common skilled reader, not all readers could exhibit the same performance, even some could not accomplish at all. Thus, the investigation of the nature of reading ability and its development plays a crucial role in getting a better understanding of this phenomenon.

Reading is a multi-componential, complex intellectual ability, including both low- and high-level cognitive processes and skills (Adam, 1990; Ehri, 2005; Gibson, 1965; Stanovich, 1986; Perfetti, 1997). For Juel (1996), the approaches to explain reading development have been divided into two main paradigms. The first paradigm regards reading as a search for meaning and proposes that accurate and fluent word recognition underlies reading success.

Readers, both experienced and inexperienced, gain access to meaning by means of their skilled word recognition. Therefore, the models in the first paradigm have given close attention to the processes involving word-level reading (Coltheart, 1978; Hoover & Tunmer, 1993). Conversely, the second paradigm distinguishes between novice and experienced readers and foregrounds the changes readers undergo as they get more experienced. Grounded within the second paradigm, the models suggest developmental stages in reading acquisition (e.g., Ehri, 1992, 1997; Frith, 1985). At this point, the review of the models developed within both paradigms is presented.

2.1.1 Cognitive models in reading

The question how words are read accurately and fluently is one of the fundamental issues in literacy research. Word recognition is referred to as the benchmark of reading development (Harris & Hatano, 1999), thus to focus on word recognition in studies has not intended to deny the relevance of higher levels of reading processes; on the contrary, it is just to get a better understanding of these higher-level components.

With regard to the cognitive models addressing word recognition, *dual-route model of reading* developed by Coltheart (1978) was among the most influential cognitive theories of reading. According to the model, there is mainly two routes for readers to follow: *phonological route* (nonlexical route) and *orthographic route* (lexical route). The former is used in the recognition of regular words with consistent phoneme-grapheme correspondences. Besides, readers resort to phonological route while reading non-words or unfamiliar words. On the other hand, orthographic route functions in reading irregular words with inconsistent phoneme-grapheme mappings. Since irregular words are stored as single units in learners' lexicon, they are accessed and retrieved through lexical route in a more automatized way.

Although phonological decoding, regarded as the "sine qua non" of reading (Share, 1995, p. 151), has been extensively investigated, the lexical route of the dual-route model has also initiated a new area of interest, referred to as *orthographic processing*. Reitsma (1983) points that orthographic processing requires "the recognition of unique letter sequences of words" (p. 335) rather than depending on phonological processing. Similarly, orthographic awareness, defined as "the ability to form, store and access orthographic representations" (Stanovich & West, 1989, p. 404) has appeared as an important component of reading skills.

Regarding the interplay between the phonological and the orthographic routes, a complex picture appears since they constantly interact with each other (Paap & Noel, 1991). Despite their consistent grapheme-phoneme correspondences, regular words are tended to be processed via orthographic route. That is, they become very familiar through practice, and this familiarity enables the reader to use the orthographic route rather than needing to use phonological route. Herein, it might be stated that phonological route functions at early stages of reading but then the readers move to use orthographic route as a more automatized way of reading. This statement conforms to Share's (1995) self-teaching hypothesis, which suggests that new words are first read through phonological skills as a self-teaching method but after sufficient practice in reading they turn out to be recognized as sight words. In a similar way, not to give any space for phonological route while reading irregular words is problematic since irregular words also include smaller regular patterns which might prompt the use of phonological knowledge (Ehri, 1992). Such interactions between the two routes help the readers by decreasing the cognitive load during word processing. Further, it suggests that the two mechanisms work in cooperation rather than functioning independently (Holland, McIntosh, & Huffman, 2004).

The cooperation between the two systems is related to two main factors, which are word frequency (Burt & Tate, 2002; Holmes & Carruthers, 1998) and the consistency in phoneme-grapheme correspondence (Frost, Katz, & Bentin, 1987; Katz & Feldman, 1983). First, high frequency words can be readily recognized as the whole-lexical units through the orthographic route since their transfer to the orthographic lexicon does not require much time, which lead the readers to use lexical route even for regular words. As for the orthographic characteristics of a language, it determines which route, the reader will use while reading. Katz and Frost (1983) argue that the readers tend to use phonological route in transparent orthographies such as Italian, Spanish, and Turkish, which have one-to-one grapheme-phoneme mappings, whereas the preferred route in opaque languages such as English is mostly the lexical due to the inconsistency in the orthography.

Along the same line, Goswami, Ziegler, Dalton, and Schneider (2003) point out the effect of orthographic features on the use of cognitive strategies in reading.

That is to say, as the orthography gets more transparent, readers tend to use phonological decoding skills and rely much less on the orthographic route. Since it is easy to follow consistent phoneme- grapheme mappings, readers do not necessarily store and retrieve words as whole-units. On the basis of the varied strategy-use among the readers of different orthographies, Ziegler and Goswami (2005) developed the phonological grain size theory. They argue that the readers rely on different psycholinguistic units based on the orthographic consistency in their language. They stated that "the dramatic differences in reading accuracy and reading speed found across orthographies reflect fundamental differences in the nature of the phonological recoding and reading strategies that are developing in response to the orthography" (p. 19). For example, while English-speaking children use both larger units such as syllables or rimes, and smaller units such as phonemes, in reading, the readers of more transparent languages tend to use only small units which always have consistent phoneme-grapheme mappings. Furthermore, the difference in the consistency of phoneme-grapheme across languages has an influence on the pace of children reading development. The comprehensive study by Seymour et al. (2003) indicated that children learn to read much slower in languages with opaque orthographies such as English, compared to those with transparent orthographies. This might be attributed to that word recognition consistently occurs through non-lexical route in transparent orthographies, whereas readers of opaque languages might have to decide which route to use while reading, which makes their progress slower. However, the role of word frequency, as mentioned above, should always be considered while studying word recognition. That is, there might be a place for orthographic route in word recognition even in transparent languages, if the word is highly frequent. In this case, the readers might not need to use phonological route and directly employ the lexical strategy, irrespective of the orthographic characteristics of their language (Seidenberg, 1985; Seidenberg, & McClelland, 1989).

2.1.2 Developmental models in reading

In addition to cognitive theories and models of reading acquisition discussed above, a developmental theory of reading that explains different phases children go through while learning to read has also garnered attention of the researchers.

One of the well-known and earliest theories of reading development was developed by Frith (1985). According to Frith's *stage theory of reading*, children progress through three stages, respectively: *logographic*, *alphabetic*, and *orthographic*. Briefly, this model suggests that reading starts at a logographic stage in which children first rely on salient visual features and contextual cues, without any phonological awareness or knowledge of phoneme- grapheme mapping. At the alphabetic stage, children require to develop the understanding of phoneme-grapheme relations and alphabetic knowledge. Unlike the previous stage, phonological knowledge plays a crucial role in this stage. At the final stage, children use a more automatized strategy to read words since they have accumulated knowledge to recognize and retrieve previously processed words. Frith (1985) states that each stage is a prerequisite for successful performance at the following one, thus children need to pass each stage successfully.

Similar to Frith's (1985) stage theory, Ehri (1995) came up with a four-phase theory of reading development. Ehri's theory suggests four phases as follows: *pre-alphabetic*, *partial alphabetic*, *full alphabetic* and *consolidated alphabetic* phases. Alphabetic processing emerges as the core of Ehri's reading theory.

During the first phase, children make connections between some visual elements of the words and their pronunciation or meaning. Similar to Frith's first stage, there is no understanding of sound-letter mappings. In the following phase, children start to develop an understanding of sound-letter correspondences, which Ehri (1995) regards "phonetic cue reading" (p. 119). The third phase of the theory, full alphabetic phase, occurs when children develop sight word reading which is pivotal to the theory. Sight words are defined as the words which have been read many times before, so their recognition occurs more accurately and rapidly. Unlike Frith's theory, it is suggested that the formation of phoneme-grapheme mappings, which involves phonological processing, is essential at this phase. The last phase, consolidated phase, overlaps with Frith's orthographic stage, where repeated letter patterns get consolidated or unitized through sufficient practice. The most striking difference between Frith's and Ehri's theories appears that Ehri does not regard the phases as prerequisites of each other as Frith does. Put differently, the phases in Ehri's theory are not completely distinct from each other, instead they are overlapping throughout the development of reading.

Taken together, both cognitive and developmental theories of reading has contributed to our understanding of reading acquisition. Herein, to review the studies investigating the cognitive and linguistic components of reading and the relative relationships among them is very likely to provide us with a more comprehensive picture of the phenomenon.

2.2 Predictors of reading ability and the review of previous studies

Reading has been acknowledged as a complex, intellectual skill which encompasses a variety of cognitive and linguistic abilities and processes. Of particular interest, reading research has discussed which abilities and processes underlie reading acquisition, and to what extent they contribute to and/or facilitate reading achievement. Among the variables which are found to be strong correlates and predictors of reading ability, the most extensively discussed ones have been phonological awareness, PA, phonological memory, PM, rapid automatized naming, RAN, and morphological awareness, MA.

Understanding the nature and the development of these constructs may shed light on how they are related to the reading ability. In regards, the following subsections of this part provide both information about the theoretical and developmental conceptualization of each construct, and a comprehensive review of the previous studies investigating their role in reading acquisition and success.

2.2.1 Phonological awareness

Children first acquire the sound structure of their language by virtue of their innate tendency for a verbal communication system (Gillon, 2007). The perception of speech sounds even starts prior to the birth, and continues to function through the initial stages of life. Jusczyk (1992), for instance, indicates that such abilities of infants as to distinguish the voice of their mother from other people's, recognize the sounds of their native language, and discriminate between sound contrasts are among the earliest acquired skills in life. Noteworthy, all these early skills occur at the unconscious level; however, children are required to move from this unconscious stage to a conscious one where they begin to explicitly reflect on implicitly acquired phonological knowledge (Mattingly, 1992). This ability to become explicitly aware of the sound structure of words is called *phonological awareness*, PA. Anthony and Francis (2005) defines PA as "one's ability to recognize, discriminate, and manipulate the sounds in one’s language, regardless of the size of the word unit” (p.256). In more specific terms, PA refers to the explicit knowledge that spoken words are composed of smaller elements (i.e., *syllables*, *onsets*, *rimes*, and *phonemes*), and these elements can also be manipulated in many different ways (i.e., *deleting*, *blending*, *segmenting*, and *altering*).

Aligned with the hierarchical phonological theories (Berndhart & Stoel-Gammon, 1994; Treiman, 1993) which suggest a hierarchical representation of PA at certain levels, Gillon (2007) describes PA as a multilevel skill including three different sub-skills: syllable awareness, onset-rime awareness, and phoneme awareness (Gillon, 2007). Figure 1 illustrates the certain representational levels for a word, *basket*.

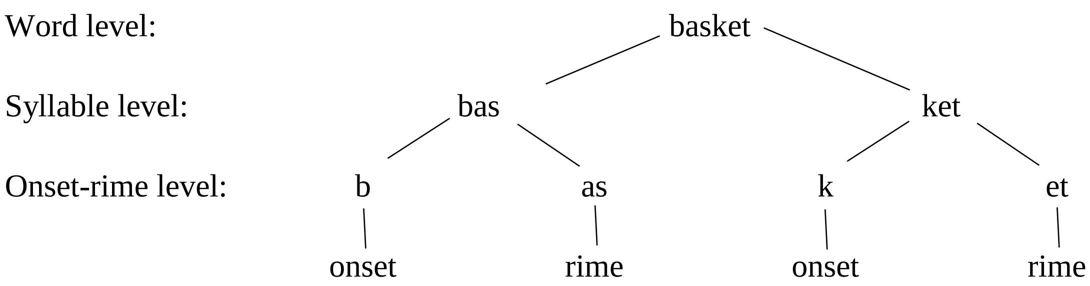

Figure 1 Representation of phonological structure of the word *basket*
(Adapted from Gillon, 2007, p. 4)

At the syllable level, PA entails the ability to break down the words into syllables, which is also called syllable awareness. At the intrasyllabic level, the awareness of the fact that syllables and words can be divided into smaller units such as onset and rime (e.g., cat; */k/* is the onset, */æt/* is the rime) is called onset-rime awareness. As for the last level, phoneme level, to know that words and syllables can be segmented into individual sounds is referred to as phoneme awareness (e.g., cat; /k/ /æ/ /t/). Phonemes are the smallest units of sound which have an influence on word meaning (Gillon, 2007). For example, the word *fish* is composed of three phonemes: /f/ /i/ /ʃ/, and the manipulation of these phonemes will create new words. The replacement of the first phoneme, */f/* with another phoneme */d/* will result in a new word, *dish*. Among these three levels of PA, phoneme awareness is regarded as the most sophisticated skill (Liberman et.al, 1974; Yopp & Yopp, 2009) and as the strongest correlate of early reading achievement (Adams, 1990).

Considering its multi-componential structure, PA is suggested to be defined and measured by means of different tasks which differ from each other with respect to which units of words (i.e., syllables, onsets, rimes, or phonemes) they focus on (Anthony & Francis, 2005). Gillon (2007) categorizes the various tasks of PA according to the levels of PA mentioned above. First, the tasks used to measure children's awareness at the syllable level are presented: *syllable segmentation, syllable completion, syllable identity* and *syllable deletion*. Then, the tasks employed to assess onset-rime awareness at the intra-syllabic level are provided: *spoken rhyme recognition*, *rhyme detection* or *rhyme oddity task* and *rhyme production*. As for the phoneme level, presented tasks vary as follows: *phoneme recognition, phoneme matching, phoneme isolation, phoneme blending, phoneme deletion, phoneme segmentation, phoneme reversal,* and *phoneme manipulation* (p. 5-7). Similar to Gillon's (2007) hierarchical categorization of PA tasks, Adams (1990) distinguishes between them with a focus on their difficulty levels. According to his categorization, the ability to remember common rhymes consists of the most primitive level, just requiring "an ear for the sounds of words" (p. 80). A second level requires the ability of children to compare and contrast the word sounds to identify rhyme and alliteration in them, which is elicited through oddity tasks. At the third level, both the knowledge that words are composed of smaller units, called phonemes, and the ability to combine these individual units to produce words are required. Phoneme blending tasks are employed to measure the awareness of children at this level. A fourth level is revealed in phoneme segmentation tasks which entail the ability to analyze the words into their smallest components. Finally, the most difficult level requires children to perform phoneme manipulation tasks in which they are expected to create new words by adding, deleting, or substituting phonemes in words.

Following the discussion of PA levels and tasks, the question how PA develops through these levels and manifests itself in different measures will herein be addressed. Anthony and Francis (2005) describe PA as a unified cognitive ability which reveals itself in a range of skills on a continuum of complexity throughout the early years of reading acquisition. As such, a great deal of research has been undertaken to unravel the developmental pattern of PA by administering various tests of PA to people ranging in age, reading levels, and languages (English: Anthony, Lonigan, Burgess, Driscoll, Phillips & Cantor, 2003; Liberman, Shankweiler, Fisher & Carter, 1974; Treiman & Zukowsky, 1991; Italian: Cossu, Shankweiler, Liberman, Katz & Tola, 1988; Spanish: Denton, Hasbrouck, Weaver, & Riccio, 2000).

The most prominent finding of this branch of research was the predictable sequence of PA development. That is, children become increasingly more aware of smaller units of words as they grow older. In all these studies which generally compared the performance of younger age groups (3-4 years of age) with older ones (5-6 years of age) on PA tasks, it was found that the highest ratios of success in PA tasks belonged to the older age groups. In addition to the age effect, the task also appeared as an important factor in these studies in that word level tasks were performed better than syllable level ones, followed by phoneme level tasks in each age group. Noteworthy, Anthony and Francis (2005) argues for a universal sequence of PA development from larger units of sounds to smaller, with the caveat that "the rate that populations of speakers of different languages progress through the sequence and the proficiency they achieve at each level vary" (p.256).

Now that a theoretical context for the developmental conceptualization of PA has been discussed, we launch into the research literature focusing on the role of PA in reading acquisition. As stated above, PA has garnered a great deal of attention from the researchers in the field of reading since Liberman and her colleagues published their seminal work in the 1970s (Liberman, Shankweiler, Fisher & Carter, 1974). Castles and Coltheart (2004) regard it as "a key to unlocking the complex process by which children learnt the relationship between spoken and written words" (p.77).

