CHAPTER 1: INTRODUCTION

Reading is crucial for human development. Reading not only increases our life skills and extends our knowledge but goes much deeper. Reading helps determine how we think. It has a fundamental effect on the development of the imagination and is a powerful influence on the development of emotional and moral as well as verbal intelligence (Harrison, 2004). For many, reading is like breathing; it does not feel like a cognitive process but rather automatic. Unlike breathing, however, reading must be learned before it can become automatic. In this process, many people, about 10% of the population, fail and these people are classified as dyslexic. Dyslexia is still a mystery and understanding normal reading acquisition may be of great help in developing new training programs for young dyslexic readers. Thus it is important to understand the steps of reading acquisition. All children learn to read letter-by-letter. It has been suggested that adults read words as whole because they recognize short and long words equally quickly.

To understand the cognitive processes that are associated with greater success in learning to read, it is helpful to divide cognitive processes into distal and proximal groups. Distal processes are those that have a general but somewhat distant relationship to the act of reading; examples include general cognitive skills such as verbal ability and memory. There is no lack of research on such distal processes, but the relationships with reading ability tend to be moderate at best, and the evidence for a truly causal link is weak. Some paradoxical results exist; for instance, reading disabled children are thought to have average to high levels of underlying cognitive abilities in spite of showing poor reading skills. (Das, Mishra & Poole, 1995).

Proximal processes are those that have a specific and close relationship to reading skills, for instance phonological awareness, letter knowledge, and decoding skills. They have stronger relationships with reading skills, and persuasive evidence exists that they are causally related (Wagner, Torgesen & Rashotte, 1994). There is now overwhelming support for the importance of these phonological and analytic skills in learning to read (Adams, 1990; Bryant & Goswami, 1990).
The earliest of the phonological constructs to appear developmentally is naming, which indicates the ability to give verbal labels for presented objects. As naming develops, it becomes faster or more efficient. Efficient naming contributes to phonological memory, whereby ordered sets of sounds can be retained and repeated. Both of these skills appear within the second year of life and continue to develop and improve; they also provide the basis for the later developing phonological skills. The next ability to appear is rhyming, which is demonstrated by the ability to recognize or produce rhyming words; it also represents the first skill in which the child must deal with units smaller than the individual word. Phonological synthesis requires the child to produce a word from individual sounds, and phonological analysis requires the breaking down of a presented word into component sounds for subsequent manipulation. In measures of the latter two abilities, sometimes jointly labeled as phonological awareness, the sounds involved may be syllables, onsets, rimes, or phonemes. Onsets and rimes are the components of syllables, the onset being the consonant or consonant cluster at the beginning and the rime being the vowel and any following consonants.

Both reading and writing are highly complex cognitive processes, which draw on several cortical areas; short and long term memory, lower and higher level visual and auditory processing and visual-spatial coordination, all are an integral part of successful reading and writing. The enormous importance of studying literacy acquisition, its progress, facilitators and stumbling blocks, is apparent. Apart from its immediate value, research that explores the mechanisms of literacy may provide deeper insights into the complex functioning of human cognition that might perhaps be the study of any other form of behavior.

The last decade has seen cognitive psychology focusing its attention on important educational tasks, not the least of which is reading. Real progress has been made, as illustrated, in the following areas:

a) Development of reading and writing skills in children, i.e. their progression from pre literacy to skilled reading: Work in this area has enabled researchers to achieve a better understanding of the cognitive skills that act as mediators and facilitators of literacy.
b) The extent of transfer of phonological and orthographic processing from one language to another: Though studied not extensively, these studies have added to the empirical knowledge base related to the extent of cross-linguistic transfer for phonological awareness skills.

c) Performance of adult/skilled readers on various reading and writing tasks: These studies carried out usually under controlled conditions have yielded insights into the processes underlying reading and writing.

d) Studies on developmental as well as acquired language disorders: More recently, cognitive and neurobiological basis of reading and dyslexia has become the focus of psycho-neurolinguistic researches.

