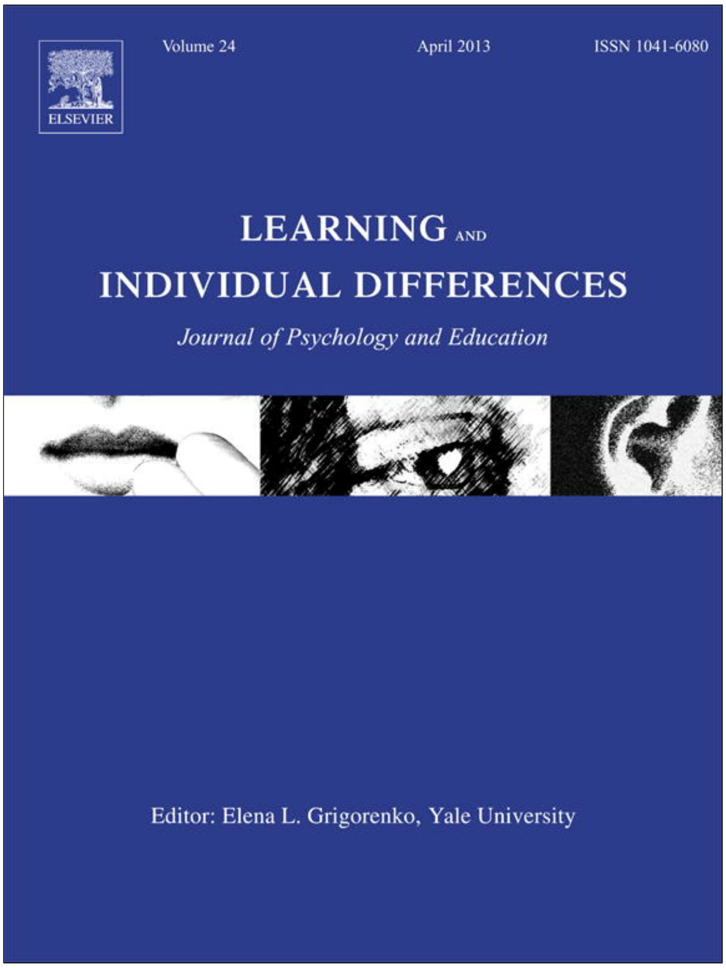
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Intelligence and metacognition as predictors of foreign language achievement: A structural equation modeling approach ☆

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ABSTRACT

This study examined the role of metacognition and intelligence in foreign language achievement on a sample of 143 Iranian English as a Foreign Language (EFL) learners. Participants completed Raven's Advanced Progressive Matrices as a measure of intelligence, and Metacognitive Awareness Inventory as a measure of metacognition. Learners' scores at the end of the semester were aggregated as a measure of foreign language achievement. The findings revealed that intelligence accounts for 12.2% of the variance in foreign language achievement, and metacognition accounts for 17.6% of the variance. Although each of them had a unique impact on foreign language achievement, metacognition outweighs intelligence as a predictor of foreign language achievement. Finally, the pedagogical implications were discussed in light of foreign language achievement.

1. Introduction

Foreign language teachers observe a wide range of performance in language classrooms. Some learners achieve high levels of proficiency, while others underachieve. This issue has attracted the attention of researchers to examine the factors that may affect foreign language achievement. Therefore, prediction of the second/foreign language achievement is of great importance among researchers (Bailey, Onwuegbuzie, & Daley, 2000; Ho, 1987; Matsuda & Gobel, 2004; Onwuegbuzie, Bailey, & Daley, 2000; Pishghadam & Zabihi, 2011). Many factors have been identified to predict foreign language achievement, among them are different cognitive, affective, and personality variables (e.g. Onwuegbuzie et al., 2000). However, two factors, namely intelligence and metacognition, have been given less attention in the field of foreign/second language (L2) learning (e.g. Pishghadam, 2009), despite the fact that these two factors have been extensively examined in relation to learning in general (e.g. Eisenberg, 2010; Schneider, 2008).

There are very few studies that have examined the relationship between intelligence and language learning, as Dornyei (2005) has not mentioned a single one in his review of individual differences research (see Ellis, 2008). Also, research has indicated that metacognition is one of the strongest predictors of learning in general (Flavell, 1976, 1979; Veenman & Elshout, 1995). However, to our best knowledge; no study has examined the simultaneous relationship of intelligence and metacognition in foreign language achievement.

