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Component Processes of Early Reading, Spelling, and Narrative Writing Skills in Turkish: A Longitudinal Study

Abstract

The study examined: (a) the role of phonological, grammatical, and rapid automatized naming (RAN) skills in reading and spelling development; and (b) the component processes of early narrative writing skills. Fifty-seven Turkish-speaking children were followed from Grade 1 to Grade 2. RAN was the most powerful longitudinal predictor of reading speed and its effect was evident even when previous reading skills were taken into account. Broadly, the phonological and grammatical skills made reliable contributions to spelling performance but their effects were completely mediated by previous spelling skills. Different aspects of the narrative writing skills were related to different processing skills. While handwriting speed predicted writing fluency, spelling accuracy predicted spelling error rate. Vocabulary and working memory were the only reliable longitudinal predictors of the quality of composition content. The overall model, however, failed to explain any reliable variance in the structural quality of the compositions.

Key words: reading, narrative writing, grammatical awareness, phonological awareness, RAN, spelling

Component Processes of Early Reading, Spelling, and Narrative Writing Skills in Turkish: A longitudinal Study

There is now a substantial body of research into reading and spelling in consistent alphabetic writing systems with simple letter-sound relationships such as German, Finnish, Greek, and Turkish (see Joshi & Aaron, 2006). So far, the primary focus of these studies has been the role of speech analysis (i.e., phonological awareness) and naming speed skills (i.e., RAN) in literacy development. Very few studies have examined the role of grammatical skills alongside these widely researched processing skills (e.g., Nikolopoulos, Goulandris, Hulme, & Snowling, 2006). Broadly, grammatical awareness refers to the ability to process the morphological and syntactic structures of the spoken language, and arguably, its role in literacy development is particularly relevant for consistent writing systems with rich agglutinative morphology, such as Turkish and Finnish. In agglutinative languages like Turkish, a series of suffixes are attached at the end of a noun or a verb and children are exposed to complex multimorphemic words from the very early stages of literacy development. Given the scarcity of research, it is not clear what role grammatical skills play in these consistent writing systems with rich inflectional morphology.

Likewise, our current understanding of the component processes of early narrative writing skills in consistent orthographies is very limited. Three central processing skills have been identified to underlie the early composition writing skills of children. These are the transcription (e.g., handwriting and spelling), verbal memory (e.g., short term memory and working memory), and text generation (e.g., oral language skills such as grammar and vocabulary) (Berninger, 1999; McCutchen, 2000). However, as the research evidence almost

exclusively comes from studies conducted in English, we do not know the relative importance of these processing skills in consistent writing systems.

The present study seeks to address these issues and has two primary aims. First, to investigate the relative role of grammatical awareness, phonological awareness, and RAN in reading and spelling; second, to investigate the role of the three central component processes (i.e., transcription, text generation, and verbal memory) in early narrative writing skills in Turkish.

Reading and spelling development in consistent writing systems: The role of phonological awareness, grammatical awareness, and RAN

Phonological awareness is undoubtedly the most powerful predictor of reading skills in English (Muter, Hulme, Snowling, & Stevenson, 2004; Wagner, et al., 1997). The research evidence from consistent writing systems, however, has been contradictory. While some have found phonological skills to play a significant role in early reading skills (Dufva, Niemi, & Voeten, 2001; Lyytinen, et al., 2006; Patel, Snowling, & de Jong, 2004; Silven, Poskiparta, Niemi, & Voeten, 2007), others have found RAN to be a more reliable predictor of reading than phonological awareness (de Jong & van der Leij, 1999; Landerl & Wimmer, 2008; Wimmer & Mayringer, 2002). Reading accuracy develops very fast in consistent orthographies and due to ceiling levels of performance, reading speed is used as an index of reading skills. However, phonological awareness is not as good a predictor of reading speed as RAN (Savage & Frederickson, 2005). Hence, this is probably one of the central reasons underlying the observed inconsistent findings. In fact, the findings of a recent cross-linguistic study further corroborate this view. In this study, English- and Greek-speaking children's reading skills were compared at Grades 1 and 2 (Georgiou, Parilla, & Papadopoulos, 2008). It was found that although

phonological awareness was related to reading accuracy in both language groups, its effect on reading accuracy was stronger in English than in Greek. Furthermore, while the relationships between phonological awareness and reading speed measures in Greek were very modest (*r* ranging from .32 to .36), those in English were much stronger (*r* ranging from .57 to .64). In this study, the Greek-speaking children's reading accuracy level was much higher than that of English-speaking children. So it seems that when the reading speed measure is not confounded by decoding accuracy skills, the relationship of phonological awareness with reading speed (which is often scored in terms of the number of accurately read words per minute) tends to decline. With respect to the role of RAN, the findings in this study have also suggested that RAN tends to play a more significant role in reading speed in Greek than in English (Georgiou, et al., 2008).

At this point, it is important to highlight the distinction between reading and spelling. Spelling is a more sensitive index of phonological processing skills than reading (Perfetti, 1997) and several studies in consistent writing systems such as Turkish, Dutch, and German have found phonological awareness to play a more central role in children's early spelling development than reading development (Babayiğit & Stainthorp, 2007; Landerl & Wimmer, 2008; van Bon & van Leeuwe, 2003; Wimmer & Mayringer, 2002). For example, in a series of studies Wimmer and colleagues have found phonological skills to be predictive of spelling but not reading, and conversely, RAN was found to be the most powerful predictor of reading but not spelling (Landerl & Wimmer, 2008; Wimmer & Mayringer, 2002).

There is, however, a caveat in comparison of reading and spelling in German and Dutch. These writing systems are consistent for reading but not for spelling. Spelling is much more complex in German and Dutch. For this reason, further studies in writing systems with relatively

balanced consistency like Turkish and Finnish are particularly important in order to clarify the observed divergence in the predictors of reading and spelling in a transparent orthography.

Thus far, the primary research focus of the studies conducted in consistent writing systems tends to be the role of phonological awareness and RAN. Hence, we do not know what role other language skills such as grammatical skills play in early reading and spelling development. Grammatical awareness[1] by definition entails semantic knowledge, awareness of morpho-phonemic structure of the words, and syntactic parsing. With respect to the relationship between reading and grammar, it is assumed that syntactic skills enable effective use of the context to facilitate word recognition (Bowey, 2005). The morphological skills are also proposed to enable effective morphological parsing of multimorpheme words, thereby facilitating recognition of these words (Bryant & Nunes, 2004). However, the research evidence into the role of grammatical awareness in early reading skills tends to be highly inconsistent. While some have reported small but reliable relationships (Carlisle, 1995; Carlisle & Nomanbhoy, 1993), others have found the effect of grammatical skills on reading to be either unreliable (Muter, et al., 2004) or indirect through its relationship with the phonological skills (Nikolopoulos, et al., 2006; Silven, et al., 2007). We now turn to the link between grammatical skills and spelling.

Most research into the grammar-spelling link has investigated the specific relationship between the ability to process certain morphosyntactic structures in oral language and the ability to spell these structures. So far, these studies have shown that the effect of grammatical skills on spelling is most evident in the processing of complex words that cannot be spelled accurately by applying the phoneme-to-grapheme correspondence rules. For example, the words that undergo phonological shift (e.g., <sign> and <signature>), contain irregular suffixes (e.g., past tense suffix -ed is pronounced differently in <hunted> and <saved> but spelled the same) or silent

morphemes (e.g., plural -s in Spanish and French) (Defior, Alegria, Titos, & Martos, 2007; Juul & Elbro, 2004; Muter & Snowling, 1997; Nunes, Bryant, & Bindman, 1997; Senechal, Basque, & Leclaire, 2006; Singson, Mahony, & Mann, 2000; Titos, Defior, Alegria, & Martos, 2003).

