On the Relationship between General Factor and Foreign Language Proficiency

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Abstract

Raven Progressive Matrices (RPMs) and Wechsler Intelligence Scale for Children (WSIC-R) are two common general intelligence measuring scales used in Iranian high schools. In this paper the relationships between g factor scales and students' reading comprehension, grammar, and vocabulary was examined by correlation and regression analysis. Standard tests of grammar and vocabulary and Cambridge Key English Test (KET) were used to elicit the overall language proficiency of Iranian high school students. The results of the study revealed that verbal intelligence and vocabulary and non-verbal intelligence measured by RPMs not WSIC-R were determining factors in reading comprehension. Verbal intelligence was found to have an important role in vocabulary knowledge. Only grammar, in spite of a weak correlation with reading and a section of WSIC-R, didn't show any remarkable correlation with intelligence or language knowledge measuring scales.

Keywords: Wechsler Intelligence Scale (WSIC_R), Raven Progressive Matrices (RPMs), Verbal IQ, Non-Verbal IQ, g Factor, General Intelligence

Received: February 2009; Accepted: January 2010

1. Introduction

Individual differences among students overall language performance have always been an important aspect of educational studies. These differences can impact the rate and quality of learning a second or foreign language in both formal and informal settings.

The difference between people in terms of their linguistic abilities and skills such as writing ability and vocabulary knowledge and the speed of reading comprehension are, all, related to the intellectual abilities which make it important to study human mind. Eyseneck (1998) believes that the role of intelligence becomes more effective when the degrees of difference of two languages are greater such as English and Japanese than English and Spanish.

Formality or informality of setting also influences the importance of intelligence in language learning. Iranian high school setting is a formal foreign language learning context in which reading comprehension, grammar and vocabulary learning are the main focus of educational system. Due to the fact that intelligence plays a significant role in education, tremendous number of studies were done through out the second part of the 20th century. Different views toward the concept affected the development of different measuring scales of intelligence.

1.1. Definitions of Intelligence and Its Structure

Many researchers and psychologists suggested different definitions for intelligence every of which influenced the field for a long period. Binet and Simon defined intelligence as "Judgment, and in the other words, wisdom, practical talent, creativity, adoption with the new situations, good understanding, and good reasoning, are the main activities of intelligence." But

Wechsler believes in intelligence as "general thinking ability which everyone uses to understand his surrounding world and meets his own needs."

Eysenck (1998) defines it as "success in problem solving, ability to learn, capacity for producing new solutions, understanding of complex instructions or simply all-round cognitive ability." Many researchers believe that intelligence is a seemingly simple idea that has proven specially, difficult to define, measure or test.

Intelligence scales are based on the presuppositions of the structure of intelligence. Every section of the test may measure a parallel section of intelligence. Guilford (1950) believed in a different pattern and suggested three dimensions including *mental operations* (cognition), *contents* (behavioral thinking), and *products* (result of the ability in content). Cattell (1971), a famous American psychologist, identified two main clusters for intelligence including: *crystallized intelligence* (reasoning verbal numerical) and *fluid intelligence* (spatial and visual awareness). David Perkins (1993) focused more on educational aspects of intelligence and suggested the following classification: *Neural intelligence* (efficiency of one's neurological system), *Experiential intelligence* (experience in different areas), *Reflective intelligence* (strategies for attacking problems).

1.2. General Factor

Charles Spearman an early psychometrician, found that schoolchildren's grades across seemingly unrelated subjects were positively correlated, and proposed that these correlations reflected the influence of a dominant factor, which he termed *g* for "general" intelligence. He believed that g factor rules the general intelligence and is autonomous, goal-directed, and highly adaptive. Then, Kattel suggested a new division of g factor (Sharifi 2005, p. 56). He believed that g factor is made up of *Fluid intelligence* which is the ability to develop

techniques for solving new and unusual problems. It is culturally free and is influenced by genetic factors. *Crystallized intelligence* is the ability to bring previously acquired problem-solving methods. It is teachable and can be influenced by culture and environment. *Visual-spatial reasoning* is a specialized ability to use visual images and visual relationships in problem solving. Howard Gardner (1983) suggested a new and totally different approach. He suggested that intelligence is divided into 7 distinct functions which are located in 7 independent areas of the brain. Then 3 other kinds were added to this classification. The types include *Visual-Spatial, Bodily-Kinesthetic, Interpersonal, Verbal-Linguistic, Musical-Rhythmic, Logical-Mathematical, and Intrapersonal.* The 3 other include *Naturalist, Spiritual/Existential, and Moral.*

General correlates with many biological factors such as mass of the prefrontal lobe, glucose metabolization rate within the brain, overall brain mass. Jensen (1998) reports that correlation between brain size and g is 0.4 and is highly mediated by genetic factors and suggests that the "*heritability* of *g* is approximately .85 - even higher than that for IQ itself. It also, correlates with social factors of success including income, academic achievement, job performance, parent's social and economic status and the like. It is also impacted by **Flynn effect** which describes a rise in IQ scores or increase in the amount of intelligence over time when the age of person increases.

