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The Relationship between English and Persian Phonological Awareness, Rapid Automatized Naming and Students' Reading Achievement in Partial Immersion and Non-Immersion Programs

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Abstract

The cognitive predictors (i.e., Phonological Awareness, and Rapid Automatized Naming) underlying reading achievement have not been researched in Iranian partial English immersion and non-immersion programs. The present study sought to investigate the relationship between English and Persian Phonological Awareness (PA), Rapid Automatized Naming (RAN) and reading achievement of Iranian students in partial immersion and non-immersion programs. To this end, one hundred forty five students from three different grade levels in a partial English immersion program and 95 students from three different grade levels in a non-immersion program were chosen. Six different English and Persian tests were utilized (namely, the Cambridge English for Young Learners (YLE) test for Reading, the Persian reading achievement test, the English and Persian Phonological Awareness Sound Detection tests, and the English and Persian Rapid Automatized Naming Tests). Given the design of the study, a number of statistical tests were run. The main findings were as follows: learners' reading achievement could significantly be predicted through both English and Persian PA and RAN. Furthermore, learning English in a partial English immersion system improves learners' reading achievement and cognitive predictors compared with non-immersion program. The findings suggest that by teaching learners PA and RAN skills, their reading achievement improves in both English and Persian.

Keywords: non- immersion, partial immersion, phonological awareness, rapid Automatized naming, reading achievement

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1. Introduction

Bilingual education including immersion education involves the teaching and learning of school subjects through two different languages. As a successful bilingual program model, French immersion (FI) in Canada has demonstrated that immersion is an effective means of facilitating preschool and primary school students' language proficiency, literacy and cognitive development, without undermining competence in their first language (Cummins & Carson, 1997). Nonetheless, closely related to the immersion program, widely carried out in the world, is the partial immersion program.

English instruction in Iranian secondary education is generally limited to the development of reading skill. However, given the findings of the various studies conducted so far, English programs in secondary education in Iran have fallen short of accomplishing this objective. Therefore, it is necessary to examine the possible factors which could be responsible for this failure.

Partial immersion program is a newcomer in Iran, and to the researcher's best knowledge, no research studies have investigated the differences between partial English immersion students and non-immersion students in terms of their reading achievement and cognitive predictors (i.e., Phonological Awareness and Rapid Automatized Naming).

For many years, research on early reading ability has mainly focused on the predictive power of phonological skills (Wagner & Barker, 1994). These skills include Phonological Awareness, which refers to the ability to manipulate the sounds in words and the awareness of the sound structure of words, and phonological decoding, which enables the reader to convert written words into oral language by analyzing individual graphemes into their corresponding phonemes (Wagner & Baker, 1994). Therefore, these two provide a solid foundation for word reading. However, researchers have recently found that phonological processes are not sufficient to explain all the variance in reading ability. Some researchers (e.g., Johnston & Kirby, 2006; Wolf & Bowers, 1999) have argued that Naming Speed is a precursor of orthographic processing and makes a unique contribution to reading performance. An important issue is whether Phonological Awareness and Naming Speed are associated with different aspects of reading, with Phonological Awareness being more related to phonological decoding (Wagner et al., 1994; Wagner et al., 1997) and Naming Speed being more related to orthographic processing (e.g. Bowers & Wolf, 1993; Manis, Seidenberg & Doi, 1999). Although there is considerable evidence that

Phonological Awareness and Naming Speed are crucial to word reading (Wagner et al., 1994; Wagner et al., 1997; Scarborough, 1998; Share, 2008), several studies (e.g. Kirby et al., 2003; Torgesen et al., 1997) have shown that Phonological Awareness and Naming Speed predict both word reading and reading comprehension.

A large body of research shows that Phonological Awareness skills in L1 and L2 correlate with each other, transfer cross-linguistically, and can predict word reading development in children's L1 and L2 (Bruck & Genesee, 1995; Comeau et al., 1999; Durgunoglu et al., 1993; Geva & Wang, 2001; Wade-Woolley & Geva, 2000).

Cognizant of this fact, the present study sought to investigate the relationship between English and Persian (Phonological Awareness (PA), Rapid Automatized Naming (RAN) and students' reading achievement.

2. Literature Review

Since the 1960s, a variety of English teaching methods have been introduced. These have generally been consistent with Communicative Language Teaching Approach. The common thread running through such methods has been the fact that language learning has been considered incidental. Content-based instruction is one such method, which is defined by Brinton et al. (2003) as "the concurrent study of language and subject matter, with the form and sequence of language presentation dictated by content material" (p. 6). According to Brown (2001), "when language becomes the medium to convey informational content of interest and relevance to the learner, then learners are pointed towards matters of intrinsic concern" (p. 49). Closely related is immersion education which emphasizes the principle of acquiring content through language (Richards & Rogers, 2001).

