On the Relationships of Iranian EFL Learner's Crystallized and Fluid Intelligences with their Vocabulary Size

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ABSTRACT

The aim of the present study was to investigate the relationships of Iranian EFL Learner's Crystallized and Fluid Intelligences with their Vocabulary Size. The Participants of the study were 100 male and female learners from Islamic Azad University of Mashhad in TEFL course that are ranged from 20 to 40 years old. To administer the study, an experimental and quantitative analysis was conducted and the relationship between variables was measured using three instruments namely, Baddeley's (1968) Grammatical reasoning Test for Fluid intelligence, Persian C-Test (2015) for crystalized intelligence, and Nation's (2012) vocabulary size Test. Data were analyzed using SPSS version 21. First, correlational analyses were conducted to find out correlation coefficients between the variables. Then, multiple coefficient tests were done to find Beta weight of variables. The results obtained from correlational analyses showed that there is a significant relationship between crystallized intelligence and vocabulary size, while there is no significant relationship between learners' fluid intelligence and their vocabulary size. Besides, regression analyses showed that the model consisting of both crystallized and fluid intelligences explains a small but significant portion (8%) of the variance in vocabulary size. It was also concluded that fluid intelligence does not significantly predict vocabulary size, but crystallized intelligence significantly predicts vocabulary size. The study implies that crystalized intelligence should be considered in language learners' curriculum to achieve the teaching and learning purposes.

Keywords: Fluid Intelligence (Gf), Crystallized Intelligence (Gc), Vocabulary Size

INTRODUCTION

The theory of fluid and crystallized intelligence (Gf-Gc theory), was first proposed by Cattell and then supplemented by Horn (see Cattell, 1963, 1971; Horn, 1968, 1970, 1975; Horn&Cattell, 1967). Cattell (1963) divided intelligence into two types: Fluid and crystallized as effective intelligences on language learners. Fluid intelligence (Gf), known as General Factor for intelligence, introduced by Cattel (1971), was defined as the ability to reason and to solve new problems and difficulties independently by previously acquired knowledge.

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Another intelligence that is necessary for educational tasks is crystallized memory (General Cognitive or GC) which means information saved and stabilized in long term memory which required to be revived immediately. According to Cattell (1971), crystallized intelligence in psychology is considered as indication of general cognitive and relies on acquired knowledge and information added to memory. According to Carrell and Eisterhold (1983). According to Kamphaus, Winsor, Rowe, and Kim (2005), GF is abbreviated form of Fluid Intelligence, because it has previously been considered as general intelligence factor. Gf is critical for a wide variety of cognitive tasks, and it is considered one of the most significant factors in learning. Fluid intelligence is related to educational and professional success. According to Kensinger and Corkin (2009), crystallized Intelligence refers to individual's ability to retrieve, revive and use information acquired throughout one's lifetime. It is opposed to fluid intelligence that means the ability to store and manipulate old and new information. Crystallized intelligence remains stable during the life, i.e. adults are better at defining words and answering questions that rely on general world knowledge, detecting spelling errors, and carrying out skills related to jobs that they have held for many years. In this study. It is operationally defined as the scores learners obtain from completing four Persian C-Test passages.

Fluid intelligence (Gf) is a complex human ability that lets us to adapt our thinking to a new cognitive problem or condition. There is considerable agreement that GF is robust against influences of education and socialization, and it is usually seen as having a strong hereditary component. In this study, Fluid intelligence (Gf) refers to the skill to reason and to solve new problems autonomously of previously acquired knowledge. It is operationally defined as the scores participants obtain on Persian version of Baddely's grammatical reasoning test, consisting of 64 statement items. GF is critical for a wide diversity of cognitive tasks, and it is considered one of the most important issues in learning. Furthermore, GF is closely associated with specialized and educational success, especially in complex and demanding environments (Primi, Ferrão, & Almeida, 2010).

Reading is an interactive cognitive process in which readers interact with the text using their prior knowledge or crystalized knowledge. In the last two decades, considerable attention has been paid to understanding what proficient and skilled readers usually do while reading, including identifying and organizing the strategies they use and how and under what situations they use those strategies to remind the forgotten vocabularies Vocabulary size as an important dimension of vocabulary knowledge is always considered as one of the most significant indicators of language knowledge in second language reading (Anderson & Freebody, 1981; Bernhardt, 2005).

