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THE CONCURRENT DEVELOPMENT OF READING AND SPELLING
IN PERSIAN AND ENGLISH

by

NARGES ARAB-MOGHADDAM, B.A., Shiraz University, Iran

A thesis submitted to
the Faculty of Graduate Studies and Research
in partial fulfilment of
the requirements for the degree of

Master of Arts
Department of Psychology

Carleton University

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THE CONCURRENT DEVELOPMENT OF READING AND SPELLING
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submitted by Narges Arab-Moghaddam, B.A.
in partial fulfilment of the requirements for
the degree of Master of Arts

Thesis Supervisor

Chair, Department of Psychology

Carleton University

February, 1997

Abstract

The present research examined the concurrent development of reading and spelling skills in two different languages, namely Persian (L1) and English (L2). Fifty-five Iranian children aged from 7.0-9.9 who were attending Persian and English schools in Ottawa, Toronto, Montreal, Waterloo, and Guelph were tested for their reading and spelling performances in both Persian and English. Positive correlations among measure of Persian and English supported cross-language transfer, indicating that children who performed better on Persian measures were likely to perform better in English measures. This study also examined the relative contribution of phonological and orthographic skills in both reading and spelling within each language. The finding for reading in both Persian and English supported the Universal Hypothesis which assumes that reading of words in any language can be accomplished mainly by the application of orthographic skills. The result of spelling did not support the Universal Hypothesis. Spelling in Persian was predicted by orthographic skills only, whereas spelling in English was predicted similarly by orthographic and phonological skills. These results are interpreted in terms of the development of literacy skills.

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Learning to read and spell is a central part of becoming literate (Ehri, 1987). In many places around the world, children read and spell in two languages. There is a large body of research on reading and spelling in first and second languages (for a review, see Kendall, Lajeuneese, Chmilar, Shapson, & Shapson, 1987; Verhoeven, 1990). Although much progress has been made in our understanding of the relationship between reading in two similar writing systems, such as English and French, many questions remain about learning to read and spell two languages for which the writing systems differ drastically, such as English and Persian.

The purpose of the present study is to examine the development of reading and spelling skills when children learn in two languages that differ in orthographic complexity (the extent to which a particular letter maps to its corresponding sound). In the present investigation, Persian and English are the first (L1) and second (L2) languages, respectively.

Several studies (e.g., Ehri, 1987) which examined learning to read and spell have shown that children may employ two types of skills when they read and spell. For example, they may use skills about the relationships between letters and their corresponding sounds (phonological skills). Alternatively, or in addition, children may

directly use their store of printed words that contains the spelling of individual words retained in memory (orthographic skills) (Ehri, 1987). The proposed study was undertaken in order to answer two main questions: (a) Do reading, spelling, phonological, and orthographic skills in English (L2) benefit from a transfer of Persian (L1) skills? (b) Does the orthographic complexity of a language influence the role played by phonological and orthographic skills in reading and spelling?

In what follows, I first describe the two types of skills which children might use when they read and spell. Second, I discuss the role of cross-language transfer in learning to read and spell in two languages. Third, I discuss the influence of the orthographic complexity of a language on learning to read and spell. I show that some writing systems that are very simple and easy to read may be more complex when it comes to spelling words. Finally, I outline a description of the characteristics of the Persian and English writing systems, the research questions, and the method used in the present experiment.

Phonological and Orthographic Skills

Studies have shown that reading and writing development in young children are influenced primarily by word-level skills such as word identification and spelling (Juel, Griffith, & Gough, 1986). Word identification refers to the

ability to identify words based on a match between a printed string of letters and a lexical representation (Frost, Katz, & Bentin, 1987). Spelling refers to the ability to name or write the letters of a word in order (Flexner, Stein, & Su, 1980).

Many researchers (e.g., Gough, Juel, & Griffith, 1992; Juel et al., 1986) claim that both word identification and spelling depend on similar sources of skills, namely phonological skills and orthographic skills. Phonological skills have many labels such as phonological knowledge, phonological information, alphabetic skills, etc. For simplicity, I use the term phonological skills to mean knowledge and use of grapheme¹-to-phoneme² correspondence rules of a written language (Foorman & Liberman, 1989). In this regard, readers read words by considering how the sounds of language correspond to letters. By applying phonological skills, readers generate a phonological decoding strategy, a process by which a grapheme is transformed into a phoneme (Gunther, 1987). To decode a

1. A grapheme or written symbol is a letter (e.g., a, b) or letter clusters (e.g., oa, th) or the minimal functional distinctive unit of any written language (French, 1976, cited in Henderson, 1984). A word 'cat' has three graphemes c, a, and t.

2. A phoneme or sound symbol is the smallest sound unit in a language. A word 'cat' has three phonemes /k/, /ae/, and /t/.

word, children examine a printed word and translate the letters into phonemes and then combine the phonemes to produce the word (Siegler, 1991).

Furthermore, phonological skills give the ability to generate spelling (Gough et al., 1992). Children who can relate graphemes to phonemes could use this ability to spell. By using phonological skills, children try to represent the phonemes in a word with its graphemes. The child may segment the phonemes in 'pat' as /p/, /ae/, and /t/ and represent each with the corresponding graphemes, p, a, t (Varnhagan, 1995). There is now much evidence indicating the importance of phonological skills in learning to read and spell. For example, researchers (e.g. Wimmer & Hummer, 1990) demonstrated that the performance of both word identification and spelling were strongly predicted by tasks that measure phonological skills such as reading pseudowords, non-real pronounceable letter strings that can be read only by application of grapheme-to-phoneme correspondence rules.

Although phonological skills enable children to read and spell, word identification and spelling cannot be reduced to these skills (Gough et al., 1992). Reading regular words (such as 'gave'), where pronunciations are exactly predictable from spelling, requires knowledge and use of grapheme-to-phoneme correspondence rules of English.

However, there are many words that cannot be decoded with this knowledge, like irregular words, words that violate grapheme-to-phoneme correspondence rules, such as 'said' and 'have'. Reading these words requires using orthographic skills.

Orthographic skills also have been labelled with different terms: orthographic information, lexical knowledge, orthographic knowledge, visual information, etc. I use the term orthographic skills to refer to the skills of identifying words directly from the lexicon. A lexicon consists of all the information that readers have acquired about the words of their language, including the spelling of the words (Coltheart, Davelaar, Jonasson & Besner, 1977, cited in Gunther, 1987).

To read irregular words, readers use a direct access strategy in which knowledge of the visual form of word is used to recognize printed words because grapheme-to-phoneme correspondence rules would provide an incorrect pronunciation (Olson, Kliegl, Davidson, & Foltz, 1985). It should be mentioned that although more common regular words (words that occur many times in common usage) may be processed using orthographic skills, all irregular words can only be read using the orthographic skills.

Similarly, spelling words in a language with inconsistent grapheme-phoneme mappings cannot be

accomplished with phonological skills alone. For example, although phonological skills help readers to spell words such as 'gun' or 'lamp', irregular words like 'enough' or 'green' cannot be spelled by grapheme-to-phoneme correspondence rules (Juel et al., 1986). Thus, in addition to phonological skills, spelling also requires considerable orthographic skills.

Generally, children try to use their knowledge about grapheme-to-phoneme correspondence rules in order to decode a word until they have sufficient exposure to print. With more exposure to many words, they can read or spell many words directly from the lexicon (Ehri, 1987). Stage-like models of the development of reading (Frith, 1985) and spelling (Ehri, 1987, 1989) suggest that children initially rely on phonological skills and then on both phonological and orthographic skills.

In sum, both phonological and orthographic skills are available for reading and spelling. There is some consensus that the acquisition of both reading and spelling is driven by similar underlying component skills in any written language (Geva, in press). In this regard, phonological and orthographic skills may play important roles in the acquisition of both reading and spelling in any alphabetic written language. Consequently, it may be logical to suggest that L2 reading and spelling may benefit from a

transfer of L1 skills (Cody, 1979).

The Role of Cross-Language Transfer

Cross-language influence is one of the most important areas in second-language acquisition (Sajavaara, 1986). In psychology, the term transfer³ refers to the phenomenon of existing or prior knowledge carried over to an area of new knowledge (Gass & Selinker, 1994; Sajavaara, 1986).

Many researchers (e.g., Durgunoglu, Nagy, & Hancin-Bhatt, 1993; Faltis, 1986) in reading acquisition are concerned with the relationship between skills in first and second-language reading. For example, studies of French immersion programs (e.g., Kendall et al., 1987) show that children who learn to read in French (L2) could transfer their knowledge to English (L1). This may indicate that children understand how letters form, become aware of blending letters to form words, then apply this metalinguistic knowledge to an alphabetic second language (Durgunoglu et al., 1993).

Studies of transfer show that phonological skills can be transferred to second-language reading (see Kendall et

³ It should be mentioned that transfer may have both positive and negative influences on the L2 learner. For example, effects of negative transfer is evident in children pronunciation and directionality (left to right or vice versa) indicating influence of native language phonology and directionality. In addition, it worth mentioning that transfer of skills may be bidirectional. That is, as L1 may facilitate L2 learning, L2 skills also may facilitate L1 learning.

al., 1987; Durgunoglu et al., 1993). Faltis (1986) studied the transfer of phonological skills among second-grade Spanish-speaking students. In this study, transfer ability from first-language reading to second-language reading was studied in terms of the relationship between Spanish and English phonological skills. The result showed a positive relation between Spanish and English phonological performances. Children who scored high on first-language tasks (Spanish phonological skills) also showed high performance in second-language task (English phonological skills). Spanish children could transfer knowledge of their first language to English reading tasks, indicating transferability of reading skills across written languages.