Hence, there is the assumption that grammatical skills support reading and spelling of complex words where phonological strategy fails to provide an accurate answer. Given the evidence for this specific relationship on the one hand, the question which arises is whether grammatical skills play any significant role in languages with transparent morphology, such as Turkish and Finnish. Clearly, there is no need for morphosyntactic knowledge for accurate reading or spelling of words in these highly consistent writing systems. On the other hand, given the central role of inflectional morphology in these agglutinative languages, one would expect grammatical skills to play a significant role in literacy development. In fact, one study has directly addressed this question with respect to spelling in Finnish and reported no specific relationships between the awareness of certain morphosyntactic structures and their accurate spelling (Lehtonen & Bryant, 2005). However, in this study, morphological skills as a measure of general oral language skills were related to spelling. At this point, it is important to note that in a recent study in Dutch, the morphological skills failed to make any reliable unique contribution to spelling at Grade 1 after taking into account the variance accounted by the phonological skills (Rispen, McBride-Chang, & Reitsma, 2008). However, Dutch is not an agglutinative language and given the scarcity of research it is not possible to ascertain to what extent language or methodological differences might have contributed to these inconsistent findings.

These findings should be evaluated with the recognition that morphological and phonological skills often show strong covariance suggesting reciprocal relationships between

these two linguistic skills and this can complicate a coherent analysis of their unique predictive role in literacy skills (Carlisle, 2000; Carlisle & Nomanbhoy, 1993). Furthermore, in agglutinative languages like Finnish and Turkish, the suffixation process draws the attention of the children to the final phoneme and internal phonemic structure of words, which can facilitate the development of phonological awareness skills (Durgunoğlu & Öney, 1999; Lyytinen & Lyytinen, 2004). Hence, according to this view the impact of morphosyntactic skills and in particular inflectional morphology on later literacy skills may be indirect through its influence on the development of phonological skills. There are several lines of supporting evidence for this view. For instance, in Finnish inflectional morphology was reported to be a reliable longitudinal predictor of phonological awareness skills (Silven, et al., 2007), as well as a reliable marker of children at genetic risk of developing literacy problems (Lyytinen & Lyytinen, 2004). Clearly, there is a large gap in our current understanding of the developmental relationships between different metalinguistic skills, hence the significance of investigating phonological skills alongside morphosyntactic skills.

The evaluation of the findings in this area of research is further complicated by the fact that the research focus tends to be on reading and spelling of single-morpheme words presented in isolation. Hence, we do not know whether these findings are also applicable to reading and spelling of inflected words in context. Needless to say, this issue is particularly relevant for agglutinative languages, in which long inflected words are the characteristic feature of the language.

Composition writing

Composition writing is clearly a complex process and taps a cascade of lower and higher level processing skills (Berninger, 1996; Flower & Hayes, 1980; Graham & Harris, 2000;

Kellogg, 1996). Young children's early writings are characterised as being *knowledge telling* that is, writing whatever a prompt brings to their mind and lacks higher levels of processing skills such as revision and planning (Bereiter, 1980). Therefore, the focus in this area of research has been on three developmental skills, specifically, transcription skills (e.g., spelling and handwriting fluency), text generation skills (e.g., transformation of ideas into oral language, which includes skills such as vocabulary and grammar), and working memory skills (Berninger, 1999). In this context, working memory is conceived as a limited information processing resource that enables the integration and coordination of the multiple components of writing. The three central component processes are in complex interaction with each other and seem to be differentially related to the different aspects of the writing skills (e.g., the length and quality of the writing) (Berninger, et al., 1992; Graham, 1999; Graham, Berninger, Abbot, Abbot, & Whitaker, 1997; Juel, 1988; Juel, Griffith, & Gough, 1986; McCutchen, 2000; Olinghouse, 2008; Swanson & Berninger, 1996).

The lack of automaticity of the transcription skills is thought to interfere with the writing process, as the novice writer struggles to monitor the ongoing content generation process while at the same time, his or her attention needs to be devoted to spelling. Hence, the lack of efficiency in the transcription process is considered to constrain content generation and writing fluency by increasing the processing load of the already limited working memory resources of young children (Swanson & Berninger, 1996). Consistent with these explanations, in a series of studies Berninger and her colleagues (1992) have shown that transcription and working memory skills are closely related to both writing fluency and writing quality among elementary school children. Furthermore, as transcription skills become more automated with increasing age, the effect of transcription skills on writing declined, while that of working memory remained

relatively stable across time (Berninger, et al., 1992). Several studies have also found handwriting fluency to play a more central role in composition writing than spelling accuracy, further underscoring the importance of automaticity of transcription skills (e.g., Graham, et al., 1997).

The text generation process is directly linked to the components of oral language such as semantic knowledge, lexical retrieval, and grammatical processes (Berninger, 1996) and individual differences in language skills have been found to play a significant role in children's writing skills (Abbot & Berninger, 1993; Bishop & Clarkson, 2003; Cragg & Nation, 2006; Fey, Catts, Proctor-Williams, Toblin, & Zhang, 2004; Juel, 1988). It is also conceived that oral language skills can influence text generation processes indirectly through its facilitating effect on verbal working memory skills (see Kintsch, 1998). In line with this view, skilled writers have been found to perform better on working memory measures that require efficient activation, processing, and retrieval of lexical information from long-term memory (McCutchen, Covill, Hoyne, & Mildes, 1994).

These findings, however, are not unequivocal. For instance, several studies have failed to find any reliable relationship between children's grammatical skills (or oral language skills) and the structural quality of their written compositions (Berninger, et al., 1992; Griffin, Hemphill, Camp, & Wolf, 2004; Mackie & Dockrell, 2004). Likewise, some studies have failed to find any reliable relationships between children's writing fluency and writing quality (Fey, et al., 2004).

Research examining writing skills in typically developing children is limited in English and even more so in consistent writing systems. In one such rare study in Finnish, it has been reported that spelling does not constrain text generation processes even during the early stages of literacy development (Maki, Voeten, Vauras, & Poskiparta, 2001). In this study, spelling

accuracy was marginally related to composition coherence from Grade 1 to Grade 2, and its relationship with writing skills became unreliable thereafter (Grade 2 to Grade 3). This was explained in terms of the relative ease and speed of spelling development in Finnish (Maki, et al., 2001). Unfortunately, automaticity of writing, oral language, or memory skills were not assessed in this study.

Taken together, notwithstanding the ever increasing research evidence, there is still a great deal to be learnt about the component processes of reading, spelling, and writing in consistent orthographies. In this study, our overall goal was to address the following three main research questions within the context of Turkish: (a) What are the relative role of phonological, grammatical, and RAN skills in early reading and spelling development?; (b) Do the relative contributions of these processing skills differ as a function of the type of literacy outcome measure (e.g., spelling versus reading or prose reading versus single word reading)?; (c) What roles do the three central component processes of composition writing play in a consistent and highly inflected writing system?

Method

Participants

Fifty-seven children (27 girls and 30 boys) were tested in the spring term of Grade 1 and then about 11 months later at Grade 2. The mean age at the beginning of the study was 6.6 years (range = 6.0 to 7.1 years). All children spoke Turkish as their first language and came from two public schools in Kyrenia, Northern Cyprus. The children were randomly selected from six different classrooms on the conditions that they did not have any formal diagnosis of neurological or sensory impairments. The two schools attract children from all socio-economic

backgrounds and the sample seemed the have reflected this diversity. The distribution of occupational level of the fathers of the participants was as follows: 3% unemployed, 18% partially-skilled manual worker, 15% skilled manual worker, 39% nonmanual skilled worker, 16% managerial, and 9 % professional. The schools in Northern Cyprus follow a set curriculum and use the same materials. For this reason, education tends to be relatively uniform across the schools.