1.3. Challenges to g

British philosopher Philip Kitcher (1985) wrote that "Many scientists are now convinced that there is no single measure of intellectual ability". Howard Gardner also doesn't believe in a general unified intelligence. He believes that the rare condition of *"savant syndrome"* in patients who are very extraordinarily, intelligent in some areas but very retarded in other areas

indicates that different intelligences act independently. Gardner questioned the construct validity of g, and suggested that the measures we used to test his theory were contaminated with verbal and logical demands. But, in response, Beth et al. (2006) rejected his ideas and defend the g factor hypothesis and explain that the construct validity of g is well established, pointing out (a) that g is expressed in a wide variety of tasks (not all of which are "school-like" tasks), (b) that g predicts many important criterion variables (not only academic achievement), and (c) that g has a well-established biological basis; moreover, *g* theorists have pointed out that *g*'s *predictive validity* has been repeatedly demonstrated. Nowadays, general scales are more widely used in educational systems especially, in Iran.

Usually these two words and the concepts behind them have been used interchangeably. But there are some differences as well as some similarities in their bases and the scales developed to measure both of them. Two widely used aptitude tests including Pimsleur Language Aptitude Battery (PLAB) and Multidimensional Language Aptitude Battery (MLAT) are now a days, common in many language programs all over the world. They are seemingly different from intelligent scales but in fact, it is believed that they are intelligence-based. Ellis (1994) believes PLAB and MLAT have significant intellectual basis. All parts are considered to be based verbal intelligence. Sasaki (1996) believes once the IQ testing approach was in place, more specialized aptitude tests could be developed.

1.4. Tests of Intelligence

In most cases, intelligence testing is required by governmental education systems to diagnose the presence of mental learning disabilities. Depending on the situation and facilities and based on underlying approaches the type or format of the test may change. The tests are usually developed and

administered in three forms including Group intelligence tests, Individual intelligence tests, or Computerized tests. They should be valid, reliable. They should pass standardization statistical processes and have longitudinal studies on the same group of people in their different ages.

Famous Austrian doctor *Joseph Gall* (1785-1825) believed that shape of skull and the juts on the skull can show us the persons' intelligences worked on relationship between the size of circumference of skull and intelligence (Sharifi 2005, p.23). *Galton* in 1840s made the first attempt to measure human intelligence. He measured a variety of physical variables, such as reaction time and grip strength. His work, of course, was a failure. The first *successful* test of intelligence was developed by French psychologist *Alfred Binet* in response to a request by French public school officials when the French parliament made education compulsory in France (Karami, 2010). During World War I, the U. S. Army saw a need for a quick-to-administer intelligence test to be used when deciding what sort of advanced training a recruit would receive.

After World War II, Lewis Terman of Stanford University translated the Binet-Simon test into English, adapted it to the American culture and school curriculum, and called it the *Stanford-Binet*. This test is still in use today.

Wechsler Intelligence Scales: There are three Wechsler Intelligence tests which all are claimed to measure g factor. The *Wechsler Intelligence Scale for Children* (WISC) -- for children up to the age of 15 or 16, *Wechsler Adult Intelligence Scale and* WPPSI-R for children before primary school. The Iranian version developed and standardized for children by Dr. Karami (2010) measures children up to 17. WAIS-R includes 12 sub-tests that 6 of them are verbal tests and 6 of them are non-verbal or practical intelligences.

Non-Verbal intelligence scale	Verbal intelligence scale
1. Picture completion	1. General public information
2. Picture Arrangement	2. Similarities in Dissimilar Objects
3. Block Design	3. Arithmetic
4. Object Assembly	4. Vocabulary
5. Digit Symbols	5. Comprehension
6. Mazes	6. Digit Span

Generally, WISC-R measures crystallized ability, visual processing, fluid reasoning, short-term memory, and processing speed. Every section measures a special type of intelligence which is believed to be functioning within g factor.