A robust body of research conducted in English has acknowledged PA as a crucial component and strong predictive of subsequent reading achievement (Stainthorp, 2003; Pullen & Justice, 2003). Their results pointed out a strong relationship between PA and reading both at initial and subsequent stages of reading development (Ball & Blachman, 1991; Bradley & Bryant, 1983; Kirby, Parilla & Pfeiffer, 2003; Torgesen, Wagner & Rashotte, 1994; Wagner et al., 1994). Some other opaque languages also showed a similar picture regarding the relation of PA to reading ability (French: Demont and Gombert; 1996; Swedish: Lundberg et al., 1980). As for the transparent orthographies with simpler and more consistent letter-sound correspondences, the studies have reported inconsistent and even sometimes contradictory results with regard to the role of PA in reading. While some studies have yielded consistent findings with research in opaque languages (Czech: Caravolas, Volin, & Hulme, 2005; Dutch: Dufva, Niemi, & Voeten, 2001; Finnish: Müller & Brady, 2001), others have argued that early PA skills do play a less important role in facilitating or predicting future reading success in regular orthographies (Dutch: de Jong & van der Leij, 1999; Turkish: Babayiğit & Stainthorp, 2007; Öney & Durgunoğlu, 1997).

Conducting one of the earliest and probably most cited studies in the literature, Bradley and Bryant (1983) investigated the predictive role of PA in later reading and spelling success of children in a longitudinal design. A total of 403 English-speaking preschool children were involved in their study, and a rhyme oddity task was administered to measure children's awareness that the words have a shared ending (i.e., rime) that can be independent from the beginning of the word (i.e., onset). The results indicated that onset-rime awareness of children measured at preschool level had a powerful and significant effect on reading achievement assessed through word recognition tasks at later grades, the first and second.

In another longitudinal study, Torgesen et al. (1994) followed 288 English-speaking children from kindergarten to grade 2, and unlike Bradley and Bryant's (1983) study, they assessed PA skills of children at the phoneme level, as well as their word reading abilities. Noteworthy, although this study included other cognitive and linguistics components of reading such as PM and RAN, the focus of the study was PA and the others were employed just to check whether PA was a unique predictor of word reading ability beyond the effect of others. The results demonstrated that PA, measured by means of two tasks, namely phoneme recognition and phoneme blending, independently contributed to subsequent word reading abilities of children at Grade 1 and 2. Also, their findings suggested that PA still held its contribution after accounting for other variables in the study while PM and RAN did not significantly explain any variance in reading measures.

Further, a very comprehensive longitudinal study was carried out by Wagner et al. (1997) in English. In their study, 216 children from kindergarten to fourth grade were followed and annually assessed on their phonological processing abilities *(i.e., phonological awareness, phonological memory* and *phonological naming*) and word-level reading skills (*real word* and *non-word reading accuracy*). Again, the focus of the study was to examine the unique influence of PA on word-level reading abilities beyond that explained by the other two aspects of phonological processing. As expected by the researchers, PA was shown to be a consistent and significant predictor of word recognition and decoding at each point of the measurement (namely, at the end of each grade). Although phonological naming and vocabulary were also found initially related to individual differences in reading abilities, these relations disappeared as the grade level increased.

Similarly, in an early longitudinal study, Demont and Gombert (1996) investigated the predictive role of PA in recoding skills (real word reading accuracy and speed) and reading comprehension in French, after controlling the effects of intelligence and vocabulary. Also, they aimed to examine the contribution of syntactic awareness to the respective reading measures compared to that of PA, again including the same control variables. They followed 23 French-speaking children from Grade 1 to 3. Their results revealed that PA measured at early years of reading development was a strong predictor of later recoding skills, while syntactic awareness predicted reading comprehension better at later grades. This study conducted in another opaque language provided more evidence consistent with English literature that acknowledged PA as a crucial predictor of word reading abilities. Besides, it interestingly showed that phonological skills were replaced with other linguistic components in predicting higher levels of reading ability.

Another comprehensive longitudinal study conducted in English came from Kirby, Parrila and Pfeiffer (2003) who followed 161 English-speaking children from kindergarten to Grade 5. They annually tested children's PA and RAN skills together with such control variables as letter knowledge, verbal and nonverbal intelligence. The focus of the study was to investigate the relative effects of PA and RAN in predicting different measures of reading. Hence, at this point, only the results regarding PA will be presented, and this comprehensive study will be re-reviewed in the RAN subsection below. That is, in this study, PA revealed as a significant predictor of all the reading measures at each grade but with a decreasing effect over time. Of particular relevance to the current study, the results showed that PA predicted non-word reading better than real word reading, which pointed to a task effect on the role of PA in reading achievement.

As for the transparent orthographies with a regular mapping of phonemes onto graphemes, the study by Müller and Brady (2001) suggested that PA was a significant predictor of reading ability in Finnish. In a cross-sectional design, they administered the measures of PA, naming speed, listening and reading abilities to the children attending Grade 1 and 4. The results revealed that at the end of Grade 1, PA was significantly related to all measures of reading ability (*i.e.*, decoding accuracy and speed, and reading comprehension), even after eliminating the effects of age, intelligence, vocabulary and naming speed. At Grade 4, the contribution of PA was found to be significant only for decoding accuracy, by explaining a small amount of the variance in that reading measure. These findings suggested that PA was importantly related to reading achievement in a transparent language, regardless of the depth of the orthography. However, the effect of PA showed a decrease in later stages of reading development, which would have been expected on the basis of previous studies such as Kirby et al.’s (2003) indicating that the effect of PA was found to diminish due to rapid gaining in reading and spelling in transparent orthographies.

Through a comparative study conducted with English- and Czech-speaking children, Caravolas et al. (2005) provided further evidence for PA as a crucial component of reading ability in both opaque and transparent orthographies. They tested two large groups of children in Grade 2 to 7 from both languages via different measures of reading, spelling and PA. Also, they used other reading-related cognitive and linguistic measures such as nonverbal ability, vocabulary, processing speed and verbal short term memory as control variables. The results showed that PA played a significant role in predicting reading ability (i.e., word reading speed, reading comprehension and spelling) of children in Grade 2 to 7 at both languages. The researchers argued that using equivalent measures of predictors and reading ability would enable to see very similar results in consistent and inconsistent orthographies. Also, they pointed to the importance of using a sensitive PA task, which was speeded measure of phoneme deletion in this case.

Although Müller and Brady (2001) and Caravolas et al. (2005) highlighted the persistent role of PA in predicting reading abilities at later stages, irrespective of the orthographic consistency, other studies reported that the significant contribution of PA to reading faded away in transparent orthographies as the grade-level increased. For instance, Öney and Durgunoğlu (1997) investigated early reading acquisition in an almost perfectly consistent orthography, Turkish which is also the context of the present study. They assessed first grade children’s performance on the tests of PA, real word and pseudo-word recognition, spelling and listening comprehension at the beginning and end of the first semester (*i.e.*, with a four-month time interval). As hypothesized in their study, PA was shown to predict word recognition only during the early stages of reading acquisition. They stated that it was since children's PA skills reached ceiling level towards the end of the first grade due to the perfect consistency of phoneme-grapheme mappings. Although the grade level included in their study was lower than the present study, it is still particularly important in terms of reflecting the orthographic characteristics of Turkish language.

Of particular interest, another study carried out in Turkish came from Babayiğit and Stainthorp (2007) who followed 56 preschool children to Grade 2. They investigated whether PA measured at kindergarten would significantly contribute to subsequent reading abilities (real word and non-word reading fluency and reading speed) and spelling skills in a highly transparent writing system, Turkish. To see the unique effect of PA on reading and spelling skills, they also included measures of vocabulary and short-term verbal memory, PM as control variables during the analyses. The results demonstrated that preschool PA did not make any significant contribution to later reading skills, while it appeared as the strongest predictor of spelling skills. Interestingly, their results showed that PM was the strongest and reliable correlate of reading speed over years. This study highlighted the importance of orthographic transparency in the predictive role of PA in different reading abilities as in several studies reviewed above. Babayiğit and Stainthorp (2010, 2011) conducted further research on the relation of PA to reading and spelling abilities in Turkish. Since these studies were carried out with a special focus on the relative roles of PA and RAN in reading, they will be reviewed in the RAN subsection below.

However, prior to reviewing the studies conducted with a special reference to the role of RAN (mostly along with PA) in reading, we will briefly mention research on the role of phonological memory, PM in reading acquisition. Although the amount of the studies carried out with a focus on the role of PM in reading is quite limited compared to research on PA and RAN, it was included in almost all the other studies as a control variable to address the unique effects of PA and RAN.

2.2.2 Phonological memory

PM, *phonological memory*, is simply defined as storing information coded in a sound-based representational mechanism only for a short time (Baddeley, 1982). Put differently, according to Wagner et al. (1994), it is the ability to use phonological segments to retain information for temporary storage. Wagner and Torgesen (1987) address PM as one aspect of phonological processing, along with phonological awareness and rapid naming, and regarding the relation of PM to reading ability, they stated that the ability to code phonological information efficiently should enable the beginning reader to maintain a precise representation of the phonemes related to letters or units of words while devoting the most of potential cognitive resources to decoding and comprehension processes. PM is generally measured through the tasks that require repetitions of non-words or digits forward or backward.

A number of studies have acknowledged the pivotal role of phonological processing abilities in reading development, and they have mostly focused on the measures of PA and RAN. Although there has been no consensus on the predictive role of PM in reading development, most of the studies included it as a control variable and reported that it had only a weak contribution to reading ability, particularly considered together with PA and RAN (e.g., Babayiğit & Stainthorp, 2007; de Jong & van der Leij, 1999; Dufva, Niemi, & Voeten, 2001; Georgiou, Parrila, & Papadopoulos, 2008; Kirby et al., 2003; Parrila, et al., 2004).

Within the scope of the literature reviewed for the current study, Dufva et al. (2001) was the only study carried out with a special focus on the predictive role of PM in reading ability. In a longitudinal design, the researchers followed a total of 222 preschool Finnish- speaking children through Grade 2. Their main aim was to investigate the interplay between PA, PM and reading development at each point of the measurement (namely, at the end of preschool, Grade 1 and Grade 2). The reading measures employed in the study were word recognition and reading comprehension. As noted earlier, the main focus of the researchers was the effect of PM assessed through three different measures, word span, sentence span and digit span forward test on reading ability. As for the results, it was revealed that the effect of PM on both word recognition and reading comprehension was an indirect and moderate effect, whereas PA emerged as the most significant predictor of word recognition. The researchers stated that the effect of PM was through its effect on PA; that's why they interpreted it as an indirect influence.

Other views and studies have also supported the interpretation of Dufva et al. (2001) that PM was not a significant predictor of reading ability alone, despite being closely correlated with other correlates of reading such as PA and RAN. Thus, it is assumed that PM might be sharing more of its predictive variance in reading ability with other aspects of phonological processing, particularly PA and RAN (e.g., Babayiğit & Stainthorp, 2007; de Jong & van der Leij, 1999; Denckla & Cutting, 1999; Georgiou et al., 2008; Parrila et al., 2004; Wagner et al., 1994). Some of these studies have already been reviewed throughout this section, and others will be also given later on. Taken together, the findings of various studies indicate that there are opposing views about the role of PM as a predictor of word reading and reading comprehension. In other words, there seems to be no general consensus among researchers as to the predictive power of PM in explaining subsequent reading skills. However, it is important to take into consideration its possible effect in a study investigating the predictors of reading ability. Therefore, the current study includes PM as a control variable.

As noted earlier and the research line given above has shown, rapid automatized naming, RAN is also among the most extensively studied cognitive components of reading, along with PA and PM. Therefore, in the following subsection of this chapter, the pertinent literature focusing on the relation of RAN to reading development will be presented.

2.2.3 Rapid automatized naming

RAN, *rapid automatized naming*, is commonly referred to as the ability to name a set of highly familiar visual stimuli such as colors, pictures, letters, and digits as quickly as possible (Wolf & Bowers, 1999; Denckla & Cutting, 1999). Since RAN was established as a useful correlate and predictor of reading by the seminal work of Denckla and her colleagues (Denckla & Rudel, 1972, 1974, 1976), it has initiated an entire area of interest in the field of literacy development.

Although the role of RAN in reading development has been widely investigated, the evidence is still inconsistent, particularly regarding the shape of its relation to reading and its position among other reading components. The first line of research defines RAN as the efficiency of phonological code retrieval and places this ability within the domain of *phonological processing*, alongside PA and PM (e.g., Torgesen, Wagner, Rashotte, Burgess, & Hecht, 1997; Vellutino et al., 1996; Wagner & Torgesen, 1998). In this account, the relation of naming speed to reading is explained that both abilities, namely RAN and reading require access to phonological information stored in the long-term memory via phonological processing.

However, another line of research argues that RAN is not a subcomponent of phonological processing and functions separately from this domain (Bowers & Wolf, 1993; Wolf, 1997). This second line of research points out the double-deficit hypothesis by Wolf and Bowers (1999) as an evidence for the differentiation between RAN and PA, since the hypothesis proposes three different types of poor readers: those with only phonological deficits, others with only RAN deficits and the last group with both deficits. Thus, they state that RAN plays an independent role from PA in reading development, and it remains as a significant predictor of reading across languages, irrespective of the orthographic consistency whereas the contribution of PA to reading varies based on the orthographic regularity.

Grounded on the Wolf's double-deficit hypothesis, Denckla and Cutting (1999) conducted a study with seventy-nine normally developing children at Grade 1, 2, and 3. They measured the participants' PA (through *phoneme deletion task*), PM (through *digits forward*), and RAN (through digit sub-test) skills as well as their word reading ability. Their results highlighted a unique contribution of RAN to word reading ability together with PA across grades. However, PM did not make any unique contribution to word reading, which was attributed to its overlap with PA by the researchers. Rather than phonological processing, this account suggests that RAN is related to reading via its role in orthographic processing (e.g., Bowers, Golden, Kennedy, & Young, 1994; Bowers & Wolf, 1993; Conrad & Levy, 2007; Manis, Seidenberg, & Doi, 1999). Orthographic processing is considered to be the mechanism by which "groups of letters or entire words are processed as single units rather than as a sequence of grapheme-phoneme correspondences" (Kirby, Georgiou, Martinussen, & Parrila; 2010, p.343). That is, when the words become recognized as sight words (Ehri, 1997), they start to act more like single visual stimuli as in RAN tasks, thus both word reading and naming speed will similarly function in access to lexical units and show strong correlations with each other.

These early theoretical explanations have just paved the way for further research that investigates the unique contribution of RAN to reading achievement, namely its position among the other correlates and predictors of reading. As noted earlier, despite the robust amount of research on the relation of RAN to reading ability, the evidence is still inconsistent and sometimes contradictory. Kirby et al. (2010) refers to the three reasons for the inconsistency in the literature: the type of reading measures and the control variables employed in the study; and the variety of languages/orthographies in which the study was conducted. RAN tasks have been employed in the studies including a variety of reading measures, both at word-level (i.e., *real word* and *non-word reading*, [both *accuracy* and *speed*]) and at text-level (i.e., *reading comprehension*, *text reading speed*, etc.). Besides, the studies vary in terms of the other variables included in their study together with RAN. Finally, the studies have been carried out in a wide array of languages, ranging from inconsistent and consistent alphabetic languages to non-alphabetic languages (for a review, see Kirby et al., 2010). Thus, these three factors have been taken into consideration throughout the review of the studies given below.

To begin with, in their longitudinal study, also reviewed in the PA section above, Kirby et al. (2003) found that both PA and RAN, measured at kindergarten level, were strong predictors of subsequent reading success over years. Although PA and RAN strongly correlated with each other, they made significant unique contributions to both reading measures, real word and non-word reading accuracy.