The children had received about seven months of formal reading instruction involving a mixture of phonetic and whole word strategies at the beginning of the study. Nine children moved, thus could not be tested by the end of Grade 2. Consent for testing was obtained from the school authorities, parents, and children.

Materials and procedures

Children were tested individually at their schools. A large battery of tasks was implemented, only the relevant ones are reported here. Further details of the measures can be obtained from the first author.

Measures implemented at Grade 1

Nonverbal IQ. Raven's Standard Progressive Matrices (Raven, 1967) and Block design subset from the Turkish version of the WISC-R (Savaşır & Şahin, 1995) were used as a measure of nonverbal IQ.

Vocabulary. This was the vocabulary subset from the Turkish version of the WISC-R (Savaşır & Şahin, 1995).

Short-Term Memory (STM). The forward digit-span subtest from the WISC-R (Savaşır & Şahin, 1995) was used to assess verbal STM skills.

RAN. Children's naming times of letters, objects, and digits were recorded (adapted from Denckla & Rudel, 1974). The objects were five single syllable common nouns (Fil [elephant], göz [eye], mum [candle], top [ball], kuş [bird]), the letters were a, o, s, d, p, and the digits were 3, 5, 4, 8, 7. For the object naming task, we used colourful pictures. The items were presented randomly as 5 rows of 10 items on each form. There was a practice trial at the beginning of each naming task to ensure that the items were accurately and consistently named. The final score was based on the average scores of the two trials for each naming task. There were very few errors and readjusted scores after taking into account the errors gave essentially the same results. Therefore, the original scores are reported. As the three RAN measures were highly related to each other (r ranging from .72 to .86, $p < .001$), it was appropriate to compute a composite mean z-score for this measure. The subsequent data analysis is based on this composite score.

Working memory. This is based on the listening span task of Daneman and Carpenter (1980). Children listened to a series of simple declarative sentences that they had to verify by stating as either true or false. Then, they had to recall verbatim the first word of each sentence in the order of presentation. In the English version of this task, often sentence-final words are asked to be recalled. However, as Turkish has subject-object-verb word order, it was only possible to have nouns with no attached suffixes at the beginning of a sentence. Therefore, we changed the format of the task and asked the children to recall the first word of each sentence (e.g., <Gül meyve-dir> [*Rose fruit-is*], in which the to-be-recalled word was <Gül> [*Rose*]).

The sets of trials ranged between two-sentence trials to four-sentence trials. Children were given two sets of practice trials with feedback at the beginning of the test. There were three trials within each set and failure on two or all three trials within each set resulted with the termination of the test. One point of score was given for each correct trial.

Phonological awareness. The syllable and phoneme deletion tasks based on Bruce's (1964) word analyses test were used to assess phonological awareness skills. There were four practice trials with feedback before each task. After the deletion, the remaining part was always a nonword. The target to-be-deleted phoneme or syllable was either in word-initial, word-medial, or word-final positions. The nonwords were constructed by changing two or more letters (which could be either consonants or vowels) of real words from different position (e.g., initial, final, or medial). Examples of these tasks are presented in Appendix A (Table 1A).

Syllable deletion. In this task, children were asked to say the remaining part of a word or nonword after deleting the target syllable spoken by the experimenter. There were a total of 21 trials with 12 real words and 9 nonwords. There were 8 two-syllable and 13 three-syllable items. Nine items involved word-initial, seven word-medial, and five word-final deletions.

Phoneme deletion. This was the same as the syllable deletion task except that the task was to omit a target phoneme. A total of 18 items with 9 real words and 9 nonwords were presented. There were 11 items with one syllable and 7 items with two syllables. Six items involved word-initial, nine word-medial, and three word-final deletions.

Grammatical awareness. Two main tasks were developed to assess children's ability to process inflectional suffixes and analyse the syntactic structure of the spoken sentences (see Appendix A, Table 2A). All items were spoken by the experimenter with a natural prosody.

Morphological awareness. This task was designed to test children's ability to process inflectional morphology and was inspired from the earlier works of Berko (1958) and Durgunoğlu (2003). The task composed of two parts. In part one, children made grammaticality judgment for the spoken sentences about a fictitious animal with the pseudonoun <KEV> (i.e., Judgment task). Nine sentences with correct and inaccurate forms were constructed making a

total of 18 test trials, which were presented randomly. In the second part, after making the grammaticality judgment, the child was also asked to provide the correct form of any sentence indicated to be wrong (i.e., judgment/correction task). This time, another pseudonoun was presented as a reference to a different fictitious animal called <BEV>. There were 18 different sentences nine of which were correct and the rest included inflectional suffixation errors. For the inaccurate items, children received a score only if they have made the appropriate correction. For some items, there were alternative correct answers. Any grammatically acceptable answer was considered accurate. Five practice trials with feedback preceded the test trials.

Syntactic awareness. This task simply involves the reordering of words in spoken sentences. There were 20 sentences with three to four words. The word order is relatively flexible in Turkish, but there are some constraints, such as the position of adjectives, adverbs, and question words (Ekmekçi, 1986). In this task, sentences with these structures were used in order to obtain a sensitive index of the ability to analyze the internal structure of the sentences. There were five practice trials with feedback prior to the test trials. Any grammatically acceptable answer received a score.

Measures implemented at Grade 1 and Grade 2

Reading tasks. Three one minute word reading tasks and two text reading tasks were developed to assess reading skills. In this way, we aimed to obtain a comprehensive assessment of reading skills.

One-minute word reading. We used three different one minute word reading tasks: word reading, nonword reading, and agglutinated word reading (see Appendix A, Table 3A). The items were presented randomly on an A4 size card printed with 16 pixel size Century Gothic fonts. The task was to read accurately but as fast as possible until asked to stop. A stop watch

was used to time the tasks and in each case the scoring was based on the number of items read correctly in one minute.

For the word reading task, 100 words varying in frequency were presented randomly. At the time of testing, there were no word frequency norms for children in Turkish, so school books and a Turkish dictionary were used to select the words. The words were either nouns or adjectives. For the nonword reading task, 90 items were created by changing several letters of real words as described before in relation to the phonological awareness tasks. Finally, for the agglutinated word reading task, 72 inflected words were selected. The list included nouns, adjectives, and verbs. The number of attached suffixes ranged from one to five. The syllable length of the items ranged between one to seven in the word and nonword reading tasks, and two to seven in the agglutinated word reading task.

Text reading accuracy and text reading speed. Two short narrative passages, one with 31 and the other with 30 words were developed to assess prose reading skills. These tasks were also timed with a stop-watch. Scores for the text reading accuracy were based on the total reading accuracy across the two passages and text reading speed was scored as the number of correct words read in one minute across the two passages.

Spelling. Spelling of single words (i.e., real words and nonwords) and sentences were assessed (see Table 3A). Each item was read aloud twice.

Single word spelling. In this task 17 items (6 words and 11 nonwords) were dictated to the children. The nonwords were constructed in the same way as noted before. First, the real words and then nonwords were presented. Children were informed about this transition point and have been told that some of the words will be strange.

Sentence spelling. In this task, nine sentences were dictated to children. The sentences included two to three words with complex morphological structures.

Hand writing speed. This task was used as an index of automaticity (see Abbot & Berninger, 1993) or speed of translation of orthographic-phonological representations from memory into writing and involved writing repeatedly the first three days of the week from memory (i.e., *Pazartesi* [Monday], *Salı* [Tuesday], *Çarşamba* [Wednesday]) until asked to stop. The total number of words written per minute was calculated.

