

Spelling Errors Made By Persian Children With Developmental Dyslexia

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Abstract

Background: According to recent estimates, approximately 4% - 12% of Iranians experience difficulty in learning to read and spell, possibly as a result of developmental dyslexia.

Objectives: The study was intended to investigate spelling error patterns among Persian children with developmental dyslexia and compare those patterns with the errors exhibited by control groups.

Patients and Methods: Some 90 students participated in this study. There were 30 fifth grade students who had been diagnosed as dyslexic by professionals, 30 normal fifth grade readers, and 30 younger normal readers. There were 15 boys and 15 girls in each of the groups. Qualitative and quantitative methods for the analysis of errors were used.

Results: This study found similar spelling error profiles among the dyslexic students and the reading-level-matched group, and these profiles were different from those of the age-matched group. However, the performances of the dyslexic group and the reading-level-matched group were different and inconsistent in some cases.

Conclusions: However, performances of dyslexic group and reading level matched group were different and inconsistent in some cases.

Keywords: Spelling, Errors, Developmental Dyslexia, Persian

1. Background

The literature review encompassed reading and spelling developmental studies involving dyslexic readers that were published in the English language. Although some researchers believe that dyslexia in all the alphabetic languages shares the same cause, namely a deficit in phonological decoding, still other researchers consider that studying dyslexia in different orthographies may contribute significantly to understanding the reading process in these languages and dyslexia in general (1-4). This notion has prompted researchers to study different orthographies in order to learn more about the reading and spelling processes in these languages as compared to the known results concerning the English language (5). No empirical epidemiological study has yet been conducted to estimate the incidence of reading difficulties and dyslexia across the Iranian population; thus, the incidence of reading disabilities could only be estimated indirectly. According to recent estimates, approximately 4% - 12% of Iranians experience difficulty in learning to read and spell, possibly as a result of developmental dyslexia (1). This estimate shows that the reading disorder is relatively common and therefore incongruent with predictions made on the basis of consistent

grapheme-to-phoneme correspondence in the Persian language.

2. Objectives

This study was intended to investigate spelling error patterns among Persian children with developmental dyslexia and compare those patterns with the errors exhibited by reading-level-matched and age-matched control groups.

3. Patients and Methods

3.1. Participants

Some 90 students participated in this study. Of these 90 participants, there were 30 fifth grade students who had been diagnosed as dyslexic by professionals, 30 normal fifth grade readers (chronological age-matched control group), and 30 younger normal readers (reading-level-matched control group). The two control groups were also matched on gender, socio-economic status, and general ability with the dyslexic group. There were 15 boys and 15 girls in each of the groups.

3.2. Screening Tests

3.2.1. General Ability Test

It is essential to match the control groups to the experiment group in terms of general ability and to confirm that the general ability of the participants in the three groups is comparable and falls within the norm. For this purpose, the Raven-R test (Raven, 1959), which has been adapted for Persian children, was used.

3.2.2. Text Reading

The reading accuracy of the participants was measured using reading texts from the third and fifth grade basal readers. This was done in order to determine the reading level of the participants.

3.2.3. Word Reading

A 40-word reading list from the appropriate basal reader (i.e., third grade or fifth grade) was presented to the participants in order to determine their reading level.

The baseline characteristics of the dyslexic students and the control children are presented in Table 1. There was no significant difference between the dyslexic students and the age-matched control group in terms of the general abilities (Raven-R) test. However, the differences in the reading accuracy test results were statistically significant. The age-matched group demonstrated skilled reading of the texts and isolated words appropriate for their age. Although the reading level of the dyslexic students did not match their chronological age, it did match the group reading level of young third grade readers. The age-matched group differed from the reading-level-matched group with regard to the general ability tests. Thus, we can determine that the dyslexic group mirrored the age-matched group on all the measures, except for the reading measures, while the dyslexic group mirrored the reading-level-matched group only in terms of reading level (Table 1).

3.3. Testing Tools

All of the spelling tests consisted of non-word and word elements.

3.3.1. Nonword Spelling

Three lists of Persian nonwords (twenty items each) were used:

- List 1 consisted of twenty nonwords with vowel diacritics.
- List 2 consisted of twenty nonwords, again with vowel diacritics, although the removal of the vowel diacritics would result in normal consonantal words.
- List 3 consisted of twenty consonantal nonwords without any vowel diacritics.

3.3.2. Word Spelling

Two lists of Persian words (twenty items each) were used:

- List 4 consisted of twenty real, albeit low frequency, words. These words were unlikely to have been seen by the children before and therefore still constituted nonwords.
- List 5 consisted of twenty common or high frequency words involving all the characteristics of the Persian writing system.