**The role of orthography and reading acquisition**

Different writing systems (orthographies) can be classified based on the levels of linguistic information that is coded in the script. DeFrancis (1989, p.56) has pointed out that all writing systems are based on phonetic aspects of language. This is the case even with Chinese, that is commonly perceived as a script consisting of only semantic coding, and that is correspondingly often mislabeled as “pictographic”, “logographic”, “ideographic” or “morphemic”. He has presented a classification that is based on, firstly, whether the phonetic components are represented with graphic or alphabetic symbols; secondly, whether written symbols represent syllables, consonant sounds, or all the phonemes of the language; and thirdly, whether the orthographic code also includes non-phonetic clues such as morphological information. DeFrancis’ classification is represented in Table 1.1.
Table 1.1: Classification of orthographies, and examples of orthographies falling in these categories according to DeFrancis (1989)

<table>
<thead>
<tr>
<th>Alphabetic symbols</th>
<th>Graphic symbols</th>
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<tr>
<td>Alphabetic</td>
<td>Consonantal</td>
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<td>“Meaning + Phonetic”</td>
<td>“Meaning + Phonetic”</td>
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<td>Korean</td>
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<td>English</td>
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It is worth noting that the classification described above is one of many, and the categories are not discrete. Nevertheless, it underlines the point that all orthographies share a phonetic base, and that inside each of the three representational levels (syllabic, consonantal and alphabetic), orthographies can be classified according to whether morphological information is coded into script, or whether the orthography is “purely” phonetic. This is also the case with alphabetic orthographies. The orthographies that are “purely” phonetic have consistent grapheme-phoneme correspondences. English is an extreme example of a language in which morphological information is also coded in spelling. This creates inconsistency in grapheme-phoneme correspondences. There are also other alphabetic orthographies that share a similar morphophonemic nature, including Danish, which has reputation of poor fit between spelling and sound. Whereas these two orthographies are symmetrical, that is, irregular both in the direction of spelling-to-sound and sound-to-spelling, some orthographies are irregular in one direction only. French is relatively regular from the perspective of reading, whereas it is less so from the point of view of spelling. The same can also be said about German and unvowelized Persian. The Roman languages are generally thought of as being relatively regular and symmetrical. At present, there exist no common measures for quantifying the transparency of orthography, although the calculations made for a few orthographies have been published. On the spelling body-rime level, 31% of English monosyllabic
words are inconsistent (Ziegler, Jacobs & Stone, 1996); the corresponding figure for French is 12% (Ziegler, Jacobs & Stone, 1996); and 16% for German (Ziegler, Perry, Jacobs, & Braun, 2001). It should be noted that the above figures are not calculated on the basis of grapheme-phoneme correspondences, where the inconsistencies supposedly are much more frequent, especially for English. Because objective measures of consistency are lacking, the term “regular orthography” has been used somewhat liberally, and studies investigating the effect of orthographic consistency have done so usually in comparison with the extreme, namely English. The “transparency” of orthography can be best thought of as a continuum. Whereas we might remain uncertain as to where on this continuum each orthography is objectively located, we can be certain of the extreme positions of this continuum. Learners of alphabetic orthographies need to memorize a small set of symbols (26 in English, 32 in Persian), but reading involves mastering complex letter-sound correspondence rules and blending skills. The level of transparency of a script also determines the cognitive demand that the script places on the reader. English is one of the irregular scripts where as the voweled Persian is certainly one of the regular scripts and may allow beginning readers to decode with more accuracy.

**Persian orthography and its characteristics**

Modern Persian is derived from Indo-Iranian group, one of the branches of the Indo-European languages. The Indo-European language group split into Indo-Iranian and Indic languages groups, from which most of the languages of India are derived. This development is estimated to have taken place around 551 B.C.E. (Khanlari, 1979, 1995). The Old Persian, dating back to around 551 B.C.E. was written in cuneiform, the wedge-shaped characters used throughout much of the Middle Eastern countries. Around the historical period known as the middle Persian (around 331 B.C.E.) the Persians created their own writing system known as Pahlavi, which remained in use until the Islamic conquest of the seventh century. What is referred to as modern Persian script is a transcription of Persian by a modified version of Arabic script. Modern Persian is spoken by over 50 million people in Iran and another 5 million in Afghanistan. In Iran it is generally referred to as Farsi, but in Afghanistan
as Dari. A variety of Persian called Tajik is spoken in Tajikistan; however, it is written in the Cyrillic alphabet (Khanlari, 1979, 1995).