However, the amount of variance they significantly explained changed over years. While PA contributed to the reading measures during the early years and tended to reduce its contribution in time, RAN's influence on the reading measures was initially weaker, and got stronger in the later grades. Another striking finding was that RAN had a weaker effect on non-word reading ability than on the real word reading measure. According to the researchers, the diminishing effect of PA in time might be explained that children's reading development moved from reliance on phonological to more orthographic knowledge. The same interpretation also explained why RAN got more important in time. That is, later reading development relies on more automatized processing (Ehri, 1997).

Similarly, Parrila, Kirby and McQuarrie (2004) followed the reading development of a group of English-speaking children from kindergarten to Grade 3. More specifically, their study aimed to investigate the joint and unique predictive roles of such measures as articulation rate, PM, RAN, and PA assessed in kindergarten and again in Grade 1 in word reading and text comprehension across Grade 1, 2, and 3. It was revealed that both PA and RAN measured in Grade 1 significantly predicted both reading measures throughout the grades. When it was measured in Grade 1 rather than kindergarten, PA was a stronger predictor of reading success. As for articulation rate and PM, they did not significantly account for any variance in reading measures, when they were analyzed together with PA and RAN, which meant that they shared their predictive effect with other phonological processing tasks. Another interesting result from this study was that PA and RAN tasks predicted subsequent reading success in more unique ways than they did early reading success.

These two studies were conducted in a very inconsistent orthography, English. They commonly indicated that both PA and RAN were two unique predictors of reading ability, and they predicted reading ability in more distinct ways at later stages of reading development, compared to the early stages. To see whether such findings can be found in transparent orthographies, studies from other languages will be reviewed at this point.

In a transparent orthography of Dutch, de Jong and van der Leij (1999) conducted a longitudinal study with 166 children from kindergarten through Grade 2. They found that when the three variables, PA, RAN and PM were measured in kindergarten, only RAN appeared as a significant predictor of word reading ability, assessed via real word and non-word decoding speed tasks, at Grade 1 and 2. If they were assessed at the beginning of Grade 1, in addition to naming speed, PA also predicted a significant amount of the variance in word reading ability at the end of Grade 1. It was revealed that the predictive role of phonological abilities increased at initial stages, but after Grade 1, this effect diminished. This finding supported the results of the study by Kirby, et al. (2003) mentioned above. Further, Moll, Fussenegger, Willburger and Landerl (2009) conducted a thought-provoking research on the changing role of RAN and PA in word-level reading ability, with a special reference to the measurement of reading ability, real word/non-word reading fluency and spelling, and the transparent orthography of German. They worked with a very large sample (N = 1248) of children at grades ranging from 2^{nd} to 5^{th}. To investigate the unique contributions of the variables, namely RAN and PA to the respective reading measures, they performed hierarchical regression analyses, controlling for the effects of age and intelligence. The results indicated that RAN was a stronger predictor of both real word and non-word reading fluency than PA, while PA was a better predictor of spelling than RAN. The researchers suggested that the RAN-literacy association should be explained through the integration of a number of processes such as “efficiency of visual-verbal processing or, in other words, with the automaticity of orthography to phonology associations at the letter and letter cluster level” (p.22).

Supporting evidence came from a very recent study conducted in a transparent language, Spanish by González-Valenzuela, Díaz-Giráldez and López-Montiel (2016). They also examined the role of cognitive variables, PA, PM and RAN in real word and pseudo-word reading abilities of first grade children by employing both accuracy and fluency tasks for reading. The results pointed to the importance of the type of orthography and the type of reading measures used while explaining the relationship between reading and various cognitive variables. That is, in Spanish with consistent phoneme-grapheme mappings, the variance in real word and non-word accuracy measures was best explained by PA, whereas the best predictor of both reading fluency measures was RAN.

There are also studies carried out concurrently in two languages that are different with respect to the regularity of their orthographies. For instance, in a comparative study, Georgiou, Parrila and Papadopoulos (2008) followed two groups of children from an orthographically irregular language, English and an orthographically regular language, Greek. While the measures of PA, PM, RAN, orthographic processing, word decoding, and reading fluency were administered to the children at Grade 1; only the reading measures were re-administered at Grade 2. The results showed that both PA and RAN uniquely contributed to reading ability at Grade 1 and 2; however, the significance of these two predictors differed in two languages, especially with regard to their influence on word decoding. PA predicted word decoding (namely, accuracy) better in English than in Greek, which means that reading development in irregular orthographies puts more demands on phonological skills than in regular orthographies. Besides, RAN was found to be a stronger predictor of word fluency in Greek than in English. This finding is consistent with the literature that RAN accounts for a substantial amount of the variance in reading fluency tasks, particularly in transparent languages.

Of particular relevance, Babayiğit and Stainthorp (2010) followed 57 Turkish-speaking children from Grade 1 to Grade 2 to investigate the predictive roles of PA and RAN in reading and spelling development. To measure word-level reading ability, they employed three different tasks such as real word reading fluency, non-word reading fluency and agglutinated word reading fluency. Their results revealed that RAN was the strongest longitudinal predictor of reading fluency, and it remained significant even after controlling for the effects of other predictors and previous reading abilities. PA did not significantly contribute to word-level reading ability of children while it explained a significant amount of the variance in spelling ability, which was not included within the scope of the current study. Regarding the respective role of PA and RAN in reading fluency, the results of their study are important for the current study which sought to address the similar issues in the context of the same language.

Similarly, Babayiğit and Stainthorp (2011) conducted one-year longitudinal study with a total of 103 Turkish-speaking children. Two groups of children from Grade 2 and 4 were followed to Grade 3 and 5, respectively. They tested these children on the following measures: PA, RAN, vocabulary, listening comprehension and working memory. They examined the relative role of these measures in predicting reading abilities, namely word reading fluency and reading comprehension, and spelling. Their study yielded consistent results with the previous research evidence from other regular orthographies reviewed above that RAN was the strongest and consistent predictor of word reading fluency, whereas PA was a powerful predictor of spelling. As for the other predictors included in the study, they did not make any significant contribution to reading measures and spelling beyond the effect of PA and RAN. This study was also important since it included higher levels of reading ability such as reading comprehension, along with word-level reading measures. However, these findings were not reported since they were beyond the scope of the present study.

Another study recently carried out in Turkish came from Sönmez (2015) who investigated the role of PA skills and RAN in predicting reading and spelling abilities of 3^{rd} and 4^{th} graders in Turkish. The results demonstrated that the performance of the fourth graders on PA measures did not differ from the performance of the third graders, while they performed significantly better in RAN, word reading and word spelling tasks. With regard to the relative role of PA and RAN in predicting reading and spelling abilities, it was revealed that RAN was a better predictor of reading abilities at both grade levels, while PA better predicted spelling skills, especially at Grade 3. Align with the previous research, PA made a significant contribution to the reading skills of the third graders while its effect diminished at Grade 4. Once again, the results highlighted that RAN was a more powerful and consistent predictor of reading ability in transparent orthographies.

Thus far, the findings of previous research on the relative role of PA, PM and RAN in predicting reading ability have been reviewed. There is another linguistic component of reading ability included within the scope of the present study, morphological awareness (MA). Thus, the last part of this chapter is devoted to MA.

2.2.4 Morphological awareness

MA is simply described as the knowledge of morphemes, which are the basic semantic units of the language (Hockett, 1958), and operationalized as the ability to reflect upon and manipulate the morphemic structure of words presented written or orally (Carlisle, 1995). It has been acknowledged as a strong predictor of performance on a range of reading measures including single-word reading, pseudo word reading, and reading comprehension. Furthermore, MA has persisted in significantly contributing to reading achievement even after controlling for the effects of other reading-related variables, namely PA, RAN, PM, vocabulary and intelligence. That is, the last few decades has recorded a growing body of research focusing on the relation of MA to reading ability. Moreover, this line of research has provided compelling evidence that MA makes a significant contribution to reading success of children in a wide range of languages (Arabic: Layes, Lalonde & Rebai, 2017; Chinese: McBride-Chang et al., 2003; Dutch: Rispense, McBride-Chang, & Reitsma, 2008; English: Brittain, 1970; Carlisle, 1995; Carlisle, 2000; Carlisle & Nomanbhoy, 1993; Fowler and Liberman, 1995; Kirby and Deacon, 2004; Mahony, Singson, & Mann, 2000; Shankweiler et al.; 1995; Singson, Mahony and Mann; 2000; French: Casalis and Louis-Alexandre, 2000; Plaza & Cohen, 2003, 2004). Herein, the pertinent literature will be comprehensively reviewed from a cross-linguistic perspective.

The general explanation underlying this unique relationship is suggested to be that MA requires the knowledge and awareness of various aspects of linguistic sensitivity including not only phonological but also syntactic and semantic knowledge; therefore, it accounts for a comprehensive index of reading development, above and beyond PA and other cognitive factors. In regards, the pertinent literature has indicated that the ability to reflect upon and manipulate the morphemic structure of words might enable children to associate the phonological units with meaning and function. The studies investigating this phenomenon vary in terms of language, the age and reading level of the participants, the study design (i.e., *cross-sectional* or *longitudinal*), the measurement of reading abilities and/or MA, and the control variable they accounted for.

Brittain (1970) was reported to be the first who studied the relationship between English-speaking children's awareness of morphology and their reading achievement as well as exploring possible grade and gender differences in these relations. A total of 134, attending Grade 1 and 2, participated in the study, in which their inflectional performance and general reading ability were assessed. To measure MA, the researcher employed a revision of the test developed by Berko (1958) in which the subjects were expected to supply the omitted words, namely inflected forms of nonsense words. As for the measurement of reading achievement, three different tasks assessing word recognition, word attack and reading comprehension skills, were administered to the subjects. A composite raw score, the total of scores taken in each subtest, was used for the statistical analysis. Besides the study variables, the researcher included a control variable, namely intelligence, in order to eliminate the possibility that the relationship between the two was only a reflection of their shared link to intelligence. First to note, although the second graders performed better than the first graders, the results showed no significant grade differences between the performance of the two groups on the inflectional performance test as hypothesized. In addition, more importantly for the current study, Brittain (1970) reported a significant relationship between inflectional performance and reading ability even after controlling for the effect of intelligence.

In another early study, Fowler and Liberman (1995) investigated the relation between MA and the reading skill during the early years of schooling. 48 English-speaking children from Grade 2, 3, and 4 were selected for the study, and they were grouped into three different levels of reading: low, average and high. MA was assessed by a test of morphological production developed for the study. Children were asked to produce the derived target provided as the base form or the base form given the derived. To assess reading ability, the researchers used two different measures: word identification and word attack. As a control variable, children’s receptive vocabulary was assessed by means of a vocabulary test, in which children choose the target picture among the four options, corresponding to the orally provided phrase. The findings were consistent with the study of Brittain (1970) reviewed above in that a significant association between MA and reading, assessed as real and non-word reading, was found beyond the variance accounted for age and vocabulary knowledge.

In a more recent study, Singson, Mahony and Mann (2000, Experiment 1) explored the relationship between sensitivity to morphology and word-reading abilities in children studying in various grades (i.e., from 3rd to 6th grade). They examined the use of derivational suffixes and reading ability as well as controlling for intelligence, vocabulary and verbal short-term memory with a group of 52 elementary school children. Sensitivity to morphology was measured by a sentence completion task, in which children were expected to choose the correct option among the derived versions of the words. To make sure that the test measured morphological skill rather than vocabulary knowledge, both real and nonsense derivational forms were included. Also, to minimize the confounding effects of decoding problems, there were two types of presentation: The ‘Written’ version requiring the participants to silently read the items, and the 'Oral plus Written' version entailing the participants to follow the items while the experimenter read them aloud. As for reading ability, it was measured through the tasks of word recognition and word attack. Unlike the previous studies reported above, this study took into consideration the effect of verbal short-term memory (PM), as well as intelligence and vocabulary. The results of the study indicated that MA suggests a genuine contribution to reading ability, independent from the effects of intelligence, vocabulary, and verbal short-term memory.

In a related study, Mahony, Singson and Mann (2000, Experiment 1) provided more evidence for the unique contribution of MA to reading ability of 2nd, 3rd, 4th, 5th, and 6th graders. This time, they administered a different measure of morphological awareness, *Morphological Relatedness Test*, which was a judgement task, requiring children to distinguish morphologically related word pairs (e.g., *teach-teacher*) from foils (e.g., *doll- dollar*). The measurement of reading ability was achieved by the same word identification and word attack subtests as in their other study (Singson, Mahony, & Mann, 2000). The only control variable was vocabulary. More central to our interest, the results indicated that although vocabulary and MA were highly interrelated components of reading, sensitivity to morphological relations significantly explained a unique amount of the variance in word- reading abilities of children in all the grades studied.

In all the studies reviewed above, reading abilities, which were measured in relation to MA remained limited to word-level tasks (i.e., word identification and word attack). Addressing to an additional and essential question, whether the awareness of morphemic structure is significantly linked to reading comprehension, Carlisle (2000) carried out a comprehensive study with the third and fifth graders in

English. In addition to word reading measures, she administered a reading comprehension test, requiring children to read short texts and choose the best answers for the following comprehension questions. Also, MA was assessed by two different productive tasks: decomposition and derivation. The results pointed to a significant contribution of MA to reading achievement in word-level and text-level tasks for both grades. As such, the awareness of structure and meaning accounted for large portions of the variance in word reading and reading comprehension, respectively 41% and 55% for the third and fifth graders.

Insofar, these early studies indicated that MA makes a unique contribution to reading abilities after controlling for the effects of other variables such as verbal and nonverbal intelligence (e.g., Brittain, 1970), vocabulary (e.g., Fowler & Liberman, 1995; Mahony, Singson, & Mann, 2000; Singson, Mahony, & Mann, 2000), and verbal short-term memory (e.g., Singson, Mahony, & Mann, 2000). Considering the powerful predictive role of PA in reading achievement as reviewed above, PA should also be taken into consideration as a control variable while studying the effects of MA in relation to reading. In one of the earliest studies addressing this critical issue, Carlisle and Nomanbhoy (1993) investigated the role of MA in reading, above and beyond the effects of PA. They targeted a similar age group to Brittain's (1970), namely 6-year-old children, and sought to answer two main questions: First, to which extent PA contributes to the MA of the students in first grade, and to which extent phonological and morphological awareness explain variance in word reading performance of the first graders. Their study group included 101 children who were all native speakers of English. Both a receptive and a productive test were administered to assess the MA of children. They also assessed PA via syllable or phoneme deletion tasks, which were believed to discriminate children with varying levels of PA. Regarding the assessment of reading abilities, a word reading test, including randomly selected 25 words, was used. The results pointed to a great overlap between phonological and morphological abilities. In that, children with better phonological skills showed significantly better performance in both morphological tasks. However, it was also revealed that MA made a unique and significant contribution to reading ability despite its small amount. In absolute terms, MA accounted for 4% of the variance in word-reading ability, separate from the 37% of the variance explained by PA for the first graders in the study.

In a similar vein, Shankweiler et al. (1995) explored the relation of phonological and morphological awareness to reading ability in children between 7 and 9 years old, including age and intelligence as confounding variables. Their study differed from Carlisle and Nomanbhoy's (1993) in terms of its sample in that they included children with reading disabilities along with normally developing child readers. They used the test battery of Rosner and Simon (1971) to measure both phonological and morphological awareness. Their results indicated that the reading-disabled group performed worse in all the measures compared to the other group as expected. Further, it was revealed that children's MA made a small but significant contribution to word-reading ability, accounting for the 4% of the variance, beyond the 11% provided by phonological awareness, which was consistent with the results of Carlisle and Nomanbhoy's (1993) study.

Besides, Singson et al. (2000, Experiment 2) carried out a study with older children between 3rd-6th grades in order to explore the relation of MA to reading. They used the same instruments as they did in Experiment 1 reviewed above, to assess the use of derivational suffixes, namely MA, vocabulary, and the real word and pseudo word reading. In addition, this time they employed a PA task, i.e., *phoneme deletion*, in which children are expected to omit certain sounds from real and nonsense words. Their results showed that MA appeared as a significant contributor, accounting for an additional 4% of the variance in reading ability, after controlling the genuine influence of PA and vocabulary, respectively explaining 9% and 6% of the variance. Further, Mahony et al. (2000, Experiment 2) confirmed these previous findings in their study conducted with children in Grades 3-6. They also administered the same measurements as they used in Experiment 1 abovementioned, to assess the awareness of morphological relations, vocabulary, and reading abilities. In addition, a task of PA, i.e., *phoneme deletion*, was used in this experiment. It was shown that the ability of children to recognize morphological relations had an independent relationship with their word reading abilities beyond the effects of PA and vocabulary.