2.1 Immersion education

The first immersion programs were developed in Canada in the 1970s. These programs were established to teach French to English-speaking students Since the 1970s, immersion programs have been adapted in many parts of the world, and alternative forms of immersion have been devised (Qiang & Siegel, 2004; Richards & Rogers, 2001).

Richards and Rogers (2001, p. 206) define immersion education as "a type of foreign language instruction in which the regular school curriculum is taught through the medium of the foreign language."

A number of studies in French immersion programs have shown that immersion is an effective means of facilitating preschool and primary school students' language proficiency and literacy (Cummins & Carson, 1997; Lapkin et al., 2003; Turnbull et al., 2001). Researchers have found that although students in an immersion program experience an initial lag in the development of English language skills, once formal English language arts instruction is introduced, they catch up quickly and in some cases even surpass students in the traditional English program (Barik & Swain, 1978; Donaldson, 1989; Genesee, 1979).

Turnbull, Lapkin, and Hart (2001) showed that academic achievement of immersion students is equivalent to that of non-immersion students studying the same subjects in their first language. Moreover, Lapkin et al. (2003) indicated that in Grade 6, immersion students' literacy and mathematics test scores were higher than their peers' in English-only programs. Similarly, Genesee (1992) found those learners who were disadvantaged with respect to academic and linguistic abilities, studying in immersion programs, had the same levels of first language development and academic achievement as those learners in non-immersion programs.

In spite of abundance of research on French immersion programs in Canada, very few studies have been carried out into immersion programs in Asia. Gupta (1994) investigated Singaporean students from two different backgrounds. The first group consisted of learners studying in immersion programs, and the second group consisted of learners who acquired English at home from birth. The results showed that those students, who had English as the primary language of instruction in immersion schools, scored higher than other students from English-speaking countries on tests of math and science. Cheng et al. (2010) demonstrated that second language immersion is an effective means of facilitating primary school students' second language learning.

2.2 Partial immersion education

In *total immersion*, the curriculum is entirely taught through the second language. In *partial immersion*, however, a minimum of 50% of the curriculum is taught in the second language for one or more years (de Bot, 2000). The basic difference between the two is essentially a difference between a second language setting and a foreign language setting.

Program comparisons indicate that early total immersion programs and early partial immersion programs yield better results than non-immersion programs (Lyster, 2007). In a study carried out on early partial immersion in Australia, de Courcy and Burston (2000) compared the children's ability in mathematics after having been taught this subject in their second language (i.e. French). The researchers' hypothesis was that the cognitive processes developed in French math instruction could be transferred to the first language, and make testing in English possible. The results were above the average when compared with Australian norms.

Chen (2004) investigated the influences of partial English immersion programs (EIPs), pointing out that EIPs might lead children to devalue their Chinese language and Chinese culture, and favor English and Western culture. The results showed that the majority of partial EIP children do not devalue their L1 and C1.

Furthermore, Uehara et al. (2009) investigated the linguistic characteristics of young Japanese learners, receiving partial English immersion education. They investigated the characteristics of the program in terms of syntax, pronunciation and the correspondence between sounds and letters. They found that the children had acquired English very naturally.

2.3 Cognitive processes in reading skill

There is growing evidence that phonological processing is a major cognitive determinant of word reading skills (Wagner & Torgesen, 1987). According to Rubin (2011), phonological processing is defined as an auditory processing skill which relates to words, but occurs in the absence of print. Phonological processing involves detecting and discriminating differences in phonemes under conditions of little or no distraction. According to Wagner and Torgesen (1987:33), phonological processing includes different abilities, such as Phonological Awareness, phonological recoding, and phonological memory. Phonological awareness is defined as the skill of analyzing words in spoken language into their syllabi and phonemes and the skill of carrying out mental processes related to the phonemes in spoken language (Denton et al., 2000).

There is substantial evidence that the relationships between phonological processing and reading are mutually enhancing (e.g., Goswami & Bryant, 1990; Wagner et al., 1994). Moreover, Stanovich (1991) stated that "the specification of the role of phonological processing in the earliest stages of reading acquisition is one of the more notable scientific success stories of the last decade"(p. 78).

In the literature reviewed above, it could be seen that in no research studies have the differences between partial English immersion students and non-immersion students in terms of their reading achievement and cognitive predictors of Phonological Awareness and Rapid Automatized Naming been investigated.

3. Research Questions

This study aims to explore the possible relationship between processes underlying reading achievement in Iranian partial English immersion and non-immersion settings in learners' first and second language. Specifically, the following questions are addressed.

