



The Dissociative Effects in Lexical and Non-lexical Reading Tasks for Bilingual Children

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Authors' contributions

This work was carried out in collaborations between all authors. Author RKN designed the study, wrote the protocol and supervised the work. Author NJM performed the statistical analysis, and managed the literature searches. Author AM managed the administration of data collection. He also assisted the first author in providing the materials and tools for this study. All authors read and approved the final manuscript.

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ABSTRACT

The aim of the study is to examine the possible dissociative effects of bilingualism on the complex and cognitively challenging task of reading. The underlying assumption is that there are two paths to reading: the lexical (semantic) path and the non-lexical (phonological) path. Bilingual individuals and monolingual individuals may assign different weights to these routes, preferring in a practical sense one over the other. It is theoretically important to know how bilingualism would function differently with reading tasks based on these two types of cognitive paths. It is also practically important to apply this knowledge as educational support for bilingual children.

The design of the study is three language groups x five school grades x two lexical reading tasks x three non-lexical reading tasks.

In total, 1614 monolingual (Persian) and bilingual (Turkish-Persian and Kurdish-Persian) primary school children (grades 1-5) are randomly included in this study from three different cities (Tehran, Tabriz and Sanandaj) of Iran. They are assessed on two lexical or semantic reading tasks (word reading and word chains) and three non-lexical or phonological reading tasks (rhyming, reading for

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non-pseudo words and phoneme deletion).

The children's response scores are analyzed and the hypotheses are tested at 0.05 level of significance by using the SPSS program. The results show that Persian monolingual children significantly perform better than bilingual children in lexical reading tasks, whereas bilingual children perform better than monolingual children in non-lexical reading tasks (except phoneme deletion task) ($P_s < .001$). The bilingual disadvantage is observed more for Turkish-Persian bilinguals, whereas the bilingual advantage is observed more for Kurdish-Persian bilinguals.

The results of this study support the dissociative effects of bilingualism in reading tasks: Lexical or semantic reading tasks and non-lexical or phonological reading tasks measure different levels of reading skills and are used differently by bilinguals. Similarity/dissimilarity between two languages and language proficiency may also have some impacts on bilingual advantages or disadvantages.

Keywords: Bilingualism; dissociative effects; lexical reading tasks; non-lexical reading tasks; primary school children.

1. INTRODUCTION

The study of bilingualism in cognitive domains has attracted the attention of many researchers and produced highly divergent results. Specifically, bilingualism has been related to two separate outcomes in terms of advantages and disadvantages within different cognitive domains. While the definition of bilingualism varies across studies, the definition used in the present study is the one proposed by Grosjean [1]. By his definition, bilingualism involves the regular use of two (or more) languages, and in particular, bilingual children use two (or more) languages in their everyday lives, typically one at home and another at school.

The traditional view of bilingualism assumes that it has negative effects on cognitive and language development [e.g., 2,3]. Indeed, recent studies have also reported negative effects on vocabulary size [e.g., 4,5], performance on speech-production tasks [e.g., 6,7] and on tasks requiring simple picture naming [e.g., 8,9]. The opposite view, however, has been gaining momentum, and argues that more positive outcomes related to bilingualism exist, e.g., creative thinking [10]; learning strategies [11]; problem-solving [12,13]; and memory [14]. A review of the literature reveals several dissociative findings. For instance, a number of studies have shown that bilinguals outperform their monolingual peers on certain cognitive tasks such as memory [e.g., 15] and executive functioning [e.g., 16,17]. In contrast, other studies have documented poorer performance among bilinguals on memory [e.g., 18] and picture naming tasks [e.g., 8]. Such discrepant findings have often been discussed in relation to the different requirements of various cognitive

tasks because each task relies upon and imposes demands on specific cognitive domains.

More specifically, upon taking a systematic look at our previous studies we discovered a mixed pattern of results on memory performance. According to a study by Kormi-Nouri et al. [14], after matching bilingual and monolingual groups on their socio-economic status (SES), Iranian-Swedish bilinguals were found to have better episodic and semantic memory than monolinguals. Later, while focusing on Iranian bilingual and monolingual children with similar cultural backgrounds but different languages (i.e., Turkish and Kurdish), Kormi-Nouri et al. [15], again found positive effects of bilingualism on these two types of memory tasks. It should be noted that, in both studies, although bilingualism was found to provide an advantage in general, there were also some indicators that bilinguals performed similarly to monolinguals or were even disadvantaged. In a third study of Kormi-Nouri et al. [19], discordant findings were again obtained, as results showed both a bilingual advantage for letter-fluency tasks but a disadvantage for category-fluency tasks. We explained our findings on the basis of the specific characteristics of each cognitive task because letter fluency essentially depends on executive control whereas category fluency is more related to lexical knowledge. Other researchers have presented a similar line of argument with regard to bilingualism's apparently divergent effects on cognition. For example, Bialystok and colleagues, in their series of studies, explored the performances of bilinguals on diverse cognitive tasks with different levels of demands (or difficulty). Their research showed that bilingual children have more advanced metalinguistic concepts than monolingual children for tasks that require high demands for

control, but they perform similarly to monolingual children on tasks based on analysis [20]; metalinguistic judgments [21,22]; and concepts of numbers [23]. They discussed their results in relation to the characteristics of the cognitive tasks: i.e., whether these tasks depended more on analysis of knowledge or on control of processing, such that higher demands for control would increase the difficulty of the task. Along these lines, Cromdal [24] compared Swedish-English bilinguals' and Swedish monolinguals' performances on cognitive tasks that tax metalinguistic skills: namely, symbol substitution, grammatical judgment, and grammatical correction. He arrived at similar results showing divergent effects of bilingualism. He likewise discussed his findings on the basis of the nature of each task (i.e., having its origin in knowledge analysis or in control processing). Oller [25,26] aptly described this pattern of dissociation as one of "bilingual profile effects," which implies that bilinguals show higher performance on some certain tasks but lower performance on others.