The simultaneous analysis allows us to see which of these two factors can contribute more to foreign language learning. For these reasons, examination of the relationships between metacognition, intelligence, and L2 learning seems timely. In this study first, we examine the unique contribution of each of these two variables, and then the simultaneous effect of these two variables on foreign language achievement will be scrutinized. Results of this study will shed more light on the role of these two important cognitive variables in learning a foreign language.

1.1. Intelligence and foreign/second language learning

In the realm of general education, intelligence has been found to be a strong predictor of learning (Chamorro-Premuzic, 2007; Primi, Ferrão, & Almeida, 2010). Chamorro-Premuzic and Furnham (2005) found that the relation between intelligence quotient (IQ) and grades is not stable and it decreases as students continue their formal education from primary school to tertiary education. According to Pind, Gunnarsdóttir, and Johannesson (2003), the reason for this decline is due to the fewer number of students who enroll in upper educational system.

Within the domain of language education, the relationship between language learning and cognitive abilities is controversial. There are two contrasting views on this relationship.

First view states that there is a special talent for language learning, that is, learning a language is different from other skills (Skehan, 1998; Sparks & Artzer, 2000). Second view, in contrast, proposes that language learning ability is the same as other skills (Sparks, Patton,

☆ We confirm that this paper has not submitted elsewhere.

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Ganschow, & Humbach, 2011). Support for the first view comes from students who have a high IQ, but are very weak in learning a language (Ganschow & Sparks, 2001) or students who have a low IQ, but are good language learners (Sparks & Artzer, 2000). After proposing the first view, this special ability for language learning was called language aptitude which is different from general cognitive ability. Language aptitude refers to a special ability for language learning which involves a number of separate factors including auditory ability, linguistic ability, and memory ability (Skehan, 1989, cited in Ellis, 2008).

Research shows that there is a positive relationship between L2 achievement and language aptitude (Ganschow & Sparks, 2001; Sparks, 2001; Sparks, Ganschow, & Patton, 2008). Some researchers claimed that language aptitude is the best predictor of L2 achievement (Gardner & MacIntyre, 1992; Sparks & Ganschow, 1991; Sparks, Ganschow, & Patton, 1995). Although language aptitude research did not receive much attention between 1960 and 1990 (because it was out-of-date, less relevant to communicative language teaching, and undemocratic to learners), it was revived again in the 1990s as the large number of studies confirm this (see Dornyei, 2005).

Considering these issues, language aptitude has become an interesting area of research during the past 22 years ago. In this respect, intelligence has been abandoned to a large extent as Dornyei (2005) has not mentioned even one single study on the relationship between intelligence and language learning. Researchers like Skehan (1989) speak extensively about aptitude but almost never about intelligence. In the same vein, Teepen (2006) stated that "those who regard innate capacity as aptitude fail to show how aptitude is fundamentally different from intelligence and what is indicated on an intelligence test" (p.8).

Sasaki (1993) examined the relationships between second language proficiency, foreign language aptitude, verbal intelligence, and reasoning ability. Results of her study indicated that 42% of the variance in second language proficiency could be accounted by the general cognitive factor. The other 58% of the variance in second language proficiency is accounted for by something other than general cognitive ability. Genesee (1976) found that intelligence is correlated with L2 French reading and usage skills, but it was not related to productive and interpersonal communication scores. Ekstrand (1977) also found a weak correlation between intelligence and tests of listening and speaking, but a stronger correlation with reading and writing tests. In a more recent study, Fahim and Pishghadam (2007) found a low-level correlation between IQ and foreign language achievement. Moreover, some other studies have found significant associations between multiple intelligences (Pishghadam & Moafian, 2008), emotional intelligence (Pishghadam, 2009) and L2 achievement. All of these studies reveal the fact that intelligence, whether it is psychometric, multiple, or emotional can predict to some extent success in L2 achievement.

1.2. Metacognition and foreign/second language learning

Metacognition is defined as "the ability to reflect upon, understand, and control one's learning" (Schraw & Dennison, 1994, p. 460) or simply thinking about thinking (Flavell, 1979). According to Flavell (1979, 1987), metacognition entails metacognitive knowledge and metacognitive experiences or regulation of cognition. Metacognitive knowledge refers to knowledge about cognitive processes used to control them (Livingstone, 1997). It is further divided into three types: declarative knowledge (knowledge about self and strategies), procedural knowledge (knowing how to use strategies), and conditional knowledge (knowing when and why use strategies) (Schraw & Dennison, 1994). Regulation of cognition involves processes that facilitate controlled aspect of learning. It includes five subcomponents: planning, information management strategies, comprehension monitoring, debugging strategies, and evaluation (Artzt & Armour-Thomas, 1992; Schraw & Dennison, 1994).