1. How well do English cognitive predictors predict English reading achievement for partial immersion and non-immersion students at different grade levels?
2. How well do Persian cognitive predictors predict Persian reading achievement for partial immersion and non-immersion students at different grade levels?

4. Sampling Procedure

To choose the participants, a multi-stage sampling technique was used. Specifically, two types of sampling design were utilized: a sampling design based on probability and a sampling design not based on probability. According to Ary, Jacobs, Sorensen and Razavieh (2010, p. 149), "Probability sampling involves sample selection in which the elements are drawn by chance procedures… Non-probability sampling includes methods of selection in which elements are not chosen by chance procedures." Based on the purposes of this study, two primary schools, one with a partial English immersion and the other with non-immersion educational program, were chosen. It should be noted that the first school (i.e., Mehr-e-Taban Bilingual School) is the only primary school with a partial English immersion program in Shiraz, and the second school (i.e., Nour-e-Kherad) is also the only school that has a non-immersion program, in the same district.

Second, a simple random sampling, was employed. After selecting the two schools, a number of students were randomly selected from the total population.

This study was conducted with 240 female students with Persian as their L1 and English as their L2. One hundred forty five students were randomly selected from the partial English immersion program and 95 students from the non-immersion program. The students who had attended the two schools from kindergarten to the time of study and had not attended any other classes qualified for the study. Thus, 240 students were selected using the simple random sampling technique. The age range of students was 6-11. The distribution of the participants is provided in Table 1.

Table 1. Students' distribution by program at each grade level

Gender	Grade 1		Grade 3		Grade 5	
	PI	NI	PI	NI	PI	NI
Female	55	30	50	35	40	30

Note. PI = Partial immersion program; NI = Non-immersion program

5. Materials and Methods

Given that this study intends to investigate the performance of test-takers on the cognitive predictors to predict their performance on reading achievement, it utilizes a multiple regression model, which is a type of ex post research method.

5.1 Instrumentation

Given the nature of the variables in question, a number of tests were used to gather the data. The following section provides a rather detailed account of the instruments used in the study.

5.1.1 English reading achievement measures

The Cambridge English for Young Learners test for Reading was administered to assess the general English language proficiency of the participants. YLE is the most popular test of English for speakers of other languages throughout the world (Cambridge ESOL, 2007). It is a paper-and-pencil test taking 20 minutes (*Starters*- Grade 1), 30 minutes (*Movers*-Grade 3) or 40 minutes (*Flyers*-Grade 5) for Reading part. Reading texts are short and constrained by a specified set of words and structures. Given that YLE was intended as an instrument, it was necessary to establish its reliability first. For this purpose, KR-21 was used. The reliability of the test was 0.82.

5.1.2 Persian reading achievement measures

School-issued achievement tests in Persian were employed to measure students' Persian reading and academic achievement. In Grade 1, the test consists of 24 items, in Grade 3, 30 items, and in Grade 5, 45 items. The test was developed by experts in the Shiraz Department of Primary School Education, and its face and content validity confirmed by three experts in this field. The reliability of the instrument estimated through KR-21 was 0.76.

5.1.3 English phonological awareness

Two tests of initial sound detection and final sound detection in English developed by Bradley and Bryant (1985) were administered to assess the onset-rime awareness. Similarly, in the English final sound detection test, the student was asked to choose which word ended with a sound different from the other three. Scores range from 0 to 10, with 1 point for each correct response in each test. The total of the initial and final sound detection which range from 0 to 20, was termed E.PA.

5.1.4 Persian phonological awareness

The Persian initial and final sound detection tests were administered to assess the onset-rime awareness. The content and face validity of this test was confirmed by three applied linguists. To estimate the criterion-related validity, the correlation coefficient between the English and Persian was estimated. The obtained r was 0.81. The reliability of the instrument estimated through KR-21 was 0.86.

5.1.5 English Rapid Automatized Naming (RAN)

For this purpose, the letter-naming component of the Rapid Automatized Naming Test, developed by Denckla and Rudel (1974), was administered. In this study, the naming performance in English was measured, using a continuous letter-naming task. The test stimuli consisted of 50 items, with five rows and ten columns of randomly arranged letters (i.e., ***a***, ***e, l, h, o, s, n, z, u,*** and ***v***) repeated in random order. To ensure the face and the content validity of the test, this test was checked by three applied linguists. The reliability of the instrument estimated through KR-21 was was 0.86.

5.1.6 Persian Rapid Automatized Naming (RAN)

This test consisted of 50 items, with five rows and ten columns of randomly arranged letters (i.e., **ت,ک, خ, غ, ف, ض, ش , ب ,ل** and **ر**) repeated in random order. The face and content validity of this test were confirmed by three applied linguists. In order to estimate the criterion-related validity, the correlation coefficient between the English and Persian test was estimated to be 0.84. The reliability of the instrument estimated through KR-21 was 0.82.