Bearing in mind that bilingualism has both advantages and disadvantages; the aim of the present study was to explore dissociative effects in bilingualism by examining another cognitively challenging task, i.e., reading. Reading is a highly complex cognitive task that requires different levels of cognition, both phonological and semantic [27,28]. Occasionally, bilinguals' scores on some measures of literacy tend to be lower than those for monolinguals [e.g., 29-31]. In contrast, some studies have revealed positive relationships between multi/bilingualism and reading, phonological awareness and decoding [e.g., 32-34]. Eviatar and Ibrahim [35] came to some dissociative findings indicating higher performance on phonological awareness tasks and arbitrariness, but lower performance on tasks measuring vocabulary. At the same time, a number of other studies have shown no differences between bilinguals and monolinguals on reading measures [e.g., 36,37].

Reading itself is an underlying cognitive process that involves the decoding of symbols, which relies on the integration of visual, orthographic, phonological, and semantic information [27]. Learning to read depends on three main factors: the lexical store, metalinguistic abilities (phonological, syntactic, lexical awareness, etc.), and cognitive development [e.g., 38]. According to the Dual Route Cascaded (DRC) model [39,40], reading is achieved either via a lexical route, which is mediated by semantic processing,

or via a non-lexical route, which involves the intercession of phonological retrieval. Thus, two distinct, parallel, co-existing channels of access exist within this theoretical structure: a lexical route, which involves retrieving words from a lexicon that already exists in the mind and consumes more semantic material, and a non-lexical (phonological) route, which takes responsibility for the conversion of graphemes to phonemes through applications of grapheme-to-phoneme correspondence rules and retrieval of words as they are uttered. The DRC model has been repeatedly tested, and has faced the challenge of taking both of these routes into account in identifying the word and/or non-word reading of both children and adults [40].

Some types of reading tasks, such as word reading and letter/word chains, which are generally used to identify reading fluency, speed of word recognition, and accuracy and efficiency in reading [e.g., 41-44] are likely to take the lexical route. Word-chain tasks have been suggested to index encoding skills [e.g., 45,46] and to be important predictors of reading comprehension and reading ability in later years [e.g., 47]. Additionally, by presupposing an indirect path between orthography and phonology (with mediation via semantics) on the lexical route, word-reading tasks are able to account for semantic reading [e.g., 48]. Although silent and loud (consonantal vs. vocalic) reading have been also suggested as to have differential lexical processing [e.g., 49]. The non-lexical route is thought to be employed more actively in tasks utilizing the structure of reader's stored phonological representations. Some types of reading tasks, such as deletion of phonemes [e.g., 50] or of rhymes/alliterations [e.g., 51] as well as non/pseudo word reading, which are mainly concerned with basic phonological aspects, would take the phonological route instead [e.g., 52]. Rhymes specifically have been suggested to "lead to develop an awareness of phonemes" [53].

In this study, the question was whether bilinguals and monolinguals act differently with respect to these two types of reading tasks and whether they consequently tend to favor one route over the other. Thus, we were interested in identifying whether, in bilingualism, one group of reading tasks would be preferred over the other rather than both being employed equally. Hence, the aim was to examine whether performance on different reading tasks yielded dissociative effects that could result in cognitive

benefits/costs for bilinguals relative to monolinguals. Theoretically, we wanted to see how bilingualism would act differently with regard to these two cognitive paths in reading. Practically, it will be important to use this knowledge as academic support in educational settings for bilinguals. Usually, in a monolingual education program, phonological (non-lexical) processing would be more the focus of education at the earlier ages of primary schools, whereas lexical (graphemetic) processing would be more the focus of education at the later ages. If bilinguals and monolinguals are different with respect to these two types of reading processes there is a need for change in bilingual education.

Most studies in the fields of bilingualism and reading have especially focused on English (as a first or second language) and on other Western languages. The present work focused instead on Iranian bilingual children in a non-Western society and covered different languages with a shared Persian cultural background. Persian has an alphabetic script, which is a modified version of the Arabic script written from right to left [54,55], in contrast to Western scripts. According to Raymond and Gordon's Ethnologue [56], there are 87 Iranian languages, of which the largest is Persian (Farsi), the main spoken and written language in Iran. Numerous other languages exist, including Balochi, Lori, Turkish and Kurdish, as well as many other common languages specific to distinct Iranian districts. This study focused on Turkish and Kurdish bilinguals who have Persian as their second language, in comparison to Persian monolinguals. In Iran, the official language exclusively used in schools is Persian. Both Kurdish and Turkish are spoken languages that have certain phonetic and structural morphological similarities to Persian. Kurdish and Persian are more similar in certain linguistic respects, such as phonology, morphology and syntax, and Persian and Turkish are less similar [57]. Bialystok, Majumder, & Martin [58] suggested that similarity between languages can be advantageous for bilinguals in terms of reading in their second language. Further, Ringbom [59] reported that Finnish children who could speak Swedish performed better at reading in English than Finnish children who did not know Swedish. This is a logical result because Swedish has a greater proximity to English than to Finnish.