Metacognition has been identified as a strong predictor of learning (Coutinho, 2007; Dunning, Johnson, Ehrlinger, & Kruger, 2003; Flavell, 1976, 1979; Kruger & Dunning, 1999; Veenman & Elshout, 1995). Research has shown that learners with higher levels of metacognition perform better than those with lower levels of metacognition (Garner & Alexander, 1989; Kruger & Dunning, 1999). The reason is that metacognitively aware learners plan, sequence, and monitor their learning in a way that improves their performance (Schraw & Dennison, 1994). They are aware of their thinking and use their awareness to control their thinking. According to Chamot and O'Malley (1994), metacognition "may be the major factor in determining the effectiveness of individuals' attempts to learn another language" (p. 372). It highlights the importance of teaching metacognition in L2 classes. Like many other subjects, metacognition can be taught to the learners. Therefore, teachers play an important role to help learners develop understanding and controlling over cognitive processes (Anderson, 2002). English as a Foreign Language (EFL) classes, teachers can help learners plan, control, and evaluate their learning by teaching metacognition.

Some studies in field of general education have indicated that metacognition contributed to learning performance independent of intellectual ability (Prins, Veenman, & Elshout, 2006; Van der Stel & Veenman, 2008).

Regarding the role of metacognition, intelligence, and learning, three models have been proposed (Veenman, 1993; Veenman & Elshout, 1991). The first model (*intelligence model*) considers metacognition as an integral part of intelligence. According to this model, metacognition cannot have a predictive value for learning independent of intellectual ability. In the second model (*independency model*), intelligence and metacognition are considered as entirely independent predictors of learning. The last model (*mixed model*) explains that metacognition and intelligence are related, but metacognition has an additional value above intelligence for prediction of learning. According to Veenman, van Hout-Wolters, and Afflerbach (2006), on average, intelligence accounts for 10% of variance in learning, metacognition accounts for 17% of variance in learning, while both predictors share another 20% of variance in learning for students with different backgrounds, ages, and fields of study. The implication is that metacognition may compensate for students' cognitive limitations. The present study aims at examining the mixed model.

1.3. Present study

Given the abovementioned relationships between intelligence, metacognition, and learning this study first examines the predictive power of intelligence and metacognition in L2 learning. Then, unique contribution of metacognition and intelligence beyond and above each other is estimated. Although some studies have examined the relations between language learning and intelligence (Ekstrand, 1977; Genesee, 1976), and language learning and metacognition (Green & Oxford, 1995; Oxford & Burry-Stock, 1995), no study has examined the simultaneous relationship of these two variables as predictors of language learning. Results will have many implications for language teachers and researchers.

2. Method

2.1. Participants

A total number of 143 EFL learners (84 females, 57 males, 2 unknown) from three private language institutes in two cities from North East of Iran participated in this study. Their ages ranged between 17 and 40 (mean = 24.35, SD = 4.24). All of them were intermediate and upper-intermediate learners of English.

2.2. Materials

2.2.1. Intelligence

In order to assess the learners' intelligence, Raven's Advanced Progressive Matrices set II was used (Raven's APM; Raven, 1958). It includes 36 matrix figures in which each matrix figure has three rows and three columns. Participants should choose among eight possible alternatives the one completing the 3×3 matrix figure. In the present study, 36 items of APM were divided into two equal parcels. A Spearman-Brown odd–even split-half reliability estimate of 0.89 was found for the APM scores in the present study.

2.2.2. Metacognition

Metacognitive Awareness Inventory (MAI, Schraw & Dennison, 1994) was used to measure different subscales of metacognition. It has 52 items accompanied by a 5-point scale ranging from strongly disagree to strongly agree. It includes two subscales, knowledge of cognition (KC) and regulation of cognition (RC). This scale has shown a good reliability and validity for metacognition assessment (Coutinho, 2007). In this study, Cronbach's α for knowledge of cognition was .91, and for regulation of cognition was .88, and total Cronbach's α was .94. Schraw and Dennison (1994) also reported a Cronbach's α of .95 for the entire scale in the original study.