5.2 Data collection

The instruments described above were used to gather the data. In the following section, an account is provided of the way in which the instruments were used to collect the data.

5.2.1 English phonological awareness

A variety of tasks have so far been used to assess Phonological Awareness. These tasks differ with respect to the level of linguistic complexity and the type of cognitive operation required to successfully perform the task. With respect to linguistic complexity, the size of the target unit varies from words, syllables, onsets, and rimes to phonemes.

Two tests of initial sound detection and final sound detection in English developed by Bradley and Bryant (1985) were administered to assess the onset-rime awareness. In the individual English initial sound detection test, after listening to four words in one item, the student was asked to indicate which word began with a sound different from the other. The time interval between each item was fixed at eight seconds for the first, five seconds for the third, and three seconds for the fifth graders. The student responded by pointing to an option. For example, after listening to ***pip, pin, hill, and pig***, the student was expected to choose option 3, having an initial sound different from the other three. There were two practice items and ten test items in each of initial sound detection and final sound detection tests.

Similarly, in the English final sound detection test, the student was asked to choose which word ended with a sound different from the other three. Scores range from 0 to 10, with 1 point for each correct response in each test. The total of the initial and final sound detection which range from 0 to 20 was termed E.PA.

5.2.2 Persian phonological awareness

The Persian initial and final sound detection tests were administered to assess the onset-rime awareness. First, in the individual Persian sound detection test, after listening to four words in one item, the student was asked to indicate which word began with a sound different from the other three during the time interval between the two items. The student responded by pointing to an option. This test also consisted of 2 practice items and ten test items. For example, after listening to **نان** /nan/,**ناز** /naz/, **تاب** /tab/, and**نام**/nam/, the student was expected to choose option 3.

Similarly, in the Persian final sound detection test, the student was asked to choose which word ended with a sound different from the other three. Scores range from 0 to 10, with 1 point for each correct response. The total of the initial and final sound detection which range from 0 to 20 was termed P.PA.

5.2.3 English Rapid Automatized Naming (RAN)

In this section, the letter-naming component of the Rapid Automatized Naming Test, first created by Denckla and Rudel (1974), was administered.

In this study, the naming performance in English was measured using a continuous letter-naming task. The test consisted of 50 items, with five rows and ten columns of randomly arranged letters (i.e., ***a***, ***e, l, h, o, s, n, z, u,*** and ***v***) repeated in random order. The students were required to sequentially read the letters in English as fast as possible, from left to right, starting at the top row. Before that, the students were instructed to self-correct during the naming task, such that if a known error was made, they were able to self-correct. This task consisted of two practice tasks. Once the student was familiar with this rapid naming test style, her letter naming time was measured, using a stopwatch. The number of seconds it took to read the letters and the number of uncorrected errors were recorded. The student's score was the number of letters named correctly divided by the time taken. This score was termed E.RAN.

5.2.4 Persian Rapid Automatized Naming (RAN)

Like the English RAN task, naming performance in Persian was measured using a continuous letter-naming task. This task consisted of 2 practice items to familiarize the students with the procedure. The students were instructed to self-correct during the naming task. The test consisted of 50 items, with five rows and ten columns of randomly arranged letters (i.e., **ک, غ, ف, ض, ش, ت ,خ, ب ,ل** and **ر**) repeated in random order. The student was required to sequentially read the letters in Persian as fast as possible, from left to right, starting at the top row. The number of seconds it took to read all the letters and the number of uncorrected errors were recorded. The student's score was thus calculated.

5.3 Data Analysis

Given the quantitative design of the study, the Statistical Package for Social Sciences (SPSS) was used to analyze the data. First, descriptive statistics were calculated to see whether any patterns or trends emerge from the data. Following that, to answer the research questions regarding the correlation between reading achievement and the variables of PA and RAN, the linear regression was run. However, before running regression, ANOVA was run to determine whether the assumption of regression analysis was confirmed.

6. Results of the Study

Descriptive statistics including mean and standard deviation for each grade level of partial English immersion and non-immersion groups are presented in the following tables.

Table 2. Descriptive statistics of English and Persian academic achievement for partial English immersion students

Variable	Grade 1 (N=55)		Grade 3 (N=50)		Grade 5 (N=40)	
	M	SD	M	SD	M	SD
English academic achievement	19.60	3.67	33.10	4.46	38.15	7.07
E.PA	17.23	2.08	17.96	1.45	17.62	1.84
E.RAN	0.96	0.36	0.61	0.13	0.59	0.15
Persian academic achievement	19.02	1.01	19.26	0.78	18.11	1.46
P.PA	18.09	1.28	19.26	0.72	18.65	1.45
P.RAN	0.87	0.23	0.64	0.12	0.61	0.13

The table shows that the mean score for English and Persian RAN has decreased with an increase in the grade level. An important finding is that the mean score of English and Persian PA and English and Persian reading achievements have increased in Grade 3, compared with that of the first and fifth grades. The following table presents the descriptive statistics for non-immersion students.