Grade (school year level) was also examined in the context of bilingual/monolingual groups and

reading tasks. It is now well-documented that older bilingual students in higher grades are more likely to be language-proficient than their younger counterparts, a finding that highlights the important role of academic schooling and literacy instruction [e.g., 60,58,19].

The first goal of the present study was to investigate whether bilinguals and monolinguals would handle diverse tasks of lexical and non-lexical reading differently. To examine lexical reading, word reading and words-chain tasks were employed; since they have been suggested to reflect encoding skills and used to examine reading fluency and comprehension with and without articulation. To examine non-lexical reading, we used non/pseudo-word reading, rhyming and phoneme deletion tasks which mostly involve with phonological representations. By this strategy, we were able to see where advantages and disadvantages would mostly appear in terms of bilingualism. The second goal was to investigate whether these bilingual advantages or disadvantages differed according to other theoretically relevant variables, such as language similarity, and school grade.

2. MATERIALS AND METHODS

2.1 Participants

The sample consisted of 1614 students from primary schools (770 boys and 844 girls). This included 582 students (255 boys and 327 girls) from Tehran (a monolingual area), 513 students (260 boys and 253 girls) from Tabriz (a Turkish-Persian bilingual area), and 519 students (255 boys and 264 girls) from Sanandaj (a Kurdish-Persian bilingual area). A total of 70 elementary schools (both public and private) were randomly selected from different districts (north, south, and central) in the three cities: 30 schools in Tehran, 20 in Tabriz, and 20 in Sanandaj. Geographical districts and school types were selected to foster the matching of children in relation to their SES in these three cities.

The bilingual (Kurdish-Persian and Turkish-Persian) and monolingual (Persian) children were selected from each of five grades (1-5) from primary schools in the Iranian educational system at the time of the study. Iranian children normally start the primary school at the age of 6, and the participants' ages varied among 7-12 years of old. It should be noted that the participants were selected at the end of each

academic grade. All children had Iranian parents. The Turkish-Persian and Kurdish-Persian bilinguals spoke exclusively Turkish or Kurdish at home with their parents, but they received their academic education exclusively in Persian. All monolinguals spoke Persian both at home and at school. This was confirmed by both parents, and teachers. Otherwise, the children were excluded from the study.

2.2 Procedure

Each participant was tested individually by a trained test leader. The tasks were conducted in Persian (the official language in Iranian schools and the educational system) for all the bilingual and monolingual children. Whenever necessary, instructions were also given to bilingual students in their first language (either Turkish or Kurdish) to ensure that everyone understood the instructions. This was especially the case for bilingual children in Grade 1 and 2 since they had Persian instruction at school for only 1-2 years and were probably in more need of using their first language. The task order was counterbalanced across children. The responses were tape-recorded and transcribed by the test leaders. The entire test lasted approximately 30 minutes.

2.3 Materials

Five tasks (two lexical reading tasks: word reading and words-chain as well as three non-lexical reading tasks: rhyming, non/pseudo-words reading and phoneme deletion) were used to measure the children's reading abilities.

2.3.1 Word reading

The children were asked to read totally 120 meaningful words aloud as accurately and rapidly as possible during a limited period of time (9 min). The Persian words with different frequencies (40 items per type) of use [low (of less than 20% frequency of use); e.g. /KAFGIR/spatula, medium (30-50%); e.g., /SARDARD/headache and high frequency (more than 50%) e.g., /BINI/nose] were used. The words were selected from a normative database of words produced by similar groups of children [19]. Scoring was based on the total number of correctly read words in 9 minutes (3 min × 3 lists) [e.g., 61,62,43]. The Cronbach's alpha of this test was .97.

2.3.2 Word chains

This task consisted of total number of 50 chains (of words). Words were selected from items (Persian words) used in Kormi-Nouri et al. [19] study (e.g., GHASHOGHYADSINIESPANIA; in English: spoon/mind/tray/Spain), SEFIDSHALVAROTOBUS; in English: white/trousers/bus). For each chain, 3 or 4 meaningful Persian words were presented, and the children were asked to separate out the actual meaningful words using a pencil without any need to read them aloud. The chains were constructed to have clear boundaries and consisted of a large proportion of high-frequency words. The number of chains marked correctly in 2 minutes was recorded for each subject [e.g., 63,62]. The Cronbach's alpha of this test was .95.

2.3.3 Rhyming

In this task, participants had to determine whether a target word matched other words according to a predefined rhyming rule [e.g., 62, 64]. The rhyming task consisted of 20 words, selected from those used in the Kormi-Nouri et al. [19], study and was limited to 2 minutes. For each target word (e.g., Nima), 3 alternatives (e.g., Shima, Homa, and Hava) were available, but only one of them was the desired answer. The target words were read aloud by the test leader, and the children responded orally. All responses were recorded by the test leader on written forms. The Cronbach's alpha of this test was .89.

2.3.4 Reading for non-pseudo words

The children read a mixed list of 20 pseudo words (e.g., SHEFID as following the same phonological and orthographic principle as for the word: SEFID (in English: white) and of 20 non-words (e.g., MISA, DASHAN; as not confirming the rules and principles of the Persian language and not simulating a certain phonological representation of an actual Persian word) from right to left and top to bottom. Words were selected for the task so that none referred to any meaningful words in the other two languages. The children were told not to focus on the meanings of the words, but to just try to read loudly them as they appeared. The items which were read correctly as expected, were allocated score 1 otherwise they were given score 0. The total number of correctly read items was considered as the total score. The task was

limited to 2 minutes [e.g., 61,62]. The Cronbach's alpha of this test was .97.

