Cognitive processes of learning to read in Persian orthography

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Abstract

Persian orthography, an alphabetic system, is unique in certain ways. The aim of the present study was to look for evidence for transition from a phonological-recoding phase to an orthographic phase as a developmental phase in Persian reading acquisition. One hundred and twenty primary school children were given special lists of words and non-words for reading and their performances were analyzed. The results suggested that the Persian children learning to read Persian do go through the stages of using phonological recoding strategy and then, move on to adopt orthographic strategy.

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1. Introduction

There are several theories on reading development, which explain the acquisition process in terms of successive stages or phases. The notion behind stages theories entails the idea that children pass through a developmental sequence in a fixed order. These stages are characterized by the specific strategies children use as evidenced by the types of error they make. The most popular theories of stages in reading acquisition are given by Marsh, Friedman, Welch, and Desberg (1981), Frith (1985), Ehri (1980, 1992a, 1992b, 1995), and Harris and Coltheart (1986). These theories are not radically distinct from each other. In fact, all of them do speak a sort of global, analytic and synthetic kind of stages occurring in that sequence during one’s literacy acquisition process. Since the present paper uses the terminologies used by Harris and Coltheart (1986), a brief account of their model is given below.

Harris and Coltheart Theory: Harris & Coltheart (1986; see also Jackson & Coltheart, 2001) proposed a general model of learning to read. According to the model children go through a sequence of three phases in becoming skill readers: (a) discrimination-net phase, (b) phonological recoding phase, and (c) orthographic phase.

In discrimination-net phase, children develop a set of sight vocabulary of words they can recognize. These are the words commonly referred to as their “reading words” and are often pasted up around the classroom. The children view reading as a discrimination task of recognizing known word among several ones largely on partial orthographic cues. For example, children may read all words and non-words of comparative length with double /l/ as ‘yellow’. In phonological recoding phase, children develop the skill of employing phonological recoding strategy to decode print

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into speech. This enables children to attempt reading any words/nonwords using grapheme-phoneme correspondence rules that they were not aware of in the previous phase. The strategy capitalizes on the auditory vocabulary already acquired in understanding the written words. However, this efficient strategy of decoding is not as fast as visual recognition of words. In addition, phonological recoding strategy is not efficient enough to deal with homophones and irregular words. In order to overcome these limitations children move on to adopt orthographic strategy that allows them to directly recognize printed words as orthographic wholes (taking spelling into consideration).

**Persian writing system:** Persian or Farsi is the official language of Iran. It has an alphabetic script with 32 letters denoting 30 phonemes including vowels. Persian is written from right side of the page to left. It has a very regular grapheme to phoneme correspondence and each grapheme has a single pronunciation that remains consistent in all kinds of words. Many of Persian graphemes are distinguished by diacritic marks and dots (which result in phonemic changes). For instance, one can notice the differences between graphemes /k/ and /g/ (/گ/ and /ـگ/) or /ch/ and /j/ (/چ/ and /ـچ/). The diacritics are smaller than letters. Most of the letters are joined while writing by hand. But the diacritics are never joined to any other letter or diacritic marks of another letter. Persian has six vowels: three long (/aː/, /iː/, and /uː/) and three short (/a/, /e/, and /o/) vowels. Long vowels have independent graphemic representation while short vowels are not shown in normal Persian print. However, the three short vowels are represented by separate diacritic marks (placed above or below the consonants), which are used only for the beginner readers. Skilled Persian readers are accustomed to reading script without those vowel diacritics; much like reading vowel-free Hebrew script. They read and interpret such words by using alternative sources of knowledge such as sequence of graphemes and context. One to many phoneme-grapheme correspondence in certain cases, however, pose some problems for spelling words with such phonemes (for example, phoneme /s/ is represented by /س/ and /ـس/; graphemes, phoneme /z/ is represented by /ض/ and /ـض/). However, there have not been many studies in Persian on reading processes or dyslexia (see Ahmad Panah & Padakannaya, 2007, 2008a, 2008b).