Table 3. Descriptive statistics of English and Persian academic achievement for non-immersion students

Variable	Grade 1 (N=30)		Grade 3 (N=35)		Grade 5 (N=30)	
	M	SD	M	SD	M	SD
English academic achievement	17.30	2.76	20.97	5.33	22.63	5.28
E.PA	14.96	2.42	15.57	2.77	16.66	2.35
E.RAN	2.52	0.77	1.10	0.35	0.79	0.19
Persian academic achievement	18.26	1.29	18.62	1.45	17.75	1.65
P.PA	17.93	1.46	18.28	1.67	17.83	1.70
P.RAN	1.07	0.36	0.73	0.20	0.67	0.12

As observed, the mean score for English and Persian RAN has decreased as students' age increased in the non-immersion group. A situation similar to that of the partial English immersion group can also be observed in the Persian PA of the non-immersion group. That is, the mean score of Persian PA has increased in Grade 3 compared with the first and fifth grades. However, the English PA seems to increase with students' age.

Comparing Tables 2 and 3, an interesting finding is that the mean scores of all English and Persian tasks are higher in the partial English immersion group compared with the non-immersion group. This can partly be due to the lack of time spent on teaching English compared with the partial English immersion group.

6.1 English reading achievements and English cognitive predictors

The main question of the present study was an attempt to investigate the correlation between the learners' English reading achievement test and their cognitive predictors. Since the basic objective of this question was to find the relationship between the test takers' scores on the test of English reading achievement and their scores on test of English PA and English RAN, linear regression analysis was run.

6.1.1 The association between first graders' English reading achievement, PA, and RAN

To investigate the relation among English reading achievement, Phonological Awareness, and Rapid Automatized Naming in Grade 1, linear regressions were run. The English initial and final phonological sound detection test administered to partial English immersion and non-immersion groups is termed E.PA. The English Rapid Automatized Naming is termed E.RAN. It is noteworthy that since RAN tasks are reported in seconds, shorter times indicated better performance (this explains the reason for the negative correlations). Tables 4 and 5 show the ANOVA for both the partial English immersion and non-immersion groups, respectively.

Table 4. ANOVA for Grade 1 partial English immersion Group

Model	df	Mean Square	F	Sig.
Regression	2	256.56	61.74	.00[a]
Residual	52	4.15		
Total	54			

Table 5. ANOVA for Grade 1 Non-Immersion Group

Model	df	Mean Square	F	Sig.
Regression	2	96.97	92.31	.00[a]
Residual	27	1.05		
Total	29			

Note. Dependent Variable: English reading achievement

a.predictors: (constant), E.PA, E.RAN

The results indicate that the assumption of regression analysis is confirmed and regression analysis can be safely run. The following tables present the summary of the regression model for Grade 1 partial English immersion and non-immersion students.

Table 6. Regression Model Summary for Grade 1 Partial English Immersion Group

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.83[a]	.70	.69	2.03

Table 7. Regression Model Summary for Grade 1 Non-Immersion Group

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.93[a]	.87	.86	1.02

Note. Dependent Variable: English reading achievement
a.predictors: (constant), E.PA, E.RAN

The results in the above tables indicate a significant correlation between the participants' scores on English reading achievement tests and E.PA and E.RAN in the partial English immersion group and the non-immersion group. The common variance between English reading achievement and E.PA and E.RAN is 0.69 in the partial English immersion and 0.86 in the non-immersion group. Table 8 presents the coefficients of Grade 1 in the partial English immersion group.

Table 8. Coefficients for grade 1 partial English immersion group

	Unstandardized Coefficients	Standardized Coefficients			
Model	B	Std. Error	Beta	t	Sig.
E.PA	1.116	.199	.632	5.610	.000
E.RAN	-2.589	1.144	-.255	-2.263	.028

Note. Dependent Variable: English reading achievement

The results indicate that a change of one standard deviation in E.PA produces a change of 0.63 of a standard deviation in English reading achievement. The results also suggest that a change of one standard deviation in E.RAN produces a change of -0.25 of a standard deviation in English reading achievement. Table 9 presents the coefficients of Grade 1 in the non-immersion group.