1. *General information* sub-test measures the student's general knowledge.
2. *Similarities in Dissimilar Objects* measure his abstract reasoning and power of conceptualization.
3. *Arithmetic* sub-test measures his mental alertness attention, concentration and arithmetic reasoning through asking arithmetic problems in a story telling manner.
4. *Vocabulary* sub-test identifies his comprehension of meanings and relations between the expressive words of his L1. This item is culturally oriented.
5. *Comprehension* sub-test measures his social awareness, common-sense and his conception of cultural values.
6. *Digit Span* sub-test assesses his auditory short memory, concentration and attention.

   He is given digit strings and asked to repeat them first forward and then backward.
7. *Picture completion* sub-test measures visual perception and the capability to visually separate essential details from unessential information by asking him to perform completion of a picture.

8. *Picture Arrangement* measures his capability to understand social interaction through non-verbal skills and his ability to find out arrangements and sequential order is also analyzed.
9. *Block Design* sub-test measures his non-verbal reasoning by requiring him to organize blocks as the given patterns on cards.
10. *Object Assembly* sub-test measures his visual spatial capabilities. It consists of four jigsaw puzzles to be completed.
11. *Digit Symbols* sub-test measures his short term memory and alertness of his visual nerves. He is given a key to match series of numbers or shapes. His performance shows His capability to understand coding patterns.
12. *Mazes* sub-test measures his ability to know the surrounding environment and find spatial solution.

Raven Progressive Matrices (RPMs): was published after World War II, this set of tests. It can check the fluid intelligence of 5-year old to adult persons through its matrices. It is claimed to be culturally free and is widely used all over the world specially in our educational system in Iran. It has two main forms:

Raven for children which contains colorful pictures and is used for children between 5-9 year old and the second for, for children more than 9 to 18 and contains simple matrices with 60 questions and is held in 45 minutes. The colorful set is standardized in Iran by Baraheni and the second set by Sanayi and Sharifi. (Sharifi 2005, p. 56)

Researchers regard Raven's as perhaps the best of all non-verbal tests of gQ, a view accepted by other psychometricians who regarded Raven's as an almost pure g test Q.

2. Review of the Related Literature

Since the beginning of modern teaching period up to 1960s, because of the influence of Skinner's behavioral theory the role of intelligence in language learning has been neglected. But when Chomsky emphasized the role of mind and brain in learning intelligence and intellectual testing became important in language teaching field. But in terms of learning the first language usually the role of intelligence hasn't been regarded as a determining factor (Chowdhury, 2010). Some researchers (Fernandez-Corugedo, 1999, Lightbown & Spada 1999) believe that in second language learning the situation is different as learners may progress in L2 learning differently because of their different intellectual levels. MacLaughlin (1987, P. 171 in Chowdhury, 2010) suggests that intelligence is an important factor in determining success in second language learning. He believes that in school settings analytical reasoning of verbal materials becomes very important. Researchers show that "intelligence correlate with some skills associated with SLA, particularly, those used in formal study of the language, such as reading, writing, language analysis and vocabulary study" (Fernandez-Corugedo, 1999, p. 29). Dornyei (2008, p. 1-2) emphasizes on the necessity of study of intellectual differences between student in schools and their language learning. The relationship between students' rate of learning, strategies, styles and many other important factors has always been the focus of many researches of the field. Eyseneck (1998) believes that the role of intelligence becomes more effective when the difference of two languages is great such as English and Japanese rather than English and Spanish. Bonar (2005) believes that IQ tests should be implemented at the pre-junior high school stage in order to select pupils who will potentially benefit from classroom based language education. Nolen (2003, p. 119) suggests that the presentation of foreign language teaching material should engage all or most of the intelligences due to the fact that each of the intelligences is potentially

available in every learner. As Kaufman (1994, p. 32) has asserted that "insightful sub-test interpretation" allows the examiner to understand why a student experiences learning difficulties and how to remediate them. So our study has focused on general IQs as well as separate items within the tests.

Many great efforts were conducted over the case. Kohler (1966 in McKamey n.d) found word knowledge, logical reasoning, and inferencing measured by RPMs to load highly on cloze test scores. McKamey (n.d.) found a relationship between students' performance on cloze test and their knowledge in vocabulary and grammar and reading comprehension as good indicators and their RPMs performance as weak indicator of cloze test. Akbari and Hosseini (2007) investigated the existence of any possible relationship between the use of language learning strategies and multiple intelligences' scores of foreign language Iranian learners of English. Skourdi and Rahimi (2010) found positive relationship between Linguistic Intelligence, Emotional Intelligence, and Vocabulary Learning in Iranian students. Baldo, et al. (2004) using RPMs found a relationship between language and intelligence and specially the impact of language on intelligence. Vanderwood et al. (2002) found out that crystallized intelligence and auditory processing play an important role in the development of reading skills.