According to Nation et al., (1995), vocabulary size simply means "the number of words a learner knows" (p. 32). It typically measures a learner's knowledge of the form of the word and the ability to link that form to a meaning. Nation (2006) believed that vocabulary size can be categorized into level of proficiency and arrangement of words from simple to most difficult, thus he categorized a range of words from simple to difficult including 140 words to rate students' level of vocabulary size. In this study, vocabulary size is operationally defined as the scores participants obtain from answering 140 multiple choice questions in Nation's vocabulary size test.

Scholars such as Laufer & Nation, (1999; Nation & Beglar, 2007; Nation & Waring, (1997) emphasized on vocabulary size and its influence on learner's performance in four language skills and

considered vocabulary knowledge as a means of potentiality to undergo related educations specially learning language for specific purposes.

Laufer and Nation (1995) indicated that "the Lexical Frequency Profile correlates well with an independent measure of vocabulary size that affect judgments of quality in writing and will be useful for examining how vocabulary growth is related to vocabulary use" (p. 307). Nation and Waring's (1997) study suggested that vocabulary size and frequency are beneficial for both teachers and students. Nation and Beglar (2007) developed an instrument to measure learners' vocabulary size. It could contribute to the studies which intended to test learners' vocabulary size. Although vocabulary size has been measured in various studies and different learning intelligences have been explored, few studies, if any, have been done to find the role of fluid and crystalized intelligence in the learners' vocabulary size.

In the Iranian context, some studies investigated the relationship between multiple intelligence and different language skills. For instance, Yeganehfar (2005) studied the relationship between multiple intelligences and language proficiency. In another study, Rahimian (2005) specified multiple intelligences and learning style to be correlated with language proficiency. In addition, Akbari and Hosseini (2008) investigated the relationship between the use of language learning strategies and multiple intelligences. Also, some studies (Barekat & Karimi, 2012; Mahdavi, 2014) emphasized on vocabulary learning and intelligence. However, fluid and crystallized intelligence's influence on language learning and vocabulary acquisition has not been investigated.

The previous literature lacks studies exploring interaction between vocabulary knowledge and Iranian EFL learners' crystallized and fluid intelligence. Besides, based on the existing relevant literature, it is not clear to what extent crystallized and fluid intelligences can explain learner's vocabulary size. Having proper knowledge about such intelligences, learners would be able to build up the size of their vocabulary through promoting and activating their crystallized and fluid intelligences. Accordingly, in the present study, the role of crystallized and fluid intelligences on the vocabulary size of Iranian EFL learners was examined.

STATEMENT OF THE PROBLEM

This study aimed at examining the relationships of Iranian EFL learners' crystallized and fluid intelligences with their vocabulary size. Although many studies have been done to find these relationships all over the world, there is still lack of research in this field in Iran. On the other hand, many studies (Laufer & Nation, 1999; Nation & Waring, 1997) have investigated the role of vocabulary size in the development of learners' four language skills, but the extent which vocabulary knowledge is related to fluid and crystalized influence has not been confirmed.

Thus, the present study aims at examining the relationships of Iranian EFL learners' crystallized and fluid intelligence with their vocabulary size. The two intelligences namely fluid intelligence and crystalized intelligence as independent variables are tested using standard questionnaires to specify whether they relate to Learners' vocabulary size as dependent variable.

RESEARCH QUESTION OF THE STUDY

To show the objectives of the study, the researcher considered the following quantitative research questions:

RQ1. Is there any significant relationship between Iranian EFL Learner's crystallized intelligence and their vocabulary size?

RQ2. Is there any significant relationship between Iranian EFL Learner's fluid intelligence and their vocabulary size?

RQ3. How well can fluid or crystallized intelligences predict Iranian EFL Learner's vocabulary size?

HYPOTHESIS OF THE STUDY

To answer the above questions, the following null hypotheses are formulated:

H01. There is no significant relationship between Iranian EFL Learner's crystallized intelligence and their vocabulary size.

H02. There is no significant relationship between Iranian EFL Learner's fluid intelligence and their vocabulary size.

H03. Fluid or crystallized intelligences cannot predict Iranian EFL learners' vocabulary size.

METHODOLOGY

Participants

In this study, one hundred EFL Learners were selected based on Morgan's (1970) table, determining Sample Size for Research Activities, the participants were from Islamic Azad university of Mashhad, Khorasan Razavi. The setting of the study was conducted at Islamic Azad university of Mashhad, Khorasan Razavi. Participants' age ranged from 20 to 40 and they were all Iranian EFL learners. The participants were selected from both genders (i,e male and female).