This scale was translated into Persian to increase the return rate. Back-translation, which is translating the original instruments into Persian and translating them back to English, was employed to ensure the accuracy of the translation.

2.2.3. Foreign language achievement

To assess the foreign language achievement, learners were asked to write their names in order that we can have an access to their final grades at the end of the semester. All of the institutes used Interchange Book Series (Richards, Hull, & Proctor, 2005). The exams administrated in these institutes were based on the tests provided by the aforementioned books; therefore, they used the same tests. Regarding the reliability of the tests, KR-21 showed a reliability of .78 for intermediate test and .82 for upper-intermediate test. Foreign language achievement test included listening, speaking, reading, and writing grades. The maximum possible grade in these institutes is 100.

2.3. Procedure

After getting the permission from the teachers, researchers distributed the two scales in the classrooms in December 2011. Participants completed Raven's Advanced Progressive Matrices set II in 30 minutes. Then they were given the Metacognitive Awareness Inventory to complete it at home and take it back next session.

3. Results

Descriptive statistics and correlations between intelligence, metacognition, and foreign language achievement scores are given in Table 1.

As can be seen in Table 1, the correlation between total metacognition and foreign language achievement ($r = .41$, $p < .01$) is higher than the correlation between total intelligence and foreign language achievement ($r = .26$, $p < .01$). In order to have a better understanding of the role of metacognition and intelligence in foreign language achievement, Structural Equation Modeling (SEM) was used.

SEM is a powerful multivariate technique used to take a confirmatory hypothesis-testing approach for the proposed structural theory. There are some significant features in SEM that set it apart from other multivariate procedures. First, “it takes a confirmatory rather than an exploratory approach to data analysis” (Byrne, 2001, p. 3). Therefore, unlike the other multivariate procedures that are descriptive in nature (like exploratory factor analysis), SEM can test a hypothesis. Second, while traditional multivariate procedures are incapable of assessing measurement error, SEM provides estimates of error variance parameters. Third, although other methods are based on the observed measurements only, SEM considers both observed and latent variables (Byrne, 2001).

Two models were specified for the analysis in this study (Fig. 1). The structures of the relationships for each of these two models are the same. Therefore, they are statistically the same, but to clarify the results, both models are involved. In order to examine the unique effects of the metacognition and intelligence, goodness of fit measures were used for checking the adequacy of the model. The goodness of fit indices used in this study are: χ^2/df (chi-square divided by the degrees of freedom), Goodness of Fit Index (GFI), Comparative Fit Index (CFI), the Tucker–Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA). An acceptable model is indicated by χ^2/df<3, GFI>.95, TLI>.95, CFI>.95, and RMSEA<.06 (Hu & Bentler, 1999). Evaluation of the model showed a good fit to the data (Table 2). As shown in model A, the relationships between the three latent variables are significant. Metacognition and intelligence shared 9% of the variance ($R^2 = .302$). Metacognition and foreign language achievement had 17.6% common variance ($R^2 = .422$). Also, intelligence and foreign language achievement shared 12.2% of variance ($R^2 = .352$). Therefore, metacognition was a stronger single explanatory factor of foreign language achievement than intelligence.

To examine the unique contribution of metacognition and intelligence beyond and above each other, R^2 increments were analyzed based on the comparison of percentage of variability in foreign language achievement shown in models A and B. In model B, metacognition and intelligence together accounted for 23% of the variance (according to SEM calculations) in foreign language achievement. Hence, intelligence accounted the additional 6% of the variance of

Table 1
Descriptive statistics and correlations.

	Mean (SD)	1	2	3	4	5	6	7
1. IQ1	10.06 (2.82)	1.00						
2. IQ2	11.53 (3.29)	.39**	1.00					
3. Total Intelligence	21.60 (5.11)	.61**	.66**	1.00				
4. KC	71.42 (12.55)	.13	.20*	.20*	1.00			
5. RC	133.62 (23.40)	.08	.10	.11	.63**	1.00		
6. Total Metacognition	205.04 (35.32)	.10	.14	.15	.59	.62**	1.00	
7. FLA	82.40 (5.83)	.21**	.22**	.26**	.43**	.39**	.41**	1.00

Note: KC = knowledge of cognition; RC = regulation of cognition; FLA = foreign language achievement.
* $p < .05$.
** $p < .01$.