3.4. Procedure and Scoring

The testing was conducted in a quiet room at the schools. The testing took place during the regular school day. The spelling tasks were given to groups of four students at a time. The investigator gave sheets of ruled paper to the children and then instructed them to write down, as accurately as they could, each word that the investigator said aloud. Each word was enunciated twice, clearly, by the investigator. The children were scored for their correct spelling of consonants and vowel diacritics. Both qualitative and quantitative methods were employed in the data analysis. In the quantitative analysis, each correctly spelled word/nonword was given a score of ONE. Thus, the maximum score for each of the lists was 20. The qualitative analysis of the participants' spelling performance was conducted on the basis of error categories developed for that purpose (based on previous studies). In addition, the spelling errors were grouped according to common categories, keeping in mind the unique characteristics of Persian orthography.

Table 1. Mean Results of the Three Groups for the General Ability and Reading Tests

Groups	Raven-R	Reading Accuracy (Text) Third Grade Level	Reading Accuracy (Isolated Word) Fifth Grade Level	Reading Accuracy (Text) Fifth Grade Level
Reading-matched	31.75 ^a	98.33	11.97	64.27
Dyslexics	45.80	98.33	11.97	64.30
Age-matched	45.96	NA	19.53 ^a	98.10 ^a

Abbreviation: NA, not available.

^ap < 0.001.

The spelling errors identified were:

- 1) **Phonetic errors (6):** This type of spelling error is made when the writer is unable to translate the specific phonemes of a certain word to graphemes.
- 2) **Semiphonetic errors (6):** This occurs when the orthography of a word does not represent the target word phonologically because of a lack of internal specific representation. However, the major orthographical-phonological chunk of the word is preserved. Such errors are caused by omitting, adding, and substituting phonemes.
- 3) **Dysphonetic errors (6):** This type of error occurs when the words are spelled incorrectly in more than one phoneme and when the spelled orthographic chunk does not represent most of the phonemes of the target words. Effectively, there is no correct grapheme-phoneme correspondence and no internal lexical representation.
- 4) **Visual letter-confusion errors:** These spelling errors were due to the children being confused between the

similar visual shapes of letters.

5) **Word omission or refusals:** Such errors occur when the children omitted whole words or due to the non-reaction of readers who failed to tackle new and unfamiliar words and so resorted to guessing strategies.

6) **Polygraphic errors (7):** These spelling errors were caused by the children being confused between the different visual shapes of some phonemes with regard to the characteristics of the Persian writing system. As already mentioned, there are several letters in the Persian alphabet that refer to a single phoneme.

7) **Writing as real words:** These errors are the result of the misspelling of words, which occurs when a speller substitutes phonemes while relying on visual orthographic guessing.

4. Results

4.1. Qualitative Analysis Results

Table 2. Frequency of the Groups' Spelling Error Types on List One

Groups' Spelling Error Type	Reading-Matched	Dyslexic Students	Age-Matched
Semiphonetic errors	40	55	12
Dysphonetic errors	24	25	3
Visual letter confusion	33	69	2
Phonetic errors	156	191	54
Polygraphic errors	NA	NA	NA
Word refusal or omission	9	10	2
Word substitution	20	23	3
Written as real words	NA	NA	NA
Total	282	373	76

Abbreviation: NA, not available.

Table 3. Frequency of the Groups' Spelling Error Types on List Two

Groups' Spelling Error Type	Reading-Matched	Dyslexic Students	Age-Matched
Semiphonetic errors	16	19	5
Dysphonetic errors	3	4	2
Visual letter confusion	7	43	0
Phonetic errors	232	217	65
Polygraphic errors	NA	NA	NA
Word refusal or omission	3	7	0
Word substitution	3	27	1
Written as real words	9	6	1
Total	273	323	74

Abbreviation: NA, not available.

Table 4. Frequency of the Groups' Spelling Error Types on List Three

Groups' Spelling Error Type	Reading-Matched	Dyslexic Students	Age-Matched
Semiphonetic errors	40	23	11
Dysphonetic errors	27	15	6
Visual letter confusion	35	52	0
Phonetic errors	40	51	26
Polygraphic errors	NA	NA	NA
Word refusal or omission	3	4	0
Word substitution	12	14	0
Written as real words	9	10	0
Total	166	169	43

Abbreviation: NA, not available.