The objective of the present study was to empirically demonstrate the transition stage of children progressing through phonological recoding stage to orthographic stage. We hypothesized that the school children would be successful in reading different types of Persian transparent nonwords (with vowel diacritics) by applying phonological recoding strategy. Older children in higher grades were expected to show better performance due to their greater knowledge of letter-sound correspondence rules. However, older children were expected to take more time for reading familiar words which had a nonconventional consonantal form (as previously mentioned, consonants in Persian are written differently depending on whether the consonant appears in initial, medial or end position of a word) at the initial position of the word if they were relying on orthographic strategy. The speed of processing such words by younger children, still in phonological recoding stage, should not be affected so adversely. There has not been any previous study directly addressing this question to the best our knowledge.

### 2. Method

**Participants:** One hundred and twenty primary and secondary school children from Tehran, Iran participated in this study. There were 30 children each from grade levels 3 (mean age = 102 months), 4 (mean age = 114 months), 5 (mean age = 126 months), and 7 (mean age = 138 months). There were equal number of boys and girls from each grade level. All children were native speakers of Persian. The medium of instruction was Persian in all the schools selected. It may be noted that Persian schools do not have grade level 6 (children get promoted from Grade 5 to Grade 7). Formal consent was obtained by parents of the children prior to selecting them as participants.

**Tests:** Three lists of stimuli, specially constructed by the investigator for the present study using certain criteria were used. List 1 consisted of twenty nonwords with vowel diacritics. List 2 also consisted of twenty nonwords with vowel diacritics but removal of which would result in normal consonantal words. List 3 consisted of twenty common words in which the first letter was written in its medial word-position form. Thus these words were orthographically illegal while phonologically acceptable. Care was taken to see that the stimuli across lists were comparable with regard to length and complexity.
**Procedure:** Participants were tested individually on the three lists described above by asking them to read them out. Participants were made to sit comfortably and approximately 60 cm away from the experimenter while testing. They were instructed to read out the list clearly as fast as possible. Verbal responses were recorded on an audiotape. The order of presentation of the lists was randomized across subjects. Auto correction was allowed while reading. Testing sessions were of approximately 30 minute duration per participant.

**Scoring:** Each word/nonword correctly read was given a score of ONE. Thus the maximum score possible for each of the lists was 20. However, for the list 3, the total time (in seconds) taken to read was also noted down.

### 3. Results

Univariate *ANOVA* followed by Duncan’s post-hoc test was employed for analyzing the results on each of the lists employed. Table 1 presents mean and SD values obtained for Grades 3, 4, 5 and 7 on lists one and two. The results of the one-way analysis indicated that the mean differences between Grades in reading accuracy were significant \[F(3, 116) = 77.893, \ p < 0.05\]. The results of post-hoc test (Duncan) revealed that all mean comparisons were significant at \(p < 0.05\) level. There was also a significant difference in the mean reading accuracy scores for Grades on List 2 \[F(3, 116) = 126.776, \ p < 0.05\]. The results of post-hoc test (Duncan) showed that all mean comparisons were significant at \(p < 0.05\) level.

![Table 1](image1.png)

Of List 1 were significant \(F(3, 116) = 77.893, \ p < 0.05\). The results of post-hoc test (Duncan) revealed that all mean comparisons were significant at \(p < 0.05\) level. There was also a significant difference in the mean reading accuracy scores for Grades on List 2 \(F(3, 116) = 126.776, \ p < 0.05\). The results of post-hoc test (Duncan) showed that all mean comparisons were significant at \(p < 0.05\) level.