McGrew and Hessler (1993), McGrew and Flanagan (1998), causal models were specified to include both direct and indirect effects of g and specific cognitive abilities on reading achievement. Smith et al. (2005) studied the relationship between intelligence and vocabulary and concluded that "WISC-III may be an effective screen for language problems." Hashemi (2007) suggests that Kinesthetic and verbal intelligence make the greatest contribution toward predicting reading ability scores. Razmjoo (2008) examined the strength of the relationship between language proficiency in English and the nine types of intelligences in an Iranian setting. Saricaoglu and Arikan (2009) and found some relationships between particular intelligence types and

students' success in grammar, listening and writing in English as a foreign language n a Turkish setting. Vellutino (2001) found a significant relationship between reading comprehension and reading achievement with measured intelligence.

Cotton et al. (2009) studied the relationship between reading comprehension and reading achievement of students using Raven colored Progressive Matrices as a scale of non-verbal intelligence. Stanovich et al. (1984) studied the relationship between general intelligence, decoding speed, phonological awareness, listening comprehension with reading comprehension of first-grade students and the strong relationship between reading comprehension and general intelligence was concluded. Rysiewicz (2008) using MLAT and RPMs respectively, and analyzed the correlation between the results of these scales with the results of Key English Test (KET) and concluded that the memory component of FL aptitude plays a relatively small role in successful FL learning in the context of non-intensive, traditionally oriented methodologies that are characteristic of much of the teaching going on worldwide in state school systems and emphasized the importance of designing an intelligence profile for every L2 learner.

Some researchers found out the relationship between reading and listening comprehension on the basis of results of two scales of verbal and non-verbal intelligence tests. Watkins and Glutting (2000) indicated some relationship between students' reading and mathematical achievement with Wechsler intelligence scale of children WSIC-III. Pishghadam (2009) determined the impacts of emotional and verbal intelligences on English language learning of Iranian students. Watson et al. (1982) studied the relationship between deaf students' English language ability and their non-verbal intelligence using WSIC as the scale. They found out that sub-tests which require visual memory are the best predictors of language performance. Skourdi and Rahimi (2010) found significant correlation between Linguistic Intelligence, Emotional Intelligence,

and Vocabulary Learning (Receptive Breadth of Vocabulary) among Iranian EFL learners. Sparks et al. (2006) worked on the native language predictors of foreign language proficiency and aptitude. Sharon (2011) in a recent study, suggests WSIC-IV as a good device to diagnose students' with reading disabilities. Zahedi and Fallah (2011) examined the relationship between vocabulary knowledge, linguistic intelligence and morphological awareness among EFL learners and concluded that educational programs should be planned in order to enhance EFL learners' linguistic intelligence. Adkins (n.d.) compared the function of Wechseler Adult Intelligence Scale III and Woodcock-Johnson III Test of Cognitive Abilities in predicting college students' reading achievement and concluded that both scales are correlated significantly with reading achievement of students and can be used whenever necessary. Baumann (2005) calculated a close relationship between vocabulary and IQ and also the centrality of vocabulary in reading comprehension.

3. Research Questions

This research, based on the previously mentioned objectives, aims to identify that:

- Which kinds of intelligences can help students understand a text, learn vocabularies and grammar?
- Is there any significant relationship between Iranian high school students' performance on RPMs and their English reading comprehension, grammatical problem solving and vocabulary knowledge?
- Is there any significant relationship between Iranian high school students' performance on WSIC-R and its sub-parts with their English reading comprehension, grammatical and vocabulary knowledge?
- Which test including intelligence and second language tests or which combination of them can have a better function in Iranian high school

settings as a learning facilitating and predicting means for a language teacher? How?

Then, according to posed question the null hypothesizes will be as follows:

H01: There is no significant relationship between students' grammar, reading and vocabulary scores.

H02: There is no significant relationship between students' scores of WSIC-R sub-tests and their grammar, reading and vocabulary scores.

H03: There is no significant relationship between students' RPMs score and their grammar, reading and vocabulary scores.

4. Method

The purpose of this study was to investigate the relationship between reading comprehension, grammatical and vocabulary knowledge of Iranian high school students with their scores in WSIC-R for and raven RPMs in Iranian high schools.

4.1. Participants

Among first-grade high school male students in Orzooyieh (a city in Kerman province), 48 students were randomly selected for intelligence tests. All ranged between 14-16 years old.