Measures implemented at Grade 2

Composition writing. This task aimed to examine children's narrative writing skills and was scored in terms of spelling error rate, fluency, content, and structure. Although composition structure and content are related dimensions, they also tap different developmental skills (see Berninger, et al., 1992). Therefore, these two indices of composition quality were examined separately.

The task simply involved writing the events depicted in a series of eight pictures. The pictures showed a hiking trip during which a boy falls and hurts his foot. The children were told to study the pictures carefully and then when they were ready, to go back to the beginning and start writing the story. All eight pictures were printed in order on an A4 size card and remained visible at the front while writing. The children were left to write their narrative essays at their own pace and their speed was recorded by a stop-watch. If they made any errors they were instructed to cross out the word and rewrite next to it.

Composition writing-fluency. Total number of words written per minute was used as an index of writing fluency.

Composition writing-spelling error rate. Children's spelling error rate was calculated by dividing the total number of spelling errors by the total number of written words.

Composition writing-content. The content of the written compositions was assessed in terms of the overall accuracy and clarity of the depiction of the events in the pictures and the appropriateness of the choice of vocabulary. The *general content* was scored on a scale of 1 to 5 ranging from 'very poor-mostly irrelevant information' to 'very good-accurate, vivid, and highly detailed explanations of the depicted events'. Children's specificity in *the choice of vocabulary* was scored on a scale of 1 to 4 ranging from 'very poor-lacks precision and may be inappropriate' to 'very rich-appropriate and specific that conveys the meaning accurately'. The scoring of the vocabulary was based on the vocabulary subscale of the written expression part of the Wechsler Individual Achievement Text-Second UK Edition (WIAT-II, Wechsler, 2005). Hence, the maximum possible score for the composition writing content was nine.

Composition writing-structure. The scoring procedure used to assess the organizational and structural quality of the compositions was partly adapted from the written expression subtest of the WIAT-II and assessed such as the use of connectives and subordinate clauses (see Appendix B). The highest possible score for the composition writing-structure was 15.

The written compositions were rescored by two experienced primary school teachers. The average inter-rater reliability coefficients (Pearson Product Moment correlation coefficients) were relatively high (see Table 1).

Results

A summary of the descriptive statistics are presented in Table 1. With the exception of text reading accuracy, reliabilities of the scores in all the measures were acceptable (≥.70). The low test-retest reliability of the text reading accuracy is likely to be due to the observed restricted

variability of the scores. As with the previous studies in Turkish (e.g., Babayiğit & Stainthorp, 2007; Öney & Durgunoglu, 1997), we have also observed ceiling effects on the reading accuracy measure. For this reason, we have dropped text reading accuracy from the subsequent analyses.

[Table 1 about here]

Correlational analyses

The concurrent and longitudinal relationships between the measures are presented in Tables 2, 3, and 4. The following is a synopsis of these analyses, specifically relevant to our research questions.

[Tables, 2, 3 and 4 about here]

The different reading measures were highly related to each other (*r* ranging from .78 to .92) at both testing occasions (see Tables 2 and 3) and their respective relationships with the predictor measures were also very similar (see Tables 2, 3, and 4). Although phonological awareness, grammatical awareness, and STM correlated with the reading measures, clearly RAN was the most powerful longitudinal correlate of reading speed (Table 4). Likewise, the single word spelling and sentence spelling measures correlated strongly with each other at both testing occasions and both were related to the phonological and grammatical awareness measures.

In line with the previous research, we have also found the different components of composition writing to be differentially related to the predictor measures (Berninger, 1999). The composition writing fluency correlated very strongly with handwriting speed (see Tables 3 and 4). Word spelling accuracy was a consistent and powerful correlate of the spelling error rate (see

Tables 3 and 4). The composition writing content shared moderate to large variances with vocabulary and working memory. However, none of the Grade 1 measures were reliably related to the composition writing structure (see Table 4). Finally, the composition writing content and structure measures correlated strongly with each other (r = .59), suggesting that those who wrote compositions with better content also tended to produce grammatically better structured texts. It is also notable that the spelling error rate and writing fluency were not related to each other, and none of them were related to either the quality of the content or the organizational structure of the written compositions (see Table 4).

Stability of reading and spelling

There was high stability between the reading speed measures from Grade 1 to Grade 2 (r ranging from .63 to .87). There was also evidence for stability in spelling accuracy measures across the two consecutive testing occasions, albeit these tended to be less strong than reading (r = .54 and .56). These results are very similar to those reported in previous studies (e.g., Landerl & Wimmer, 2008). Hence, although there was a sharp increase in children's overall reading speed and spelling accuracy from Grade 1 to Grade 2, those who read slowly were also slow readers one year later, and a substantial proportion of children continued to make spelling mistakes. A closer examination of the scores revealed that about 50% of the children with spelling accuracy scores below the mean at Grade 1 were still performing below the mean of their same age peers at Grade 2. Their difficulty was particularly evident in the sentence dictation task, suggesting that the spelling of complex long words can be challenging in Turkish despite the consistency of phoneme-to-grapheme correspondences.

It should be also highlighted that spelling in Turkish is consistent to the extent that the spoken language matches the standard language (see Babayiğit, in press; Treiman & Kessler,

2005). Any subtle variations in pronunciation can make spelling less consistent. Likewise common linguistic processes such as assimilation, which occurs when a sound becomes more similar to adjacent sounds, can complicate spelling even in a highly consistent system (for a comprehensive discussion of the assimilation process in Turkish, see Demircan, 2001). Clearly, further research needs to confirm these findings and examine which phonological structures are particularly difficult to spell in Turkish.

Multiple regression analysis

The measures we have used to assess each processing skill, namely nonverbal IQ (Raven's Standard Progressive Matrices and block design), phonological awareness (syllable deletion and phoneme deletion), and grammatical awareness (morphological awareness and syntactic awareness) shared large variances with each other (see Table 2). For this reason, it was appropriate to form composite measures of these measures by calculating the mean standardized scores of the relevant component measures. This procedure not only serves to simplify the subsequent multiple regression analyses but also strengthens the reliability and validity of the measures used to assess each processing skill. The longitudinal correlations between these composite measures and the Grade 2 measures are presented in Table 4.

The diagnostic procedures for the multiple regression analyses (see Tabachnick & Fidell, 2001) have revealed no multivariate outliers. Several measures were skewed. However, the transformation of the scores of these measures did not change the pattern of results. Hence, the following results are based on the nontransformed scores.

Longitudinal predictors of reading and spelling

IQ and vocabulary were not related to either reading or spelling (see Table 4). In order to simplify the following data analyses, we excluded these measures from the regression models. Table 5 shows the Grade 1 predictors of reading at Grade 2.

[Table 5 about here]

First, we conducted hierarchical multiple regression analyses of data and examined the unique contribution of each predictor measure after taking into account the variance accounted by previous reading skills (i.e., the autoregressor) at Step 1. As Model 1 (see Table 5) clearly shows, after controlling for the autoregressor measure, only RAN made reliable unique contributions to reading measures. The only exception to this was text reading speed, whereby the effect of RAN was completely mediated by the powerful autoregressor. We repeated the same analysis and examined the predictive effects of Grade 1 measures after removing the powerful mediating effect of the autoregressor measure from the regression analysis. Model 2 (see Table 5) shows that after controlling for verbal STM, phonological awareness made reliable albeit small contributions to word and agglutinated word reading but its effect on the nonword reading and text reading were negligible. Once again, the most powerful unique predictor of reading speed was RAN (see Table 5, Model 2). In this study, grammatical awareness was not a reliable longitudinal predictor of reading skills. Finally, the patterns of relationships were comparable across the different measures of reading skills suggesting uniformity in the underlying component processes of reading at this level of literacy development.