Considering the appropriate control variables, these studies provided strong evidence for the unique role of MA in reading ability, assessed both at word-level and text-level. Moreover, in their cross-sectional studies, Mahony et al. (2000), Singson et al. (2000) and Shankweiler et al. (1995) reported that the effects of MA on reading increase as children master in their reading skills. This finding highlighted an important developmental aspect of MA; however, these studies did not demonstrate a longitudinal nature which might allow the researchers to follow developmental changes for the same groups of children.

One of the few longitudinal studies in this field was carried out by Carlisle (1995). She initially included 154 kindergarten students, and ended up with only 85 of this initial group, arriving at second grade. She investigated three research questions; whether MA significantly developed between kindergarten and 2nd Grade, whether MA was a unique predictor of second-grade reading ability, and whether PA and MA differed in terms of their predictive nature and strength of reading ability. To measure MA and PA, a morphological judgement and a phoneme deletion task were administered respectively, while reading ability was assessed via pseudo word reading and reading comprehension tests. In relation to the first question, first graders were found to perform significantly better in MA tasks compared to their kindergarten performance. As for the second, MA, measured at first grade, emerged as a unique contributor of second-grade word reading and reading comprehension. Lastly, while PA was reported as the strongest predictor of word reading, MA appeared as the strongest predictor of reading comprehension at second-grade level.

Another significant longitudinal study was carried out by Kirby and Deacon (2004). Their study explored the relative independent contributions of PA and MA to reading ability, including the appropriate control variables such as verbal and nonverbal intelligence. They followed a group of English-speaking children over the course of four years, from Grade 2 to 5. While PA was measured by a sound oddity task, MA was assessed by a Sentence Analogy task, requiring children to complete the chain of sentences with another one (e.g., *Peter plays at school. Peter played at school. Peter works at home.* _). As in previous studies in the literature, the following reading tests were employed: word attack, word identification and passage comprehension. The findings of this study provided robust evidence for a significant independent role of MA in reading achievement, after taking into consideration other pertinent measures such as PA, verbal and nonverbal intelligence. It was also revealed that MA made a stronger contribution to reading comprehension than to real word reading. Surprisingly, pseudo-word reading was also significantly predicted by MA in this study. The researchers accounted for this finding by the assumption that children might have processed pseudo-words considering their morphemic structure.

Besides, as in the study by Carlisle (1995), the effect of MA in reading measures was found to increase over the course of reading development.

In a more recent longitudinal study, Kirby et al. (2012) followed 103 English speaking children from Grades 1 to 3 by assessing their MA and reading ability. They explored the relation of MA to five different measures of reading, namely word reading accuracy and speed, pseudo-word reading accuracy, text reading speed, and reading comprehension. For the assessment of MA, a word analogy task, requiring various morphological transformations, was employed. As for the results, MA was found to be a strong predictor of all measures of reading in the study, after taking account of intelligence and PA. The results also supported the increasing effect of MA to reading over time. While MA made no significant contribution to any of the reading measures in Grade 1, it significantly accounted for the variance in reading outcomes measured in Grades 2 and 3.

The studies pointing to the unique contribution of MA to reading went beyond English literature. Further evidence was also gathered through research conducted in other languages. Plaza and Cohen (2003), for instance, explored the performance of 267 French-speaking first- grade children on tasks measuring PA, MA, and RAN. They also measured children’s reading ability through three different measures, namely word and pseudo-word reading, and reading comprehension. They reported that MA explained a significant portion of the variance in the first-grade children’s reading abilities, after the variance in PA and RAN had been controlled. In a subsequent study, Plaza and Cohen (2004) tested reading abilities of 199 children, also included in their previous study (Plaza & Cohen, 2003), at the end of Grade 2. They sought to find whether PA, MA, and naming speed measured in Grade 1 could account for reading ability in Grade 2 by performing several hierarchical multiple regression analyses. The results confirmed that, in French as in English, the three variables accounted for a significant independent proportion of variance in reading ability.

In their longitudinal study, covering the last year of kindergarten to the second grade, Casalis and Louis-Alexandre (2000) investigated the interrelations between PA, MA and reading ability of 50 French-speaking children. It was revealed that MA made significant contributions to reading achievement of only second-grade children but not of first-graders, independently of the contribution made by the other variables including intelligence, vocabulary and PA. However, PA remained significant for both grades after controlling the effects of others. This finding conformed to some evidence provided in English that the effect of MA increased throughout reading development of children (e.g., Carlisle, 1995; Deacon, & Kirby, 2004; Mahony et al., 2000; Singson et al., 2000).

Supporting evidence came from the study carried out by Rispense, McBride-Chang, and Reitsma (2008) who investigated the influence three types of MA (i.e., *inflectional*, *derivational*, and *compounding morphology*) on word reading of Dutch-speaking children. A total of 216 children from two different grade-levels (104 from first grade, and 112 from sixth grade) were included in their study. The findings revealed that only noun inflection task was uniquely linked to word recognition of the first graders, while only derivational morphology independently contributed to word reading of the sixth graders, explaining the 3% of unique variance to the equation. Important to note, the study included age, vocabulary, intelligence, and PA as control variables. Unlike the previous studies suggesting the increasing contribution of MA to reading ability over time (Casalis & Louis-Alexandre, 2000; Carlisle, 1995; Deacon & Kirby, 2004; Mahony et al., 2000; Singson et al., 2000), no such an effect was revealed in this study. That is, there was almost no difference in the magnitude of the variance explained by MA between the two grades, and PA persisted into the following grades as the strongest predictor of reading. As Deacon, Wade-Woolley and Kirby (2007) suggest, this conflicting result might be attributed to the implementation of different tasks to measure MA and reading ability in the two studies. Plaza and Cohen (2003, 2004) used a judgemental task entailing both syntactic and morphological knowledge, while Casalis and Louis-Alexandre (2000) employed more specifically morphological tasks such as morphemic segmentation.

Investigating the same issue in a very different orthography, namely Chinese, McBride-Chang et al. (2003) assessed MA of 100 kindergarten and 100 second grade Chinese-speaking children, along with other reading-related variables including age, PA, RAN, speed of processing, and vocabulary. They employed two unique measures of MA developed with regard to particular properties of Chinese language. The results provided additional evidence to previous findings that MA played a strong predictive role in reading achievement of children. In this study, after accounting for the influence of the controls, MA significantly contributed to the variance in Chinese character reading of kindergarteners and second graders, with the proportions of 3-9%. Similarly, in a comparative study addressing Chinese and English, Ku and Anderson (2003) followed the morphological development of 412 Taiwanese and 256 American students in second, fourth, and sixth grades, with a specific reference to the effect of their MA to reading ability. The findings from both Chinese- speaking and English-speaking children highlighted the vital importance of MA for reading development in all the grades. Furthermore, MA still remained significant after accounting for the variance explained by the only control variable in the study, vocabulary. The results also confirmed previous findings that the significant portion of the variance in reading ability attributable to MA increased from the lower grade level to the higher.

In a very recent study carried out with Arabic-speaking children, Layes, Lalonde and Rebai (2017) addressed the same issue, the relation of MA to reading ability, in a morphologically based orthography of Arabic. Their study involved three different groups of readers: a group of sixth-graders with dyslexia (N=20), a group of sixth-grade normal readers (*N=20*), and a group of fourth-grade normal readers (*N=18*). They measured word reading, reading comprehension, MA and RAN skills of all the participants, along with their nonverbal intelligence. Note to first, as expected, a significant difference was found between dyslexic group and the other two with respect to all the reading-related measures in the study. More importantly for the current study, the results indicated a unique independent contribution of MA to reading comprehension of this group of Arabic-speaking children, after eliminating the influence of RAN and intelligence. In contrast, no significant association between MA and word reading was revealed for the same group. The researchers suggested that the ability of children to reflect on and manipulate the internal structure of the words is crucial for them to attain meaning. Furthermore, the study pointed to the increasing effect of MA in children's literacy development in subsequent years of elementary school, and the researchers attributed this finding to the increasing number of multi-morphemic words children encountered over time.

Taken together, all these studies confirmed the unique role of MA in reading achievement across languages, which foregrounded the notion that children's insights into the internal structure of words play a crucial role in reading development. Arguably, the role of such an ability in reading development is relevant, particularly for the languages with rich agglutinative morphology, such as

Turkish. Therefore, MA constitutes one of the crucial reading components to be investigated within the scope of the present study. Given that this study examines phonological and morphological components in reading acquisition of Turkish-speaking primary school children, some information in regard to Turkish phonology and morphology is presented next in Chapter 3.

CHAPTER 3

CHARACTERISTICS OF THE TURKISH LANGUAGE

This chapter briefly presents the characteristics of the Turkish language under two subsections. First, the phonological features of Turkish consonants and vowels are introduced. Then, some information about the morphological structure of the Turkish language is provided.

3.1 Turkish phonology

The articulation of words is carried out through the combination of different phonological units, namely consonants and vowels. The Turkish language contains 23 consonant phonemes, which are distinguished from each other based on the voicing quality *(i.e.*, *voiced* or *voiceless*), the place of articulation, and the manner of articulation (Erguvanlı-Taylan, 2015). With regard to the place of articulation, Turkish consonants are divided into eight categories as follows: *bilabial, labiodental, dental*, *alveolar*, *alveo-palatal, palatal*, *velar*, and *glottal*. Regarding the manner of articulation, they are categorized as follows: *stops, plosives, affricates, fricatives, nasals, laterals*, and *glides* (see Table 1 for details).

Table 1. Turkish Consonants

	Bilabial	Labio-dental	Dental	Alveolar	Alveo-palatal	Palatal	Velar	Glottal
Plosives	*p* *b*		*t* *d*			*c* *ɟ*	*k* *g*	
Affricates					*tʃ* *dʒ*			
Fricatives		*f* *v*	*s* *z*		*ʃ* *ʒ*		*ɣ*	*h*
Nasals	*m*		*n*					
Tap (Flap)				ɾ				
Lateral			*ɫ*		*l*			
Glide						*j*		

Source: Erguvanlı-Taylan (2015, p.11).

On the other hand, there are eight phonemically distinctive vowels in Turkish. The classification of the Turkish vowels depends upon the position of the tongue (*front* or *back*), the height of the tongue (*high*, *mid* or *low*), and the position of the lips (*rounded* or *unrounded*) (Erguvanlı-Taylan, 2015). There is no long vowel in Turkish, instead all of them are short with lax pronunciation. Table 2 illustrates the categorization of the Turkish vowels.

Table 2. Turkish Vowels

	Front		Back	
	Non-round	Round	Non-round	Round
High	*i*	*y (ü)*	*ɯ (ı)*	*u*
Mid	*e*	*œ (ö)*		*o*
Low	*ɛ*		*a*	

Source: Erguvanlı-Taylan (2015, p. 17).

One of the most well-known property of the Turkish language is probably *vowel harmony,* which is referred to as a set of constraints on the co-occurrence of vowels within words (Erguvanlı-Taylan, 2015). According to vowel harmony, the initial syllable of words may include any of the eight vowels since it is unpredictable; however, the vowel features in the following syllables are determined by the features of the preceding vowels in a sequential manner. As such, each subsequent vowel is conditioned by the preceding with regard to frontness/backness and rounding. Besides, the suffixes attached to the words are subject to vowel harmony through the same principles, which account for vowel alterations in the word roots (Topbaş & Yavaş, 2006).

With respect to the acquisition of phonological properties of Turkish in normally developing children, it is revealed that particular sounds are acquired earlier than others (Topbaş, 1997). For example, /b/, /d/, /k/, and /m/ are among the earliest acquired sounds, which are followed by /n/, /t/, and /p/, and then by /v/ and /s/ at later stages. In terms of the route children follow throughout their phonological development, the findings of the studies with Turkish-speaking children are consistent with the cross-linguistic literature (Seymour, Aro, & Erskine, 2003; Topbaş, 1997; Topbaş & Konrot, 1998). However, the transparency of the orthographic system accelerates the acquisition of phonological skills in Turkish, thus Turkish-speaking children master phonological processes more rapidly compared to children who learn to read in opaque languages (Babayiğit & Stainthorp, 2007; Öney & Durgunoğlu, 1997; Topbaş & Bleile, 2004).

3.2 Turkish morphology

Turkish is an agglutinative language, that is, Turkish words are mostly formed by productive affixations of inflectional and derivational morphemes to the roots. Being well-known for its rich morphological structure, the Turkish language allows a multitude of affixes to be added to the word root, each of which has a certain meaning and grammatical function (Göksel & Kerslake, 2011). Oflazer, Göçmen, and Bozşahin (1994) illustrates the richness of Turkish morphology with a common, exaggerated example of a Turkish word, "*osmanlılaştıramayabileceklerimizdenmişsiniz*", which can be broken down into the morphemes as follows:

"*osman – lı – laş – tır – ama – yabil – ecek – ler – imiz – den – miş – siniz"* (p.2).

Interestingly, the translation of this one word into English appears as "(behaving) as if you were of those whom we might consider not converting into an Ottoman" (p.3). Although it seems complex, the word formation in Turkish is quite straightforward. That is to say, morphemes that build up words are easily decomposed and recognized since they do not combine with each other, and there is always one-to-one correspondence between form and function (Erguvanlı-Taylan, 2015). In other words, each segment in a multi-morphemic word maintains its phonological and syntactic identity along with its meaning. Also, the order of the morphemes that form words is predictable in that derivational morphemes precede inflectional morphemes, which always appear in the word final position. Even among the same type of morphemes (*i.e*., inflectional or derivational), there is a predictable sequence, and a shift in the sequence of the morphemes leads to ungrammatical forms or forms with changing meanings (Göksel & Kerslake, 2011).

With respect to inflectional morphology, Erguvanlı-Taylan (2015) reports that the number of nominal inflections in Turkish is eight, including case markers, plural and possessive suffixes, whereas the number of verbal inflections is around thirty, consisting of negation, question, voice, person agreement, tense, aspect, and modality markers. As for derivational morphology, there is an exhaustive list of derivational suffixes which derive verbs from verbs, or verbs from nominals, as well as deriving nominals from nominals, or nominals from verbs (Göksel & Kerslake, 2011). Both in inflectional and derivational morphology, suffixation is the most common type of affixation occurring in the Turkish language. Only a few examples of pre-fixation appear in the language, they are indeed loan words that are not productively used such as “*natamam* [incomplete]” and “*namüsait* [inconvenient]” (Erguvanlı-Taylan, 2015, p. 106).

A multitude of morphophonemic rules constrain and modify the surface representations of morphological formations. For instance, vowels of the affixes have to agree with the preceding vowel in some aspects to maintain vowel harmony. Sometimes vowels in the stems and affixes are to be deleted. In a similar vein, consonants in the root of the words, or in the affixed morphemes are modified, and even deleted under certain conditions (Oflazer, Göçmen, & Bozşahin, 1994).

As for the morphological development of Turkish-speaking children, the studies highlighted an early acquisition of grammatical markers in Turkish due to the richness of the morphological structure (Aksu-Koç, 1998; Batman-Ratyosyan, 2003; Ketrez, 1999). The results of these studies revealed that Turkish-speaking children achieve mastery of most verbal inflections until the age of three and productively use them around at the age of five. Even the mastery of nominal inflections is gained earlier, around at the age of two.

This chapter has introduced the characteristics of Turkish phonology and morphology as well as presenting brief information about the developmental pattern Turkish-speaking children follow in the respective aspects of the language. The next chapter presents the methodology of the present study in detail.