Results of some studies (e.g., Durgunoglu et al., 1993) also show that children's performance on word identification in a first language (Spanish) is related to word identification in a second language (English). For example, Durgunoglu et al. (1993) found that children who had higher performance on Spanish word identification also had higher performance on English word identification compared to children who performed poorly. Based on their results, Durgunoglu et al. (1993) concluded:

Similar types of processing underlie both Spanish and English word recognition. For example, in both of these alphabetic languages, children need to identify the phonological subcomponents of the spoken words and understand how orthographic symbols are mapped onto

those phonological subcomponents. Such metalinguistic awareness need not be language specific (p. 462).

Such research leads us to conclude that phonological skills and word identification acquired in a first language can be transferred to a second language when the two languages have similar writing systems. But the experimental research has concentrated on the relation between two Roman alphabets and mostly two similar languages (such as English and French or Spanish). Less effort has been devoted to investigating the influence of languages that are drastically different. The limited evidence does show positive and significant correlations between reading and spelling measures in two different languages. For example, positive correlations were found among word identification and phonological skills in English (L1) and parallel measures in Persian (L2) (Gholamian, 1992). Geva, Wade-Woolley, and Shany (1993) also found positive correlations among measures of reading, spelling, phonological, and orthographic skills in English (L1) with parallel measures in Hebrew (L2). Moreover, children who performed better in English tasks also performed better in Hebrew tasks while children who experienced difficulties in English tasks showed poor performance in Hebrew tasks.

Most studies of the role of transfer in children do not suggest how children's orthographic skills in a first

language can be transferred to a second language. However, studies of adult readers show that the process of identifying words directly from the lexicon is transferred to the process of word identification in a second language. For example, adult readers of orthographies that rely more on orthographic skills in word identification employ these skills in reading a second language. For example, Koda (1988) found that Japanese adults (who rely more on orthographic skills) performed better in English (L2) tasks that required orthographic skills than on a task using phonological skills.

Taken together, the results of these studies suggest that transfer occurs between languages with very different alphabetic orthographies. The relationships among skills in first and second languages shows that the same cognitive processing system underlies skills across different orthographies (Geva & Ryan, 1993).

It has thus been shown that phonological and orthographic skills play important roles in the development of reading and spelling in any written language. Written languages differ in their orthographic complexity, that is, the extent to which a grapheme corresponds to its phoneme. Variations in the orthographic complexity of languages beg the question of whether reliance on phonological and orthographic skills is different across first and second

alphabetic written languages. For example, some orthographies may constrain children to rely more on phonological skills than orthographic skills.

The Role of Orthographic Complexity

Alphabetic orthographies differ in the complexity of their grapheme-to-phoneme mappings. For example, in some orthographies the correspondences between spelling and pronunciation are direct and simple, whereas, for others there are no direct grapheme-to-phoneme correspondences. It is interesting to ask whether variation in the complexity of this mapping has any influence on how phonological and orthographic skills are used in reading and spelling.

The Orthographic Depth Hypothesis (Frost et al., 1987; Katz & Frost, 1992) has been proposed to address some differences in reading and spelling in different orthographies. According to the Orthographic Depth Hypothesis, both phonological and orthographic skills are available in all orthographies, but the phonological skills make more of a contribution to word identification in reading shallow orthographies (that is, orthographies with almost a direct and completely consistent grapheme-to-phoneme correspondences such as German and Persian) than in reading deep orthographies, orthographies with a lack of consistency between grapheme-to-phoneme correspondences, such as Chinese and English (Besner & Smith, 1992). Because

shallow orthographies have simple grapheme-to-phoneme correspondences, it is easier for readers to decode words phonologically (Katz & Frost, 1992). Reading in a shallow orthography makes the acquisition of grapheme-to-phoneme correspondence rules a simpler task for young readers, since they require mastering few rules (Wolf, Pfeil, Lotz, & Biddle, 1994).

In contrast to shallow orthographies, there are fewer benefits to phonological decoding in deep orthographies (Katz & Frost, 1992). There may be one or more graphemes that map unpredictable phonemes. For example, in English, the pronunciation of words such as 'have' cannot be predicted from its graphemes, because this word cannot be read in a way that rhymes with 'gave' and 'save'. Therefore, orthographic skills are probably more important in a deep orthography than in a shallow orthography (Lyytinen, Leinonen, Nikula, Aro, & Leiwo, 1995).

In contrast to the Orthographic Depth Hypothesis, the Universal Hypothesis, supposes that skilled reading may sometimes be achieved by means of the phonological skills, but it more often relies upon the orthographic skills in any orthography (Patterson & Coltheart, 1987). This notion was tested by Baluch and Besner (1991) in a set of three experiment through the comparison of reading Persian transparent words (words that vowels are specified) and

opaque words (words that vowels are not specified) of adult native Persian language. It was expected that if phonological skills were used to read the transparent words (that is, to read words without any contact with the lexicon), then no effect of lexicality (low-or high-frequency) and semantic relatedness (Semantic related or unrelated words) factors would be observed. Whereas, because opaque words are read by the use of orthographic skills, then these words are sensitive for the influence of both lexical and semantic factors. Generally, at least in English, high-frequency words are read faster than low-frequency words. In addition, reading is faster with the related context compared with an unrelated context. In their Experiment, Baluch and Besner (1991) presented their subjects with a list that included transparent and opaque words and nonwords. They found that transparent words and nonwords were read by using phonological skills, whereas opaque words were read using orthographic skills. Experiment 2 (in which the list was consisted of transparent and opaque words) and Experiment 3 (transparent words only), on the other hand, revealed that using phonological skills to read transparent words is just a consequence of reading these words in the context of transparent nonwords. That is, the factor that encouraged Persian readers to use phonological skill was the presence of nonwords in the list.

Baluch and Besner (1991) concluded that even when orthographies differ there are some psychological universals that apply to reading of any orthography. The result support for the Universal Hypothesis by demonstrating that adult readers of Persian made use of orthographic skills. According to the Universal Hypothesis, phonological skills play an important role in learning to read any orthography, however, in large part, the skilled reading of words is accomplished by application of orthographic skills, regardless of which orthography is being read (Baluch & Besner, 1991).

In most studies, the Orthographic Depth Hypothesis is used to describe a factor relevant to reading (Geva, in press; Golamian, 1992). It is worthwhile to evaluate whether this hypothesis extends to spelling, as well. The level of orthographic complexity does not necessarily remain the same for word reading and spelling (Geva & Willows, 1994). As Geva et al. (1993) argued, it is possible for the same written language to be relatively shallow for readers such as vowelized Hebrew where no grapheme has more than one corresponding phoneme. However, the same written language can be deep for spellers, such as in vowelized Hebrew where there is more than one grapheme corresponding to the same phoneme. It follows that the use of phonological skills for reading in a shallow orthography may result in successful

reading. In contrast, reliance on phonological skills may not always result in correct spellings instead, spelling in that specific language may require a greater reliance on orthographic skills since it is deep in terms of orthographic complexity.

The effect of orthographic complexity on the differential role of phonological and orthographic skills in children's reading as well as spelling was investigated in a longitudinal study by Geva et al. (1993). They studied Grade 1 and 2 children's reading and spelling development in English (L1), as a deep orthography, and in Hebrew (L2), as a shallow orthography in terms of reading but deeper in terms of spelling. Their results showed that phonological skills and orthographic skills predicted scores on the English reading and spelling in grade 1, while measure of orthographic skills (visual recognition task) only predicted reading and spelling in grade 2. Their results indicated that although phonological and orthographic skills play roles in the emergence of reading and spelling in any orthography, orthographic skills quickly dominate in a deep orthography such as English.

As expected, Geva et al.'s (1993) results for Hebrew showed that phonological skills were better predictors of reading which suggested that phonological skills have a more prominent role in a shallow orthography. Although the

results of reading performance in Hebrew support the Orthographic Depth Hypothesis, spelling performance results were inconclusive. Unexpectedly, Geva et al. (1993) found that in grade 2 the best predictor of Hebrew spelling was the phonological skills task, not the orthographic skills task. Indeed, they concluded that reliance on the phonological skills for spelling in Hebrew may not have been the most appropriate strategy for the children because they found that children performed significantly worse on the spelling task compared to the reading task in Hebrew. We must consider Geva et al.'s (1993) conclusion with caution, however, because the items they used for testing reading and spelling were not identical and the items for English spelling were limited to a dozen easy words.

Geva et al.'s (1993) pattern of results for L1 English performance, however, does not replicate the pattern of results reported for monolingual children by Juel et al. (1986). Juel et al.'s results for reading and spelling showed that both orthographic and phonological skills accounted for a significant portion of variance in reading and spelling in grade 1 and grade 2.

Although there is some evidence for how children spell words in English, there is no study (except for Geva et al.'s study) as to how words are spelled in other orthographies. This limits our evaluation of whether the Orthographic Depth

Hypothesis offers a better account of differences in orthographic complexity in spelling than the Universal Hypothesis.

The Present Study

Since the two orthographies that were used in the present study were Persian and English, a brief description of the characteristics of Persian and English orthographies would be relevant.

Persian Orthography

Persian (or Farsi) is the official language of Iran. It is an alphabetic system in which a written symbol is associated with a phoneme and it contains thirty-two alphabetic letters and thirty phonemes (including vowels). The Persian alphabet is basically Arabic and its shapes are barely related to the Roman alphabet (like English or French Script). The direction of reading and writing in Persian is from right to left. Written Persian gives information about the pronunciation and sound of words. It has a very regular grapheme-to-phoneme correspondence and each grapheme has one pronunciation that remains consistent throughout changes in words. Letters of the Persian orthography are generally distinguished by marks and dots (for example, ک/k/, گ/g/, پ/p/, ت/t/, and ث/s/). The marks and dots indicate different phonemes.