The Persian Alphabet

The Persian has an alphabetic system in which a written symbol is associated with a phoneme and it contains thirty two alphabetic letters, the original 28 Arabic letters and an addition of four letters that represent phonemes that are not represented by Arabic letters. The additional four letters are graphically identical to Arabic letters but differ only with the addition of dots and cross to the Arabic letters. Furthermore, the addition of a stroke on the top of the Arabic letter and the Persian invented letter distinguishes these letters from the original Arabic letters. However the rules of transcription and letter shapes for the invented letters follow that of Arabic writing. Indeed, it is a noticeable feature of the Arabic alphabet and invented Persian letters that there are only eight basic forms for letters. Other letters are simply a variant of one of these basic forms, with the difference of (dot)s in almost all cases. Persian like Arabic and Hebrew is written from right to left. Most letters are written in a joined fashion, rather like English cursive handwriting. However, some letters, depending on their position in the word, are never joined to a following letter. Although there are no uppercases or lowercases in Persian letters, there are many letters that have different shapes depending on their position in the word and whether or not they should be written connected to another letter. Even though the transcription of Persian letters in cursive format is helpful in marking word boundaries, readers may experience difficulty in deciding word boundaries when they encounter letters that do not join other letters. Some letters have only one form, regardless of their position within the word. Like English, most words are separated by a space. However, in view of the cursive form of written Persian, if the first word ends in one of the characters that is left enjoined to a preceding letter, the end of the word may not be as predictable as most other words in the text (Baluch, 2005).

In modern Persian the number of vowels has been reduced from eight in old Persian to six. Three vowels (a, e and o), generally known as short vowels, are represented by diacritic superscript or subscript marks attached to the letters of the
alphabet. The other three vowels are the long vowels (A, I and U) and are conveyed by letters of the alphabet. There is a direct, one to one relationship between letters of the alphabet and phoneme in Persian. Moreover, Persian script, in so far as grapheme-phoneme correspondences are concerned, in it's fully vowelized format is a highly regular orthography. However, similar to English, in Persian a phoneme may be presented by more than one letter of the alphabet. In addition, in practice, diacritic vowels are used in writings used by beginning readers and in religious texts; but short vowels are almost always omitted from general text. Long vowels are never omitted from text. This creates phonological, semantic and some visual orthographic ambiguities (Baluch, 1992). Phonological and semantic ambiguity results when the reader is faced with a string of consonantal letters. For example, the consonantal string /KRM/ can be pronounced with different vowel combinations resulting in five possible pronunciations and meanings /KeRM/ [worm], /KaRaM/ [generosity], /KeReM/ [cream], /KRoM/ [chrome], and /KaRaM/ [vine]. The manner in which a reader may eventually retrieve the correct pronunciation and meaning has been subject of the researches. The absence of vowels makes the words somewhat shorter. Thus there are fewer visual cues to identify the words. Indeed, research on English has shown a direct relationship between word length and word recognition (Weekes, 1997).

**Persian Grammar**

Persian is classified as an SOV language, i.e. sentences are made in the order Subject-Object-Verb. Modifiers follow the nouns they modify, and the language has prepositions. However in normal daily conversations, it appears as a highly free word order language, i.e. the sentential constituents can be moved around in the clause, especially the adverbial and prepositional phrases. Subject, if not completely omitted (because Persian is a pro-drop language), can move around almost anywhere in the sentence. Such deviations from the canonical word order are often used for focused or topicalized readings. But we should take into consideration that in formal language style especially in written form, although most elements may appear in relatively free word order, the sentences often remain verb-final. Adverbs and prepositional phrases,
however, can appear in various positions quite freely. The language relies on an affixal system that makes use of both prefixes and suffixes.