Table 9. Coefficients for grade 1 non-immersion group's English phonological awareness and rapid automatized naming

	Unstandardized Coefficients	Standardized Coefficients			
Model	B	Std. Error	Beta	t	Sig.
E.PA	.627	.127	.550	4.937	.000
E.RAN	-1.573	.400	-.438	-3.932	.001

Note. Dependent Variable: English reading achievement

The results of Table 9 show that a change of one standard deviation in E.PA produces a change of 0.55 of a standard deviation in English reading achievement. The results also reveal that a change of one standard deviation in E.RAN produces a change of -0.43 of a standard deviation in English reading achievement.

6.1.2 The association between third graders' English reading achievement, PA, and RAN

To investigate the relationship among English achievement, Phonological Awareness, and Rapid Automatized Naming in Grade 3, linear regressions were run again. The results for ANOVA of both groups are reported in the following tables.

Table 10. ANOVA for grade 3 partial English immersion group

Model	df	Mean Square	F	Sig.
Regression	2	317.08	43.28	.00[a]
Residual	47	7.32		
Total	49			

Table 11. ANOVA for grade 3 non-immersion group

Model	df	Mean Square	F	Sig.
Regression	2	330.30	34.27	.00[a]
Residual	32	9.63		
Total	34			

Note. Dependent Variable: English reading achievement
a. predictors: (constant), E.PA, E.RAN

To ensure that the regression analysis could be run, ANOVA was checked. Tables 10 and 11 show the ANOVA for both the partial English immersion and non-immersion groups, respectively. As the results indicate, the regression in both groups is highly significant at the 0.01 level. As a result, it could safely be argued that the assumption of regression analysis is confirmed and regression analysis can be run. The following tables show the summary of the regression models for Grade 3 students of the two educational groups.

Table 12. Regression model summary for grade 3 partial English immersion group

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.80[a]	.64	.63	2.70

Table 13. Regression model summary for grade 3 non-Immersion group

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.82[a]	.68	.66	3.10

Note. Dependent Variable: English reading achievement
a. predictors: (constant), E.PA, E.RAN

As seen above, there is a significant correlation between the participants' scores on English reading achievement tests, E.PA and E.RAN in the partial English immersion group and the non-immersion group. The findings also indicate that the common variance between English reading achievement and E.PA and E.RAN is 0.63 in the partial English immersion and 0.66 in the non-immersion group. The following table presents the coefficients of Grade 3 in the partial English immersion group.

Table 14. Coefficients for grade 3 partial English immersion group

	Unstandardized Coefficients	Standardized Coefficients			
Model	B	Std. Error	Beta	t	Sig.
E.PA	1.544	.398	.503	3.884	.000
E.RAN	-11.568	4.198	-.357	-2.756	.008

Note. Dependent Variable: English reading achievement

The findings indicate that a change of one standard deviation in E.PA produces a change of 0.50 of a standard deviation in English reading achievement. The results also reveal that a change of one standard deviation in E.RAN produces a change of -0.35 of a standard deviation in English reading achievement. Table 15 shows the coefficients of Grade 3 in the non-immersion group.

Table 15. Coefficients for grade 3 non-immersion group

	Unstandardized Coefficients	Standardized Coefficients			
Model	B	Std. Error	Beta	t	Sig.
E.PA	1.080	.265	.562	4.081	.000
E.RAN	-4.923	2.049	-.331	-2.402	.022

Note. Dependent Variable: English reading achievement

The results suggest that a change of one standard deviation in E.PA produces a change of 0.56 of a standard deviation in English reading achievement. It can also be understood that a change of one standard deviation in E.RAN produces a change of -0.33 of a standard deviation in English reading achievement.

6.1.3 The association between fifth graders' English reading achievement, E.PA, and E.RAN

To investigate the relationship among English reading achievement, Phonological Awareness, and Rapid Automatized Naming in Grade 5, linear regressions are run.

Table 16. ANOVA for Grade 5 Partial English Immersion Group

Model	df	Mean Square	F	Sig.
Regression	2	666.09	39.82	.00[a]
Residual	37	16.72		
Total	39			

Table 17. ANOVA for Grade 5 Non-Immersion Group

Model	df	Mean Square	F	Sig.
Regression	2	289.44	33.66	.00[a]
Residual	27	8.59		
Total	29			

Note. Dependent Variable: English reading achievement
a.predictors: (constant), E.PA, E.RAN

To make sure that the regression analysis could be run, ANOVA was checked. From the results of ANOVA, it could be seen that the regression in both groups is highly significant at the 0.01 level. It could, thus, be argued that the assumption of regression analysis is confirmed. The regression model summary of Grade 5 students in both educational groups are shown in Tables 18 and 19, respectively.