Next, we examined the longitudinal predictors of spelling skills at Grade 2 (see Table 6). After controlling for the autoregressor, only grammatical awareness explained unique and reliable variance in word spelling (see Table 6, Model 1). Although phonological awareness also explained 4% further variance, this was not statistically significant. With respect to sentence spelling and spelling error rate, the autoregressor was the only reliable predictor.

Once again, we re-ran the regression analyses and explored these relationships after removing the powerful mediating effect of the autoregressor measures (see Table 6, Model 2). Grammatical awareness explained reliable unique variances in both word and sentence spelling. Although phonological awareness also explained reliable variance in word spelling skills, the effect became very small and unreliable once the variance accounted by grammatical skills was taken into account (see Table 6, Model 2). RAN failed to explain any reliable variance in spelling skills.

[Table 6 about here]

Interestingly, with the exception of the autoregressor (word spelling), none of the Grade 1 measures predicted spelling error rate in this study. This may partly suggest that other processes were influencing children's spelling performance whilst composing text. Children can clearly be more selective and choose words that they know and can spell well (see Mackie & Dockrell, 2004). They may also make spelling mistakes because of limitations in information processing or attentional resources. Writing makes use of both spelling and content generation skills simultaneously. Therefore, it is a multiple task condition that can contribute to more spelling errors among younger children with limited information processing resources (Abbot &

Berninger, 1993). Overall, these two main factors might have introduced much noise into the data contributing to the observed unreliable relationships. In fact, the concurrent relationship between the word spelling accuracy and spelling error rate was only moderate (44% shared variance) at Grade 2 (Table 3), further suggesting that these two measures of spelling are not tapping the same processing skills (for similar findings, see Abbot & Berninger, 1993). Hence, in contrast to reading, the patterns of results tended to differ across the different measures of spelling skills.

Predictors of composition writing-spelling error rate and composition writing-fluency

In the next series of multiple regression analyses, we have examined the role of word spelling accuracy and handwriting skills in the mechanics of writing (viz., composition writing-spelling error rate and composition writing-fluency). We conducted both the concurrent and longitudinal analysis of data. The results were the same across the two testing periods (see Tables 7 and 8). Word spelling accuracy was the only reliable predictor of spelling error rate and handwriting speed was the only reliable predictor of writing fluency. The latter is in line with the findings of the previous reports (e.g., Berninger, et al., 1992). It seems that spelling error rate and writing fluency are dissociable skills even during the early stages of writing development. This possibly reflects the consistency of the Turkish spelling system and will be further elaborated in the Discussion section.

[Tables 7 and 8 about here]

Predictors of composition writing quality: Content and organizational structure

Note that handwriting speed, IQ, and STM were not related to composition writing quality. In order to simplify the subsequent regression models, we included word spelling accuracy as an index of transcription skills, working memory as an index of verbal memory, and vocabulary and grammatical awareness as indices of oral language skills. Table 9 shows the results of the simultaneous multiple regression analysis. Vocabulary and working memory were the only reliable and unique predictors of composition writing-content (see Table 9).

[Table 9 about here]

Although the observed effect of vocabulary was expected and is in line with the previous findings regarding the role of oral language skills in text generation (Abbot & Berninger, 1993), we were also interested to find out whether this relationship was evident after vocabulary choice scores (i.e., *the choice of vocabulary*) were removed from the content scores. As Table 10 clearly shows the overall effect size of vocabulary remained almost the same suggesting that the observed effect of vocabulary was not solely due to the vocabulary component of the content scores.

[Table 10 about here]

The redundant role of spelling accuracy and grammatical awareness in composition writing quality as well as the failure of the overall regression model to explain any reliable variance in composition writing-structure are surprising but have been reported before

(Berninger, et al., 1992; Griffin, et al., 2004). We discuss the possible reasons for these findings in the next section.

Discussion

In line with the previous research, the findings have revealed a clear dissociation between the predictors of reading and spelling. While RAN was a powerful and consistent longitudinal predictor of reading speed, there was evidence for stronger relationships between oral language (i.e., grammatical and phonological awareness) and spelling accuracy skills. With respect to the composition writing skills, while word spelling accuracy predicted composition writing-spelling error rate, handwriting speed predicted composition writing-fluency. There was also a divergence in the predictors of composition-content and composition-structure. Vocabulary and working memory made reliable contributions to the composition-content, but the overall model failed to explain any reliable variance in the structural quality of the compositions. Finally, the findings suggested that the component processes of reading are comparable irrespective of the mode of assessment of reading skills but this may not apply to spelling, as we have observed differences across the different measures of spelling skills.

Predictors of reading speed

The observed powerful predictive relationship between reading speed and RAN measures was expected and is certainly in line with the extant research evidence from consistent writing systems (de Jong & van der Leij, 1999; Georgiou, et al., 2008; Landerl & Wimmer, 2008; Wimmer & Mayringer, 2002). Furthermore, this strong relationship remained irrespective of the word type (single-morpheme words or multi-morpheme words) or the mode of presentation of the words (in isolation or context). Although, phonological awareness was reliably related to

reading skills at Grade 2, its effect on the reading speed measures became redundant when RAN was taken into account. Given the observed ceiling levels of performance on the reading accuracy measures in this study, these results were not surprising and clearly echo those reported in other consistent orthographies (e.g., Landerl & Wimmer, 2008).

Our current understanding of why RAN is such as powerful predictor of reading speed is limited. Nonetheless, the observed divergence between the phonological awareness and RAN measures in this study further corroborates the view that they tap different component processing skills (Jones, Obregón, Louise Kelly, & Branigan, 2008; Powell, Stainthorp, Stuart, Garwood, & Quinlan, 2007; Wolf, Bowers, & Biddle, 2000), and that care should be exercised when comparing speed with accuracy measures with different developmental patterns (see Paris, 2005).

In this study, we did not find any reliable effect of grammatical awareness on reading skills. These results are in line with the findings of previous longitudinal studies in English and Finnish (e.g., Muter, et al., 2004; Silven, et al., 2007). It seems that during the early stages of reading development, grammatical skills do not play any reliable role in reading even in a highly inflected orthography and this seems to be the case irrespective of the word type or the mode of reading assessment. Further research needs to replicate these findings and clarify to what extent these results reflect differences in orthographic consistency (e.g., relative ease of decoding in Turkish might render the role of morphosyntactic skills redundant) or the timing of measurement. It is conceivable that the relationship between the grammatical awareness and reading skills may become stronger among older age groups when the grammatical awareness skills become more proficient and children are exposed to more complex texts (Carlisle, 2000; Singson, et al., 2000). Finally, as noted before these findings should be evaluated with some

caution as any comparison of accuracy (e.g., grammatical awareness) with speed measures (e.g., reading speed) is inherently problematic.

Predictors of spelling

Although the autoregressor mediated the effects of phonological and grammatical awareness skills on spelling at Grade 2, clearly these two oral language skills were strongly related to spelling skills in this study, which is in accordance with the previous research findings (Babayiğit & Stainthorp, 2007; Landerl & Wimmer, 2008; Lehtonen & Bryant, 2005). It is notable that grammatical awareness was the most reliable unique predictor of sentence spelling at Grade 2. The close relationship between the spelling of complex multi-morpheme words and grammatical skills is somewhat unsurprising but it is not clear why phonological awareness failed to predict sentence spelling. One possible reason may be the use of very complex multi-morpheme words in the sentence spelling task that might have called for more morphosyntactic rather than phonological knowledge and strategies when children were trying to dictate these long words. Given the educational implications of these findings, further research needs to confirm these findings and also clarify to what extent the observed powerful link between grammar and spelling might have been shaped by the agglutinative nature of Turkish.

Finally, the overall findings from the different measures of spelling skills suggested that the mode of spelling assessment may influence the observed pattern of findings highlighting the importance of a comprehensive approach to spelling assessment (see Abbot & Berninger, 1993; Pattison & Collier, 1992).