2.3.5 Phoneme deletion

In this task, the test leader presented 30 words orally, which then had to be pronounced while eliminating a target sound [65,66]. For example, "Say AHAN, without /A/." The missing sounds could occur at different places in the words, i.e., at the beginning (e.g., "A" in /AHAN/), middle (e.g., "M" in /ALMAN/), or end (e.g., "AS" in /GILAS/). For each child, the number of successful responses produced in 2 minutes was recorded. The Cronbach's alpha of this test was .95.

3. RESULTS

3.1 Word Reading

The means and standard deviations for this word reading task for the three groups of bilingual and monolingual children are shown in Table 1. Since there was the same pattern of data for different types of word frequency it was not included as a factor in the analysis and we analyzed all words together and the means of all items are presented in the Table 1.

A 3 (Group) × 5 (Grade) ANOVA was performed on the data presented in Table 1, with both

variables as between-group variables. The ANOVA showed a main effect of group, $F(2, 1590) = 33.47$, $Mse = 363.09$, $p < .001$, $\eta^2 = .04$. A Tukey post-hoc test showed that the scores on the word-reading task were significantly higher for Persian monolinguals ($M = 106.75$, $SD = 23.00$) than for Kurdish-Persian ($M = 101.24$, $SD = 28.03$) and Turkish-Persian ($M = 97.42$, $SD = 30.19$) bilinguals ($Ps < .001$). The main effect of grade was significant, $F(4, 1590) = 406.11$, $Mse = 363.09$, $p < .001$, $\eta^2 = .51$. Tukey post-hoc analysis showed that scores in Grade 1 ($M = 64.60$, $SD = 32.22$) were significantly lower than those in Grade 2 ($M = 103.00$, $SD = 22.45$), Grade 3 ($M = 111.35$, $SD = 14.99$), Grade 4 ($M = 114.00$, $SD = 11.13$), and Grade 5 ($M = 116.42$, $SD = 6.24$). The scores in Grade 1 and Grade 2 were significantly different from each other and from the other grades ($Ps < .001$). However, the differences between the other grades (3, 4 & 5) were not significant ($Ps > .40$). The group × grade interaction was significant, $F(8, 1590) = 4.18$, $Mse = 363.09$, $P < .001$, $\eta^2 = .02$ indicating that a negative bilingual effect was more evident in lower grades than in higher grades. More specifically, in Grade 1, Persian monolingual group scored better than both bilingual groups. In grades 2 and 3, however, Persian monolinguals only scored better than Turkish-Persian bilinguals. In grades 4 and 5, there were no significant differences between monolingual and bilingual groups (see Fig. 1).

Table 1. Means and (standard deviations) for words correctly read by children in different school grades (Total scores for high, medium & low frequency words)

	Grade1	Grade2	Grade3	Grade4	Grade5
Kurdish-Persian (n=512)	60.33 (32.10)	105.58 (19.28)	113.37 (8.27)	112.74 (13.38)	115.68 (6.35)
Turkish-Persian (n=511)	57.50 (31.18)	94.80 (27.68)	105.66 (21.65)	112.23 (13.04)	115.09 (8.60)
Persian (n=582)	74.73 (30.93)	107.92 (17.60)	114.99 (9.25)	116.68 (5.03)	118.13 (2.22)

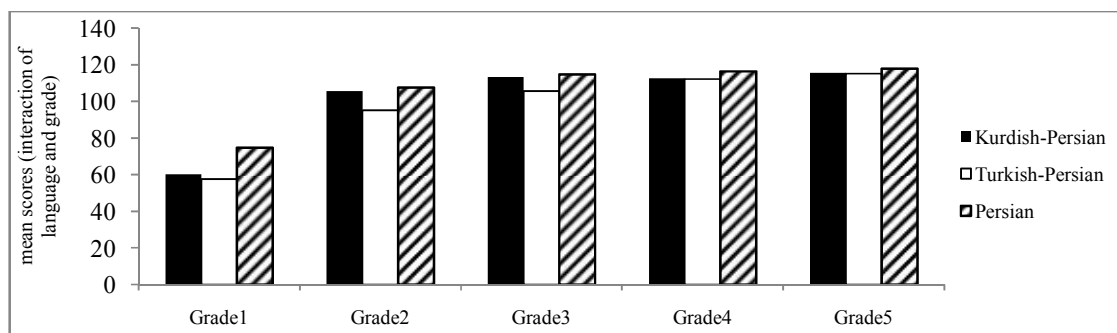


Fig. 1. The interaction effect between group and grade in word-reading task

3.2 Word Chains

The means and standard deviations for the word-chain task in the three groups of children are presented in Table 2.