However, much of the complex nominal and verbal inflection of Old Persian has been lost in modern Persian, including the inflectional distinction of case, and gender. However human and non-human types are distinguishable within the pronominal system. Also person and number distinctions are maintained, and specified objects of transitive verbs are marked by a marker. Persian has no articles. An unmarked noun refers to a class of objects rather than a single thing. For example, the phrase “man ketāb mixānam.” (I book read.) means “I read books.” i.e. the singular unmarked noun “ketāb” represents the whole class of “books” in general rather than any specific known book. The suffix “-i” is added as an indefinite marker, e.g. "ketāb-I" refers to “a book”, so the phrase “man ketāb-i mixānam.” means "I read a book", but the book here is indefinite, i.e. the listener doesn’t know which book I read. In Persian there is no equivalent of the English definite marker “the”. Nouns are marked for specificity. There is one marker in the singular and two in the plural. The two markers of specific plurality in Persian are either the Persian plural markers “-an” and “-ha” or the Arabic "broken plural" forms. However, the Arabic broken plural may only be applied to Arabic loan words, and is not productive in Persian, i.e. it cannot be added to newly form Persian words. On the contrary Arabic words can also change into plural form using Persian plural suffixes (so they can have two different plural forms.). In formal language, the Persian plural marker “-an” is used for humans and “-ha” for inanimate objects and animals. But recently, “-ha” is used indiscriminately. As mentioned above, most of the time nominal modifiers follow the nouns they modify (though demonstrative adjectives and numerals precede nouns). Head nouns are connected to the modifiers that follow them by what is called ezafe’, represented by “-e” sometimes realized as “-y” (phonetically determined).

There are two ways of indicating possession in Persian. The clitic “-e” or the enclitic pronoun “-am” may be used to mark possessed nouns. For example, “ketāb” is “book”; “ketāb-e man” and “ketāb-am” both mean “my book”. The suffix "rā" is

* Ezafe is an unstressed vowel “-e” (“-ye” after vowels) which appears on various positions in Farsi such as (i) a noun before another noun (attributive), (ii) a noun before an adjective, (iii) a noun before a possessor (noun or pronoun), (iv) an adjective before another adjective, etc.
used to mark specific direct objects in Persian. On the other hand indirect objects and adverbial phrases are marked by prepositions. The Persian interrogative pronouns are “ki”, and “ce”, which function like “who” and “what”. The particle “ke” is used to introduce relative clauses. It functions like both “who” and “which” in English. The clitic “-i” is added to a noun modified by a restrictive relative clause. The head noun may be represented pronominally within the relative clause. For example: mard-i ke az u gereft-âm- as (The man from whom I got it).

Verbs are formed using one of two basic stems, present and past; aspect is as important as tense: all verbs are marked as perfective and imperfective. The latter is marked by means of prefixation. Both perfective and imperfective verb forms appear in three tenses: present, past and inferential past. While all forms may be used in a future context, future is not marked. Verbs usually agree with the subject in person and number. An important about Persian verbs is that they are normally compounds, i.e. consisting of a noun and a verb (light verbs). The nominal often can be Arabic loan word, for example, the verb “montazer budan/shodan”, meaning “to wait”, literally means “to be/become waiting”. The verbs “budan”, and “shodan” (“to be” or “to become” respectively) are particularly productive function verbs in this respect. Finally negation of sentences is brought about by adding the prefix “na-“to the main verb. (World languages knowledge fair, Persian) (Karine Megerdoomian 1999).

**Differences between the Persian and English writing systems**

A major difference is that English is written from left to right whereas Persian is written from right to left. Also, unlike the English script, in the modern Persian script there are groups of different Persian consonant letters that are strikingly similar in shape, only distinguishable by the number and position of diacritics and dots. Furthermore, as already noted, the form for the majority of Persian letters varies according to position in a word. The difference between the word-final forms and the corresponding non-final forms is sometimes much greater than the differences between many contrasting pairs of Persian letters.
The presence of diacritics, or more specifically of a ‘pointing system’ for specifying vowels in the Persian script, and the absence of any such system in the English script, is another major difference between the English and Persian writing systems. This pointing/vowelling system is present in script for children and is not normally used in script written for adults. In contrast, in English the orthographic system is the same for both beginning and skilled readers, and vowels are part of the alphabet and are represented by specific letters. Vowelled Persian orthography is transparent or ‘shallow’, since letter–sound correspondences are simple and invariant, and the deduction of phonological information is straightforward. In contrast, the unwovelled script as used for adult reading is opaque or ‘deep’.

Usually the context, the grammatical construction and/or prior knowledge will be the key factors for deducing vowel phonemes and deciding which meaning and pronunciation are intended. Thus, a Persian reader confronted with unwovelled individual Persian words taken out of context would often be unsure of the intended word. Therefore, an essential difference between Persian and English orthography is that in English skilled readers rely on their autonomous decoding of each word and do not need the context to facilitate word recognition (except in the rare cases of heterophonic homographs such as ‘lead’).