![Table 2](image2.png)

Table 2 presents reading accuracy and reading speed means for different Grades on list 3. Table 3 represents the results of one way *ANOVA* on accuracy scores of the list. The results indicated that there was no significant difference in reading accuracy scores across the grades \(F(3, 116) = 1.927, \ p > 0.05\). Table 4A represents the results of one way *ANOVA* on reading speed measure for the list followed by the summary of multiple comparisons among the means depicted in Table 4B. The results revealed that there was a significant difference across the Grade levels \(F(3, 116) = 132.5, \ p < 0.001\). Further, the results of Duncan’s test showed that the mean scores of grades 4 and 5 were significantly different from Grade 3 as well as Grade 7.
Table 3. Summary of One-way ANOVA comparing reading accuracy across grades on List 3

| Source                | df | MS   | F    | Sig. |
|-----------------------|----|------|------|------|
| Between grades        | 3  | 0.322| 1.927| 0.129|
| Within grades         | 116| 0.167|      |      |
| Total                 | 119|      |      |      |

Table 4 A. Summary of One-way ANOVA comparing grades reading speed on List 3

| Source                | df | MS   | F    | Sig. |
|-----------------------|----|------|------|------|
| Between grades        | 3  | 55.475| 132.5| <0.001|
| Within grades         | 116| 0.419|      |      |
| Total                 | 119|      |      |      |

Table 4 B. Summary of Duncan’s Multiple Range Test

| Grades | N   | Subset for alpha= 0.05 |
|--------|-----|------------------------|
|        | 1   | 2         | 3         |
| Three  | 30  | --        | 60.53     |
| Four   | 30  | 57.63     | --        |
| Five   | 30  | 57.67     | --        |
| Seven  | 30  | --        | 58.53     |
| Sig.   | 0.997| 1.000    | 1.000     |

4. Conclusion and Discussion

The results of the present study, as expected, showed a gradual and significant improvement over different grade levels on reading accuracy scores of all the lists used (refer to the $F$ values obtained). It may be noted that the overall performance of the group was best on List 3, followed by List 1 and List 2. The superior performance on List 3 over the other two could be ascribed to the general advantage of lexicality (words over nonwords). Between the Lists 1 and 2, the List 2 had a disadvantage probably due to the fact that those nonwords constituted real words wrongly vowellized, some of which the children were likely to have seen before. This might have had some kind of inhibition effect on processing those nonwords resulting in slightly lower performance as compared to the List 1. The better performance of older children in reading scores also indicated their superior mastery of phonologically mediated strategy of reading. However, a careful examination of the results on the List 3 reveals the gradual shift towards orthographic strategy taking place in the older children. An inspection of the Table 2 shows that the scores on word reading in List 3 increased over the grades, though the improvement was not statistically significant (see Table 3). On the other hand, the time taken for reading by different graders follow a ‘V’ shaped curve. The time
taken by the children in Grade level 3 was the highest, which reduced significantly at grade levels of 4 and 5 (see Tables 4A and 4B) only to increase significantly again at Grade level 7. Obviously, the children at grade level 3 were still poor in reading as their performance on reading nonwords as well as the speed of reading was significantly inferior to higher grade children. They could still be in the stage of mastering phonological mediation strategy of reading. On the other hand, children at grade level 7 scored high on accuracy in all the lists but in terms of the time taken for reading their performance was significantly poorer than that of grade levels 4 and 5. This could only happen due to some kind of interference. Our interpretation is that the students at grade level were moving away from the strategy of reading through phonological mediation (after mastering it as evidenced by perfect scores on reading accuracy of nonwords) and were in the stage of developing orthographic strategy by which one could process the word at lexical level without breaking that into phonology. However, the nonconventional visual form of the first consonant in List 3 words, though phonologically accurate, was coming in their way of processing the word visually. Hence, some kind of verification process or delayed fall back on phonemic mediation must have resulted in taking significantly longer time for reading. Becoming a skilled reader of Persian, as probably observed in children of Grade level 7, involves adopting a whole-word reading strategy. A whole word strategy, however, suffers when words are presented in orthographically unfamiliar form (such as in List 3).

Thus the present study has been able to capture successfully the scenario of shifting strategy from phonemically mediated one to visual orthographic one by observing the reading performance of Persian children. The results of the present studies are complimentary to the study reported by Ahmad Panah and Padakannaya (2008b), which dealt with how Persian children go through these different stages of reading in their normal acquisition of reading skill.

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