CHAPTER 4

METHODOLOGY

This chapter explains the methods and procedures implemented in the present study. It is composed of five subsections as follows: research questions and hypotheses, participants, instruments, procedure and data analysis. First, the research design is presented together with the overview of the research questions and hypotheses of the study. In the following two sections, the participants and instruments employed in the data collection are respectively introduced in detail. Then, the procedure followed during the data collection is provided. Finally, the methods utilized in order to analyze the data are explained.

4.1 Research questions and hypotheses

The present study aims to investigate the role of phonological awareness (PA), phonological memory (PM), rapid automatized naming (RAN), and morphological awareness (MA) in predicting Turkish-speaking children's real word reading (WREAD) and non-word reading (NWREAD) abilities at Grade 2 and 4. In accordance with this purpose, a cross-sectional research design was employed in the current study since it enabled the researcher to characterize the main features of reading development of a group of monolingual children attending different grades (*i.e.*, second and fourth) at a particular point in time. As such, the current study sought to address the following research questions:

1) Is there a significant difference between Grade 2 and Grade 4 with regard to their PA skills, RAN performance, PM, MA skills, WREAD and NWREAD abilities in Turkish?

2) What are the correlations of PA, PM, RAN, and MA with WREAD and NWREAD in Turkish? Does the pattern of the relationships among the measures differ across Grade 2 and 4?

3) Do PA, PM, RAN, and MA skills account for a significant amount of variance in WREAD ability in Turkish? Does this relationship remain the same at both grades?

4) Do PA, PM, RAN, and MA skills account for a significant amount of variance in NWREAD ability in Turkish? Does this relationship remain the same at both grades?

On the basis of the research questions stated above, the following outcomes were hypothesized:

1) Considering the developmental progression of these abilities, it is hypothesized that the fourth graders will perform significantly better than the second graders in the tasks measuring their RAN performance, PM and MA skills as well as their WREAD and NWREAD abilities (Anthony & Francis, 2005; Carlisle, 2000; Ehri, 1992; Kirby, et al., 2010). However, there will be no statistically significant difference between Grade 2 and Grade 4 in the measures of PA since both groups will have high levels of PA due to the early attainment of this skill in the transparent orthography of Turkish (Babayiğit & Stainthorp, 2007; Öney & Durgunoğlu, 1997).

2) Due to its facilitative role in orthographic processing (Denckla & Cutting, 1999; Wolf, 1997), RAN is expected to significantly correlate with both WREAD and NWREAD abilities, especially measured via fluency tasks, irrespective of the grade level (Babayiğit & Stainthorp, 2010; Georgiou et al., 2008; Moll et al., 2009). Also, MA will exhibit high levels of correlation with both reading abilities since the knowledge of morphemic structure of words would enhance their recognition, particularly in a rich morphology of Turkish (Carlisle, 1995; Ravid & Geiger, 2009). However, PA and PM are not expected to correlate with any reading measures as strongly as RAN and MA both due to the extreme transparency of the Turkish language and the nature of the reading measures, fluency tasks employed in the study.
3) RAN will make a significant unique contribution to WREAD at both grade levels; however, the amount of the variance explained by RAN will be larger at Grade 4 than Grade 2 due to its increasing effect on reading over years (Ehri, 1995; Share, 1995). On the basis of the literature, the more students get automatized in their reading abilities, the less they rely on phonological skills (Ehri, 1997; Kirby et al., 2010). Also, MA is expected to significantly contribute to WREAD at both grades due to its facilitative role in word recognition (Carlisle, 1995; Ravid & Geiger, 2009). PA or PM is not assumed to contribute to WREAD beyond RAN and MA at any grade level.
4) It is hypothesized that RAN will make a significant contribution to NWREAD ability of the participants at both grade levels. Also, at only Grade2, PA will make an additional contribution to NWREAD since reading non-words might require the use of phoneme-grapheme correspondences while decoding at early grades (Kirby et al., 2003). MA or PM is not assumed

to make any unique contribution to NWREAD especially beyond RAN on the basis of the previous studies and due to the nature of reading measure, fluency (Babayiğit & Stainthorp, 2010, 2011; Georgiou et al., 2008; Moll et al., 2009).

4.2 Participants

A total of 87 children, attending Grade 2 and Grade 4, constituted the participants of the present study. All the participants attended a public elementary school in the district of Sarıyer, İstanbul. Forty-four of the students were at Grade 2 (21 boys and 23 girls, mean age of 7;8) and 43 were at Grade 4 (22 boys and 21 girls, mean age of 9;6). The school was selected based on its convenient location and the voluntariness and willingness of the school administration, teachers and student families. All participants were native speakers of Turkish, and none were diagnosed with any speech or hearing deficiencies. At each grade level, there were three students who had some learning difficulties, as acknowledged by their teachers. Given the current study aimed to investigate the reading development of normally developing children, the respective students were excluded from the sample. The students mostly came from families with middle-to-low socioeconomic backgrounds. Parental permission to participate in the study was taken for all the students in each grade. Except for the three students with no preschool experience, all the others completed their one-year preschool education in the same school. The demographics about the participants (*i.e.,* age and gender by grade) are also presented in the Table 3.

Table 3. Participants Demographics

			Age (Months)	
Grade	Gender		X	SD
2	Male	21 (47.7%)	7;8	.37
	Female	23 (52.3%)		
	Total	44		
4	Male	22 (%51.2)	9;6	.38
	Female	21 (%48.8)		
	Total	43		

Chall (1983) points out that, humans are not predisposed to acquire literacy skills, as they are to acquire language, only by environmental exposure to print materials; instead, they must be explicitly taught to read and write. With regards to literacy education, all the participants of the current study started to have literacy training at the first grade by means of the same method: the phoneme based sentence approach. This method has been employed in primary schools in Turkey since the Ministry of National Education (MoNE) put it into practice in the 2005-2006 academic year. The adoption of the phoneme based sentence approach was a result of the shift to the new goal, which was to increase literacy effectiveness, and of the negotiation with primary school teachers, supervisors and managers to reach to the new target (Turan, 2007). Since there is one-to-one sound/letter correspondence in Turkish as aforementioned, this method is considered to be appropriate for Turkish sound system, which allows students to notice the similarities between writing and speaking more easily. It is also believed to facilitate the process of shifting from spoken language to written language for students (MEB, 2005). According to this currently implemented method, the steps of reading and writing are as follows: readiness for reading and writing; feeling, recognition and discrimination of sounds; constructing syllables from letters/sounds , words from syllables, and sentences from words, and finally texts from sentences. Also, there are six groups of sounds/letters to be followed in teaching literacy, which is decided based on the frequency of the letters and the possibility of producing words by combining these letters (Erol et al., 2006):

Group 1 (Ee, Ll, Aa, Tt),
Group 2 (İi, Nn, Oo, Rr, Mm),
Group 3 (Uu, Kk, Iı, Yy, Ss, Dd),
Group 4 (Öö, Bb, Üü, Şş, Zz, Çç),
Group 5 (Gg, Cc, Pp, Hh), and
Group 6 (Ğğ, Vv, Ff, Jj).

While teaching the sounds/letters of the first group, teachers have students form syllables along with raising students' awareness of the relationship between sounds and letters. The teaching of the second group is implemented together with the introduction of words, and the teaching of the third group includes introducing sentences. From the fourth group on, teachers focus on text formation (MEB, 2015, p. 12).

4.3 Data collection instruments

The instruments employed in the current study involved previously developed tests by various researcher groups. They were all developed on the basis of the standardized English tests which have been widely used in literacy research. Important to note, the language-specific features were taken into consideration while developing the Turkish versions of these tests, and their standardization was mostly enabled by the researcher groups who adapted them to Turkish. The list of the study instruments is as follows: Turkish Comprehensive Test of Phonological Processing (KFFT: Kapsamlı Fonolojik Farkındalık Testi, Babür, Haznedar, Erçetin, Özerman, & Erdat-Çekerek, 2013), the Turkish Version of WISC-R for Children – Revised (Savaşır & Şahin, 1995), Turkish Test of Rapid Automatized Naming (HOTIT: Hızlı

Otomatik İsimlendirme Testi, Bakır & Babür, 2009), Turkish Test of Morphological Awareness (Morfolojik Farkındalık Testi), and Turkish Test of Word Reading Efficiency (KOBIT: Kelime Okuma Bilgisi Testi, Babür, Haznedar, Erçetin, Özerman, & Erdat-Çekerek, 2013). Figure 2 illustrates all the instruments, and sample items from each test can be seen in Appendix.

4.3.1 Turkish comprehensive test of phonological processing (KFFT: Kapsamlı fonolojik farkındalık testi)

KFFT (Kapsamlı Fonolojik Farkındalık Testi) is the Turkish version of the English Comprehensive Test of Phonological Processing (*CTOPP*, Wagner, Torgesen, & Rashotte, 1999) originally developed to assess children's decoding kills. The Turkish adaptation was developed by Babür, et al. (2013) with regard to the characteristics of the Turkish language. As in the English CTOPP, the KFFT also includes six core subtests and six supplemental subtests. In the present study, seven subtests from the KFFT were employed to measure the participants' PA skills in Turkish: rhyme recognition, rhyme production, phoneme recognition, phoneme blending, phoneme segmentation (words), phoneme segmentation (non-words), and phoneme deletion.

In rhyme recognition task, three different words were read aloud to children by the experimenter, and children were asked to say which ones end with similar sounds (e.g., *baş: taş*, *gel*. Now say which two words end with the same sounds. The answer is: *baş-taş* [head-stone]); on the other hand, in rhyme production task only one word was read aloud by the experimenter, and children were asked to produce

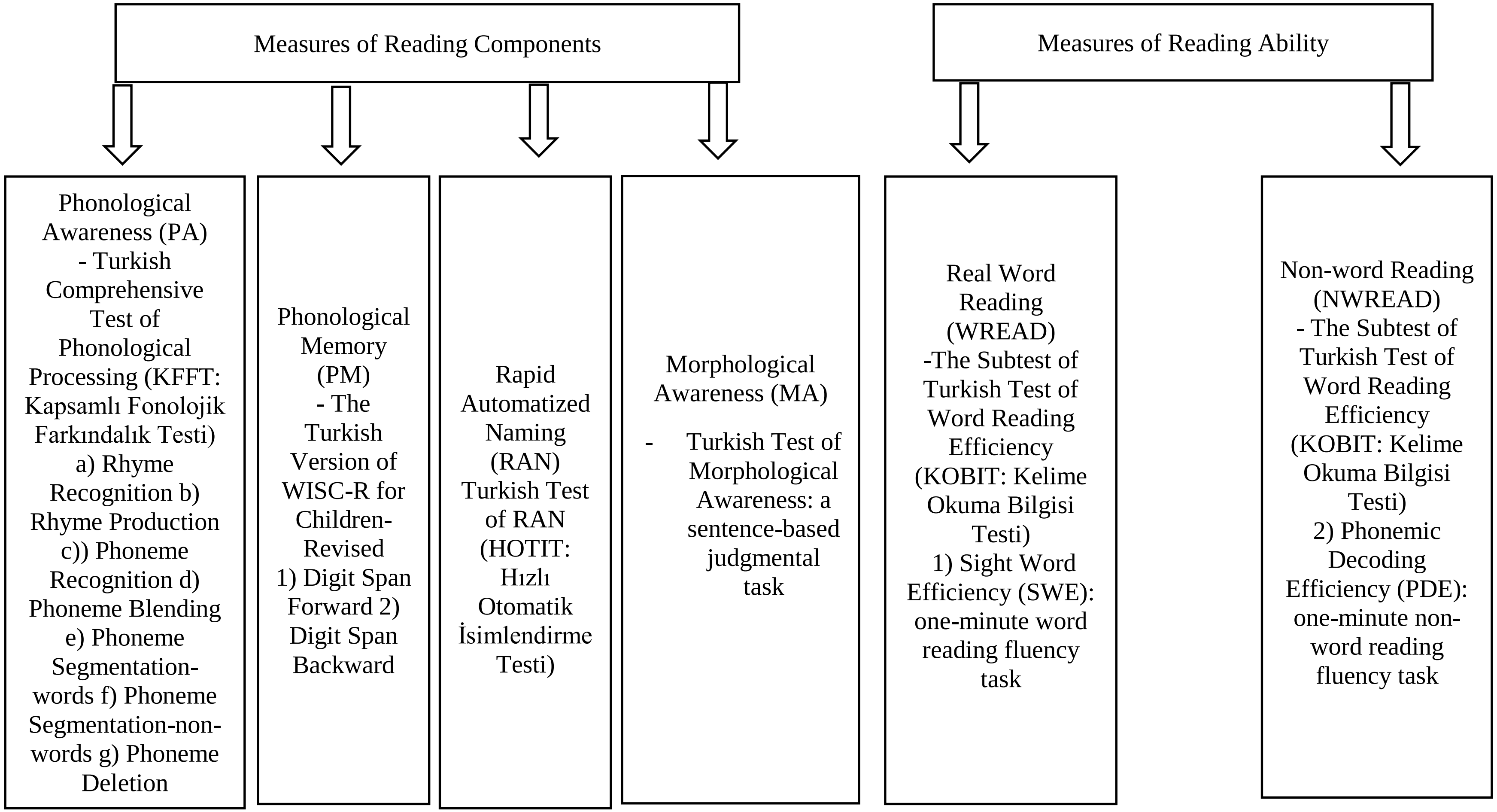

Figure 2 Data collection instruments

another word ending with the same sounds (e.g., Say *baş* [head]. Now say another word ending with similar sounds. The answer could be *taş* [stone]). Phoneme recognition task required children to recognize the initial sound of the words and find another word starting with the same sound (e.g., *at* [horse]. Tell me a word starting with the same sound of this word's initial sound. The answer could be *ağaç* [tree]). In phoneme blending task, children were expected to combine individual sounds to make a whole real word (e.g., What word do these sounds make?: */b/ /a/ /k/*. The answer is *bak* [look]). In phoneme segmentation (words) task, children were asked to divide words into their sounds (e.g., Say *dağ* [mountain]. Now say *dağ* one sound at a time.). Similarly, phoneme segmentation (non-words) task required children to segment non-words into their sounds (e.g., Say *cım*. Now say *cım* one sound at a time.). Finally, in phoneme deletion task, children's ability to delete parts of the words, in this case, phonemes in initial or final positions within the test words was tested (e.g., Say *zincir* [chain]. Now say *zincir* without */z/*).

All the KFFT subtests employed in the study included 10 items, except for the phoneme blending task including 16 items. In each subtest, to make sure that children understood what they were expected to do, four practice items were done prior to the test through the explanations of the experimenter. The administration of each subtest was stopped after four consecutive errors of the participants. The score for each subtest is counted as the number of the correct responses in the respective subtest.

4.3.2 The Turkish version of WISC-R for children – revised

WISC-R is one of the most commonly used intelligence assessments in Turkey. It is adapted to Turkish language by Savaşır and Şahin (1995). In the current study, the forward and backward digit span subtests from the Turkish version of WISC–R was employed to measure children's phonological memory (PM). It was implemented in accordance with the formal guidelines. Each subtest includes two sets of digits in rows. The number of the digits in each set increases in each following row. Children are expected to immediately repeat the series of digits forward or backward, just after the experimenter read them aloud. When children miss two sets of digits in the same row, the administration is discontinued. The total score is counted as the number of each correctly repeated digit set.

4.3.3 Turkish test of rapid automatized naming (HOTIT: Hızlı otomatik isimlendirme testi)

RAN test was originally created by Denckla (1972) and then developed by Denckla and Rudel (1974, 1976a, 1976b) to assess individuals' speed of naming visual stimuli such as familiar objects, colors, or symbols (letters or numbers). Performance in RAN tasks has been documented to be strongly linked to subsequent reading ability of children across languages (Cornwall, 1992; Norton & Wolf, 2012; Wolf & Bowers, 1999). Wagner et al. (1997) explains that RAN measures children's capability to efficiently retrieve phonological representations of words from the long-term memory. The Turkish version of the RAN test (HOTIT: Hızlı Otomatik İsimlendirme) was developed by Bakır and Babür (2009) based on the standardized RAN tasks, and the evidence for the validity and reliability of the Turkish version was also supported by the researchers. In HOTI tasks, participants perceive visual symbols such as familiar objects, colors, letters or numbers and are required to name these stimuli as rapidly and accurately as possible. It has been reported that alphanumeric stimuli (i.e. letters and digits) are more strongly correlated with reading skills than non-alphanumeric stimuli (i.e. colors and objects) and more frequently preferred for use with older students in the studies of literacy development (Bowey, McGuigan, & Ruschena, 2005; Compton, 2003; Cronin & Carver, 1998, Wolf, Bally, & Morris, 1986). In the current study, Bakır and Babür's (2009) HOTI sub-test for digits was employed in order to assess RAN performance.