The language has six spoken vowels, three long vowels

of ای /i/, او /u/, and آ /ā/ each represented by a letter, and three short vowels, /e/, /o/, and /a/ represented by diacritics (a mark added to letters to signal pronunciation) inserted above or under the consonants. Thus, the same letter may have different pronunciation depending on the presence of diacritics. For example, ب /ba/, بَ /be/, and بُ /bo/. It is worth mentioning that diacritic spelling of vowels is provided only for beginning readers. A lack of diacritics for short vowels does not cause problems for skilled readers. Skilled readers read and interpret these words by using alternative sources of knowledge such as letter sequences and contexts.

With a few exceptions, use of the grapheme-to-phoneme correspondence rules may be a good strategy to read words in Persian. However, a problem encountered in this orthography is the representation of a single phoneme by more than one grapheme, such as phoneme /s/ represented by ث , س , and ص graphemes; or phoneme /z/ represented ز , ذ , ض , and ظ . Therefore, some words composed of these different letters may produce identical sounds (غزا , قضا , and غزا) which have different meanings. Thus, in the Persian language, reading words is easier than spelling.

Teaching in Persian. The instruction of reading in Persian is based on phonics. Phonics is the study of relationship between sounds and spellings. If one learns

the grapheme-to-phoneme correspondences, she or he has sufficient knowledge to read many words in the language. The materials are a series of school books increasing in difficulty. Children learn to read words by learning the sounds of individual letters. This knowledge is improved by reading aloud and sounding out new words. Generally speaking, reading and spelling strategies usually involve decoding of words, with great emphasis on correct pronunciation and vocabulary definition and also practice on correct spelling. By the end of Grade 1, all the letters of the alphabet and their constituent sounds are taught.

English Orthography

The English alphabet has 26 letters and approximately 44 phonemes (Taylor & Taylor, 1983). English is relatively irregular and therefore somewhat unpredictable. For example, many graphemes in English have different pronunciations and phonemes can be spelled in various ways. Therefore, many words cannot be correctly read or spelled based on knowledge of grapheme-to-phoneme correspondence rules in English (Seidenberg, 1992). A given grapheme ('a') may represent several possible phonemes (/e/, /ae/, and /a/). For example, compare 'ea' in meat, steak, head, theatre, and pineapple (Gough et al., 1992). Several graphemes ('c' and 's') can represent the same phoneme /s/. Thus, there is more than one way to spell some words ('cite'

and 'site'). Sometimes, consonant graphemes are doubled ('ll' in 'skill') or are used in combination to spell a single sound (/s/ in 'science'). In spelling, some phoneme-grapheme mappings are hard to learn. For example, the link between phoneme /w/ and grapheme 'w' may be hard to remember because the name of the letter begins with /d/ rather than /w/ (Treiman, 1993).

Teaching in English. In an interview with a teacher in a Canadian school in Ottawa, some information about method of teaching reading and spelling was gathered. A combination of whole language and phonics methods is used in many English-language schools. In a whole-language program children are encouraged to listen and read stories. This program provides maximum exposure and practice so that children memorize the words.

In phonics instruction, teachers teach some letter names, letter sounds and correct letter formation. Usually children in English schools are taught links between individual letters and individual sounds. For example, they learn that 'b' makes the sound /b/. Then, the teacher teaches short vowel sounds with three-letter words examples, such as 'pan', 'pin', and 'pen'. As children advance in grades, she teaches these rules respectively: consonant digraphs ('sh' in 'shop' and 'ch' in 'chop'), consonant blends ('tr', 'br', and 'fl'), long vowel sounds (the use of

/e/ to make a vowel long such as, 'mat' and 'mate'), vowel digraphs ('ai', 'ay', and 'oa'), short and long double vowels ('look'-'moon' and 'head'-'leaf'), silent letters ('kn', 'gn', and 'wr'), and irregular sounds ('ph' and 'gh' as in phone and rough).

From the above description of the structure of Persian and English orthographies and the way children are taught, various hypothesis can be generated about children's reading and spelling abilities in the two written languages.

Research Questions

The purpose of the present study was to examine the development of reading and spelling skills among children (Grade 2 and Grade 3) learning to read and spell concurrently in Persian (L1), a language with a shallow orthography in terms of reading and deep in terms of spelling skills, and in English (L2), a language with a deep orthography in both reading and spelling. The study focussed on (1) the role of cross-language transfer in learning to read and spell; (2) the effect of orthographic complexity on the role of phonological and orthographic skills in learning to read and spell.

The role of cross-language transfer. The role of cross-language transfer in learning to read and spell in two alphabetic languages is worth considering. The specific question was to know whether reading, spelling,

phonological, and orthographic skills in a child's first language (Persian) were interrelated to the parallel skills in a completely different language (English). Positive and significant correlations among equivalent tasks in Persian and English would suggest cross-language transferability. It was expected that children who were good at Persian tasks were more likely to perform well in the equivalent English tasks. In addition, it was hypothesized that if L1 skills were transferable to reading processes in the L2, then reading and spelling in English might be predicted by phonological and orthographic skills in L1.

The role of orthographic complexity. Phonological and orthographic skills play roles in the emergence of reading and spelling in any alphabetic language. However, the Orthographic Depth Hypothesis predicts that the extent to which each skill predominates depends on the complexity of a specific orthography. Alternatively, the Universal Hypothesis supposes that there is some universality for the reading of all orthographies. In the present study, I assessed whether phonological and orthographic skills contributed similarly in reading and spelling in both written languages.

Based on the Orthographic Depth Hypothesis, I expected that phonological skills play a more important role in a shallow orthography (Persian) than a deep orthography

(English), while orthographic skills play a more predominant role in a deep orthography (English) than a shallow orthography (Persian). However, the advantage of the shallow orthography for reading in Persian could not be maintained for spelling in Persian, since more than one grapheme representation for a phoneme is possible. Therefore, it was expected that Persian reading is mainly predicted by phonological skills, but Persian spelling might also be predicted by orthographic skills. On the other hand, based on the Universal Hypothesis it was predicted that complexity of an orthography does not affect the skills that children may apply.

Method

Participants

The sample consisted of 71 Iranian students attending Grade 2 and Grade 3 with Persian, as their first language (L1) and English as their second language (L2). Persian was indicated as the children's first language because their oral and literacy skills in Persian were superior to English oral and literacy skills. The children's age ranged from 7.0-9.9 years with the mean age of 8.2 years. The children were Iranian students in five schools in Ottawa, Toronto, Montreal, Waterloo, and Guelph attending both Persian and English. The students were in the same grades in Persian as in their English classes. For example, a child in Grade 2

in Persian school was also on Grade 2 in English schools.

Of the 71 children, nine were deleted; four of them did not meet the criteria of concurrent learning in two languages, and five of them could not perform the English tasks due to lack of reading and spelling fluency in English. In addition, three other students were omitted because they did not complete all the tasks, and two additional students were not matched (i.e., they were not the same grades in Persian as in English). Moreover, after preliminary analyses of the data, two students were considered outliers on two or three measures. Data for these individuals, therefore, were subsequently deleted from further analysis. Thus, complete data from 55 children (32 girls and 23 boys) was analyzed.

A Parental questionnaire (Appendix 1), in Persian, was sent to the parents to gather basic information about age, grade, language spoken at home, length of instruction in both Persian and English, years of residence in Canada, and reading and spelling activity at home.

Measures and Tasks

The tasks consisted of word reading, spelling, pseudowords (a measure of phonological skills), visual recognition (a measure of orthographic skills), and vocabulary knowledge (a control variable). These tasks were in both Persian and English. Spelling and visual

recognition tasks were administered in a group format in the Persian school for some of the participants. The remaining tasks were administered individually in a quiet room. The maximum time for individual testing was approximately 90 minutes. Children were assigned randomly to one of two possible orders of presentation of the tasks. The first order of presentation was as follows: Persian vocabulary knowledge, Persian word reading, Persian orthographic skills, Persian phonological skills, Persian spelling, English vocabulary knowledge, English word reading, English orthographic skills, English phonological skills, and English Spelling. The second order of presentation was as follows: English vocabulary knowledge, English Spelling, English phonological skills, English orthographic skills, English word reading, Persian vocabulary knowledge, Persian spelling, Persian phonological skills, Persian orthographic skills, and Persian word reading. There was a 10 minute break after five administered measures. In addition, during the experiments children were always asked to stop whenever they felt tired.

To familiarize children with the procedure of each task, the children first completed a series of practice items followed by the experimental list. The participants were not given any feedback on the accuracy of their responses during the experiment. In addition, based on the

instructions given in the Woodcock-Johnson (1989) manual about researcher's decision to continue testing, if I believed that a subject would get an item correct above the criteria for an apparent ceiling, I continued testing. Nonetheless the apparent ceiling was used to compute the children's scores in all the analysis below.

Word Identification

Researchers (e.g., Siegler, 1991) believe that the development of reading in the early grades depends on the development of skills in identifying individual words. Although reading is not only word identification, for this study word identification was chosen as a measure of reading skill to examine children's ability to read words out of sentence contexts in their first and second languages. Word identification has been used in many studies (e.g., Durgunoglu et al., 1993; Geva et al., 1993) as a measure of reading skill.