A 3 (group) × 5 (grade) ANOVA, both as between-group variables, was performed on the word-chain data. This ANOVA showed that the effect of group was significant, $F(2, 1590) = 7.34$, $Mse = 40.32$, $P < .001$, $\eta^2 = .00$. A Tukey post hoc test revealed no significant difference between Persian monolinguals ($M = 13.75$, $SD = 7.74$) and Kurdish-Persian bilinguals ($M = 14.27$, $SD = 8.38$) ($P > .70$). However, both of these groups scored better than Turkish-Persian bilingual group ($M = 12.77$, $SD = 8.57$) ($Ps < .01$). The main effect of grade was significant, $F(4, 1590) = 270.10$, $Mse = 40.32$, $P < .001$, $\eta^2 = .00$. Tukey post-hoc analysis indicated that the scores significantly increased from lower to higher grades: Grade 1 ($M = 4.99$, $SD = 3.79$), Grade 2 ($M = 10.62$, $SD = 5.3$), Grade 3 ($M = 14.33$, $SD = 6.18$), Grade 4 ($M = 17.73$, $SD = 6.57$), and Grade 5 ($M = 19.69$, $SD = 8.77$). All grades were significantly different from each other ($Ps < .001$). The interaction between group and grade was not significant, $F(8, 1590) = 1.13$, $Mse = 40.32$, $p > .30$, $\eta^2 = .00$.

3.3 Rhyming

A 3 (group) × 5 (grade) ANOVA was performed on the rhyming data (see Table 3).

The ANOVA revealed a significant effect for group, $F(2, 1586) = 22.17$, $Mse = 8.37$, $P < .001$, $\eta^2 = .02$. A Tukey post hoc test showed that both Kurdish-Persian ($M = 8.37$, $SD = 2.76$) and Turkish-Persian bilingual groups ($M = 8.00$, $SD = 3.06$) scored significantly better than Persian monolingual group ($M = 7.23$, $SD = 2.6$) ($Ps < .001$). The main effect of grade was significant, $F(4, 1586) = 14.17$, $Mse = 8.37$, $p < .001$, $\eta^2 = .03$. A Tukey post hoc test showed that the scores at Grade 1 ($M = 6.86$, $SD = 3.07$) were significantly lower than at other grades (Grade 2: $M = 7.80$, $SD = 2.91$; Grade 3: $M = 8.08$, $SD = 2.85$; Grade 4: $M = 8.16$, $SD = 2.52$; Grade 5: $M = 8.46$, $SD = 2.46$) ($Ps < .001$). The differences between other grades were not significant ($Ps > .10$). The interaction between group and grade was not significant, $F(8, 1586) = .97$, $Mse = 8.37$, $p > .50$, $\eta^2 = .00$.

3.4 Non/pseudo Words

A 3 (group) × 5 (grade) ANOVA was performed on the non/pseudo word data (see Table 4).

The ANOVA showed that the main effect of group was significant, $F(2, 1589) = 37.62$, $Mse = 67.53$, $p < .001$, $\eta^2 = .04$ indicating that Kurdish-Persian bilingual group ($M = 35.52$, $SD = 10.52$) scored significantly better than either Turkish-Persian bilingual ($M = 32.79$, $SD = 11.21$) or Persian monolingual groups ($M = 31.27$, $SD = 7.54$). The main effect of grade was significant, $F(4, 1589) = 156.80$, $Mse = 67.53$, $p < .001$,

Table 2. Means and (standard deviations) for words marked correctly by children in different school grades

	Grade1	Grade2	Grade3	Grade4	Grade5
Kurdish-Persian (n=519)	5.18 (3.47)	10.98 (4.56)	15.87 (5.89)	18.05 (5.99)	21.26 (9.37)
Turkish-Persian (n=513)	5.29 (5.75)	10.05 (5.90)	13.14 (7.47)	17.03 (7.70)	18.33 (8.24)
Persian (n=582)	5.19 (3.92)	10.80 (5.36)	14.59 (5.46)	18.21 (5.79)	19.94 (7.08)

Table 3. Means and (standard deviations) for words rhymed correctly by children in different school grades

	Grade1	Grade2	Grade3	Grade4	Grade5
Kurdish-Persian (n=517)	7.39 (3.87)	8.43 (2.85)	8.68 (2.60)	8.50 (2.85)	8.84 (2.36)
Turkish-Persian (n=503)	6.94 (3.75)	7.47 (3.09)	8.35 (3.69)	8.49 (2.77)	8.75 (2.38)
Persian (n=581)	6.25 (2.78)	7.48 (2.75)	7.20 (2.65)	7.48 (2.23)	7.77 (2.32)

Table 4. Means and (standard deviations) for correctly read non/pseudo-words by children in different school grades

	Grade1	Grade2	Grade3	Grade4	Grade5
Kurdish-Persian (n=516)	27.98 (9.85)	34.81 (7.67)	37.44 (5.20)	38.64 (3.03)	38.71 (2.50)
Turkish-Persian (n=507)	20.82 (12.63)	33.78 (8.65)	36.99 (4.98)	36.73 (6.04)	35.64 (8.30)
Persian (n=581)	20.91 (11.64)	30.41 (11.29)	34.43 (9.80)	34.93 (8.38)	36.66 (6.40)

$\eta^2 = .00$. A Tukey post hoc test showed that students in Grade 1 ($M = 23.24$, $SD = 11.95$) and Grade 2 ($M = 33.00$, $SD = 9.42$) had significantly lower scores than those in the upper grades, i.e., Grade 3 ($M = 35.95$, $SD = 7.54$), Grade 4 ($M = 36.77$, $SD = 6.28$), and Grade 5 ($M = 37.00$, $SD = 6.16$) ($P_s < .001$). The interaction between group and grade was significant, $F(8, 1589) = 3.84$, $Mse = 67.53$, $p < .001$, $\eta^2 = .00$ (see Fig. 2). A Tukey post hoc test showed that differences between monolingual and bilingual children were more apparent in lower than higher grades.