Predictors of composition writing

Single word spelling accuracy was the only reliable predictor of spelling error rate in the narrative writing task. In line with the previous findings, we have also found handwriting automaticity indexed by the handwriting speed measure to be a more powerful predictor of children's writing fluency than spelling accuracy (Berninger, et al., 1992; Graham, et al. 1997). Hence, the overall findings support the notion that children's early composition writing fluency can be constrained by handwriting automaticity. However, in this study we found no evidence for a limiting effect of these transcription skills on the writing quality. The transcription and quality indices were unrelated. Likewise, the mechanics of writing indexed by the spelling error rate and writing fluency were not related to the writing quality. These findings clearly echo those of Maki et al. (2001) who found unreliable relationships between spelling accuracy and writing quality and those of Fey et al. (2004) who reported unreliable relationships between writing fluency and writing quality. Once again, this early dissociation between the mechanical skills and writing quality may be due to the high levels of consistency of the Turkish spelling system. The observed inconsistent patterns of findings in the literature may also reflect differences in educational practices (see Barnett, Stainthorp, Henderson, & Scheib, 2006). In Northern Cyprus, where this study was conducted, there is much emphasis on good handwriting skills and spelling takes up a large proportion of children's early literacy activities. This might have further facilitated the development of children's transcription skills so much so that it ceased to constrain the writing quality.

In this study, the individual differences in the semantic quality of the compositions were best predicted by the vocabulary and verbal working memory measures. Broadly, these findings fit well with the previous research that have outlined the oral language and working memory as

the two central skills linked to young children's writing quality (Berninger, 1996; Fey, et al., 2004). Although related, semantic and structural quality seem to tap different component processes, as none of the measures predicted the quality of composition structure. It is notable that Berninger and colleagues (1996) have also failed to find any reliable relationships between the oral language skills (i.e., verbal IQ, syntax) and the quality of the organizational structure of the compositions among similar age groups of children. One possible explanation for this finding might be the developmental lag between children's oral and written narrative skills. It is well documented that young children's written narrative skills lag behind their oral narrative skills, and with increasing age the quality of their written narrative skills become more commensurate with their oral narrative skills (Bereiter, 1980; Fey, et al., 2004). The structural simplicity of early writings of young children is also reflected in the tendency to produce descriptive narratives with simple sentence structures (Bereiter, 1980). We have also observed this profile of writing in this study where most children (89%) used either none or only one linking expression. It follows that the structural quality of children's early written narratives might not capture individual differences in oral language skills at least among typically developing children. This might be one contributory factor to the observed dissociation between the oral language skills and structural quality of the compositions. These are clearly very important issues that need to be further investigated with different writing measures. Nonetheless, overall findings suggest the importance of educational practices to help children to bridge the gap between their oral and written language skills.

Conclusion

The present study has made a contribution to this area of research by not only replicating the previous findings in relation to the central role of RAN in reading speed in a consistent

orthography, but by showing also that these findings can be extended to a variety of reading outcome measures and word types. Most importantly, we have found that in addition to phonological awareness, grammatical skills also play a significant role in spelling development in a highly consistent spelling system with rich inflectional morphology. Hence, the findings suggested that different component processes underlie children's early reading and spelling skills in Turkish. Finally, the findings underscored the need to differentiate across the different aspects of children's written compositions, which seem to be influenced by distinct processing skills.

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Appendix A

Table 1A

Examples from the Phonological Awareness Measures

Syllable Deletion		
Words	*To-be-deleted syllable*	*Answer*
Kalem (pencil)	Ka	Lem
Kedi (cat)	Di	Ke
Pencere (window)	Ce	Penre
Nonwords		
Taska	Tas	Ka
Dezmene	Ne	Dezme
Sormato	Ma	Sorto
Phoneme deletion		
Words	*To- be-deleted phoneme*	*Answer*
Kuş (bird)	K	Uş
Top (ball)	P	To
Tost (toast)	S	Tot
Nonwords		
Döm	D	Öm
Tar	R	Ta
Delp	L	Dep

Table 2A

Examples from the Grammatical Awareness Measures

Judgment	**English Translations**
Inaccurate inflectional suffix	
KEV-e ormanlarda yaşar.	KEV (dative suffix '-to') lives in forests.
Accurate inflectional suffix	
KEV-in uzun kulakları vardır.	KEV (genitive suffix, '-in') has long ears.
Judgment/Correction	
Inaccurate inflectional suffix	
BEV-i yemek verdim.	I gave food the BEV (accusative suffix, -'i').
Accurate inflectional suffix	
BEV-e yemek verdim.	I gave food to the BEV (dative suffix, '-e').
Syntactic Awareness	
a) Inaccurate word order	
Kardeşim üç var.	
Accurate word order	
Üç kardeşim var.	I have three siblings.
b) Inaccurate word order	
Bütün çalıştı gün.	
Accurate word order	
Bütün gün çalıştı.	(She or he) worked all day.

Table 3A

Examples from the Reading and Spelling Measures

One Minute Reading		
Word reading	*Nonword reading*	*Agglutinated word reading*
ay (moon); yol (road)	uk; tup	orman-da-ki-ler (those in the forest)
Spelling		
Word	*Nonword*	*Sentence*
kuzu (lamb); ayakkabı (shoes)	fut; tamar	Elbiseyi diktireceğim. (I am going to have the dress made.)

Appendix B

Scoring the Composition Writing-Structure

a) Appropriate sequencing:

0) Incorrect

1) Correct

b) Sentence Structure

0) Majority of sentences are incomplete, fragments or run-ons.

1) One or two incomplete sentences. Majority of sentences are complete.

2) Every sentence is a complete sentence.

c) Sentence variety

0) Repeating

1) Varied

d) Complexity of sentence structure

0) All simple sentences.

1) One sentence with one subordinate clause.

2) Two or more sentences with one subordinate clause in each.

3) One sentence with two or more subordinate clauses, and one or more sentences with one subordinate clause in each.

4) Two or more sentences with multiple subordinate clauses in each.

e) Linking expression (and, or but, while, then, before, suddenly)

0) No linking expressions

1) Two or fewer linking expression of the same kind. E.g., if only one type of linking word such as AND is used

2) Three or four linking expressions. At least one is a word other than AND.

3) More than five linking expressions. At least three are a word other than AND.

f) Consistency of tense

0) Switching of tense

1) Tense is appropriate and consistent

g) Grammar

0) Very poor grammar that makes interpretation difficult

1) Some grammar errors that sometimes interfere with meaning or interpretation

2) A few errors but do not detract the overall quality of expression

3) Error free

Table 1

Measures and Descriptive Statistics

Measure/ Maximum possible score	Grade 1 (N = 57)		Grade 2 (N = 48)	
	M (SD)	Reliability	*M (SD)*	Reliability
1. Raven's Standard Progressive Matrices/ 60 [a]	13.70 (3.40)	.95 [d]		
2. Block design/ 69 [a]	8.06 (5.91)	.92 [d]		
3. Vocabulary/ 68 [a]	12.88 (4.78)	.96 [d]		
4. Forward digit span/ 14	3.35 (1.17)	.98 [d]		
5. RAN/ na	50.81 (10.82)	.98 [e]		
6. Working memory/ 9	2.45 (1.43)	.95 [e]		
7. Syllable deletion/ 21	10.09 (5.53)	.87 [f]		
8. Phoneme deletion/ 18	5.93 (5.06)	.79 [f]		
9. Morphology awareness/ 36	22.87 (5.43)	.78 [f]		
10. Syntactic awareness/ 20	7.60 (3.78)	.80 [f]		
11. Word reading/ na [b]	13.33 (6.99)		25.56 (8.18)	.75 [g]
12. Nonword reading/ na [b]	12.85 (6.52)		20.88 (6.06)	.74 [g]