Table 18. Regression model summary for grade 5 partial English immersion group

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.82[a]	.68	.66	4.08

Table 19. Regression model summary for grade 5 non-immersion group

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.84[a]	.71	.69	2.93

Note. Dependent Variable: English reading achievement
a. predictors: (constant), E.PA, E.RAN

According to the tables, there is a significant relationship between the participants' scores on English reading achievement tests and E.PA and E.RAN in the partial English immersion group and the non-immersion group. Moreover, the findings suggest that the common variance between English reading achievement and E.PA and E.RAN is 0.66 in the partial English immersion and 0.69 in the non-immersion group. Table 20 shows the coefficients of the Grade 5 students in the partial English immersion group.

Table 20. Coefficients for grade 5 partial English immersion group

	Unstandardized Coefficients	Standardized Coefficients			
Model	B	Std. Error	Beta	t	Sig.
E.PA	2.358	.550	.617	4.288	.000
E.RAN	-11.666	6.631	-.253	-1.759	.087

Note. Dependent Variable: English reading achievement

The results show that a change of one standard deviation in E.PA produces a change of 0.61 of a standard deviation in English reading achievement. However, the results also suggest that a change of one standard deviation in E.RAN did not produce a significant change in the standard deviation of English reading achievement. Table 21 presents the coefficients of the Grade 5 students in the non-immersion group.

Table 21. Coefficients for grade 5 non- immersion group

	Unstandardized Coefficients	Standardized Coefficients			
Model	B	Std. Error	Beta	t	Sig.
E.PA	.637	.356	.283	1.791	.085
E.RAN	-16.327	4.241	-.609	-3.850	.001

Note. Dependent Variable: English reading achievement

The findings suggest that on the one hand, a change of one standard deviation in E.PA did not produce a significant change in the standard deviation of English reading achievement. On the other hand, a change of one standard deviation in E.RAN produced a change of -0.60 of a standard deviation in English reading achievement.

7. Discussion

As noted earlier, the basic objective of the current study was to determine whether there is any relationship between cognitive predictors in students' reading achievement in English and Persian, in a partial English immersion and non-immersion settings. Also an attempt was made to investigate the difference among the two educational systems regarding learners' reading achievement and the cognitive predictors. In the following sections, these questions will be addressed separately and the findings of the present study will be related to the findings of similar studies.

7.1 The impact of cognitive predictors on reading achievement

Most studies on cognitive predictors of reading achievement have argued that PA and RAN are crucial to word reading (Scarborough, 1998; Wagner et al., 1997; Wagner et al., 1994), and have an important impact on reading comprehension (Shankweiler et al., 1999). For example, in their study, Wagner et al. (1997) investigated the effects of phonological processing abilities, word-level reading skills, and vocabulary annually from kindergarten through 4th grade, as the learners developed from beginning to skilled readers. These researchers found that individual differences in PA were related to word-level reading, and individual differences in RAN were related to word-level reading initially, but the relations faded as learners developed from beginning to skilled readers. They concluded that PA and RAN were crucial for developing word reading abilities.

In line with these findings, the results of the descriptive statistics and ANOVA also indicate that both English and Persian cognitive predictors have a significant relationship with reading achievement in all three grade levels of the two educational settings.

Moreover, some researchers have found that as educational level increases, students' performance on naming tasks improve (Lezak, 2004; Spreen & Strauss, 1998). Thus, the results of descriptive statistics of the current study yield similar results. The mean score for English and Persian RAN decreased as students' grade level increased in both the partial English immersion and non-immersion groups indicating a better performance.

The literature reviewed on bilingualism and partial immersion programs suggests that immersion students achieve a high level of second language proficiency without any detrimental effects on their first language (Cummins & Carson, 1997; Lapkin et al., 2003; Swain & Johnson, 1997; Turnbull et al., 2001). In a recent study, Cheng et al. (2010) demonstrated that immersion students performed better in Chinese (L1), English (L2), and mathematics at three different grade levels.

The results of the unvariate analysis of the current study are also consistent with previous findings. The results indicate that there is a significant difference among partial English immersion and non-immersion groups in terms of learners' reading achievement scores. There are two reasons for the superior performance of the students in partial English immersion program. The first is bilingualism. Some researchers have argued that bilingualism makes cognition more flexible as a natural consequence of learning two languages (Campbell & Sais, 1995; Rubin & Turner, 1989). These researchers argue that the contrast between two languages makes bilingual children pay more attention to phonologies and orthographies of words. Thus, the cognitive predictors and reading achievement of partial English immersion students grow faster than that of non-immersion students, resulting in better performance in different grade levels.

The second reason could be the educational system itself. The students in partial English immersion school spend much more time studying Persian and English. Moreover, for the students in the partial English immersion program a minimum of 50% of the curriculum is taught in the second language. As Richards and Rogers (2001) state, in such educational programs the foreign language is the vehicle for content instruction with the objective of developing students' level of language proficiency in the foreign language. On the other hand, in such educational programs, students gain designated skills and knowledge in the content areas of the curriculum compared with other programs.