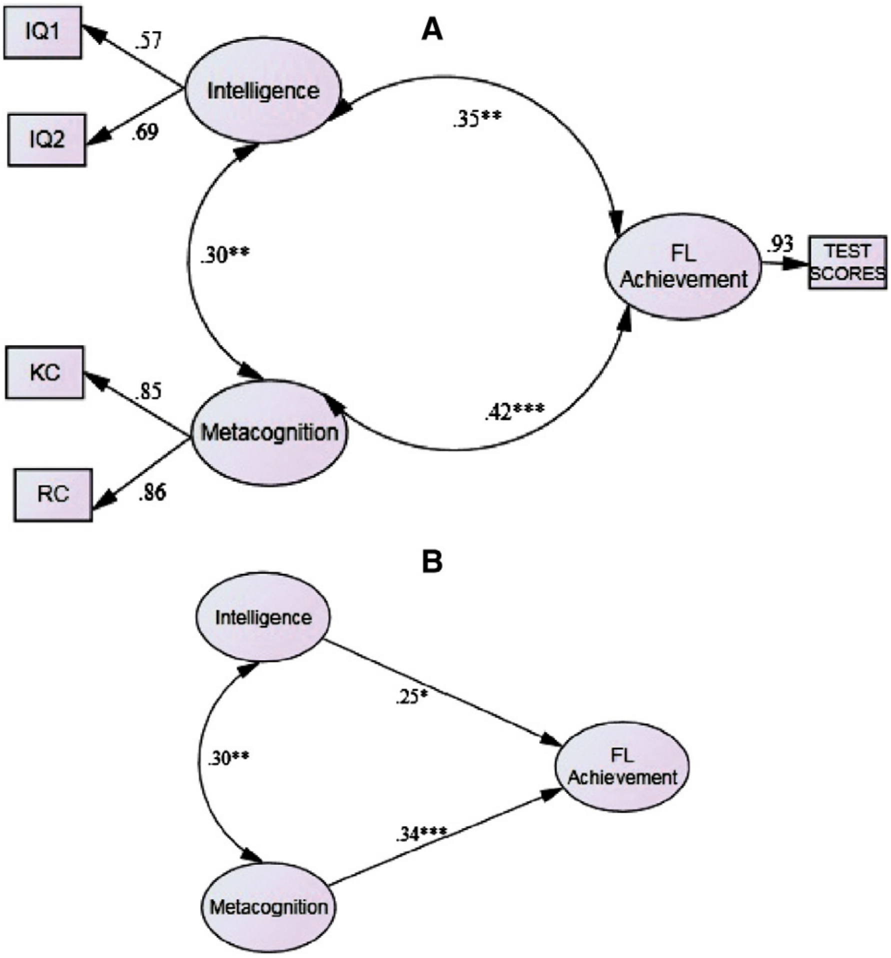

Fig. 1. Intelligence and metacognition as predictors of foreign language achievement. Observed variables for the model B is the same as for the model A. Note: KC = knowledge of cognition; RC = regulation of cognition. $^{*}p<.05.^{**}p<.01.^{***}.p<.001$.

foreign language achievement, beyond the single metacognition explanatory factor ($\Delta R^2 = .23 - .17 = .06$). The unique contribution of metacognition in predicting foreign language achievement above the intelligence factor was 11% ($\Delta R^2 = .23 - .12 = .11$). As the results indicate, again the unique contribution of metacognition was higher than intelligence in prediction of foreign language achievement.

Then, the unique contribution of intelligence and metacognition on foreign language achievement was examined by constraining each of the related beta weights to zero and then corresponding χ^2 changes were evaluated in model B. If constraining beta weights to zero resulted in significant decrease in χ^2, the unique contribution of each variable in predicting foreign language achievement would be significant. The fit indices for the models are presented in Table 2. Constraining beta weights to zero in both model A1 ($\beta_{\text{intelligence}} = 0$) and model A2 ($\beta_{\text{metacognition}} = 0$) resulted in significant chi-square changes (model A1 ($\beta_{\text{intelligence}} = 0$): $\Delta\chi^2$ (1, N = 140) = 5.27, $p<.05$; model A2 ($\beta_{\text{metacognition}} = 0$): $\Delta\chi^2$ (1, N = 140) = 6.14, $p<.05$). The results indicated the significant unique contribution of intelligence and metacognition as predictors of foreign language achievement.

Table 2
Goodness of fit indices.