Measure/ Maximum possible score	Grade 1 (N = 57)		Grade 2 (N = 48)	
	M (SD)	Reliability	*M (SD)*	Reliability
13. Agglutinated word reading/ na [b]	10.44 (4.89)		18.22 (5.48)	.75 [g]
14. Text reading accuracy/ 61	58.81 (2.36)		59.46 (1.43)	.30 [g]
15. Text reading speed/ na [b]	32.40 (12.57)		52.12 (15.59)	.84 [g]
16. Spelling-word/ 17	7.70 (3.60)	.81 [f]	12.57 (2.46)	.79 [f]
17. Spelling-sentence/ 9	1.80 (1.83)	.70 [f]	4.60 (1.96)	.73 [f]
18. Handwriting speed/ na [c]	4.49 (1.56)		10.65 (2.07)	.71 [g]
19. Composition writing-spelling error rate/ 100			.10 (.08)	.99 [h]
20. Composition writing-fluency/ na [c]			7.62 (1.74)	.98 [h]
21. Composition writing-content/ 9			4.32 (1.38)	.83 [h]
22. Composition writing-structure/ 15			7.81 (2.48)	.74 [h]

Note. /na = Not applicable. [a] Raw scores were used, as there were no norms for Northern Cyprus; [b] The number of correct words per minute; [c] Total number of words written per minute; [d] Reported in the test manual; [e] Split-half reliability; [f] Cronbach's alpha; [g] Test-retest reliability after 11 months; [h] Inter-rater reliability.

Table 2

Correlations between the Measures at Grade 1

Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.RSPM	-																
2.BD	.54*	-															
3.VOC	.17	.18	-														
4. STM	.39*	.39*	.05	-													
5. WM	.15	.18	.36*	.18	-												
6. SD	.40*	.41*	.25	.50*	.41*	-											
7. PD	.56*	.50*	.22	.55*	.32*	.70*	-										
8. RAN	-.08	-.13	-.11	-.02	-.13	-.39*	-.20										
9. MA	.29*	.36*	.23	.46*	.16	.32*	.31*	-.17	-								
10. SA	.56*	.61*	.35*	.45*	.40*	.53*	.53*	-.17	.57*	-							
11. WR	.24	.26	.13	.49*	.24	.50*	.45*	-57*	.51*	.38	-						
12. NWR	.16	.17	.08	.43*	.29*	.48*	.45*	-.60*	.40*	.29*	.92*	-					
13. AWR	.24	.33*	.14	.45*	.29*	.57*	.46*	-.66*	.36*	.40*	.88*	.85*	-				

Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
14. TRS	.10	.17	.05	.35*	.14	.40*	.26	.70*	.23	.22	.81*	.79*	.78*	-			
15. SpW	.17	.29*	.17	.41*	.16	.51*	.46*	-.13	.61*	.50*	.64*	.57*	.62*	.51*	-		
16. SpS	.15	.43*	.33*	.44*	.09	.38*	.34*	-.15	.60*	.55*	.56*	.45*	.50*	.34*	.68*	-	
17. HWS	.12	.08	-.05	.40*	.32*	.05	.18	-.42*	.29*	.39*	.39*	.36*	.39*	.26	.55*	.46*	-

Note. RSPM = Raven's Standard Progressive Matrices; BD = Block design; VOC = Vocabulary; STM = Short-term memory; WM = Working memory; SD = Syllable deletion; PD = Phoneme deletion; RAN = Rapid automatised naming; MA = Morphological awareness; SA = Syntactic awareness; WR = Word reading; NWR = Nonword reading; AWR = Agglutinated word reading; TRS = Text reading speed; SpW = Spelling-word; SpS = Spelling-sentence; HWS = Handwriting speed.

* $p < .05$.

Table 3

Correlations between the Measures at Grade 2

Measures	1	2	3	4	5	6	7	8	9	10	11
1. WR	-										
2. NWR	.87*	-									
3. AWR	.79*	.83*	-								
4. TRS	.88*	.81*	.78*	-							
5. SpW	.19	.09	-.09	.15	-						
6. SpS	.34*	.28	.07	.32*	.51*	-					
7. CWE	-.38*	-.26	-.15	-.34	-.44*	-.54*	-				
8. CWF	.14	.24	-.01	.13	.17	.32	-.21	-			
9. CWC	.11	.06	-.13	.09	.28	.23	-.07	.20	-		
10. CWS	-.05	.10	-.08	.24	.20	.21	-.24	.34*	.59*	-	
11. HWS	.19	.18	.13	.11	.18	.25	-.35*	.63*	.08	.12	-

Note. WR = Word reading; NWR = Nonword reading; AWR = Agglutinated word reading; TRS = Text reading speed; SpW = Spelling-word; SpS = Spelling-sentence; CWE = Composition writing-spelling error rate; CWF = Composition writing-fluency; CWC = Composition writing-content; CWS = Composition writing-structure; HWS = Handwriting speed.

* $p < .05$.

Table 4

Longitudinal Correlations between the Grade 1 and Grade 2 Measures

Grade 1	Grade 2 Measures										
Measures	WR	NWR	AWR	TRS	SpW	SpS	CWE	CWF	CWC	CWS	HWS
1. RSPM	.11	.07	-.02	-.04	.23	.22	-.14	.08	.22	.17	.17
2. BD	.22	.14	-.02	.09	.20	.23	-.10	.11	.23	.20	.31
3. IQ	.21	.14	-.03	.07	.21	.20	-.14	.12	.14	.23	.25
4. VOC	.03	-.00	-.12	.04	.14	.07	.14	.08	.53	.09	.13
5. STM	.40*	.33*	.28*	.40*	.35*	.37*	-.16	.25	.16	.27	.39*
6. WM	.15	.15	.16	.25	.13	.23	.06	.05	.55*	-.04	.02
7. SD	.39*	.33*	.31*	.38*	.52*	.25	-20	.02	.25	.22	.32*
8. PD	.34*	.25	.30*	.23	.31*	.24	-.24	.14	.18	.16	.43*
9. PA	.35*	.28*	.30*	.29*	.42*	.23	-.20	.09	.17	.17	.39*
10. RAN	-.73*	-.67*	-.56*	-.64*	-.22	-.25	.20	-.04	-.15	.07	-.38*
11. MA	.22	.04	-.04	.28*	.45*	.53*	-.35*	.11	.17	.10	.31*
12. SA	.18	.08	.02	.19	.42*	.40*	-.15	.18	.34*	.27	.33*
13. GA	.20	.06	-.02	.22	.59*	.49*	-.29*	.20	.20	.20	.32*

Grade 1	Grade 2 Measures										
Measures	WR	NWR	AWR	TRS	SpW	SpS	CWE	CWF	CWC	CWS	HWS
14. WR	.75*	.72*	.63*	.78*	.36*	.41*	-28*	.10	.21	.17	.24
15. NWR	.78*	.74*	.72*	.77*	.29*	.38*	-.29*	.06	.18	.14	.17
16. AWR	.78*	.75*	.64*	.78*	.35*	.43*	-.25	.16	.16	.28*	.16
17. TRS	.87*	.83*	.71*	.84*	.24	.38*	-.40*	.00	.16	.23	.17
18. SpW	.44*	.32*	.25	.54*	.57*	.64*	-.50*	.11	.12	.29*	.18
19. SpS	.39*	.30*	.11	.38*	.48*	.54*	-.20	.20	.24	.22	.34*
20. HWS	.42*	.46*	.24	.44*	.24	.55*	-.19	.47*	.23	.21	.71*

Note. RSPM = Raven's Standard Progressive Matrices; BD = Block design; IQ = Composite measure of IQ; VOC = Vocabulary; STM = Short-term memory; WM = Working memory; SD = Syllable deletion; PD = Phoneme deletion; PA = Composite measure of phonological awareness; RAN = Rapid automatised naming; MA = Morphological awareness; SA = Syntactic awareness; GA = Composite measure of grammatical awareness; WR = Word reading; NWR = Nonword reading; AWR = Agglutinated word reading; TRS = Text reading speed; SpW = Spelling-word; SpS = Spelling-sentence; HWS = Handwriting speed; CWE = Composition writing-spelling error rate; CWF = Composition writing-fluency; CWC = Composition writing-content; CWS = Composition writing-structure.