Another major difference between the Persian and English writing systems is that the letter–sound or grapheme–phoneme correspondence in the (vowed) Persian script is very predictable and regular (i.e., only one phoneme can ever be assigned to any particular grapheme in literary Persian), whereas there are many irregular or exception words (approximately 25%) in English – words, such as ‘colonel’ or ‘steak’, that disobey standard grapheme–phoneme rules. Moreover, many graphemes in English are multiletter graphemes (such as the ‘th’ and the ‘igh’ in ‘thigh’) but all graphemes in Persian are single-letter graphemes, thus, the mapping of letters to phonemes in Persian is largely but not entirely one-to-one.

In addition, Persian (unlike English) does not possess any heterographic homophones, that is, words identical in pronunciation but different in spelling – only one grapheme can ever correspond to any particular phoneme. Hence, in Persian, if two words have the same pronunciation they must also have the same spelling. In
English, on the other hand, sets of words that are identical in pronunciation but
different in spelling and meaning are quite common, for example, ‘sail’ and ‘sale’.
Furthermore, heterophonic homographs, that is, words identical in spelling but
different in pronunciation and meaning, do not exist in voweled Persian - only one
phoneme corresponds to any particular grapheme. In contrast, English possesses
words that can have more than one pronunciation for a given spelling, such as ‘bow’
(as in ‘to tie a bow’) and ‘bow’ (as in ‘to take a bow’). Homophonic homographs, i.e.,
words identical in spelling and pronunciation but different in meaning (e.g., ‘bank’),
exist in Persian as they do in English. For example, the spoken Persian "Shir" used for
‘lion’ and ‘Milk’ are homophonic and homographic.( "Zang" for "Rust" and "Bell" )

The Persian script, however, is polygraphic because some phonemes are
represented by more than one grapheme. For example, the phoneme /s/ can be
represented by three different graphemes and the phoneme /z/ can be represented by
four graphemes. The polygraphy of Persian should not have any consequences for
reading because any given letter consistently has the same pronunciation, in contrast,
the polygraphy of Persian should affect the spelling of words because the speller has
to select from an array of possible candidates the letter that accurately spells a given
words.

**Methods of teaching reading and writing in Persian**

The following provides a general description of methods of teaching reading
(and writing) in Persian. The major task for the Kindergarten and Grade 1 beginning
reader in Persian is learning to recognize letters, and remembering their names and
sounds. From teacher’s point of view this means teaching basic letter–sound
correspondences, one letter at a time.

Although for some letters there are different forms for all three word positions,
as well as an isolated form, at this stage the different position forms are treated as
independent letters corresponding to the same phoneme. The sound corresponding to
each Persian letter represents the sound of the initial consonant of the letter name.
Initially, children are taught to sound out consonants using these sounds. Gradually,
each letter is then taught in the context of its associated short and long-vowel sounds. The children may have some difficulty with the vowels. Apart from teaching the letter names and the letter sounds simultaneously, those letters whose phonemes are relatively easier to discriminate from other phonemes are taught first, and those whose phonemes that are relatively more difficult to discriminate from other phonemes are taught later in Grade one. In Grade 2, more attention is paid to mastering long vowels. Typically, the children are taught to recognize and write each letter individually in its initial, medial, and final forms. Word writing involves repeatedly copying the same words. A technique passed on to children to facilitate their word reading involves analyzing each word by phonemic “cutting and pasting”. The teacher speaks a monosyllable word to the child, and the child has to break the word into phonemic units comprising the consonant and its corresponding diacritic (usually a vowel sign at this stage), and then phonemically “pasting” or pronouncing these phonemic units together, resulting in a complete pronunciation of the word. This strategy is then used to decode words made up of two and three syllables. This technique may also be referred to as “sounding-out” phonemic units. This fosters development of phonemic awareness. The teaching methods employed in Grade 2 include those employed in Grade 1. Typically, there is a continual revision from year to year of previously learned information. For example, from Grades 1 to 3 children continue to revise the different forms of the letters they have learned, and their short and long vowels. In Grade 2, however, there is greater emphasis on word reading by “cutting and pasting” or by “sounding-out” letters and their corresponding diacritics. That is, word recognition and reading in Grade 2, compared to Grade 1, is accomplished by greater phonological awareness, and greater use of letter–sound correspondences and phonological decoding, and is less “off-by-heart”. This is further developed by encouraging children to write (i.e., generate) rather than copy words, and by the use of listening comprehension tasks. In addition, children in Grade 2 are exposed to new diacritic signs, such as the ‘Tashdid’ that helps to differentiate between phonologically similar letters.