3.5 Phoneme Deletion

A 3 (group) \times 5 (grade) ANOVA was performed on the phoneme deletion data (see Table 5).

This ANOVA showed no main effect for group, $F(2, 1599) = 1.30$, $Mse = 34.28$, $p > .20$, $\eta^2 = .00$. The main effect of grade was significant, $F(4, 1599) = 215.16$, $Mse = 34.28$, $p < .001$, $\eta^2 = .35$. A Tukey post hoc test showed that scores tended to increase significantly from grades 1 to 5: Grade 1 ($M = 12.54$, $SD = 6.3$), Grade 2 ($M = 18.56$, $SD = 6.37$), Grade 3 ($M = 21.62$, $SD = 5.99$), Grade 4 ($M = 23.68$, $SD = 5.21$), and Grade 5 ($M = 24.27$, $SD = 4.71$) ($P_s < .001$). The difference between Grades 4 and 5 was not significant ($P > .70$). There was no interaction between group and grade, $F(8, 1599) = 1.06$, $Mse = 34.28$, $p > .30$, $\eta^2 = .00$.

4. DISCUSSION

The aim of this study was to examine the performances of bilingual and monolingual children in different types of lexical and non-lexical reading tasks. Summarizing the findings, in the word-reading task, Persian monolinguals achieved higher scores than Kurdish-Persian and Turkish-Persian bilinguals. In the word-chain task, Persian monolinguals outperformed Turkish-Persian bilinguals, whereas Kurdish-

Persian bilinguals performed at a comparable level to Persian monolinguals. In the rhyming and non/pseudo-word-reading tasks, both bilingual groups performed better than the monolingual group. Finally, in the phoneme-deletion task, no differences were found between the bilingual and monolingual groups. The dissociative effects of bilingualism in the context of cognition have been reported repeatedly in previous research. The dissimilar patterns in children's performances on reading tasks in the present study are discussed in relation to the different origins of the cognitive tasks. Bialystok et al. [23,20] compared bilingual and monolingual children on tasks requiring different levels of difficulty and cognitive demands (i.e., relying more on either knowledge analysis or control). They found that bilinguals had an advantage over monolinguals on tasks demanding higher cognitive control. In light of this, Kormi-Nouri et al. [19] found another dissociative effect: a bilingual advantage for a letter fluency task concurrently with a bilingual disadvantage for a category fluency task. The former was explained by its reliance on executive function and the latter by its origin in lexical knowledge. Finkbeiner, Gollan, & Caramazza, [67] have referred to the "hard problem" faced by bilinguals in lexicalization, acknowledging that the process of approaching lexical representations is rather more difficult for bilinguals than for monolinguals. It seems that synonymous or equivalent words from two lexicons compete with each other when bilinguals try to retrieve them.

An increasing number of comparably complex models of bilingual and monolingual reading have been presented in the literature, e.g., Bilingual Interactive Activation Plus [68], Connectionist model of reading [69] and Multi-trace connectionist model of reading; Ans [70]. The DRC model [39,40] was adopted to highlight the basis of our study. The DRC clearly suggests two routes for the reading process [71], in which contrasting paths (either via semantic processing

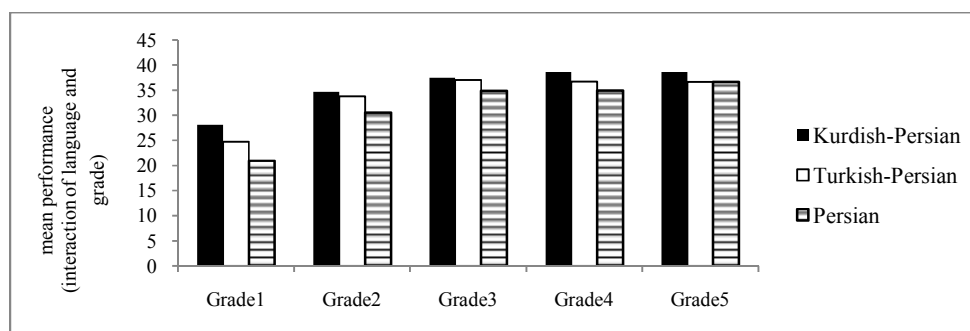


Fig. 2. The interaction between group and grade in non/pseudo-word task

Table 5. Means and (standard deviations) for words correctly phoneme-deleted by children in different school grades

	Grade1	Grade2	Grade3	Grade4	Grade5
Kurdish-Persian (n=519)	12.10 (6.26)	18.91 (5.76)	22.85 (5.33)	23.85 (5.59)	24.57 (4.69)
Turkish-Persian (n=513)	12.34 (7.05)	18.38 (7.34)	20.65 (7.64)	23.82 (6.95)	24.21 (5.50)
Persian (n=582)	13.18 (5.44)	18.39 (6.00)	21.39 (5.41)	23.37 (3.64)	24.03 (4.24)

or phonological retrieval) would let us more easily examine the dissociative results from diverse reading tasks. The present study used specific reading tasks that referenced the two dissimilar systems of reading: semantic (lexical) and phonological (non-lexical) processing. For lexical processing, we used two tasks: The word-chain task involves silent word reading, whereas a prerequisite for performing the word-reading task is to read aloud, which demands that readers articulate the individual words [72,45]; however, both of these tasks were selected to reflect the lexical reading. Given that the lexical (orthographic) route is thoroughly integrated into the word-recognition process, these two tasks were selected to index lexical reading, although they are different with respect to lexical processing and the involvement of phonological processing [49]. For non-lexical processing, we used three different tasks, mostly concerned with basic phonological aspects and all of which are related to reading outcomes: rhyming [62,64], non/pseudo word reading [e.g., 52] and phoneme deletion [e.g., 66]. Bilingual and monolingual children’s reading performances were assessed according to characteristics of the reading tasks, which presupposes that the various cognitive tasks involved in reading tap into different cognitive representational systems for phonological (non-lexical) and semantic (lexical) processing. On this account, it is the type of

reading task that determines whether one route is preferred over the other.