Table 5. Frequency of the Groups' Spelling Error Types on List Four

Groups' Spelling Error Type	Reading-Matched	Dyslexic Students	Age-Matched
Semiphonetic errors	45	42	22
Dysphonetic errors	26	23	7
Visual letter confusion	33	55	20
Phonetic errors	103	116	84
Polygraphic errors	182	188	125
Word refusal or omission	4	5	0
Word substitution	5	7	0
Written as real words	0	0	0
Total	398	436	258

Table 6. Frequency of the Groups' Spelling Error Types on List Five

Groups' Spelling Error Type	Reading-Matched	Dyslexic Students	Age-Matched
Semiphonetic errors	0	2	
Dysphonetic errors	0	0	0
Visual letter confusion	2	2	0
Phonetic errors	2	2	0
Polygraphic errors	20	19	1
Irregular spelling rules	9	11	1
Word refusal or omission	0	0	0
Word substitution	0	0	0
Written as real words	0	0	0
Total	33	36	2

4.2. Quantitative Analysis Results

Table 7 presents the one-way ANOVA results of the three groups' scores for the different lists. The results indicate a significant difference between the three groups. The results of the Duncan post-hoc comparisons between the dyslexic, reading-level-matched, and age-matched

groups indicate a nonsignificant difference between the dyslexic group and the reading-level-matched group. However, the differences were statistically significant when the dyslexic group and the reading-level-matched group were compared with the age-matched group.

Table 7. One-Way ANOVA Comparing the Groups' Spelling Accuracy on Different Lists

Between Groups	df	F	P Value
List one	2	376.330	0.000
List two	2	764.822	0.000
List three	2	327.295	0.000
List four	2	373.153	0.000
List five	2	24.840	0.000

5. Discussion

The results of this study indicate approximately similar spelling error profiles among the dyslexic students and the reading-level-matched group, and those profiles were different from those of the age-matched group. However, the performances of the dyslexic group and reading-level-matched group were different and inconsistent in some cases. This could be attributed to the phonological lag that characterizes the reading disabled but not the normal reading-level-matched group. The rate of errors on short vowels was higher in the reading-level-matched group than in the dyslexic group. This may be due to the fact that the remedial education centers in Iran place a great deal of emphasis on reading short vowels. The rate of long vowel errors was almost equal in both groups (8, 9). The most prominent types of spelling errors among the dyslexic group and the reading-level-matched group were errors in vowels, letter substitution (visually and auditory), polygraphic errors, multiple graphemic form errors, and irregular spelling rule errors in nonwords and word spelling lists. The vowel errors indicate that mastery of using the vowels of Persian orthography in their correct place requires more time. Similar vowel error profiles were observed in the reading-level-matched and the dyslexic groups. There could be two possible explanations for this. First, both the dyslexic group and the reading-level-matched younger group still had poor phonological skills. Second, one should note that there is not much difference in the way short and long vowels are pronounced in Persian (even older age-matched children demonstrated some of these errors).

One of the most common spelling errors in the nonword and low frequency real word lists were those related to homophonetic letters (i.e., letter substitution based on sound similarity). The dyslexic and the reading-level-matched groups also showed difficulties in spelling exceptional or irregular words. In other words, they experienced difficulties in applying spelling rules based on lexical writing. According to (10), an unskilled speller faces difficulty in retrieving the specific orthographic structure of the target words. Steffler (11) argues that implicit memory is responsible for the retrieval of the specific orthographic unit and that such a procedure develops through the correct and adequate exposure of the reader to written messages, which constitutes the basis for perceiving the stored

orthographic units in the memory (12). Good spellers rely on their orthographic lexicon as well as their phonological knowledge (13). The other common spelling errors that characterized Persian orthography were related to polygraphic spelling and irregular spellings. Both polygraphic and irregular spelling errors are related to poor visual orthographic skills, which result in inaccurate but phonologically acceptable spellings. There are some phonemes that are represented by more than one grapheme in Persian orthography. Thus, the polygraphic error patterns observed in list four indicate that Persian orthography clearly demands orthographic skills when spelling. The spelling patterns were influenced by the Tehrani dialect. All three groups, especially the dyslexic students and the reading-level-matched group, tended to spell words according to their spoken form and not according to their conventional spelling form. Informal or colloquial spoken Persian is different from the formal language and what is written and read in the formal system. Persian readers, especially unskilled readers, rely more on the phonology of their spoken words (7, 14, 15).

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Footnote

Authors' Contribution: Prakash Padakannaya and Mohammad Ahmadpanah drafted the manuscript. Mohammad Haghghi, Ali Ghaleiha, Leila Jahangard, and Amineh Akhondi performed the analysis and coordination. Marzieh Nazaribadie edited the manuscript.

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