Word identification in Persian. To assess children's ability to read words in Persian, a test was developed based on the Persian vocabulary introduced in Iranian schoolbooks at different grades. The list consisted of 38 words with the vowels, represented by diacritics above or below the letter inserted. The design of the test was based on level of difficulty and the length of words. The first 20 words (10 one-syllable and 10 two-syllable) were easy words all

familiar to children in Grade 2 and 3. The easy items were selected from the vocabulary introduced in Grade 1 and the first part of Grade 2 schoolbooks (since children attending Grade 2 had already read some part of their books).

The selection of the easy words was based on three criteria: (a) all easy words were selected from the appropriate grade level reading books, (b) the words were considered to be in the children's spoken vocabulary, and (c) the meaning of the words was known to the children. For more careful selection of words, two teachers and two parents were asked to check the words in terms of familiarity in printed texts, spoken vocabulary, and meaning. According to the parents and teachers, all words in the list met all three characteristics.

The remaining 18 words were difficult words relative to the subjects' reading levels and consisted of six one-syllable, six two-syllable, and six three- or more syllable words. These words were selected from the reading vocabulary taught in Grade 4 and 5 curricula. Care was taken to select words that were probably known (familiar in terms of meaning) to children, as judged by two teachers. It was important to select words with familiar meaning, because a word would have the status of nonwords if children encountering unknown words (Geva et al., 1993).

Half of the words in both the easy and difficult

categories were words for which each letter corresponded to only one sound (called transparent words), such as, برف (barf), کفش (kafsh), while the other half were words for which different letters might represent the same phoneme (called opaque words). For example, the word سب (seab) can be written in different ways, صیب (seab) or شب (seab). The Persian words had a mean length of 5.2 letters including vowels. Since in Persian, short vowels are not specified as a specific letter, it seems that the average number of the letters per word was smaller than in English. However, the range of phonemes per word was similar in the two languages. Appendix 2 gives the Persian-word list. The reliability for all items administered in this measure was 0.81.

The children read aloud the words at their own pace and skipped any word they could not read. The procedure was to point to the word on the subject's side and say: "What is this word?" Testing was stopped when the child read six consecutive errors. The responses were tape-recorded for later verification of correct pronunciation. One point was given for each correct word. When a child paused for too long on a particular item, he or she was encouraged to skip that item and continue reading. This procedure and scoring were identical to that of Woodcock-Johnson (1989).

Word identification in English. To assess children's ability to read words in English, some words were selected

from both Woodcock Reading Mastery Tests (Woodcock, 1973) and Woodcock-Johnson Letter-Word Identification Task (Woodcock-Johnson, 1989). The words introduced in the two standard tests (almost 200 words) begin with highly familiar words, then proceed to less frequent and orthographically more complex words.

To make an equivalent sample of English and Persian words, 38 words were selected in terms of level of difficulty and word length. Easy words, consisting of 10 one-syllable and 10 two-syllable words, were selected from words introduced in Grade 1 and Grade 2. The meanings of the words were known to children in Grade 2 and 3. Difficult words consisted of six one-syllable, six two-syllable, and six three- or more syllable words selected from words used in Grade 3, 4, and 5. The words averaged 5.5 letters in length. Of the 38 words, 16 had one syllable and consequently could be classified as 11 regular words and 5 irregular words. The list of English words is given in Appendix 3.

The testing procedure was identical to those for the Persian word list. Since the experimenter was not a native English speaker, the responses were tape-recorded for later verification of correct pronunciation. English word reading was scored by a native English speaker for verification of correct pronunciation. On the other hand, based on

instruction in the Woodcock-Johnson (1989) manual, dialect should not be considered as incorrect pronunciation. Therefore, it was necessary that an examiner who is familiar with the subjects' speech pattern score the English words. To be more cautious, both types of scoring were analyzed and reported. Scoring by the native Persian speaker was termed liberal scoring and scoring by the native English speaker was termed conservative scoring. The correlation between the liberal and conservative scoring was strong and positive (.92). The reliability for all items administered in English reading with conservative scoring and liberal scoring was .91 and .89, respectively.

Spelling

Spelling skill is acquired during the early school years. To measure students' spelling ability, words were read by a native speaker, and the participants were asked to attempt to write the words. To provide an equivalent measurement of reading and spelling, an attempt was made to equate the word identification and spelling tests by using the same items in each task. The order of presentation of the word identification and spelling tasks was counterbalanced across subjects.

Spelling in Persian. To assess children' ability to spell words in Persian, the same words in the Persian word identification task tests were used. The words were read by

a native Persian speaker and children were asked to spell the words. Spelling accuracy was measured by counting the total number of words spelled correctly. The reliability for this measure was .70.

Spelling in English. To assess children's ability to spell words in English, the same words as in the English word identification were used. Children heard each word on a tape recorder, pronounced by a native English language, and were asked to attempt to spell the words. The scoring was identical to that of the Persian word spelling task. The reliability for this measure was .82.

Phonological Skills

A pseudowords task can be a valid indicator of children's use of phonological skills (Wimmer & Hummer, 1990). Pseudowords are letter strings that do not correspond to real words but may have a pronunciation corresponding to real words. Therefore, an understanding of grapheme-to-phoneme correspondences is necessary for decoding pseudowords. There is no help from orthographic skills for pronouncing pseudowords as the child has not seen these words before (Olson, Frosberg, & Wise, 1994a). Generally, pseudowords may be generated by modifying real words, replacing two or three letters with others (e.g., cap to hap). This approach was used by Katz & Feldman (1983). These tests measure the ability of children to pronounce

regular nonsense words (Geva et al., 1993).

Phonological skills in Persian. A task was developed using words from Persian schoolbooks to examine children's ability to decode Persian pseudowords. Thirty easy to decode one-, two-syllable, and multisyllable pseudowords were constructed by changing either the initial, medial, or final consonant of real words. In some words, long vowels were replaced with other long vowels. The pseudowords were all vowel intact to encourage the use of the phonological skills. As mentioned previously, for beginning readers, short vowels sounds are conveyed by adding small diacritical marks to the consonants. The words averaged 5.6 letters in length (The list of Persian pseudowords is given in Appendix 4). The reliability for all items administered in this measure was .76.

The children were told that the words were not real words. They were asked to read the pseudowords aloud, and if s/he did not respond, they were encouraged to do so. If the child still did not respond, they were encouraged to continue reading. Testing was stopped when the child made six consecutive errors (Woodcock, 1973). Scoring was based on the number of words read correctly.

Phonological skills in English. The Word Attack Subtests of Woodcock (1973) and Woodcock-Johnson (1989) were used to test the ability of children to decode English

pseudowords. The thirty pseudowords consisting of one-syllable, two-syllable, and three- or more syllables that were selected from the two tests. The words averaged 5.8 letters in length. (See Appendix 5 for the English pseudowords list).

Since the experimenter was not a native English speaker, the children's responses were audiotaped for later verification of correct pronunciation. The procedure and scoring were identical to those used for the Persian pseudowords list. Pseudowords were also scored by both a native Persian speaker and a native English speaker. Scoring by the native Persian speaker was termed liberal scoring and scoring by the native English speaker was termed conservative scoring. The correlation between the liberal and conservative scoring was strong and positive (.83). The reliability for all items administered in English phonological skills measure with conservative scoring and liberal scoring was .85 and .84, respectively.

Orthographic Skills

Visual recognition tasks were chosen to assess children's ability to recognize words based on orthographic skills, that is, directly from the print without phonological mediation. Some researchers (Olson et al., 1994a; Olson, Frosberg, Wise & Rack, 1994b) have used a forced-choice discrimination task in which subjects were

presented with a word and a pseudohomophone that sounds like that word (cake, caik) and they were asked to select the one that was a real word. Olson et al. (1985) claimed phonological skills could not be used to make a correct decision between the pair words since both words sound the same. Instead, a correct decision had to be based on the word's orthographic characteristics.

Orthographic skills in Persian. A task was developed to assess children's ability to recognize Persian words. The correctly spelled words consisted of 48 common words in which eight words served as practice pairs and 40 words served as experimental pairs. The words were selected from the vocabulary introduced in Grade 1 schoolbooks and the first part of Grade 2 schoolbooks. The words averaged 4.6 letters in length. In this task, children were asked to identify which of the items in each stimulus pair was spelled correctly. Scoring was based on the number of words correctly identified. The Persian visual recognition task is presented in Appendix 6. The reliability for all items administered in this measure was .76.

Orthographic skills in English. A standard test developed by Olson et al. (1985) was used. These words were common words and were selected from second-grade reading vocabularies. The task consisted eight practice and 40 experimental word pairs. The words averaged 4.5 letters in

length. Olson et al. (1985) used these words for readers with the mean age of 10. The procedure and scoring were identical to those for the Persian list. The English visual recognition task is presented in Appendix 7. The reliability for all items administered in this measure was .85.

Vocabulary Knowledge

One of the primary areas of research on the development of reading and spelling in L1 and L2 is the contribution of language proficiency (Geva et al., 1993). Thus, it was necessary to ascertain that the expected differences across languages were not due to individual differences in oral language proficiency. To test students' oral language proficiency, different approaches have been used in many studies, such as parental interview, teacher rating scales, oral language interview, or vocabulary knowledge (e.g. Geva, in press; Gholamian, 1992). In the present study, a short version of the Peabody Picture Vocabulary Test-Revised, a standard receptive vocabulary task (Dunn & Dunn, 1981), was used. In this task, the experimenter read a word and children were asked to select from an array of four pictures the one that represents the named word. A short version was successfully used by Cunningham and Stanovich (1991) as a reliable measure of vocabulary. For the purpose of the present study, four practice plates, 24 plates for Persian

vocabulary task and 24 plates for English vocabulary task were selected. These plates represented words ranging from items 7 to 109 taken from form L for English and form M for Persian of The Peabody Picture Vocabulary Test-Revised (PPVT-R). These plates represented a range of words from easy to hard in that they were selected to correspond to words appropriate for children aged 3 to 15. The Persian vocabulary knowledge task is presented in Appendix 8 and the English vocabulary knowledge task is presented in Appendix 9. The reliability for all items administered in Persian and English vocabulary was .70 and .78, respectively.