In the present study, the findings of advantage of bilinguals in performance on non-lexical reading tasks (rhyming) and disadvantage in lexical reading tasks (word reading and word chain) are in line with previous research showing that bilinguals performed better on phonological-processing tasks than on semantic tasks. Several studies have shown that bilinguals are inferior to their monolingual peers in lexical access because of a smaller vocabulary store [e.g., 4,73], but they have been recognized as superior to monolinguals on tasks requiring executive control [e.g., 6]. Kormi-Nouri et al. [19] also observed that while bilingual children performed better than monolingual children on letter fluency tasks, which are assumed to be mediated by executive function and phonological processing, they performed worse on category-fluency tasks, which are assumed to be mediated by semantic (lexical) knowledge. According to Ivanova and Costa [74], different explanations exist for these findings. For example, bilinguals use the dominant language less frequently, so plausibly, there is interference between the languages that compete for word retrieval. Some researchers have emphasized the word-frequency effect [e.g., 75], which implies that disadvantage from bilingualism originates from the actuality that bilinguals use their dominant

language less frequently than monolinguals, and consequently, have fewer lexical representations available. Other researchers have discussed the cross-language interference that bilingualism supposedly entails [e.g., 76,67], whereby words from the language that is not in use are in a struggle to select when employing the other language's lexical representations.

The present study considers two other aspects that might further explain bilingual advantage in phonological processing, but disadvantage in semantic and lexical processing. First, it should be noted that Kurdish and Turkish are spoken languages in Iran, but that bilingual children do not receive educational training in written form in their first language in Iranian schools. Thus, it is suggested that acquisition of the first language in our bilingual children was mainly based on phonological, not on orthographical processing. Second, our data showed that bilingual advantage in the non/pseudo-word reading task (non-lexical processing) and bilingual disadvantage in the word-reading task (lexical processing) was only evident in the lower grades (grades 1 and 2). These findings can be found as in line with the assumptions of Frith's [77] standard model of reading (particularly of an alphabetic reading system) suggesting that children's language performance was more dependent on phonological processing in lower grades (mostly in grade 1) than during later school years, when it seemed to be based more on orthographic processing and lexical demands. According to this model, every stage of reading (as proposed in a respective order of logographic, alphabetic and orthographic stages) entails a more extent of establishment of representations, connections and alphabetical processing.

Kurdish and Turkish are two spoken languages that differ from each other in terms of their similarity/dissimilarity to Persian; specifically, Kurdish and Persian are more similar, whereas Turkish and Persian are more dissimilar, with regard to a number of characteristics, such as phonological and morphological processing [57]. Our results showed that, while there was more of a bilingual advantage in non-lexical tasks (rhyming and non/pseudo word reading) for Kurdish bilinguals, there was more of a bilingual disadvantage in lexical reading tasks (word reading and word chain) for Turkish bilinguals. These findings can indicate that similarity and dissimilarity between the first and second

language may play an influential role in bilingual advantage/disadvantage. Our findings in this area were in line with some previous research. Bialystok et al. [58] and Ringbom [59] have shown that similarity between languages can be considered as advantageous for bilinguals in terms of learning their second language. Deacon, Chen, Luo, & Ramirez [78] reported that the transfer of orthographic processing, and consequently reading, is facilitated if the written units of the languages, i.e., the letters within the alphabets, are the same.

In the present study, some dissociations within each original category of reading tasks (i.e., non-lexical and lexical) were also found. In the non-lexical (phonological) reading tasks, a bilingual advantage was observed in rhyming for both Kurdish and Turkish bilinguals. In non/pseudo word reading, a bilingual advantage was only observed for Kurdish bilinguals, but on the phoneme-deletion task, neither bilingual advantage nor disadvantage was found. Now, we are fairly well aware that phonological awareness is one of the main predictors of later reading ability [79-82] and in different languages [e.g., 83]. Rhyming appears to be an easier task for the measurement of phonological awareness than tasks that require phoneme manipulations [e.g., 64]. Non/pseudo word-reading tasks have also been suggested to depend on phonological awareness processing [e.g., 40]. Broadly, our findings of bilingual advantages on rhyming and non/pseudo word reading tasks are consistent with parts of earlier studies which have documented a bilingual advantage in tasks that utilize phonological awareness skills at pre-school ages and during the initial years in school [e.g., 84,85]. Bialystok et al. [58] failed to accumulate sufficient documentation to support the notion that there is a bilingual advantage across the range of tasks that rely on phonological awareness skills. However, they correctly asserted that research on the metalinguistic awareness of bilinguals requires greater attention and vigilance because there are numerous issues that possibly affect cognitive outcomes, such as type of cognitive task, language of schooling, and age of language acquisition. This notion is also supported by our overall impression that bilingualism has dissociative effects. Hence, results on the effects of bilingualism on different reading tasks, and consequently on reading ability, remain divergent and inconsistent due to the varying conditions under which bilingualism arises.