The subtest of Rapid Digit Naming was composed of five numbers *(i.e*., 2, 4, 6, 7 and 9) which were randomly situated as 5 rows with 10 items per row. Subjects were prompted to recognize and name all the 50 items from left to right, as rapidly as possible, avoiding any errors. Prior to the test administration, a training session was provided by means of a practice sheet involving the same digits, which enabled the examiner to guarantee that the examinee was capable of identifying the test items. Then, the test was started after repeating the instructions. The examiner kept timing via a chronometer. Timing started with the utterance of the first test item and ended with the utterance of the last. The score for this subtest was counted as the time (*i.e*. seconds) which the participant spent to accomplish the task.

4.3.4 Turkish test of morphological awareness

Turkish Test of Morphological Awareness was developed for the current study. It was a sentence-based judgmental morphological task, including a total of 30 sentences. Cronbach alpha score for this test was .80. While some of the sentences were grammatically correct, some other were not, and their ungrammaticality resulted from the violation of morphological structures of the words. Children were asked to read the sentences aloud and decide whether the sentence was grammatically correct, or not. Prior to administering the test, two examples were enabled to the participant by the experimenter, and four practice sentences were done together. Asking children to read aloud the sentences enabled the researcher to make sure that there was not any decoding problems which might have affected the evaluation of the measurement of MA. The test was ended when all the test sentences were answered by the participant. The number of the correctly answered items was counted as the total score for this measurement.

4.3.5 Turkish test of word reading efficiency (KOBIT: Kelime okuma bilgisi testi)

Turkish Test of Word Reading Efficiency (KOBIT) was developed with the aim of following and assessing word reading ability of elementary school students aged 6-11 as well as identifying those with reading difficulties (Babür, et al., 2013). The results of the reliability and validity studies of the KOBIT have indicated that it can be used as a reliable and valid measurement of reading in Turkish. KOBIT is grounded in the English Test of Word Reading Efficiency (TOWRE) developed by Torgesen, Wagner, and Rashotte (1999) as a measurement tool of people's ability to read words accurately and fluently. Parallel to TOWRE, KOBIT is composed of two subtests as Sight-Word Efficiency (SWE) and Phonemic Decoding Efficiency (PDE). Both subtests consist of word lists prepared according to the phonological and grammatical structure of Turkish.

4.3.5.1 Sight-word efficiency (SWE)

The subtest of Sight-Word Efficiency (SWE) measures the ability of children to automatically identify and read isolated words without the need of phonological encoding. The test is comprised of 104 real words which are chosen according to the number of their syllables and frequency. Since 77 % of Turkish words consisted of 3, 4, or 5 syllables and the ration of one-syllable words is less than 0.1% in Turkish, only six one-syllable words are included in the list (Babür et al., 2013). The list is arranged based on the difficulty level of the words. In that, while the list starts with frequent and short items such as *bir*, the words including more syllables and more difficult to read such as *çarptırılmış* take place through the end of the list. The test was administered to assess the real word reading ability (WREAD) in Turkish. Prior to the test, some practice items were provided to the participant in order to inform him regarding the test procedures. Then, the participant was given the list of test items and asked to read aloud as many words as possible in the list within 60 seconds. The participant was recommended to follow the sequence in the list and not to skip any word as long as they were able to read. The score for this subtest was calculated as the total number of the words read accurately in the given time.

4.3.5.2 Phonemic decoding efficiency (PDE)

The subtest of Phonemic Decoding Efficiency (PDE) was employed to assess the ability of children to recognize and read aloud printed non-words, which are phonetically and orthographically plausible in Turkish, by means of their phonemic decoding skills. The test includes a total of 63 pseudo words, and as in the subtest of SWE, the items are arranged in the sequence of increasing difficulty. For example, such non-words as *ge, misi* precede others like *cülümküzde, daldamdakaydı* in the list. Initially, the practice items were presented to the participant to make sure that he understood the test procedure. Following the practice session, the test was started, and the participant was expected to read aloud as many non-words as possible in the list during 60 seconds. The number of non-words read accurately in the given time was counted as the score of the participant for this subtest.

Important to note, these two subtests of KOBIT were used to measure real word and non-word reading fluency rather than accuracy. Considering the evidence coming from Turkish and other transparent orthographies that children gain mastery of decoding skills within a few months of literacy instruction (Durgunoğlu & Öney, 1997; Georgiou et al., 2008; Moll et al., 2009), it would not be useful to employ a word accuracy task with our sample including Grade 2 and 4 students. To use a word accuracy task would lead to ceiling effects as in the previous studies.

4.4 Procedure

The data collection took place in the spring semester of 2016-2017 academic year. Regular school visits enabled the researcher to complete the data collection process within one and a half month (from the middle of March to the end of May). Prior to the data collection, permission from parents, teachers and school administrations was obtained through consent forms.

All the tests were individually administered to the participants by the researcher in a quiet room in their schools, and the same instructions were enabled to all participants, which maintained the uniformity of the study. The battery of tests was implemented over two sessions, each requiring 30-40 minutes based on the pace of the individual participant. The interval between the two sessions did not exceed two weeks for each child. In the first session, the following order was kept for each participant: KFFT, WISC-R Digit Span, and Turkish Test of Morphological Awareness, whereas both reading measures, namely the two subtests of KOBIT (*SWE* and *PDE*), and HOTIT were administered in the second session. However, the sequence of the subtests was changed for each participant in order to minimize the effect of mental and physical fatigue on the participants' performance.

4.5 Data analysis

As stated above in detail, the present study employed a battery of measures such as KOBIT (SWR & PDF) to assess reading abilities, and KFFT, WISC-R Digit Span, HOTIT and the Turkish Test of MA to assess PA, PM, RAN, and MA respectively.

To analyze the quantitative data of the present study, SPSS (Statistical Package for Social Sciences) for Windows 22.0 was used. During the initial data screening, it was revealed that RAN, PA and NWREAD scores of both 2nd and 4th graders did not meet the normality assumption. The values for asymmetry and kurtosis between -2 and +2 are considered acceptable in order to prove normal univariate distribution (George & Mallery, 2010). However, our data displayed higher scores than the acceptable range. To check the outliers on these variables, Inter-Quartile Range Boxplots were first checked, and the cases identified as an outlier by SPSS were specified within the data set. Instead of simply eliminating the data of the outliers, their scores underwent the process of winsorizing, which is a suggested way to minimize the influence of the outliers in the data by assigning them a raw score (one unit higher or lower than the following most extreme score) for the related variable (Tabachnick & Fidell, 2013). Only 3 % of the cases were winsorized, which was acceptable according to Tabachnick and Fidell (2013) who emphasized that the process of winsorizing could be applied to less than 5 % of the cases. Following this procedure, the normality of the data was rechecked, and all the variables fell within the acceptable range of normality (even now, between -1 and +1) at both grades ($p < .01$). In the current study, the following statistical analyses were carried out with regard to the research questions: Independent samples t-tests, Pearson product-moment correlations, and hierarchical regression analyses.

CHAPTER 5

RESULTS

This chapter presents the results of the quantitative data analyses in accordance with the research questions. As noted earlier, the following statistical analyses were carried out with regard to the research questions: Independent samples t-tests, Pearson product-moment correlations, and hierarchical regression analyses.

Research Question 1: Is there a significant difference between Grade 2 and Grade 4 with regard to their PA skills, RAN performance, PM, MA skills, WREAD and NWREAD abilities in Turkish?

To begin with, descriptive statistics showed that the fourth graders performed better in the measurements of all reading-related components, PA, PM, and MA, than the second graders. Similarly, the fourth graders' RAN performance was faster than the second graders, which revealed their faster processing the visual stimuli. As for reading measures, a similar pattern was observed in that the fourth graders' scores on both WREAD and NWREAD tasks were found to be higher than the second graders. While the scores of the two groups at the NWREAD task were not very different from each other, their scores at the WREAD task indicated a certain superiority of the fourth graders. Table 4 reports the means and standard deviations for all the variables, namely PA, RAN, PM, MA, WREAD and NWREAD, for each grade level.

Table 4. Descriptive Statistics for Grade 2 and Grade 4.

Variables	Second Grade (N=44)		Fourth Grade (N=43)		
	Mean	SD	Mean	SD	t-test
PA	78.85	7.811	84.23	8.902	-2.998**
RAN	32.17	4.463	24.97	3.871	8.025***
PM	9.79	1.662	11.33	2.112	-3.785***
MA	70.45	16.292	83.34	7.831	-4.594***
WREAD	35.07	13.715	54.04	13.080	-6.599***
NWREAD	22.19	7.095	28.92	6.729	-4.537***

Note. PA = Phonological Awareness, RAN = Rapid Automatized Naming, PM = Phonological Memory, MA = Morphological Awareness, WREAD = Word Reading, NWREAD = Non-word Reading. ** $p < .01$. *** $p < .001$.

As discussed through the descriptive statistics for both grades above, the fourth graders surpassed the second graders in all the variables measured in the current study. To testify whether these observed numeric differences between Grade 2 and 4 were statistically significant, Independent Samples T-tests were carried out for each variable separately (see Table 4 for details). Since multiple comparisons were conducted, the alpha level was set at .01 so that the likelihood of Type I error could be minimized. Prior to reporting the results of t-test, the assumption of homogeneity of variance was checked, and the results indicated that the equality of variance assumption was met for all the variables ($p < .05$), except for MA ($F(85) = 18.293$, $p = .000$). Hence, the findings of the t-tests were accordingly interpreted.

The results of the t-tests demonstrated that there was a statistically significant grade effect on all the variables. That is to say, the fourth graders performed significantly better at all of the tasks compared to the second graders. More specifically, it was found that PA, RAN, PM, and MA tasks significantly differentiated between the participants at Grade 2 and 4. Along this vein, the fourth graders attained significantly higher scores in the reading ability measures, namely WREAD and NWREAD. This was probably due to the fact that higher levels of achievement in all the reading-related abilities fostered word-level reading abilities at higher grade-levels.

These results partially confirmed the research hypotheses regarding the first research question. As such, it was confirmed that the fourth graders performed better at the tasks of PM, RAN, MA and word reading (both WREAD and NWREAD) than the second graders, as expected. However, the results were inconsistent with the assumption that the two groups would not differ from each other in terms of their PA skills since these abilities reach ceiling levels at very early grades (around the middle of the first grade) in Turkish (Babayiğit & Stainthorp, 2007; Öney & Durgunoğlu, 1997; Topbaş & Konrot, 1998).

Research Question 2: What are the correlations of PA, PM, RAN, and MA skills with WREAD and NWREAD abilities in Turkish? Does the pattern of the relationships among the measures differ across Grade 2 and 4?

In order to answer the first part of the second research question, Pearson product-moment correlations were computed for the whole data set, including Grade 2 and 4 (see Table 5).

Table 5. Intercorrelations among the Variables

Variables	1	2	3	4	5	6
1. PA	-					
2. RAN	-.360**	-				
3. PM	.416**	-.353**	-			
4. MA	.487**	-.536**	.322**	-		
5. WREAD	.499**	-.705**	.444**	.612**	-	
6. NWREAD	.453**	-.558**	.366**	.481**	.828**	-

Note. PA = Phonological Awareness, RAN = Rapid Automatized Naming, PM = Phonological Memory, MA = Morphological Awareness, WREAD = Word Reading, NWREAD = Non-word Reading. N = 87. $^{**}p < .01$.

As Table 5 illustrates, all the variables were found to be significantly correlated with each other. The highest correlation coefficient appeared between the two measures of reading ability, WREAD and NWREAD. More central to our interest, considering the relationship between the correlates of reading and reading measures, RAN was the variable having the highest correlation with both WREAD and NWREAD abilities. As seen, RAN showed a negative correlation with both reading measures and all the other variables, which supports the notion that the completion of this task within shorter time requires higher levels of performance. Following the RAN task, MA had the second highest correlations with WREAD and NWREAD. Both RAN and MA were found related to reading ability, particularly to the measure of WREAD. PA significantly correlated with both reading measures; however, the strength of the correlation appeared below the moderate level. Finally, PM was found to have the weakest but significant correlation with reading ability.

With regard to the pattern of the relationships within each grade level, correlation analyses were repeated for both grades separately. Table 6 and 7 summarize the inter-correlations among all the measures for Grade 2 and 4, respectively. As can be seen in Table 6 and 7 below, the grade levels differed from each other with respect to the pattern of the relationships among the variables. A different pattern was observed both in the correlations between the predictors (*i.e.*, PA, RAN, PM, and MA) and reading measures, and in the relationships among the predictors themselves.

Table 6. Intercorrelations among the Variables at Grade 2

Variables	1	2	3	4	5	6
1. PA	-					
2. RAN	-.163	-				
3. PM	.314*	-.116	-			
4. MA	.536**	-.418**	.220	-		
5. WREAD	.503**	-.500**	.176	.563**	-	
6. NWREAD	.392**	-.292	.209	.420**	.742**	-

Note. PA = Phonological Awareness, RAN = Rapid Automatized Naming, PM = Phonological Memory, MA = Morphological Awareness, WREAD = Word Reading, NWREAD = Non-word Reading. $^{*}p < .05$. $^{**}p < .01$.

As can be seen in Table 6, the variables significantly correlating with WREAD ability at Grade 2 were as follows (from the strongest to the weakest correlation): MA, PA, and RAN. As for the NWREAD ability, the variables significantly associated with the respective ability were as such (from the strongest to the weakest correlation): MA, and PA. While RAN was significantly related to WREAD ability at Grade 2, it did not show any significant correlation with

NWREAD ability at this grade level. Also, PM showed no significant correlation with any of the reading measures at this level. One interesting finding was that MA had the strongest significant correlations with both reading measures at Grade 2, although it was assumed to weakly correlate with the reading measures compared to PA and RAN. However, this finding should be evaluated cautiously considering the high significant correlations of MA with PA (r = .53, p < .01) and RAN (r = .41, p < .01)

Table 7. Intercorrelations among the Variables at Grade 4

Variables	1	2	3	4	5	6
1. PA	-					
2. RAN	-.281	-				
3. PM	.358*	-.184	-			
4. MA	.292	-.275	.206	-		
5. WREAD	.331*	-.560**	.404**	.394*	-	
6. NWREAD	.353*	-.528**	.268	.273	.829**	-

Note. PA = Phonological Awareness, RAN = Rapid Automatized Naming, PM = Phonological Memory, MA = Morphological Awareness, WREAD = Word Reading, NWREAD = Non-word Reading. N = 43. **p* < .05. ***p* < .01.

As Table 7 reports, a different picture emerged with the fourth graders. It was revealed that the variables significantly correlating with WREAD ability were as follows (from the strongest to the weakest correlation): RAN, PM, MA, and PA. As for the NWREAD ability, only RAN (r = -.52, p < .01) and PA (r = .35, p < .05) indicated significant correlations. Considering the relationships among the predictors, no significant correlations were observed among the scores of the fourth graders, except for the weak correlation between PA and PM (r= .35, p< .05).

Research Question 3: Do PA, PM, RAN, and MA skills account for a significant amount of variance in WREAD ability in Turkish? Does this relationship remain the same in both grades?