Results

Table 1 presents the descriptive statistics for the parents reports about literacy and language activities. The results revealed differences between hours of children's participation in Persian (L1) and English (L2) schools. For example, children spend more hours per day in English schools than in Persian schools (5.95 vs 2.02 hours/day); $t(54)=31.66$, $p<.0001$.

Children's involvement in storybook reading also indicated differences between the two languages. Because of availability of English storybooks, children spend more time reading English than Persian storybooks (3.28 vs 1.52 hours/week); $t(53)=8.07$, $p<.0001$. A similar pattern, likely due to the same reason, was observed for watching

English language programs on TV (1.46 vs .46 for English and Persian, respectively); $t(53)=5.84$, $p<.0001$.

The descriptive statistics for the Persian and English measures are displayed in Table 2. Preliminary analyses of children's performance in both languages showed that children were more proficient in Persian (L1) than in English (L2); Wilks' Lambda (2,53)=174.54, $p<.0001$. This is consistent with the findings that second language learning lag behind first language learning. Children's performance was also higher in Grade 3 than in Grade 2 in all Persian measures ($F(1, 53)=24.70, 12.30, 19.78, 7.99$, $ps<.000$ for Persian reading, phonological skills, spelling, and orthographic skills tasks, respectively). However, only children's spelling and orthographic skills in English measures were significantly higher in Grade 3 than in Grade 2; $F(1,53)=5.78, 5.53$, $ps<.02$, respectively. Moreover, the preliminary analysis revealed that individual or group administrations of spelling and orthographic tasks had no significant effects in either Persian and English. Finally, the order of presentation for reading and spelling in each grade had no significant effect in either languages. In addition, I examined the distribution of scores children had on all measures in Persian and English in order to look for floor and ceiling effects, outliers, etc. Although, the distributions were somewhat skewed in the direction of high

scores, they were all approximately normal and no ceiling effects were found.

To investigate the relation among the reading, spelling, phonological, and orthographic skills in Persian and English, partial correlations controlling for grade and vocabulary were calculated and are presented in Table 3. Vocabulary knowledge was included to control for individual differences due to children's oral language proficiency. Examination of Table 3 revealed that, within each language, all tasks were positively intercorrelated; for example the correlation coefficients between Persian reading (P-word reading) and each of Persian spelling (P-Spelling), Persian phonological skills (P-Phonological skills), and Persian orthographic skills (P-Orthographic skills) were 0.59, 0.64, and 0.72, respectively, as indicated in Table 3. Similarly, correlation coefficients between English reading (E-word reading) and each of English spelling (E-Spelling), English phonological skills (E-Phonological skills), and English orthographic skills (E-Orthographic skills) were 0.76, 0.77 and 0.83, respectively. This findings replicated those of Geva et al.'s (1993) study and others (e.g. Gholamian, 1992) in which indicates emergence of reading and spelling are interrelated in both L1 and L2 acquisition.

The Role of Cross-Language Transfer

It was predicted that better readers of an alphabetic

language are also more likely to succeed at learning to read and spell in a second alphabetic language. As expected, cross-language transfer of skills between the two languages were observed from interrelations between the same tasks in the two languages (see Table 3). The findings showed positive, but moderate to low, significant correlations for most of the measures. For instance, spelling as well as phonological and orthographic skills in Persian language showed correlations of 0.49, 0.48 and 0.52, respectively, with the parallel tasks in English.

To examine whether the first language (Persian) variables affect children performances in the second language (English), a multiple-regression analysis was performed. The reason that Persian was selected as the first language while they are learning to read and spell in two languages concurrently is that, children were more proficient in Persian and also Persian was their mother language and they must be familiar with the phonological representation of sounds in their first language. It was expected that transferability would be confirmed if Persian tasks show significant weights for English reading and spelling. For this purpose, English reading and spelling were considered as criterion measures and analyzed separately. The results are presented in Table 4. Grade, Persian vocabulary, Persian phonological skills, and Persian

orthographic skills explained a significant 20% of the total variance in English reading, $F(1,53)=3.15$, $p<.02$. Contrary to expectation, Persian phonological and Persian orthographic skills were not significant contributors to English reading.

The pattern of results for the liberal scoring of English words was somewhat different as can be seen from Table 4. In this analysis, Grade, Persian vocabulary, Persian phonological skills, and Persian orthographic skills explained 28% of the total variance in English reading, $F(1,53)=5.10$, $p<.001$. In addition, Persian orthographic skills showed a significant contribution in English reading, $F(1,53)=5.35$, $p<.01$.

The multiple regression analysis (Table 4) for English spelling also showed that grade, Persian vocabulary as well as Persian phonological and Persian orthographic skills explained 33% of the total variance in English spelling, $F(1,53)=6.17$, $p<.0004$. In this analysis, Persian orthographic skills was a significant contributor to English spelling, $F(1,53)=5.94$, $p<.004$. This is in accord with the prediction that was made about the transferability of skills from L1 to L1 language.

The Role of Orthographic Complexity

The effects of orthographic complexity on the role of phonological and orthographic skills in reading and spelling

were examined. Based on Orthographic Depth Hypothesis, it was expected that the variance in reading in Persian should be accounted more by a phonological skill measure than by a orthographic skill measure. However, the variance in spelling in Persian should be accounted mostly by orthographic skills as compared to phonological skills. In addition, phonological skills should play a role in reading and spelling in English; however, a substantial proportion of the variance should be explained by orthographic skills. This pattern of results would suggest that orthographic skills play an important role when children read and spell in English as a deep orthography and in spelling in Persian as compared to when they read in Persian as a shallow orthography. An alternative view, the Universal Hypothesis, was that phonological skills show significant variance in reading or spelling; however, a substantial proportion of variance should be explained by orthographic skills in both shallow and deep orthographies.

To examine the mentioned hypotheses, a series of fixed-order hierarchical regression analyses were conducted to find out whether phonological skills and orthographic skills predicted reading and spelling in Persian and English similarly. Separate analyses were conducted for Persian and English. In these analyses, the variables that may affect children's performances, such as grade and vocabulary were

entered first as controls. The criterion measures in these analyses were reading and spelling. The predictor measures were phonological skills and orthographic skills. After controlling for grade and vocabulary, phonological and orthographic skills were entered in different orders to determine which variable explained a unique amount of variance when the other variable was entered first in the equation. Analyses for the reading and spelling in Persian and English languages are reported in Table 5, Table 6 and Table 7, respectively.

For Persian reading in Model 1 the measure of orthographic skills was entered first and the measure of phonological skills second into the equation, after entering grade and Persian vocabulary, as shown in Table 5. In this analysis, both phonological and orthographic skills accounted for a statistically significant portion of the variance in Persian reading. Orthographic skills explained 31% of variance in Persian reading once grade and vocabulary were controlled. Phonological skills explained significant additional variance (4%) in Persian reading.

In Model 2, after phonological skills were entered into the equation, orthographic skills still explained a significant amount of variance (12%) in Persian reading. However, the independent variance of orthographic skills was three times as large as for phonological skills. The result

indicated that although both phonological and orthographic skills made contributions for explaining the total variance in Persian reading, there was a predominance of orthographic skills. Supporting the Universal Hypothesis, the results suggest that the predictors of performance on Persian reading are phonological and orthographic skills with greater dominance of orthographic skills.

For Persian spelling, when the variables were entered in Model 1 (that is, orthographic skills followed by phonological skills) the latter variable did not account for a statistically significant portion of variance. Contrary to the prediction of both Universal Hypothesis and Orthographic Hypothesis, these results indicate that orthographic skills were a better predictor of performance in Persian spelling than were phonological skills. In Model 2, after entering grade and Persian vocabulary, phonological skills were entered first and orthographic skills second into the equation. In this analysis, orthographic skills explained a significant amount of variance (25%) in Persian spelling as indicated in Table 5.

For English reading, in Model 1, after entering grade and English vocabulary, phonological skills were entered first and orthographic skills second into the equation. In this analysis, orthographic skills still explained a significant amount of variance (12%) in English reading as

indicated in Table 6. In Model 2, when orthographic skills and phonological skills were entered respectively, the latter variable still explained a significant amount of variance (5%) in English reading. Based on the Universal Hypothesis, this result was expected and indicated that both phonological and orthographic skills accounted for unique variance in English reading, but the variance was twice as large for orthographic skills. The same patterns of results were also observed for English reading with liberal scores as indicated in Table 7.

For English spelling, in Model 1, after entering grade and English vocabulary, phonological skills were entered first and orthographic skills second into the equation. In this analysis, orthographic skills still explained a significant amount of variance (9%) for English spelling as indicated in Table 6. When the variables were entered in Model 2, that is, phonological skills followed by orthographic skills, the former variable still explained a significant amount of variance (8%) in English spelling. Unexpectedly, this result indicated that both phonological and orthographic skills had independent contributions for explaining the total variance in English spelling without dominance of orthographic skills as indicated in Table 6.

The same patterns of results were also observed for English spelling using a liberal phonological skills scoring

criterion (scored by a native Persian speaker) as indicated in Table 7.