In Grades 4 and 5, children practice reading aloud short passages individually and in groups, and are required to answer comprehension questions regarding these passages. Activities typically draw on the children’s reading or word recognition, comprehension, and listening skills. Grade 5 students also begin to learn about
adjectives. Activities may include categorizing a list of words into adjectives, nouns, and proper nouns, generating sentences that consist of a noun and adjective and other activities that develop the children’s ability to read and write using these words. In Grade 5, instruction is provided regarding adjectives and rules that determine precise grammatical inflections and construction of words and sentences. Most Grade 5 students are generally able to read and comprehend full passages and stories fairly well.

**Biliteracy and Biscriptality:**

An increasing number of people are learning to read and write in more than one language, often having scripts that are quite dissimilar. Biliteracy has its own consequences, in terms of the involved cognitive processes. Several researchers have documented the influence of reading and writing in one script on the acquisition and operation of literacy in another script. Although first and second language [L₁ & L₂ ] interaction and transfer have been researched , most studies have dealt with adult readers of L₁ learning an L₂ (Wade-Woolley & Geva, 1999; Hatta, Kawakami & Tamaoka, 1998; Muljani, Koda & Moates, 1998; Bebout, 1985). A few studies have been done on the concurrent development of speech and literacy skills in more than one language (Padakannaya, Rekha, Vaid & Joshy, 2002; Arab-Moghaddam & Senechal, 2001; Geva & Siegel, 2000; Geva, Wade-Woolly & Shany, 1993). Cross linguistic comparisons are necessary to assess whether the models of literacy acquisition developed for English generalize to other languages. In most of studies, however, alphabetic scripts compared were similar (e.g., English, French, or Spanish), but much less work has been done on learning to read and write in two alphabetic scripts that differ drastically like English and Persian.

**Dyslexia, reading and spelling difficulty**

Dyslexia is a word of Greek origin. It begins with a prefix that means impaired. Its base word means word. Individuals with developmental dyslexia exhibit impairment in word-level processes in written language, that is, in oral reading and
written spelling. However, their verbal comprehension or listening comprehension is spared. Once they learn to read words they can usually understand reading material (Berninger, 2006). More than three decades of research in English speaking countries has identified three marker measures that are not oral reading or written spelling per se but tend to be impaired in dyslexics and explain their problems with learning written words: phonological coding, orthographic coding, and rapid automatic naming (RAN) (Berninger, Abbott, Thomson & Raskind, 2001).

A simple check in the Medline database (http://www.ncbi.nlm.nih.gov) shows that about two-thirds of all publications on developmental dyslexia since 1998 have came out of English-speaking countries (US, UK, Australia, Canada, and New Zealand). Given the dominance of research using the English language, it is of great importance to know whether dyslexia is the same in countries that use different languages (Ziegler & Goswami, 2005). The ideal research design would be to give dyslexic children who are learning to read different languages the same reading tests with highly comparable linguistic material while also ensuring that participants had been matched for other potentially important variables such as age, vocabulary development, and general intellectual ability. Unfortunately, only very few studies have met these strict criteria (Frith, Wimmer, & Landerl, 1998) and they produced slightly conflicting results. The neuroimaging studies suggest a universal basis for dyslexia, whereas the behavioral studies suggest that the nature and prevalence of dyslexia might differ between orthographies (Landerl et al., 1997a). As concerns the origin of developmental dyslexia, the most unifying hypothesis suggests that dyslexic children have specific impairments in representing, storing, and retrieving phonological information (i.e., the phonological deficit hypothesis, see Snowling, 2000; Wagner & Torgeson, 1987). Because reading acquisition requires the child to learn the mapping between orthography and phonology, problems in the representation and use of phonological information inevitably lead to problems in reading acquisition (Bryant & Goswami, 1990).