As stated in the third research question, one of the main purposes of the current study was to investigate the unique contributions of different variables, namely PA, PM, RAN, and MA, to reading skills both within the whole sample and across grades. To this end, several sets of hierarchical regression analyses were carried out to obtain comparative predictive power of these variables in reading abilities. The correlations among the variables and theoretical rationale were taken into consideration for the entry sequence of the variables to the model. More specifically, on the basis of the previous studies, PM was entered as a control variable to the all regression analyses to eliminate its shared effect with other variables on both reading abilities. Then, the reading-related variables (*i.e.*, PA, PM, RAN, and MA) were entered to the regression models regarding their correlations with the respective reading measure, WREAD or NWREAD, from the strongest to weakest correlation. Prior to performing the analyses, the pertinent assumptions such as collinearity scores (i.e., *Tolerance* and *VIF*) and Mahalanobis distance were checked and found to be within acceptable limits (Coakes, 2005; Hair, Black, Babin, Anderson, & Tatham, 1998).

The results of the regression analyses conducted with the whole group scores for WREAD were presented in Table 8.

Table 8. Summary of Hierarchical Regression for Word Reading

Dependent Variable: WREAD (N = 87)					
Independent Variable	B	*t*	*R*	R^2	ΔR^2
Step 1			.444	.197	.197
PM	.444	4.568^{***}			
Step 2			.735	.541	.343
PM	.223	2.820^{**}			
RAN	-.626	-7.924^{***}			
Step 3			.775	.601	.061
PM	.174	2.306^{*}			
RAN	-.480	-5.673^{***}			
MA	.299	3.553^{***}			
Step 4			.786	.617	.016
PM	.132	1.704			
RAN	-.471	-5.632^{***}			
MA	.241	2.727^{**}			
PA	.155	1.871			

Note. PA = Phonological Awareness, RAN = Rapid Automatized Naming, PM = Phonological Memory, MA = Morphological Awareness, WREAD = Word Reading, B = Standardized Beta, ΔR^2 = R Squared Change. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

A summary of the models generated by the four-step hierarchical multiple regression procedure is presented in Table 8. In the final model, explaining approximately 62 % of the variance in WREAD, four of the variables entered the equation according to the entry criteria mentioned above: PM, RAN, MA, and PA. In line with the extant literature, RAN appeared to be as the strongest predictor of WREAD ability, explaining 34 % of the total variance. Also, MA explained an additional 6 % of the variance in WREAD ability at the third step independently from that contributed by RAN and PM (F (1,83) = 12.62, p = .001.). Although PA explained 2 % of the variance at the final step, its explanation could not reach the significance level (p < .05). PM entered the equation as a control variable at the first step lost its significance in explaining WREAD ability when it was evaluated with other variables at the final step.

In order to evaluate the differences between Grade 2 and 4, two more hierarchical regression analyses were conducted. The results of these analyses are respectively displayed in Table 9 and 10.

Table 9. Summary of Hierarchical Regression for Word Reading at Grade 2

Dependent Variable: WREAD (N = 44)					
Independent Variable	B	*t*	*R*	R^2	ΔR^2
Step 1			.176	.031	.031
PM	.176	1.159			
Step 2			.565	.319	.288
PM	.055	.416			
MA	.550	4.168***			
Step 3			.611	.374	.054
PM	-.004	-.028			
MA	.411	2.767**			
PA	.284	1.862			
Step 4			.686	.471	.098
PM	.-.019	-.157			
MA	.252	1.677			
PA	.318	2.230*			
RAN	-.345	-2.683*			

Note. PA = Phonological Awareness, RAN = Rapid Naming, PM = Phonological Memory, MA = Morphological Awareness, WREAD = Word Reading, B = Standardized Beta, ΔR^2 = R Squared Change. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

To begin with the second graders, once again PM was entered to the model as a control variable at the first step. Then, at the second step, MA which had the highest correlation with WREAD ability, was entered the equation to check whether it significantly contributed to WREAD and keep its contribution to the end of the model. It was revealed that MA accounted for additional 29 % of the total variance in the WREAD ability, after controlling for the non-significant effect of PM, which also accounted for 3 % of the variance at the first step. Entered into the model at the third step, PA was accounted for an additional 5 % of the variance; however, it could not reach the significance level at even .05. Finally at the fourth step, RAN was entered and explained 10 % of the remaining variance and significantly contributed to WREAD ability over and beyond PM, MA and PA. Interestingly, MA lost its significance when it was evaluated with other variables at the final step, while PA reached a significant level. All predictors together explained 47 % variance of WREAD ability of the second graders.

Table 10. Summary of Hierarchical Regression for Word Reading at Grade 4

Dependent Variable: WREAD (N = 43)					
Independent Variable	B	*t*	*R*	R^2	ΔR^2
Step 1			.404	.163	.163
PM	.404	2.824**			
Step 2			.638	.407	.244
PM	.311	2.511*			
RAN	-.503	-4.059***			
Step 3			.670	.449	.042
PM	.272	2.214*			
RAN	-.445	-3.546**			
MA	.219	1.730			
Step 4			.672	.451	.002
PM	..258	1.982			
RAN	-.436	-3.381**			
MA	.209	1.598			
PA	.051	.381			

Note. PA = Phonological Awareness, RAN = Rapid Automatized Naming, PM = Phonological Memory, MA = Morphological Awareness, WREAD = Word Reading, B = Standardized Beta, ΔR^2 = R Squared Change. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

As for Grade 4, a summary of the models generated by the four-step hierarchical multiple regression procedure is presented in Table 10. All predictors together explained 45 % of the variance in the WREAD ability of the fourth graders. In line with the existing literature, RAN appeared to be as the strongest predictor of WREAD ability, explaining 24 % of the total variance, entered to the equation at the second step. MA failed to make an additional significant contribution to WREAD of the fourth graders at the third step. PA was entered lastly into the analysis and it could not account for additional significant variance in WREAD abilities of fourth graders, either. As expected, PM accounting for 16 % of the total variance in WREAD ability at the second step, lost its significance when other predictors were entered into the analyses.

Research Question 4: Do PA, RAN, PM, and MA skills make significant contributions to NWREAD ability in Turkish? How much variance do these variables explain at Grade 2 and Grade 4?

To address the fourth research question, hierarchical regression analyses were once again carried out with NWREAD ability as a dependent variable this time. Table 11 shows the results of the hierarchical regression analysis for the whole group.

Table 11. Summary of Hierarchical Regression for Non-word Reading

Dependent Variable: NWREAD (N = 87)					
Independent Variable	B	*t*	R	R^2	ΔR^2
Step 1			.366	.134	.134
PM	.366	3.620**			
Step 2			.587	.344	.211
PM	.192	2.038*			
RAN	-.490	-5.194***			
Step 3			.617	.381	.037
PM	.154	1.641			
RAN	-.377	-3.570**			
MA	.233	2.225*			
Step 4			.639	.409	.028
PM	.100	1.038			
RAN	-.364	-3.504**			
MA	.158	1.439			
PA	.201	1.954*			

Note. PA = Phonological Awareness, RAN = Rapid Naming, PM = Phonological Memory, MA = Morphological Awareness, NWREAD = Non-word Reading, B = Standardized Beta, ΔR^2 = R Squared Change. *p < .05, **p < .01, ***p < .001.

As can be followed from Table 11, the results revealed that RAN significantly explained additional 21 % of the variance in NWREAD ability, after controlling the effect of PM which also accounted for 13 % of the total variance at the first step. Adding MA to the model at the third step accounted for an additional 4 % of the variance in NWREAD, and this contribution was significant ($F(1,83) = 4.95$, $p < .05$). At the fourth step, the contribution of PA to NWREAD was also significant, accounting for 3 % of the remaining variance. The final step indicated that the strongest predictor was found to be RAN which uniquely accounted for 21 % of the variance in NWREAD. This substantial amount highlighted RAN as a strong precursor of the NWREAD ability. All predictors together explained 41 % of the variance in NWREAD for the whole group.

In addition to the whole group statistics, two separate hierarchical regression analyses were performed in order to explore the unique contribution of PA, RAN, PM and MA in the explanation of NWREAD ability in Turkish at Grade 2 and 4. The results for the two grade-levels are respectively presented in Table 12 and 13.

At the second grade level, PM was the first entered variable to the regression model, which explained only a small part of the variance, 4% but this small amount of contribution was not significant as expected. MA, which had a strong significant correlation with the NWREAD ability, was added to the model at the second step. The reason behind this decision was to check whether MA would significantly predict NWREAD as could be expected from its strong correlation with NWREAD. Thus, MA, added to the analysis at the second step, accounted for 15 % of the variance in the NWREAD ability, and its unique contribution was significant. At the following two steps, PA and RAN were respectively included in the equation; however, they did not explain any significant additional variance in NWREAD ability of the second graders. When all the predictors were evaluated at the final step PM, PA and RAN remained non-significant in explaining any variance in NWREAD at Grade 2. MA which was the only significant predictor lost its significance. The model explained 24 % of the total variance in NWREAD at this grade-level.

Table 12. Summary of Hierarchical Regression for Non-word Reading at Grade 2

Dependent Variable: NWREAD (N = 44)					
Independent Variable	B	*t*	*R*	R^2	ΔR^2
Step 1			.209	.044	.044
PM	.209	.1384			
Step 2			.437	.191	.147
PM	.122	.849			
MA	.394	2.733**			
Step 3			.470	.221	.030
PM	.078	.533			
MA	.289	1.747			
PA	.212	1.248			
Step 4			.491	.241	.020
PM	.071	.485			
MA	.218	1.208			
PA	.228	1.333			
RAN	-.156	-1.012			

Note. PA = Phonological Awareness, RAN = Rapid Automatized Naming, PM = Phonological Memory, MA = Morphological Awareness, NWREAD = Non-word Reading, B = Standardized Beta, ΔR^2 = R Squared Change. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

Table 13 demonstrates the comparative predictive roles of PA, RAN, PM and MA in the NWREAD ability at Grade 4. In the analysis, PM was entered to the model as a control variable, and explained 7 % of the variance in the NWREAD ability of children at this level, but its explanation was not significant. When RAN was next added to the model at the second step, it alone accounted for 24 % of the variance in NWREAD. At the following two steps, PA and MA were respectively entered to the equation, and they accounted for unique 3% and 1 % of the variance.

However, their explanations were not statistically significant. Considering the contributions of all the variables to the NWREAD ability, PM, PA and MA remained non- significant in explaining any variance in the NWREAD abilities of the fourth graders. On the other hand, RAN persisted into as a significant predictor of NWREAD ability at this level. All predictors explained the 34 % of the total variance in the NWREAD of the fourth graders.

Table 13. Summary of Hierarchical Regression for Non-word Reading at Grade 4

Dependent Variable: NWREAD (N = 43)					
Independent Variable	B	*t*	*R*	R^2	ΔR^2
Step 1			.268	.072	.072
PM	.268	1.781			
Step 2			.556	.309	.237
PM	.177	1.323			
RAN	-.495	-3.702**			
Step 3			.550	.336	.027
PM	.119	.849			
RAN	-.454	-3.328**			
PA	.182	1.269			
Step 4			.586	.343	.007
PM	.109	.767			
RAN	-.435	-3.081**			
PA	.164	1.106			
MA	.090	.627			

Note. PA = Phonological Awareness, RAN = Rapid Automatized Naming, PM = Phonological Memory, MA = Morphological Awareness, NWREAD = Non-word Reading, B = Standardized Beta, ΔR^2 = R Squared Change. *p < .05, **p < .01, ***p < .001.

To sum up, it was revealed that the fourth graders significantly performed better than the second graders in all the measures. It substantially confirmed the study hypothesis regarding the grade-level differences. It was assumed that the fourth graders would surpass the second graders considering the developmental progress in these skills. However, one interesting finding was that PA skills also differentiated between the two groups, which was not expected due to the early attainment of these skills in the transparent orthography of the Turkish language. In terms of the relationships between the reading predictors and reading ability measures, RAN, followed by MA, appeared as to have the strongest correlation with both real word and non-word reading ability at Grade 4, while interestingly, MA and PA were significantly correlated with both reading measures at Grade 2. It provided further evidence for the literature showing that in transparent orthographies, RAN was the strongest correlate of reading ability measured with a fluency task, especially at higher grade levels, whereas PA had a relationship with reading ability only at early grades. As expected, MA was also found to be related with word reading abilities considering the rich morphological structure of the respective language. Of particular interest, with regard to the comparative predictive power of the study variable in word-level reading ability, RAN appeared as the best predictor at both grade levels. Previous research emphasized that children had higher levels of automatization skills through more experience in reading ability, which led RAN to establish more connections with both real and non-word reading fluency (Babayiğit & Stainthorp, 2010, 2011; Sönmez, 2015). PM was not found to be a significant contributor to reading ability at any grade although it had significant correlations. This finding was also in accordance with the previous results that PM did not make a unique contribution to reading ability since it shared its effect with other variables, PA and RAN (e.g., Babayiğit & Stainthorp, 2010; Dufva et al., 2001; Parrila et al., 2004).

CHAPTER 6

DISCUSSION

This final chapter provides the discussion of the results attained from data analyses in relation to the relevant literature. In light of the findings, it also provides some implications for literacy instruction in Turkish. In the final part, the limitations of the current study are acknowledged, and some suggestions are made for future studies in reading research.

6.1 Discussion

6.1.1 Grade-level differences in word-level reading abilities and predictors

The current study aimed to explore the development of word-level reading ability and predictors of this ability in Turkish at Grade 2 and 4. The results demonstrated that the fourth graders performed significantly better both in the measures of word-level reading ability, i.e. real word and non-word reading fluency, and in the measures of word-level reading predictors, i.e. PA, RAN, PM and MA. This finding partially confirmed what we hypothesized for grade-level differences in the study variables.

To begin with PA skills, we did not expect any significant differences between Grade 2 and 4 assuming that both groups would have high levels of PA due to the early attainment of this skill in Turkish (Babayiğit & Stainthorp, 2007; Öney & Durgunoğlu, 1997) as in other transparent orthographies such as German (Wimmer & Mayringer, 2002), Dutch (de Jong & van der Leij, 1999, 2002), Finnish (Holopainnen, Ahonen & Lyytinen, 2001), and Greek (Harris & Giannouli, 1999).

However, the results indicated a significant grade effect on the PA scores of the two groups. With regard to other predictors of reading ability, the analyses demonstrated that the fourth graders surpassed the second graders in all the measures, as hypothesized. Of particular interest, the results indicated a certain increase in RAN performance and MA skills across the grades. It might be assumed that children at higher grades had more developed automatization and morphological awareness skills.

Similarly, the grade-level differences occurred in word-level reading abilities of the two groups. Considering that the fourth graders (with the mean age of 9:6) were consisted of skilled readers without having any decoding difficulty, they would naturally perform better than the second graders (with the mean age of 7:8) at word reading tasks (Ehri, 1999; Frith, 1985). One interesting finding was that although the fourth graders were found to be better than the second graders in both reading measures, namely WREAD and NWREAD abilities, they performed more similarly to the second graders at non-word reading tasks. This subtle finding might indicate that RAN as the variable showing the largest development across grades enabled the fourth graders to have more developed orthographic strategies and to perform better at the real word reading task than the non-word reading. As such, this finding was consistent with the research line suggesting that RAN is related to reading via its role in orthographic processing (e.g., Bowers, Golden, Kennedy, & Young, 1994; Bowers & Wolf, 1993; Conrad & Levy, 2007; Manis, Seidenberg, & Doi, 1999). Orthographic processing is referred to be the mechanism by which “groups of letters or entire words are processed as single units rather than as a sequence of grapheme-phoneme correspondences” (Kirby, et al., 2010, p.343). That is, when the words become recognized as sight words (Ehri, 1997), they start to act more like single visual stimuli as in RAN tasks, thus both word reading and naming speed will similarly function in access to lexical units and show strong correlations with each other. Further, Kirby at al. (2003) found that the relationship between RAN and non-word reading ability was weaker than that between RAN and real word reading ability.

6.1.2 The interactions among the reading predictors and outcomes

The correlational results of the current study provided insights into the way that such cognitive skills as PA, RAN, PM and MA are differentially related to reading ability in a language with a transparent orthography and rich morphology. First, the results foregrounded a common finding in the literature that RAN is a more significant and stronger correlate of reading achievement than PA and other reading-related variables in transparent writing systems. Thus, as expected, RAN appeared as having the strongest correlation with both real word and non-word reading abilities. Here, it was assumed that an alphabetic orthography with a more consistent grapheme-phoneme correspondences made the role of PA skill in reading less important, even redundant, whereas to employ orthographic strategies were playing a crucial role in word-level reading achievement. While MA had the second highest correlation with real word reading, it was PA for non-word reading. This suggests that decoding real words entailed the awareness of morphology as well as automatization revealed by rapid naming, non-word processing more relies on PA skills.