Although our finding that there was no difference between bilinguals and monolinguals' performances on the phoneme-deletion task was inconsistent with our expectation, it remains in line with parts of previous studies. For instance, Demont [86] showed that there were no differences between German-French bilingual and monolingual groups of 6-7-year-old children in performances on a phoneme-deletion task. Muter and Diethelm [87], by comparing English monolinguals and speakers of various other languages, also found no differences in phoneme completion and deletion. Furthermore, in a study by Laurent and Martinot [88], English-French pre-readers were found not to differ from their English monolingual peers on a phoneme-deletion task. It seems that, when deleting phonemes, bilinguals and monolinguals might benefit from similar strategies to complete the task, and both the lexical and non-lexical routes to reading might be used with the same extent. This finding once again highlights the dissociative effect of bilingualism on reading.

Bialystok et al. [58], after finding a greater bilingual disadvantage for pre-school children than for children in grades one and two, argued for the distinct role of literacy instruction in the development of phonological awareness skills, claiming that the prerequisites for reading and language proficiency are increasingly met as children advance through the academic grades. Similarly, Kormi-Nouri et al. [19], considering participants from the same cultural population, noted that, since Kurdish-Persian and Turkish-Persian bilinguals receive schooling only in their second language (Persian), their language proficiency in Persian clearly improves with grade. In the present study, bilinguals were found to perform almost equally in Grade 1 and Grade 2 on non/pseudo-word reading and phoneme-deletion tasks, but their performances increased significantly in Grade 3. Likewise, on the word-reading task, the scores of all groups increased with grade, although Persian monolinguals showed better performance at Grade 1 than did bilinguals. This trend of an incremental increase in scores was observed for word chains, on which both girls and boys steadily performed better throughout the upper grades. This pattern is somewhat consistent with findings from the National Reading Panel (NRP) [89], which suggested that systematic phonics instruction after Grade 1 is not reliably related to reading ability in either normal or poor-reading children. Ehri, Nunes, Stahl, & Willows [90] presented

similar patterns of results. By receiving exclusive schooling in Persian, Kurdish and Turkish bilinguals appear to obtain the amount of knowledge essential for recognizing and reading odd/pseudo words during the first two grades.

4.1 Limitations

There are a few necessary issues to be addressed which may limit the generalizability of our findings and we tend to interpret our results with some cautions. First of all, it should be noted that we did not have access to the all information about the variables which determine the levels of bilingualism in our bilingual populations. The level of language proficiency in the first as well as in the second language is supposed to be an important factor to affect the outcome performances. Second, to have control over SES, we selected the students from different types of schools of different geographical areas. However, due to practical barriers of handling such a huge database, we were not perfectly aware about other information e.g., their background variables like parent's education and economic status. Third, our bilinguals were examined exclusively in their second language while monolinguals were tested in their first language (i.e., both groups were tested in Persian). Therefore, it seems of importance to note that it might not be completely clear by this data whether if the larger extents of using the phonological route when reading (by bilinguals) is the source of difference in comparison with monolinguals, since phonological route is typically recruited with more difficult and low frequency items. That is, it is possible that this difference originated from the fact that the bilinguals showed more extensive use of the phonological reading route in their second language and might show a different pattern when reading in their first language. Fourth, our selected reading tasks did not thoroughly cover all of the (basic) measurements of reading components (e.g., rapid naming of letters, spelling, reading fluency or short-term working memory) and were limited to five of the principal tasks. Fifth, our study was a cross-sectional study for using different children in different grade/age groups. It would be interesting to study longitudinally the same bilingual versus monolingual children in school years in order to see the developmental changes for different cognitive or reading tasks. In future research, we need to have a better control over all these variables.

5. CONCLUSION

Generally speaking, the suggestion that there are dual (lexical and non-lexical) requirements for bilingual reading can have a significant impact on schooling and educational policy. A noticeable finding of our study was that our bilingual children were better in non-lexical (phonological) reading tasks, which are basically shaped at early ages. Development of this ability is not a direct focus of educational practice although it is strengthened by education at later ages. In contrast, Persian monolinguals were superior in lexical reading tasks, implying a key role of schooling and of a first-language-friendly educational system for non-official languages (in our case, Kurdish and Turkish within the Iranian instructional system). This would be especially more important for dissimilar languages (e.g., Turkish and Persian) than for similar languages (e.g., Kurdish and Persian). The results of the present study can provide a support for the bilingual education program [e.g., 91,92] that leads to the development and maintenance of bilingual cognitive skills according to grade/age of children and similarity/dissimilarity of two languages. We have to consider these bilingual advantages and disadvantages for reading, as one of the most complicated cognitive task, in such bilingual education program. If bilinguals and monolinguals are different with respect to phonological (non-lexical) and lexical processes of reading, this needs to be acknowledged and appreciated by educational programs and not considered as limitations for bilinguals. We need to support the shift from seeing bilingualism as a barrier to academic achievement to having children's bilingualism as the essential element in their academic success.

CONSENT

Since this project was approved and financed by the Ministry of Education in Iran, the data collection was administered by their educational research organizations in the three cities of Tehran, Tabriz and Sanandaj. The schools were randomly selected and contacted by these research organizations. After receiving the agreements of teachers and parents, our test leaders could administer the study's tasks with pupils during the school times.

ETHICAL APPROVAL

All authors hereby declare that all experiments have been examined and approved by the

appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki."

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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