* $p < .05$.

Table 5

Hierarchical Regression Analysis: Grade 1 Predictors of Reading Skills at Grade 2

		Reading skills at Grade 2							
		Word Reading		Nonword reading		Agglutinated word reading		Text reading speed	
Step	Grade 1 Measures	R^2	ΔR^2	R^2	ΔR^2	R^2	ΔR^2	R^2	ΔR^2
Model 1									
1	Autoregressor		.57***		.55***		.41***		.70***
2	STM	.57	.00	.55	.00	.41	.00	.70	.01
2	Phonological awareness	.57	.00	.55	.00	.41	.00	.70	.00
2	Grammatical awareness	.57	.00	.55	.00	.41	.00	.70	.00
2	RAN	.76	.11**	.65	.07*	.43	.04*	.70	.01
Model 2									
1	STM		.16**		.11*		.08*		.16**
2	Phonological awareness	.22	.06*	.14	.03	.14	.06*	.18	.02
3	Grammatical awareness	.22	.00	.14	.00	.14	.00	.18	.00
2	Grammatical awareness	.16	.00	.11	.00	.08	.00	.16	.00

		Reading skills at Grade 2							
		Word Reading		Nonword reading		Agglutinated word reading		Text reading speed	
Step	Grade 1 Measures	R^2	ΔR^2	R^2	ΔR^2	R^2	ΔR^2	R^2	ΔR^2
3	Phonological awareness	.22	.06*	.14	.03	.14	.06*	.17	.01
4	RAN	.62	.42***	.55	.41***	.41	.26***	.53	.34***
2	RAN	.61	.50***	.52	.42***	.36	.30**	.50	38***
3	Phonological awareness	.62	.01	.52	.00	.37	.01	.50	.00
4	Grammatical awareness	.62	.00	.52	.00	.37	.00	.50	.00

Note. ΔR^2 = Change in explained variance; RAN = Rapid automatized naming.

*$p < .05$. **$p < .01$. *** $p < .001$.

Table 6

Hierarchical Regression Analysis: Grade 1 Predictors of Spelling Skills at Grade 2

		Spelling skills at Grade 2					
		Spelling-word		Spelling-sentence		Spelling error rate	
Step	Grade 1 Measures	R^2	ΔR^2	R^2	ΔR^2	R^2	ΔR^2
Model 1							
1	Autoregressor		.35***		.29***		.22**[a]
2	STM	.35	.01	.32	.02	.23	.00
2	Phonological awareness	.39	.04, p = .091	.30	.00	.22	.00
2	Grammatical awareness	.42	.09*	.32	.03	.24	.00
2	RAN	.35	.00	.29	.00	.22	.00
Model 2							
1	STM		.10*		.14**		.03
2	Phonological awareness	.24	.14**	.15	.01	.07	.04
3	Grammatical awareness	.41	.17**	.26	.13*	.09	.02
2	Grammatical awareness	.35	.27***	.25	.14**	.06	.03
3	Phonological awareness	.40	.05, p = .067	.26	.00	.07	.01

		Spelling skills at Grade 2					
		Spelling-word		Spelling-sentence		Spelling error rate	
Step	Grade 1 Measures	R^2	ΔR^2	R^2	ΔR^2	R^2	ΔR^2
4	RAN	.41	.00	.26	.00	.08	.00
2	RAN	.12	.02	.14	.00	.04	.01
3	Phonological awareness	.26	.14**	.15	.01	.08	.04
4	Grammatical awareness	.41	.17**	.26	.12**	.08	.00

Note. ΔR^2 = Change in explained variance; [a] = Spelling-word; RAN = Rapid automatized naming.

*$p < .05$. **$p < .01$. *** $p < .001$.

Table 7

The Longitudinal Predictors of Composition Writing-Spelling Error Rate and Composition Writing-Fluency

	Composition writing- spelling error rate			Composition writing -fluency		
Grade 1 Measures	*B*	*SE B*	β	*B*	*SE B*	β
Spelling- Word	-.04	.01	-.52*	-.14	.08	-.29
Handwriting speed	.01	.01	.10	.63	.16	.66**

Note. R^2 (adjusted) = .23 (.19) for composition writing-spelling error rate; R^2 (adjusted) =.28 (.25) for composition writing-fluency (*p*s < .01). *B* =Unstandardized beta; *SE* = Standard error; β = Standardized multiple regression coefficient.

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

Table 8

The Concurrent Predictors of Composition Writing-Spelling Error Rate and Composition Writing-Fluency

	Composition writing- spelling error rate			Composition writing -fluency		
Grade 2 Measures	*B*	*SE B*	β	*B*	*SE B*	β
Spelling-Word	-.03	.01	-.42*	-.13	.20	-.08
Handwriting speed	.00	.01	.07	.48	.10	.62**

Note. R^2 (adjusted) = .17(.13) for composition writing-spelling error rate; R^2 (adjusted) =.40 (.37) for composition writing-fluency (*p*s < .05). *B* = Unstandardized beta; *SE* = Standard error; β = Standardized multiple regression coefficient.

*$p < .01$. ** $p < .001$.

Table 9

The Longitudinal Predictors of Composition Writing-Content and Composition Writing-Structure

Grade 1 Measures	Composition Writing-Content			Composition Writing-Structure		
	B	*SE B*	β	*B*	*SE B*	β
Spelling-Word	.10	.17	.10	.17	.22	.18
Vocabulary	.35	.14	.35*	.03	.16	.03
Working Memory	.41	.15	.39**	.02	.18	.02
Grammatical awareness	.02	.18	.02	.07	.22	.07

Note. R^2 (adjusted) = .43 (.37), $p < .01$ for composition writing-content; R^2 (adjusted) = .06 (-.05), $p > .05$ for composition writing-structure. *B* = Unstandardized beta; *SE* = Standard error; β = Standardized multiple regression coefficient.

*$p < .05$. **$p < .01$.

Table 10

Does Vocabulary Explain Variance in Composition Writing-Content after excluding the Choice of Vocabulary Ratings from the Overall Content Scores?

	Composition Writing-Content (after excluding the choice of vocabulary)		
Grade 1 Measures	*B*	*SE B*	β
Spelling-Word	.12	.14	.16
Vocabulary	.26	.12	.34*
Working Memory	.21	.12	.27
Grammatical awareness	-.09	.16	-.11

Note. R^2 (adjusted) = .27 (.19), $p < .05$. *B* = Unstandardized beta; *SE* = Standard error; β = Standardized multiple regression coefficient.

*$p < .05$.

Footnote

[1] There are clearly important differences between syntactic and morphological processing skills and possibly clear differences also in their relationship with literacy skills. However, empirical distinction between these two metalinguistic skills becomes much more complicated within the context of agglutinating languages where a single word may correspond to a whole sentence or phrase. For instance, the Turkish word <gidebileceklerse> means ‘if they are going to be able to go’. For this reason, in this paper, the generic terms grammatical and morphosyntactic awareness were used and the relevant research evidence based on both syntactic and morphological processing skills have been reported.