Materials

The study was performed using three instruments including Persian Adaptation of Baddeley's (1968) Grammatical reasoning, C-Test (2015), and Nation's (2012) Test of Vocabulary Size.

Persian Adaptation of Baddeley's Grammatical Reasoning Test

To measure the participants' fluid intelligence, the Persian Adaptation of Baddeley's Grammatical reasoning Test were administered. The test is a translation of the original Baddeley's (1968) Grammatical reasoning Test into Persian. The test consisted of two parts. One part asks about the participants' demographic information such as name, gender, age, field of study and the other part consists of 64 statements which the participants have to read and on the basis of the shapes opposite each statement, mark the statements as true or false. The time allocated to the test was 3 minutes. The participants were not allowed to use erasers during the test. The Cronbach's alpha reliability of the test was reported .91 as measured by Eckes and Baghaei (2015). To ensure validity of the test, the ideas of the experts of the TEFL course at IAU of Mashhad University were asked; the test was approved by experts of the course especially the supervisor and the advisor.

C-Test (2015)

To measure crystallized intelligence, a valid C-Test battery validated and used by Baghaei and Tabatabaee (2015) was administered. To do the test, the participants were supposed to perceive words in the sentences even if spelling of the words was not clear or left blank intentionally. C-Test (2015) is proved to be a standard test for measuring crystallized intelligence.

Since it had been previously implemented and validated in the Iranian context, it was used in the present study, intact. The test consisted of four paragraphs; each passage has 20 black spaces for incomplete words that are known as a gap filling test. The term that might be used in gaps is related to the specific topic. The total score of the exam was 80 due to 80 gaps. The number of words that the test takers can reconstruct correctly is a good criterion for measuring their crystallized intelligence. The amount of crystallized intelligence was measured from 100% in the study. Participants were given 15 minutes to complete the test. Reliability of the test was reported as .85 by Nation (2006) and validity of the test was ensured by asking experts' ideas.

Nation's Test of Vocabulary Size

Nation's (2012) vocabulary size test was used to measure the vocabulary size of the participants. The test included 140 multiple choice questions that must be answered in 40 minutes. The test was designed so that from every 1000 words, 10 words is presented to measure the words with the same range of difficulty. Accordingly, the test included 14 multiplies 10 words. To specify the vocabulary size, the final score is multiplied in 100 to determine the size of words that are out of 14000 words. In multiple questions, a term is used and four meanings are provided so that participants should select the most relevant answer. The test was organized from simple to difficult. The participants were given 40 minutes to answer the items on the test. The Cronbach's alpha for reliability of the test was measured by Beglar (2010) and it was .83. This ensured the researcher that it was a reliable test of measuring vocabulary size used in the current study. Also, validity of the vocabulary test was approved by the supervisor and advisor of the present study.

Procedure

In this study that was implemented in the Islamic Azad University of Mashhad among learners in the field of Teaching English, 100 learners were selected as sample. They answered all the questionnaires during one session. The participants received crystallized and fluid intelligence test at first. They were given 3 minutes to answer the fluid test and 15 minutes for completing the crystallized test. Then, the test for measuring vocabulary size was distributed among them and they had 40 minutes to complete the test. During the data collection, the researcher explained the instruction of the tests whenever ambiguity or question rose. At first, Cronbach's alpha reliability of the vocabulary test, the C-test, and Baddeley' grammatical reasoning test were tested, and then normality distributions were examined. Next, using SPSS software, correlations between all the variables were calculated. Finally, the regression test was used to determine the Beta weight of variables, and to find the best predictor for vocabulary size.

This study is quantitative and practical and aims at measuring the relationship between the fluid and crystallized intelligences, as two independent variables, and vocabulary size as a dependent variable. In this study regression and correlational analyses were performed to test the hypotheses

about the relationships among crystallized and fluid intelligences and the vocabulary size using SPSS, 21.

RESULTS AND DISCUSSIONS

Descriptive Statistics included the means, standard deviations, variances, minimum, and maximum. Table 4.3 shows the means, standard deviations, variances, minimum, and maximum for each of the variables in the study. Since the nature and the number of items in each test are different, the tests cannot be compared directly. In all tests, for each correct response one point was awarded.