The current definition of dyslexia recommended by the International Dyslexia Association is unexpectedly low accuracy and/or rate of oral reading or spelling of neurobiological origin. Nevertheless, many diagnosticians and interventionists continue to focus only on the reading and not on the spelling problems of dyslexics.
Dyslexia is typically thought to be a reading disorder. Students with dyslexia may also have significant problems in writing skills that require assessment and instructional intervention.

There are shared representations that underlie reading and spelling skills. Katz (1989) suggested that the spelling process demands mapping phonological units into orthographic units, which is the opposite of the reading process. However, Curtin, Manis, and Seidenberg (1999) suggest that the spelling process involves shared efforts of some sources that also motivate the readers’ reading skills. The spelling process is a complicated process at a higher level than reading, because there is always one way to pronounce one phoneme, but there is sometimes more than one phonological representation for a phoneme. Thus, spellers need their orthographic lexical knowledge to ensure correct spelling. Readers may also rely on partial orthographic knowledge of those words in the text while reading, i.e., context of text, in order to reach exact pronunciation of phonemes (Siegel, 1988). Accordingly, the spelling process demands awareness of orthographic units more than the reading process itself and the unskilled speller faces problems in retrieving the specific orthographic unit of the specific word. According to Steffler (2001), retrieving the specific orthographic unit is a matter of implicit memory skill that develops as a result of exposure to written verbal messages that constitute the basis of acquiring and developing the orthographic units of words in the memory. According to these reading models, the textual stimulus, orthographic units trigger the stored orthographic lexicon (Ellis, 1993).

According to the reviewed literature, the spelling skill is well developed if reading has developed naturally. This enables readers to acquire orthographic knowledge about words. Siegel (1988) explains the spelling process through the dual route model. He argues that the spelling process is developed through two different channels. First, the phonological where children learn how to represent sounds of words in letters, how to translate the phonemic codes to graphemic codes; the second involves direct lexical access without phonological intervention. The main conclusion of Siegel (1988) is that children learn to spell using phonological and orthographic strategies, namely skilled spellers use phonological as well as visual codes effectively in the process of spelling. Consistently, Snowling (2000) assumes that there is a
compensation process between different sources of orthographic knowledge, reading and spelling. Dyslexic children who suffer from low phonemic awareness fail to make it to the orthographic stage (Frith, 1985) and tend to develop dysgraphia in spite of their ability to acquire some alphabetical spelling skill. Temple (1986) distinguishes between two types of dysgraphia. In the first type, phonological dysgraphia, children spell real words correctly and fail to spell pseudowords correctly. The explanation for this type of dysgraphia is the natural conservation of the lexical access while the spelling phonological route is deficient. The second type is surface dysgraphia in which children write phonetically but with the incorrect orthographic structures, and also fail to write homophonic words. According to Temple (1986), the explanation for this type of dysgraphia is natural phonological development while the spelling-lexical access is deficient. From one side universal theory of dyslexia predicts that phonological deficits are very similar for dyslexics in different scripts and from the other side different writing systems show different and unique linguistic characteristics that affect the reading and spelling process in different languages. Reading and spelling error analysis contributes essential knowledge to understanding the cognitive strategies that children use in doing reading and spelling assignments.

**Objectives and Overview**

The present study was designed with a broad-based set of goals. It was planned to throw open new avenues for research work in Persian in three major areas and accordingly, the work was planned and carried out in three parts as below:

a) Part one was a study on reading acquisition in Persian primary school children in hope of shedding light on the cognitive processes involved. It was also aimed at providing insight into the strategy used by Persian students in reading Persian orthography.

b) Part two attempted to examine children's relative reliance on phonological and orthographic skills in early Grades of reading and spelling Persian and English, within and across orthographies. In other words it was conducted to examine whether children rely on similar skills when reading and writing in languages that differ in orthographic complexity. The differences in using
orthographic and phonological processing strategy while dealing with two divergent scripts were examined.

c) Part three was planned to investigate reading and spelling error patterns among Persian children with developmental dyslexia and compare that with the errors exhibited by reading-level matched and age-matched control groups.

The specific objectives of each phase of the study, including the research questions and hypotheses will be stated in the relevant sections.