Furthermore, with regard to cognitive processes underlying reading achievement, there was a significant interaction between the test types and the partial English immersion and non-immersion groups. This finding is consistent with the majority of studies which have also reported an advantage for bilingual children (Bruck & Genesee, 1995; Yelland et al., 1993).

7.2 The relationship between reading achievement and cognitive predictors

The available literature on cognitive predictors holds that both PA and RAN are significant predictors of word reading ability and reading comprehension (Badian et al., 1990; Catts et al., 2002; Neuhaus & Swank, 2002; Wolf & Bowers, 1999). For example, Catts et al. (2002) found that both PA and RAN predicted reading achievements. They also indicated that PA and RAN were correlated with learners' IQ and were weaker in poor readers than in skilled readers. Badian et al. (1990) investigated 163 boys from kindergarten through fourth grade and found that PA and RAN are strong predictors of reading achievement. In line with such research findings, the results of the current study also indicate that both English and Persian cognitive predictors have a significant impact on reading achievement in all three grade levels of the two educational settings. The results of the post hoc test revealed that English PA and RAN have a significant effect on English reading achievement; and also Persian PA and RAN have a significant impact on Persian reading achievement.

Li (2008) found that for English immersion students, English predictors proved to be strong predictors of English reading achievement in grades 2, 4, and 6. However, Li found that of the cognitive predictors, English PA and RAN predicted English reading achievements in Grades 2 and 4, and English RAN predicted reading achievement in Grade 6 (Li, 2008). However unlike Li's (2008) study, the results of the current study indicated that students' scores on English PA and RAN significantly accounted for their scores on reading achievement at all three grade levels in both groups. Similar to the above mentioned studies, the results revealed that there was a strong correlation between the cognitive predictors and reading achievements and that poor readers performed weaker on their PA and RAN tasks than skilled readers. In line with the findings above, the results of the regression analysis showed that English PA and RAN could significantly predict reading achievement in all three grade levels. The results also indicated that English PA and RAN were stronger predictors of reading achievement in Grade 1 non-immersion program. The adjusted Rs between English cognitive predictors and reading achievement in Grade 1 were 0.69 and 0.86 for the partial English immersion and non-immersion, respectively. This could be due to the fact that Grade 1 students begin to learn English with a holistic approach of recognizing English words but without having their attention directed to the internal details (e.g., spelling) of written words. By Grade 3, students are in partial and full alphabetic phases. They have learned spelling and phonological decoding, and have paid more attention to sounds and letters in an analytic way, which may have increased their phonological awareness skill. In Grade 5, in the consolidated and automatic alphabetic phases, the students recognize more words as whole orthographic units, rather than as individual letters, which may have weakened the effect of their phonological awareness.

The adjusted Rs between English cognitive predictors and reading achievement in Grade 3 were 0.63 and 0.66 for the partial English immersion and non-immersion, respectively. Finally, the adjusted Rs between English cognitive predictors and reading achievement in Grade 5 were 0.66 and 0.69 for the partial English immersion and non-immersion, respectively. There are two reasons for the superior performance of the students in partial English immersion program. The first is bilingualism. Some researchers have argued that bilingualism makes cognition more flexible as a natural consequence of learning two languages (Campbell & Sais, 1995; Rubin & Turner, 1989). These researchers argue that the contrast between two languages makes bilingual children pay more attention to phonologies and orthographies of words. The second reason could be the educational system itself. The students in partial English immersion school spend much more time studying Persian (L1) and English (L2) compared with the non-immersion group.

A word of caution is in order. Given that there were some limitations in the way in which the present study was conducted, the findings should be interpreted with caution. First, the present study was conducted on female students. Thus, gender was not taken into account in this study. Including participants from both genders may bring about different results. Second, most of the previous studies were based on the relationship between oral word reading and cognitive predictors (Burgess & Lonigan, 1998; Wagner et al., 1997); however, this study used achievement test rather than word reading test as the outcome measure. Though this may be a methodological preference, the comparability of the findings could be an issue.

Phonological awareness consists of syllable awareness, onset-rime awareness, and phoneme awareness. The current study only measured the onset-rime awareness of learners, using the initial and final sound detection tasks. Therefore, using a variety of Phonological Awareness tasks, will improve our understanding of how Phonological Awareness relates to reading development of students.

In future undertakings, it is possible to take these limitations into account to see whether the same results will be produced or not. In addition, the current study only measured the onset-rime awareness of learners' using the initial and final sound detection tasks. Other researchers may be interested in exploring the different levels of Phonological Awareness tasks to examine how Phonological Awareness relates to reading development of students. It is also possible to opt for picture naming and digit naming tasks instead of letter naming RAN tasks adopted in this study.

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