Complementary analysis

Examining the relation between reading and spelling may also provide information about underlying skills that children may use. If children use the same underlying skills for reading and spelling, then, it follows that reading and spelling should be highly correlated. On the other hand, if different skills are used, then reading and spelling should be more weakly correlated. The correlation between reading and spelling in English was strong and positive (.80) whereas it was weaker for Persian (.59). The difference between these two correlation coefficients was statistically significant ($p < .05$; Steiger, 1980).

Discussion

In the present study, I examined the development of reading and spelling skills of children learning to read and spell in Persian (L1) and English (L2) concurrently. The study was conducted to address two questions: (a) Do reading, spelling, phonological, and orthographic skills in English language benefit from a transfer of Persian skills? (b) Does the orthographic complexity of each language influence the role played by phonological and orthographic skills in reading and spelling?

The Role of Cross-Language Transfer

The first question pertained to the cross-language transfer as measured using the performance on various tasks in Persian (L1) and English (L2). Specifically, the question was whether reading, spelling, phonological, and orthographic skills in Persian (L1) are interrelated to the parallel measures in English (L2), a completely different language. The prediction was that children who are good at Persian tasks are more likely to perform well in the parallel English tasks.

I found positive correlations among the Persian and English measures. This finding replicated those of Gholamian (1992) and others (see Geva et al., 1993; Durgunoglu et al., 1993) suggesting that skills in one language are related to the skills used in the second language. Students who were better in one alphabetic language were likely to succeed in another alphabetic language. As a whole, these results are consistent with the view that skills and knowledge gained in one language can be transferred to a second language.

I found, however, that the magnitude of the correlations between the measures in both Persian and English languages was small to moderate (.26 to .63). This is in accord with other studies comparing different languages such as English and Persian (Gholamian, 1992);

English and Hebrew (Geva et al., 1993); as well as adult readers of Chinese and English (Jackson, Lu, & Hu, 1994).

I also conducted multiple regression analyses to determine what skills are transferred from L1 to L2 reading and spelling. My goal was to find out whether phonological and orthographic skills in Persian predict performance in English reading and spelling. The finding that none of the Persian skills accounted for a statistically significant proportion of the variance in English reading using a conservative scoring criterion (scored by a native speaker of English) was not consistent with my hypothesis that if L1 skills are transferable to reading and spelling in the L2, reading and spelling in English may be predicted by phonological and orthographic skills in L1.

Persian orthographic skills, however, accounted for a statistically significant amount of the variance in English reading using a liberal scoring criterion (scored by a native Persian speaker) as well as a significant amount of the variance in English spelling. Wagner and Barker (1994) regard orthographic processing influenced by individual differences; children who can figure out the visual form of words in their first language use this strategy to read and spell words in a second language. Some evidence of cross-language transfer of orthographic skills was found in adults (Jackson, Lu, & Ju, 1994): Chinese readers of English, as a

second language, were be able to take advantage of orthographic patterns when reading English words (Jackson et al., 1994).

The Role of Orthographic Complexity

The second question in the present study concerned the relative importance of phonological and orthographic skills in leaning each language. Based on Orthographic Depth hypothesis, the extent to which phonological and orthographic skills predominate in each language depends on the on the complexity of the specific orthographies. It was expected that phonological skills play a more important role in a shallow orthography (Persian) than a deep orthography (English), while orthographic skills play a more predominant role in a deep orthography (English) than a shallow orthography (Persian). However, the advantage of the shallow orthography for reading in Persian could not be maintained for spelling in Persian, since more than one grapheme representation for a phoneme is possible.

Therefore, it was expected that Persian reading was mainly predicted by phonological skills, but the Persian spelling might also be predicted by orthographic skills.

Alteratively, based on the Universal Hypothesis, it can be expected that because there is no effect of the depth or shallowness of orthography, orthographic skills play a larger role in any written language.

I examined the relations between phonological and orthographic skills and Persian reading using fixed-order regression analyses. The analyses revealed that both phonological and orthographic skills predicted Persian reading. However, orthographic skills accounted for more variance. This finding contradicts Geva et al.'s (1993) results, using stepwise multiple regression analyses, which indicated that beginning Hebrew readers generally rely on their phonological skills in reading. The finding for Persian reading is also inconsistent with the Orthographic Depth Hypothesis. According to this hypothesis, both phonological and orthographic skills are available in all orthographies, but the phonological skills make more of a contribution to word identification in reading a shallow orthography (such as Persian) than in reading a deep orthography (such as English). The result of the present study, on the other hand, is consistent with the result reported by Baluch and Besner (1991) for adult Persian readers showing that words were read more by using orthographic skills. Overall, the results of the present study and Baluch and Besner (1991) support the view that word reading in at least some shallow orthographies can be accomplished more by orthographic skills (Baluch & Besner, 1991).

One possible explanation for these differences in

results may be due to the advantage of a shallow orthography that despite the limited amount of instruction in Persian, enabled the children to move fast to direct access of word from memory after they learn all phonological rules. This may indicate that knowledge of grapheme-to-phoneme correspondences not only helps children to decode words phonologically but also helps them in learning to read words by sight, that is, accessing the form of words stored in memory (Ehri, 1989). Therefore, the readers who learn to use their phonological skills may be better able to use their orthographic skills. Generally, orthographic regularity of words or scripts may not necessarily obligate readers to use phonological skills only. Instead, the regularity of language makes the spelling of words more structured and perhaps easier to remember (Ehri, 1992).

The fixed-order regression analysis for Persian spelling unexpectedly revealed that orthographic skills were the only significant predictor of performance in Persian spelling. The finding for Persian spelling is striking. It seems that for scripts in which many words have multiple graphemes and one sound, the correct spelling can be chosen only through orthographic skills. This nature of Persian spelling may limit the possibility of using phonological skills in spelling. The finding is consistent with the view that facility in spelling is dependent on individual

differences in orthographic skills (Wagner & Barker, 1994). In addition, it confirms the idea that the level of orthographic complexity does not necessary remain the same for reading and spelling in the same language (Geva et al., 1993).

Comparing Persian reading with Persian spelling may indicate that different emphases on strategies may have been applied in the reading and spelling of Persian. Both phonological skills and orthographic skills play major roles in reading while for spelling, which is deeper than reading, orthographic skills predominate.

A series of fixed-order regression analyses were also carried out to examine the relative importance of phonological and orthographic skills in English reading and spelling. The analyses revealed that orthographic skills made more contribution in English reading than did phonological skills. Interestingly, this result is consistent with the results for monolingual English children studied by Juel et al. (1986) showing that orthographic skills explained an additional significant portion of variance (20%) in reading after controlling for phonological skills. In addition, the result that for monolingual English children both phonological and orthographic skills played significant role in reading and spelling contradict Geva et al.'s (1993) finding that by the end of grade 2

orthographic skills were a better predictor in reading and spelling than were phonological skills.

The fixed-order regression analysis for English spelling, contrary to the hypothesis, revealed that both phonological skills and orthographic skills played significant role in English spelling. This result contradicts those of Juel et al. (1986) who found that orthographic skills explained more additional variance (15%) than did phonological skills. These contradictory results may be the indication of a slower transition from less advanced reliance on phonological skills to more advanced reliance on orthographic skills. One of the challenges facing second language learners is that the pace of development from phonological stage (the stage in which phonological skills have more important role) to orthographic stage (the stage in which orthographic skills predominate) is slower than in first language learners (Geva et al's, 1993). Since spelling is more difficult than reading, children's transition to the application of orthographic skills in spelling was slower (Juel et al., 1986).

Overall, considering the results of the relevant contribution of phonological and orthographic skills in both Persian and English, it seems that Universal Hypothesis accounts for the data of present study more satisfactorily

than Orthographic Depth Hypothesis in reading of both English and Persian. However, since spelling Persian words is more difficult than reading them and thus needs more representation of words in the memory, it seems that greater orthographic skills were required.

The finding of differences between reading and spelling in both languages in the present study is consistent with the view that spelling accuracy consistently lags behind reading and should not be attributed to the complexity of an orthography (Shankweiler & Lundquist, 1992). Spelling requires fully detailed representation of words while reading requires only partial representations of words (Dreyer, Luke, & Melican, 1995).

The results of present study must be interpreted in the light of several limitations. First used correlation as a measure of transfer. Correlations show the relation between two or more variables but do not indicate direction of nature of causation. It is known that a correlation between L1 and L2 can be affected by unknown variables, which make interpretation difficult. It may be that memory or intelligence, for example, could influence the relation between performance in the two languages. In addition, correlational studies do not reveal the direction of the transfer. Although, first language skills may facilitate second language learning, second language skills may indeed

affect first language skills. Future research should be longitudinal to gather information on children over time in order to determine more accurately the temporal and causal sequences of language transfer.

Second, the findings cannot be generalized to the entire population of bilingual Persian children due to restriction of the sample. Children who participated in the study were not randomly selected, they were children of one or both parents' who were Ph.D. student and who came to study in Canada for a certain period of time. Thus, the results found in the data of these children may not be generalized to other groups or settings.

Third, designing standardized tests for Persian was not possible in Canada, although the lack of standardized tests is a common drawback in many studies (e.g. Geva et al., 1993; Gholamian, 1992). These limitations place some restrictions on the generality of the findings.

However, the results do point to some directions for future research. First, in the present study I examined the role of two skills in reading and spelling. To gain better understanding of the skills involved in reading and spelling in Persian, the roles of other cognitive factors should be assessed. Phonological and orthographic skills are not the only cognitive factors that contribute substantial variance in reading and spelling (Vellutino, Scanlon, & Chen, 1995).

Morphological knowledge of the structure and meaning of words in reading and spelling is another factor that must be considered in studying Persian orthography.