Of particular interest in grade-level differences, the correlations were calculated for each grade separately. To start with Grade 2, the results demonstrated that MA, PA, and RAN significantly correlated with real word-reading ability at this level. In the research hypothesis, PA and RAN were assumed to be significantly associated with real-word reading ability. Hence, this finding highlighted two important points: First, PA might be a strong correlate of word recognition at early grades since children still rely on phonological processing in word recognition, even in transparent orthographies (Öney & Durgunoğlu, 1997). Second, due to its facilitative role in orthographic processing in transparent writing systems, RAN had a significant relationship with real word reading ability (Babayiğit & Stainthorp, 2007). Unlike the research hypothesis in the study, MA was found to be significantly related to both real word and non-word reading ability at Grade 2. It demonstrated that the second graders utilized the morphemic structure of the words while reading.

As the grade level increased, the relation of PA to reading ability tended to lose strength for both real and non-words. It revealed that children kept using their awareness of phonological units while reading real and non-words over years; however, their reliance on PA decreased as they got older. On the other hand, RAN acted in a certain different manner, which means that it started to exhibit stronger correlations with reading ability when compared to Grade 2. While we saw that RAN increased its existing significant relation to real word-reading ability from Grade 2 to 4, its non-significant relationship with non-word reading ability at Grade 2 turned out to be significant at Grade 4. It might be assumed that children resort to their automatization skills even while reading non-words if the non-words include very familiar units to frequent real words in readers' lexicon. This finding provided more evidence that the extent to which non-words are similar to real words in terms of patterns of letter clusters and spelling-to-sound regularity has an influence on non-word processing (McClelland 1976; Spoehr & Smith 1975; Ziegler & Goswami, 2005). Thus, this finding evoked a hotly-debated question whether, contrary to what dual-route theory suggests (Coltheart, 1975), lexical and non-lexical routes interact with each other while reading non- words. According to the dual-route theory, non-words must phonologically processed through lexical route; however, research evidence suggested that non-word processing is influenced by lexical knowledge, particularly when non-words are phonologically and orthographically similar to real words (Humphreys & Evett, 1985). In sum, children had higher levels of automatization skills when they got more experiences in reading ability, which led RAN to establish more connections with both real and non-word reading. With regard to MA, it seems that MA remained significantly related to real word reading ability through Grade 2 to 4, as hypothesized.

Lastly, the results made an interesting point that the correlation between PA and RAN measures did not reach significant levels at any grade, which provided further evidence for the notion that the two measures are related and contributed to different aspects of the reading ability. In this regard, while phonological knowledge is more linked to non-word reading ability, orthographic knowledge and automatization revealed by rapid naming is more related to real word reading ability (Cutting & Denkla, 2001; Wolf & Bowers, 1999).

6.1.3 The role of PA, RAN, PM, and MA in real and non-word reading ability

Although the correlates of reading ability is an extensively studied area in English, the cognitive underpinnings of this skill at different languages is still an issue of interest. Thus, the current study addressed this issue in a language, namely Turkish, which provided an appropriate context to investigate the role of different cognitive abilities in word-level reading achievement (Babayiğit & Stainthorp, 2007).

With regard to real word reading ability for the whole group, the results of regression analyses fully validated the research hypothesis, suggesting that: 1) RAN would be the most crucial predictor of real word reading, accounting for a significant substantial amount of the variance, 2) MA would also make a small but significant contribution to word recognition, 3) no significant contribution of PA and PM was assumed for real word reading ability.

First, the results suggested that RAN accounted for significant 38 % of the variance in real word reading ability, above and beyond the contribution of other predictors, PA, PM, and MA. Considering the well-established relation of RAN to word recognition in the literature, this result was expected in the current study. RAN is simply defined as the ability to accurately name visual stimuli such as letters or digits as rapidly as possible (Denckla and Rudel; 1974; Wolf & Bowers, 1999). As for the relation of naming speed to reading; it has been stated that RAN and reading share similar cognitive processes such as automatized recognition and retrieval of phonological representations of visual stimuli from the long-term memory (Kirby et al., 2010). Ehri (2005) pointed out that the way of reading words accurately and automatically occur by memory or sight, called *sight word reading*. According Ehri (2005), readers do not need to sound out and blend graphemes into phonemes during sight word reading. In a study conducted by (Ehri & Wilce, 1983), the results showed that the skilled readers at both Grade 2 and 4 read the words as rapidly as they named the single digits. Hence, the researchers interpreted the significant relationship between these two abilities as an indication of sight word reading.

Dual-route theory also suggests that real words are processed through lexical route without undergoing phonological processing (Coltheart, 1975). While it may be assumed that children resort to non-lexical route in real word processing in transparent orthographies in which decoding is acquired earlier and does not pose a big challenge. However, research on this issue demonstrated that lexical processing and the predictive role of RAN in word recognition exist in transparent writing systems. As stated before, Defior, Cary, and Martos (2002) studied with Spanish-speaking children from first to fourth grades and found that children at all grades read the familiar words faster than the unfamiliar but decodable pseudo- words, showing that the words were read from memory rather than decoded. Also, the speed of naming digits significantly predicted the real word reading abilities of all the participants. In this regard, RAN which requires a quick mapping between visual stimuli and their corresponding names plays a crucial role in retrieving words by sight through lexical processing irrespective of the transparency of orthography. Further, this finding provided supporting evidence for the previous studies that revealed RAN was a strong predictor of reading ability across languages (Babayiğit & Stainthorp, 2007; Kirby, Prailla, & Pfeiffer, 2003; Sönmez, 2015; Wolf & Bowers, 1999).

As hypothesized, MA also appeared to be a significant precursor of real word reading ability in the study, explaining an additional, significant but small, variance in word reading beyond RAN. It might be assumed that the ability to reflect on morphemes enabled children to make the connections between sound, meaning, and function, particularly in such a language as Turkish acknowledged with its rich morphology. This finding of the current study was consistent with the previous studies in the literature. For instance, Fowler and Liberman (1995) investigated the role of MA in real and non-word reading ability of children across Grade 2, 3 and 4, and found a significant association between MA and these word-level reading abilities, independent from the effect of age and vocabulary knowledge. In a similar vein, Singson, Mahony, and Mann (2000, Experiment 1) and Mahony, Singson, & Mann (2000, Experiment 1) indicated that the awareness of morphology suggested a genuine contribution to word-reading ability of children across Grade 3 to 6, after controlling the effects of intelligence, vocabulary, and verbal short-term memory.

What was surprising for the role of RAN and MA in the current study was that their predictive power was more than PA which has been acknowledged as mostly the best precursor of word-level reading ability in the previous studies. Regarding the comparison between RAN and PA, the first assumption was that the transparent orthography of Turkish made PA to lose its predictive value in reading. Several studies conducted in transparent writing systems provided supporting evidence for this assumption. As mentioned earlier, Verhagen et al. (2008) investigated the role of PA and RAN in Dutch children‘s word recognition at Grade 1 and 2. Their results were compatible with their assumption regarding the consistent orthography of the languages: while RAN appeared to be a more reliable and powerful predictor of word reading ability, PA had an influence on word recognition ability only at initial stages of reading acquisition. More evidence also came from the study by Furness and Samuelsson (2011) that RAN was a more powerful and reliable predictor of reading ability than PA in the Scandinavian languages having a transparent writing system. Lastly, conducted in the same language as this study's, Babayiğit and Stainthorp's (2010) study highlighted that RAN predicted reading achievement better than PA in Turkish.

Considering the relative contribution of PA and MA to word recognition ability, the pertinent literature portrays a different pattern than the current study. A robust body of research acknowledged MA as a strong predictor of reading ability; however, its contribution to word reading mostly remained behind the contribution of

PA. For instance, the studies conducted in English (e.g., Carlisle & Nomanbhoy, 1993; Kirby & Deacon, 2004; Shankweiler et al., 1995; Singson et al., 2000, Experiment 2), in French (Plaza & Cohen, 2003, 2004), and in Chinese (e.g., McBride-Chang et al., 2003) highlighted a significant contribution of MA in word reading ability which was found to be smaller compared to the contribution of PA. However, the results of the current study pointed out that MA was a more powerful and reliable predictor of reading ability than PA. This result is associated with the rich and complex morphology of Turkish language.

With a focus on grade-level differences, the same regression analyses were repeated for each grade, and RAN appeared to be the only significant predictor of real word reading ability at both grade levels. It was assumed that RAN would explain the largest portion of the variance in real word reading ability at both grade levels, while PA would not significantly contribute to the variance. The results were compatible with this assumption of the study. Both second and fourth graders appeared to have higher levels of mastery in orthographic processing revealed by RAN. As in the studies by de Jong and van der Leij (1999, 2002) propose, the contribution of PA to real word reading ability did not reach significant levels in explaining the variance in word recognition ability. Several other studies also found similar findings that the predictive role of PA in word reading abilities, particularly in transparent orthographies, diminish at very early grades while RAN persists in as a strong predictor (Babayiğit & Stainthorp, 2007; Harris & Giannouli, 1999; Holopainnen, Ahonen & Lyytinen, 2001; Öney & Durgunoğlu, 1997; Wimmer & Mayringer, 2002).

On the other hand, MA was expected to play a role in predicting real word reading ability in Grade 4; however, the results did not confirm this hypothesis. The word-level measures of reading ability might be accounted for this finding. That is, as the grade level increases, the readers will differ from each other more at higher aspects of reading ability, such as reading comprehension. Most probably, the inclusion of a measure of reading comprehension would provide a different relationship between MA and reading ability at Grade 4. The findings of the previous studies are in agreement with these assumptions. For instance, Kirby and Deacon (2004) found that the effect of MA on reading measures increased across the grade levels (from Grade 2 to Grade 5) in their study as aforementioned. Moreover, it was revealed that the type of reading measure played an important role in the effect of MA to reading abilities. That is, MA contributed to reading comprehension rather than word-level reading abilities.

6.2 Conclusion

The findings of the present study highlighted the importance of the automatized recognition and retrieval of phonological representations of words from the long-term memory in fluent word recognition. As such, RAN which is defined as the ability to name a set of highly familiar visual stimuli such as colors, pictures, letters, and digits as quickly as possible (Wolf & Bowers, 1999; Denckla & Cutting, 1999) appeared to be the strongest correlate and predictor of word-level reading abilities. This situation indicated that the students at Grade 2 and 4 were actively engaged with sight word reading strategies as indexed by their RAN performances. These findings are in accord with previous studies showing that RAN is an important predictor of reading fluency in transparent orthographies. Also, its effect on reading increases over years when children get more experienced, automatized in reading. On the other hand, as the grade level increases, the relation of PA to reading ability tends to lose strength. It is revealed that children's reliance on PA decreases as they get older, especially in transparent languages. This might be due to the fact that the second graders applied to phoneme-grapheme correspondences as a compensatory strategy whereas the fourth graders had higher levels of mastery in automatized word reading, which could diminish the potential effects of phonological skills involved in the reading processes. Thus, it can be stated that even in transparent orthographies, lexical route is utilized in reading familiar items instead of phonological route. Here, two factors could be important: word frequency and the nature of reading measure, fluency. Also, it seems difficult to ignore the role of MA in reading since the knowledge of morphology could aid the recognition of words in a language with a rich morphological structure such as Turkish.

6.3 Pedagogical implications of the study

As noted earlier, reading is a crucial ability which has life-long social and academic outcomes for people. Unlike acquiring language, people should make a special effort to learn reading. It has been hotly debated which is the best way to teach children to read and write. A robust body of research has shown that linguistic and cognitive components of reading acquisition play differential roles with regard to the characteristics of the given language. Therefore, the present study provides new insighta into our understanding of reading processes in Turkish and empowers teachers and professionals who teach children how to read. One of the interesting findings of the present study was that rapid automatized naming was very important for children in efficient word reading. Put differently, children rely on their orthographic knowledge for reading rather than their phonological knowledge compared to the English literature has widely suggested. Thus, as well as teaching phonics to children, words should be also presented to children as whole meaningful units, which will reinforce their capability of retrieving correct words effortlessly while reading. As well as the importance of orthographic skills, the present study has pointed to the importance of morphological knowledge of children. Morphemes are the basic units of words that have meaning, therefore, they can support children's reading process, especially at higher levels of reading.

6.4 Limitations of the study

This present study has some limitations which should be kept in mind both for the evaluation of its findings and for further research. First of all, it was a cross-sectional design which did not allow the researcher to follow the same group of children with a special reference to their reading development. Although the present study enabled us to compare two different grade- levels, it is still difficult to mention the developmental pattern of reading skills. In regards, it was a one-time assessment; however, to assess the study variables at different times would enhance the understanding of the predictive roles of the variable in reading acquisition.

Secondly, the sample size would be improved in that a small sample decreased the power of the statistical analyses as well as the generalizability of the results. One more limitation was the variety of the measurements. That is, for instance, the measurement of MA in the present study was not comprehensive enough to address certain aspects of morphological development. Together with MA measurement, reading and PA measures were not overarching enough. Clearly, it was very difficult to tap into all the aspects of such complex skills as reading, phonological and morphological awareness; however, it would be still possible to develop more sensitive and comprehensive measurements of the variables.

Finally, there was no standardized scaling for the scores of the tests for a group of Turkish children, which made it impossible to mention whether the children performed above or below a norm for their age group.

6.5 Suggestions for further research

Considering the limitations of the current study, first it is suggested that future research can focus on data from a longitudinal study through which it would be possible to address developmental patterns of reading acquisition in Turkish, particularly with a larger sample size. Besides, it is highly suggested to include more sensitive and inclusive measures of the linguistic and cognitive components of the reading ability. For instance, the use of higher levels of MA and PA tasks might have an impact in predicting reading ability. In addition to different types of measurement, different variables can also be investigated. It would be interesting to include reading comprehension measure along with newly developed MA and PA measurements. In addition, including different age groups (both lower and higher levels) will portray a wider picture of the phenomenon. Finally, a comparison between normally developing children and children with special reading difficulties will enhance the understanding of the issues discussed in the present study.

APPENDIX

SAMPLE ITEMS FROM THE DATA COLLECTION INSTRUMENTS

KFFT

1) Rhyme Recognition

tay: kay, çal?

tuzak: uzak, kumaş?

dağcı: bağcı, kapı?

2) Rhyme Production

yat – kat

boş – hoş

tel – sel

3) Phoneme Recognition

at (araba, ağaç)

bebek (baba, biz)

kuş (köpek, kalem)

4) Phoneme Blending

/ö/ /p/: öp

/s/ /e/ /ç/: seç

/s/ /i/ /n/ /e/ /k/: sinek

5) Phoneme Segmentation – Words

al /a/ /l/

en /e/ /n/

çorap /ç/ /o/ /r/ /a/ /p/

6) Phoneme Segmentation – Non-words

du /d/ /u/

nas /n/ /a/ /s/

şurt /ş/ /u/ /r/ /t/

7) Phoneme Deletion

piş de ama /p/ deme (iş)

boya de ama /a/ deme (boy)

çapak de ama /k/ deme (çapa)

HOTIT (Sayı)

2 6 9 4 7 6 2 9 7 4

4 6 7 2 4 9 6 9 2 7

WISC-R

1) Digit Span Forward

7-4

3-8-6

5-1-7-4-2-3-8

2) Digit Span Backward

2-5

3-7-4

6-9-1-6-3-2-5-8

KOBIT

1) SWE

bir

irkildiler

döndüğümde

2) PDE

ge

heştün

tümsütülmüş

Turkish Test of Morphological Awareness

Bu mavi.

Sen iyi mi?

Süpürgenin sapısı kırılmış.

Ona görünce çok şaşırdım.

Pencere açıldığında içeri giren kuş çok ürkmüştü.

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