	χ^2	df	χ^2/df	GFI	TLI	CFI	RMSEA
Models A and B	5.52	3	1.84	.98	.97	.99	.06
Model B_1 ($\beta_{\text{intelligence}} = 0$)	10.79	4	2.69	.97	.96	.98	.06
Model B_2 ($\beta_{\text{metacognition}} = 0$)	11.66	4	2.91	.95	.95	.95	.05

4. Discussion

This study examined the role of intelligence and metacognition as predictors of foreign language achievement.

Previous research on the role of intelligence in language learning has shown contradictory views, the first view claims that learning language is different from other subjects and intelligence is not related to language learning, while the second view suggests that learning a language is the same as other skills, and intelligence is a predictor of learning (see Sparks et al., 2011). Findings of the present study support the second view as intelligence had a unique contribution in predicting foreign language achievement.

Results of the study showed that intelligence and metacognition individually accounted for 12.2% and 17.6% of the variance in foreign language achievement, respectively. This finding shows that metacognition is a stronger predictor of foreign language achievement than intelligence.

Taken together, intelligence and metacognition accounted for 23% of the variance in foreign language achievement, and each of them had a unique impact on foreign language achievement. Findings suggest that although metacognition predicts foreign language achievement stronger than intelligence, we cannot deny the unique role of intelligence as a determinant of foreign language achievement. Therefore, this study confirmed that the role of intelligence in language learning is the same as other skills, and one cannot ignore its unique contribution in this field.

Results of this study also corroborated the mixed model in which metacognition contributed to learning (here foreign language achievement) on top of intelligence (Veenman, Wilhelm, & Beishuizen, 2004). It also confirms the claims of Chamot and O'Malley (1994) who stated that metacognition is one of the major factors in determining the effectiveness of individuals' attempts for learning another language. It shows that if L2 learners have a low level of intellectual ability, their metacognitive ability can compensate for this shortcoming.

However, it should be mentioned that metacognition is achieved through observation and vicarious learning which highlights the role of others (peers, parents, and teachers) in this process.

Prior studies had examined the mixed model in different tasks and fields (see Veenman et al., 2004), but L2 learning was not among them. Therefore, the present study confirmed that the mixed model can be generalized to L2 learning in EFL contexts.

There are some implications for foreign language researchers and teachers based on the results of this study. This study showed that metacognition is a strong predictor of foreign language achievement, even beyond intelligence. This important finding suggests that foreign language teachers can compensate for intellectual shortcomings of the learners by turning to metacognition. Like many other procedures, metacognition can be taught. For this purpose, teaching metacognitive strategies to students in order that they can plan, monitor, and evaluate their own learning is necessary. Teachers can explicitly teach the strategies, when and how students need to use them, and why they are important. For instance, metalinguistic awareness is one aspect of metacognitive ability, which can be taught by teachers. In fact, it deals with the ability to deliberately think and manipulate the structural features of spoken language, (Tunmer & Cole, 1985), leading learners to understand the nature of language rather than the ability to use language to communicate meaning (Dita, 2009).

In the same vein, by keeping a reflective journal in which students write about their thoughts, feelings, beliefs, and what they know, teachers can function as a mental guide. Also, talking about thinking in that learners talk to themselves about their thinking process can help them with learning. Furthermore, teachers can use a metacognition questionnaire in order to find those students who have a low level of metacognition, and then teach them the required metacognitive strategies.

Results of this study should be interpreted in light of some limitations. First, we utilized the total foreign language achievement of the learners in this study, and its subscales (listening, reading, writing, and speaking) were not examined separately. As previous studies (e.g. Ekstrand, 1977; Genesee, 1976) have distinguished between productive and usage skills, future research is needed to examine the role of intelligence and metacognition with regard to these subskills of foreign language achievement. Another shortcoming is related to the use of a questionnaire for assessing metacognition. According to Veenman and Van Hout-Wolters (2001), use of questionnaires for assessing metacognition is less valid than performing tasks on measures like Knowledge Monitoring Assessment (KMA). Also, with respect to generalizability of the results of this study, it was done among a sample of Iranian students. Therefore, generalizing these findings in other contexts should be done cautiously.

In spite of these limitations, the results of the present study provided unique empirical data on the role of intelligence and metacognition in foreign language achievement, in particular indicating the contribution of metacognition. The results also implied that metacognition instruction should be an integral part of language learning classes in order to enhance learning other languages.

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