Table 4.3

Descriptive Statistics for the Tests Used in the Study

	N	Minimum	Maximum	Mean	Std. Deviation
Baddeley	100	3	62	30.24	13.90
Vocabulary	100	14	84	38.06	15.39
C-test	100	17	69	46.44	10.62

Inferential Analysis of the Data

Analyses of Research Hypotheses

In this section, each research hypothesis is presented along with the results obtained. Before analyzing each research hypothesis in details, correlation coefficients for all the variables are reported in Table 4.4. Table 4.4 shows the correlations between the vocabulary size, the grammatical reasoning test, and the C-Test.

Table 4.4

Matrix of Correlations between the Variables

	Vocabulary	Baddeley	C-Test
Vocabulary	1	.19	.28**
Baddeley		1	.27**
C-Test			1

** Correlation is significant at the 0.01 level (2-tailed).

The above table represents correlation coefficients of vocabulary size, crystalized intelligence, and fluid intelligence. Details about the significance of the correlations are discussed in the following subheadings.

Analysis of the First Hypothesis

$H0_1$: There is no significant relationship between Iranian EFL Learner's crystallized intelligence and their vocabulary size.

Crystallized intelligence was measured with a Persian C-Test. As Table 4.4 shows there is a positive and significant correlation between the vocabulary size test and the C-Test (r=.28, p<.01), in other words, the sig level is higher than standard error (0.5%). It can be concluded that there is a significant relationship between crystallized intelligence and vocabulary size test even though the magnitude of the correlation is rather small. Therefore, the first null hypothesis was rejected.

Analysis of the Second Hypothesis

$H0_2$: There is no significant relationship between Iranian EFL Learner's fluid intelligence and their vocabulary size.

Fluid intelligence was measured with the Persian version of Baddeley' grammatical reasoning test. Table 4.4 shows that the correlation between vocabulary size test and the grammatical reasoning test is .19 (r=.19, p>.05) which is not significant (p>.05). It should be concluded that there is no significant relationship between learners' fluid intelligence and their vocabulary size. Therefore, the second null hypothesis was confirmed.

Analysis of the Third Hypothesis

$H0_3$: Fluid or Crystallized Intelligences cannot predict Iranian EFL Learner's vocabulary size.

To analyze the third research hypothesis, multiple regression analysis was used. The variables representing fluid intelligence and crystallized intelligence, i.e., the grammatical reasoning test and the C-test were entered as independent variables and the vocabulary size test as the dependent variable. Table 4.5 indicates the explanatory power of the two types of intelligence, fluid and crystallized, in explaining vocabulary size.

Table 4.5

Beta Weights for the Variables in the Regression Analysis and Their Significance

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	17.09	6.83		2.50	.01
	BaddelyTotal	.14	.11	.12	1.25	.21
	C_Total	.36	.14	.24	2.47	.01

The third research hypothesis had two parts, each part was analyzed here separately. The analysis of the first part, i.e. fluid intelligence cannot predict learners' vocabulary size, showed that fluid intelligence, as measured with grammatical reasoning test, did not significantly predict vocabulary size

(Beta = 0.12, p=0.21). Thus, the first part of this null hypothesis was confirmed. The analysis of the second part, i.e. crystallized intelligence cannot predict learners' vocabulary size , showed that crystallized intelligence, as measured with C-Test, significantly predicted vocabulary size (Beta = .24, p< .01) . Thus, the second part of this null hypothesis was rejected. Table 4.5 shows the beta weights, their t-values, and significance for the independent variables.

The results also showed that the model explains a small but significant portion of the variance in the vocabulary size scores F (2, 97) = 5.09, p< .01, R^2 = .10, adjusted R^2 = .08. That is, the two independent variables explain about 8 % of the variance in the vocabulary size test.

GENERAL DISCUSION

This study concerned the relationship of fluid and crystallized intelligence with Iranian EFL learners' vocabulary size. Participants level of fluid and crystallized intelligence and their correlation with vocabulary size was examined and it was concluded that there was a significant relationship between crystallized intelligence and vocabulary size, but the relationship between fluid intelligence and vocabulary size was not approved. Multiple regression analysis showed that between the two types of intelligences, only crystallized intelligence could predict vocabulary size significantly but weakly as the relavant Beta weight was .24. Further analysis indicated that the entire model consisting of both crystallized and fluid intelligence altogether could explain a small portion of variance in vocabulary size. In general, the current study showed that the two types of intelligence altogether slightly explain the variation in vocabulary size. Thus, it seems rational to claim that the variance left unaccounted in this model can be explained by other factors such as educational quality, efforts, and environmental factors.

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