In future research, comparison of the present results with a sample of children learning to read and spell only in Persian would allow us to examine the Orthographic Depth Hypothesis for Persian beginning readers and spellers. This would help determine whether the results of the children's performance in the present study were biased by the effect of strategies that children learned in English schools due to concurrent learning in two languages. In addition, more studies are needed to determine the developmental process of reading and spelling as it moves from phonological skills to orthographic skills in a shallow orthography.

In conclusion, the results of the present study provide evidence for positive correlations among reading and spelling when children learning both Persian and English concurrently, thus indicating transferability of skills among Persian (L1) and English (L2). The results of relevant contribution of phonological and orthographic skills in both Persian and English suggest that the Orthographic Depth Hypothesis does not account for dominance of these two skills in Persian (L1) and English (L2).

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Teaching Resources.

Appendix 1: English Translation of Parents' Questionnaire

1. Please indicate:

Child's name-----

Gender-----

Your child's birth date-----

Grade in Persian school-----

Grade in English school-----

2. Please indicate: Language spoken at home: English---

Persian---

Others, please specify---

3. How often does your child speak in Persian or English
with friends:

Persian:

Never---seldom---sometimes---often---always---

English:

Never---seldom---sometimes---often---always---

2. How long have you been in Canada?----years

3. What grades has your child completed in Persian schools?

Grade 1---Grade 2---

4. What grades has your child completed in English schools?

Preschool---Grade 1---Grade 2---

5. Which school does your child attend now?

Persian school---English school---both---

6. How many hours does your child spend in each program?

Persian school----hours a day

English school----hours a day

7. How often does your child read English and Persian books (other than schoolbooks) at home in a week?

Persian Books: Never---once---2 times---3 times---
more---

English Books: Never---once---2 times---3 times---
more---

8. How often do you, or other members of the family, read English and Persian books (other than schoolbooks) to your child in a week?

Never---once---2 times---3 times---4 times---more----

9. How many hours do you, or other members of your family, help your child through their assignment at home in a week?

Never---1-3 hours in a week---4-6 hours in a week---7-9
hours in a week---10-12 in a week---more---

10. How many hours does your child watch TV at home per day and on weekends?

Never---1-2 hours---2-3 hours---more---

11. How many hours does your child watch video films with Persian language per week?

Never---1-2 hours---2-3 hours---more

12. How do you teach your child at home?

Thank You

Appendix 2. Persian Word Recognition and Spelling Tasks

Easy Words

One-Syllable		Two-Syllables	
دست	(Dast)	مسواک	(Meswak)
سیب	(Seab)	لباس	(Lebus)
کفش	(Kafsh)	سلام	(Salum)
برف	(Barf)	بیدار	(Beedar)
فصل	(Fasl)	معلم	(Moaallem)
غذا	(Ghaza)	تعطیل	(Taatlill)
خرف	(Zarf)	گلدان	(Goldun)
فکر	(Fekr)	دیوار	(Deawar)
پیر	(Pear)	کمک	(Comac)
فیل	(feal)	بهار	(Bahur)

Difficult Words

One-syllable	Two-syllables	Three- and more-syllables
فرش (Farsh)	تنبيه (Tanbee)	عاشورا (Ashoorat)
خرج (Kharj)	قطار (Ghatar)	سرماء خوردگی (Sarmakhordagea)
گیج (Geage)	کوشش (Kooshesh)	آشامیدانی (Ashameadani)
قهر (Ghahr)	جمعه (Jaabae)	پشیمان (Pashimun)
مغز (Maghz)	درود (Dorude)	قهرمانان (Ghahramun)
قرص (Ghorse)	دستگاه (Dastgah)	مرورید (Merwareed)

Appendix 3. English Word Recognition and Spelling Tasks

Easy words

One-Syllable	Two-syllables

go	water
not	paper
had	rabbit
got	better
from	listen
said	body
she	angry
man	always
what	morning
name	until

Difficult Words

One-Syllable	Two-syllables	Three-syllables

piece	rudely	vehicle
young	lagoon	professional
point	social	inventor
use	urgent	departure
built	giggle	amazement
bought	valid	however

Appendix 4. Persian Phonological Skills Task

One-syllable	Two-syllables	Three- and more-syllables
جگ (Jug)	ماحول (Masool)	آسمان دوباری (Asedobary)
میتز (Seeze)	سانگین (Surgeen)	موبافوقیت (Mobafogheat)
طیل (Teal)	بیرجه (Bearjæ)	باروماگی (Baromagy)
تون (Toon)	غاروم (Ghroom)	چوناسورانہ (Chonasoranae)
لیم (Leam)	خیگار (Kheagur)	آتیشانانی (Atishanani)
جال (Jal)	فایض (Foleaz)	مباریجانی (Mobazeajani)
لود (Lood)	جناش (Janash)	ثانرسیکال (Sasoursical)
رات (Rot)	سیراث (Searath)	ناماد: بانی (Namadaybani)
لیج (Leage)	بالوش (Baloosh)	دانوشودان (Dancoshoodan)
یان (Youn)	بوشت (Booshut)	واروکاریم (Warookaream)

Appendix 5. English Phonological Skills Task

Child names the words shown by experimenter.

Sample items:

1. nat

2. ib

Items:

One syllable Two syllables Three syllables

hap	floxy	centizen
foy	yerdle	depronlel
eam	koodoo	phintober
fim	imbaf	doitibility
ven	lundy	querpostonious
jop	quib	telequik
ift	eldop	polybendable
kak	hudned	conration
nen	baunted	bafmotbem
tob	gradly	wubfambif

Appendix 6. Persian Orthographic Skills Task

Sample items:

زمین - زمین	(Zamean)	قند - غند	(Ghand)	آب - عاب	(Ub)
استراحت-استراحت	(Esterahat)	ماه - ماه	(Muh)	عابر - اابر	(Anar)
		خاهر - خواهر	(Khahar)	اصب - اسب	(Asb)

Items:

صورت - صورت	(Souat)	فریز - فریز	(Ghermez)	درس - درث	(Darth)
صبح - صبح	(Sobh)	دوست - دوعس	(Doost)	کنیف - کسيف	(Kaseaf)
عصر - عثر	(Athr)	بید - بید	(Sabad)	زمستان - زمستان	(zemestun)
زرد - خرد	(Zard)	صنّی - سنی	(Seani)	مهریان - مهریان	(Mehraban)
باق - باغ	(Bugh)	مريض - مریذ	(Mareaz)	سوزن - سوزن	(Soozan)
بعری-بعفی	(Bazea)	راه - راج	(Rawh)	توپ - طوپ	(Toop)
آزادی - آزادی	(Azadi)	آواز - عوزار	(Awaz)	بسر - بئر	(Pesar)
دبستان - دبستان	(Dabestun)	دانت - دانت	(Mast)	دانشان - دانشان	(Dustan)
بشغوب - بشغوب	(Boshghub)	تصمیم-تصمیم	(Tasmeam)	کوه - کوح	(Koh)
نماز - نماز	(Namuz)	خوشحال - خوشحال	(Khoshhal)	سفید - سفید	(Sefead)

Appendix 7: English Orthographic Skills Task

Child selects the items in each stimulus pairs that is spelled correctly.

Sample items:

rume	room	boal	bowl
young	yung	clown	cloun
tertle	turtle	circus	sircus
snoe	snow	wroat	wrote

Items:

take	taik	wurd	word
goat	gote	coat	cote
please	pleese	rane	rain
sleap	sleep	stoar	store
streat	street	wagon	wagun
answer	anser	beleav	believe
betwean	between	chooze	choose
deap	deep	dream	dreem
eazy	easy	evry	every
face	fase	few	fue
heavy	hevvy	hole	hoal
hert	hurt	keap	keep
laik	lake	learn	lurn
need	nead	nise	nice
roar	rore	scair	scare

Appendix 8. Persian Vocabulary Task

تایفی
لامپ
پانسمان
تور
گِره زدن
ناز کردن
چتر نجات
کُروه
ساقه
تعجب
تنه درخت
انسان
سوراخ بینی
مخالفت
مراسم
کُره
وسیله نقلیه
جمعیه
متعجب
گفتگو
شکستنی
شعله ور
اندیشیدن
تیر کمان

Appendix 9: English Vocabulary Knowledge Task.

circle

reading

pulling

kite

whale

track

branch

tugging

liquid

wrist

hive

entertainer

directing

artist

ceiling

secretary

cliff

furious

weary

triplet

applauding

compass

arctic

archaeologist

Table 1
Descriptive Statistics: Background Variables

	Grade			Grade			Overall		
	Mean	SD	N	Mean	SD	N	Mean	SD	N
Age (year)	7.61	0.38	27	8.75	0.52	26	8.17	0.73	53
Number of girls	13			19			32		
Number of boys	14			9			23		
Residency in Canada (year)	4.47	2.12	26	4.10	2.09	28	4.28	2.09	54
<u>Children Communication^a</u>									
Persian	1.92	0.84	26	2.29	0.90	28	2.11	0.88	54
English	2.08	0.84	26	1.71	0.90	28	1.89	0.88	54
<u>School background^b</u>									
Persian	2.04	0.34	27	5.18	0.55	28	3.64	1.65	55
English	2.63	0.78	27	4.82	1.96	28	3.75	1.86	55
<u>Attending school (hours/day)</u>									
Persian	2.07	0.78	27	1.96	0.58	28	2.02	0.68	55
English	5.89	0.58	27	6.0	0.00	28	5.95	0.40	55
<u>Storybook reading/week^c</u>									
Persian	1.31	1.32	26	1.71	1.21	28	1.52	1.27	54
English	3.42	1.06	26	3.14	1.01	28	3.28	1.04	54
<u>Parents involvement(hours/week)</u>									
Storybook reading ^c	2.00	1.39	26	2.07	1.25	28	2.04	1.30	54
Teaching ^d	2.31	1.26	26	2.79	1.42	28	2.56	1.36	54
<u>Watching TV</u>									
Persian (hours/week)	0.38	0.90	26	0.54	1.00	28	0.46	0.95	54
English (hours/day)	1.46	0.65	26	1.46	0.51	28	1.46	0.57	54

a: Children communication with their friends 1=Never; 2=Seldom; 3=Sometimes; 4=Often; 5=Always
 b: 0=never; 1=Kindergarten; 2=Grade 1; 3=Kindergarten & Grade 1; 4=Grade 2; 5=Grade 1 & Grade 2, and
 6=Kindergarten, Grade 1 & Grade 2.

c: 0=Never; 1=Once a week; 2=Twice a week; 3=Three weeks; 4=More than three weeks

d: 0=Never; 1=Three hours/week; 2=Four to six hours/week; 3=Seven to nine hours/week; 4=Ten to twelve hours/week;
 5=More than twelve hours/week

Table 2
Descriptive Statistics: Persian and English Measures (N=27 for Grade 2 and N=28 for Grade 3)

Variable (Maximum Score)	Grade 2		Grade 3		Overall	
	Mean	SD	Mean	SD	Mean	SD
P-Vocabulary (24)	17.07	2.45	20.82	1.66	18.98	2.80
P-Word Reading (38)	31.33	3.74	35.79	2.86	33.60	3.98
P-Spelling (38)	26.67	4.81	31.39	2.86	29.07	4.57
P-Phonological (30)	24.07	4.52	27.43	2.23	25.78	3.90
P-Orthographic (30)	27.56	2.94	29.25	1.17	28.42	2.36
E-Vocabulary (24)	16.37	4.44	17.71	3.84	17.05	4.16
E-Word Reading (38)	22.89	9.30	27.32	8.06	25.15	8.90
E-Word Reading I (38)	26.74	9.28	30.89	6.77	28.85	8.29
E-Spelling (38)	14.44	8.08	19.25	6.70	16.89	7.73
E-Phonological (30)	10.85	6.29	12.75	6.48	11.82	6.40
E-Phonological I (30)	18.26	7.38	20.11	6.95	19.20	7.16
E-Orthographic (30)	24.11	5.60	27.29	4.36	25.73	5.21

P=Persian language; E=English language
 E-Word Reading & E-Phonological=Conservative Scoring
 E-Word Reading I & E-Phonological I=Liberal Scoring

Table 3
Partial Correlations with Grade Controlled (above the diagonal) and with Grade and Vocabulary (Persian and English) Controlled (below the diagonal).

Variable	1	2	3	4	5	6	7	8	9	10
Persian										
1. P-Word Reading	–	0.64	0.67	0.70	–0.08	0.07	0.05	0.01	0.21	0.04
2. P-Spelling	0.59	–	0.42	0.71	0.00	0.16	0.25	0.14	0.26	0.19
3. P-Phonological	0.64	0.40	–	0.56	0.19	0.24	0.25	0.29	0.36	0.21
4. P-Orthographic	0.72	0.71	0.56	–	0.28	0.43	0.46	0.32	0.49	0.41
English										
5. E-Word Reading	0.16	0.27	0.34	0.45	–	0.94	0.84	0.84	0.80	0.86
6. E-Word Reading I	0.31	0.42	0.37	0.58	0.92	–	0.85	0.82	0.87	0.89
7. E-Spelling	0.26	0.49	0.37	0.59	0.80	0.80	–	0.83	0.84	0.82
8. E-Phonological	0.24	0.43	0.43	0.48	0.77	0.76	0.78	–	0.87	0.74
9. E-Phonological I	0.44	0.51	0.48	0.63	0.74	0.84	0.79	0.83	–	0.84
10. E-Orthographic	0.22	0.40	0.31	0.52	0.83	0.87	0.78	0.68	0.81	–

$N=55$; $r \geq 0.26$, $p < 0.05$; $r \geq 0.32$, $p < 0.01$; $r \geq 0.43$, $p < 0.001$

P=Persian language;

E=English language

E-Word Reading & E-Phonological=Conservative Scoring

E-Word Reading I & E-Phonological I=Liberal Scoring

Table 4
Regression Analyses for the English Reading (E-Word Reading and E-Word Reading1) and English Spelling (E-Spelling).

Criterion	β	F	p
<u>E-Word Reading</u>			
Grade	0.34	3.88	0.058
P-Vocabulary	-0.36	3.95	0.054
P-Phonological	0.15	1.65	0.413
P-Orthographic	0.24	2.93	0.149
<u>E-Word Reading1</u>			
Grade	0.29	3.48	0.088
P-Vocabulary	-0.34	3.97	0.053
P-Phonological	0.10	1.17	0.562
P-Orthographic	0.41	5.35	0.010
<u>E-Spelling</u>			
Grade	0.32	3.96	0.053
P-Vocabulary	0.30	3.59	0.079
P-Phonological	0.08	0.94	0.641
P-Orthographic	0.45	5.94	0.005

N = 55

P=Persian language; E=English language

E-Word Reading1=Liberal Scoring

Table 5
Hierarchical Regression Analyses for the Persian Reading (P-Word Reading) and Persian Spelling (P-Spelling).

Criterion Predictor	R ²	R ² Change	F	p	β
<u>P-Word Reading</u>					
Model 1					
Grade	0.32	0.32	24.70	0.000	0.10
P-Vocabulary	0.41	0.10	8.62	0.005	0.26
P-Orthographic	0.72	0.31	55.59	0.000	0.45
P-Phonological	0.76	0.04	8.83	0.005	0.29
Model 2					
Grade	0.32	0.32	24.70	0.000	0.10
P-Vocabulary	0.41	0.10	8.62	0.005	0.26
P-Phonological	0.64	0.23	32.89	0.000	0.29
P-Orthographic	0.76	0.12	24.75	0.000	0.45
<u>P-Spelling</u>					
Model 1					
Grade	0.27	0.27	19.78	0.000	0.19
P-Vocabulary	0.30	0.03	2.15	0.148	0.16
P-Orthographic	0.65	0.35	51.84	0.000	0.65
P-Phonological	0.65	0.00	< 1	0.900	-0.01
Model 2					
Grade	0.27	0.27	19.78	0.000	0.17
P-Vocabulary	0.30	0.03	2.15	0.148	0.16
P-Phonological	0.41	0.10	8.97	0.004	-0.01
P-Orthographic	0.65	0.25	35.77	0.000	0.65

N = 55; P=Persian language; E=English language

Table 6
Hierarchical Regression Analyses for the English Reading (E-Word Reading) and English Spelling (E-Spelling).

Criterion Predictor	R ²	R ² Change	F	p	β
<u>E-Word Reading</u>					
Model 1					
Grade	0.06	0.06	3.57	0.060	0.01
E-Vocabulary	0.35	0.28	22.49	0.000	0.14
E-Phonological	0.73	0.39	73.60	0.000	0.36
E-Orthographic	0.85	0.12	39.79	0.000	0.54
Model 2					
Grade	0.06	0.06	3.57	0.060	0.01
E-Vocabulary	0.35	0.28	22.49	0.000	0.14
E-Orthographic	0.80	0.46	118.37	0.000	0.54
E-Phonological	0.85	0.05	16.05	0.000	0.36
<u>E-Spelling</u>					
Model 1					
Grade	0.10	0.10	5.78	0.020	0.10
E-Vocabulary	0.27	0.17	12.46	0.001	0.01
E-Phonological	0.71	0.47	77.93	0.000	0.46
E-Orthographic	0.80	0.09	22.85	0.000	0.47
Model 2					
Grade	0.10	0.10	5.78	0.020	0.10
E-Vocabulary	0.27	0.17	12.46	0.001	0.01
E-Orthographic	0.72	0.45	83.68	0.000	0.47
E-Phonological	0.80	0.08	19.74	0.000	0.46

N = 55; P=Persian language; E=English language

Table 7
Hierarchical Regression Analyses for the English Reading (E-Word Reading1) and English Spelling (E-Spelling).

Criterion Predictor	R ²	R ² Change	F	p	β
<u>E-Word Reading1</u>					
Model 1					
Grade	0.06	0.06	3.61	0.060	0.02
E-Vocabulary	0.27	0.21	15.00	0.000	0.09
E-Phonological1	0.78	0.51	120.31	0.000	0.38
E-Orthographic	0.86	0.08	28.12	0.000	0.54
Model 2					
Grade	0.06	0.06	3.61	0.060	0.02
E-Vocabulary	0.27	0.21	15.00	0.000	0.09
E-Orthographic	0.82	0.55	159.14	0.000	0.54
E-Phonological1	0.86	0.04	13.69	0.000	0.38
<u>E-Spelling</u>					
Model 1					
Grade	0.10	0.10	5.78	0.020	0.12
E-Vocabulary	0.27	0.17	12.46	0.001	0.07
E-Phonological1	0.72	0.45	82.20	0.000	0.41
E-Orthographic	0.77	0.05	10.73	0.002	0.43
Model 2					
Grade	0.10	0.10	5.78	0.020	0.12
E-Vocabulary	0.27	0.17	12.46	0.001	0.07
E-Orthographic	0.72	0.45	83.68	0.000	0.43
E-Phonological1	0.77	0.05	10.06	0.003	0.41

N = 55

P=Persian language; E=English language

E-Word Reading1 & E-Phonological1 = Liberal Scoring