4.2. Instruments

A reliable multiple-choice test including 25 vocabulary items (reliability= .76), a reliable multiple-choice test including 30 grammar items (reliability= .75) and the reading section of KEY English Test (KET) at Level 2 of the Common European Framework of Reference for Languages (reliability= .81) were used

as second language measuring device. The tests were administered to a pilot group first. The tests were arranged in an increasing manner of difficulty and the item difficulty index of every item is calculated by SPSS to assure the normal distribution of whole tests. The reliability indexes of the tests calculated using cronbach-a after second adaption and necessary changes done by the research group to increase the reliability of the tests after a pilot session. A pack of Revised Wechsler Intelligence Scale for Children (WSIC-R) (reliability= .96) which is standardized for Iranian setting by Karami (2010) is used through out the study to interview students one by one and item by item. The reliability index is reported in the following table according to Rahmani (2007).

A set of Raven Progressive Matrices (reliability=.91) was used in one session for students in a paper and pencil form. SPSS Version 17 was the heart of all studies through the research to analyze the relationship between all the variables.

4.3. Procedure

Within two months 48 students were selected randomly to be interviewed in the same room, the data was first analyzed by correlation of two hours time was allotted per each student for the interview, usually under the same situation on Wechsler Scale of Intelligence. Then the data was balanced according to the previously prepared tables by Karami. Raven Progressive Matrices were held for the students in one session for 63 students and the data gained was balanced according to the standard table prepared by Ministry of Education. Some students who were distinguished by the counselor to be unwilling to participate in the intelligence tests or not in a normal mental or physical situation were omitted out of the study since their unreal performance may have affected the reliability of the data. The remaining number of students became 48. Then, the

standard tests of vocabulary, grammar and reading comprehension were held in the same situations and the data gathered was submitted to SPSS version 17 to investigate any relationship and the probable strength of relationships between the data elicited by Raven Progressive Matrices, 12 sub-parts of WSIC-r and verbal IQ and non-verbal IQ elicited by WSIC-R, and students reading comprehension, vocabulary and grammatical knowledge firstly in a correlation analysis and then by a regression analysis.

5. Results and Discussion

To measure the degree of relationship between grammar, vocabulary and reading comprehension tests and intelligence scales, Pearson Correlation formula was employed. Also, the regression analysis was used to identify the proportion of every variable in determining the grammar, vocabulary and reading comprehension grades. The regression analysis is conducted through a step-wise method in which the most powerful variables are entered into the equation one by one and this process is continued up to the moment that the error of significance test reaches the amount of 0.5. As a result, the variables functioning as trivial variables in determining the variance of dependent variable are omitted from the model. According to the results the null hypothesis is rejected.

Table 1. IQ and Language correlations

	Grammar	Vocabulary 2	Reading Comprehension	Verbal IQ	Non-verbal IQ	Rion IQ
Grammar	1					
Vocabulary 2	.265*					
	.034					
Reading Comprehension	.242*	.649**	1			
	.049	.000				
Verbal IQ	.128	.529**	.616**	1		
	.193	.000	.000			
Non-verbal IQ		.221	.297*	.501**	1	
	.498	.066	.020	.000		
Raven IQ	-.168	.109	.373**	.334*	.604**	1
Raven IQ	.127	.230	.004	.010	.000	1

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

	Grammar	Vocabulary 2	Reading Comprehension	Information	Similarities	Arithmetic	Vocabulary	Comprehension	Digit span	Picture completion	Picture arrangement	Block design	Object assembly	Digit symbols	Mazes	Verbal IQ	Non-verbal IQ	General IQ	Raven IQ
Grammar	1																		
Vocabulary2	.265*	1																	
	.034																		

Digit span		Comprehension			Vocabulary		Arithmetic		Similarities		Information		Reading Comprehension	
.039	.257*	.079	.207	**Grammar**	.424	.028	.139	.160	.360	.053	.371	.049	.049	.242*
.290	.082	.003	.398**	**Vocabulary 2**	.161	.146	.369	.049	.093	.194	.219	.115	.000	.649**
.105	.184	.000	.492**	**Reading Comprehension**	.028	.277*	.105	.185	.189	.130	.010	.334*		1
.005	.372**	.000	.525**	**Information**	.018	.304*	.006	.364*	.065	.221		1		
.049	.242*	.049	.242*	**Similarities**	.005	.370*	.380	.045		1				
.000	.552**	.048	.243*	**Arithmetic**	.338	.062		1						
.095	.192	.001	.450**	**Vocabulary**		1								
.060	.227		1	**Comprehension**										
	1			**Digit span**										
				Picture completion										
				Picture arrangement										
				Block design										
				Object assembly										
				Digit symbols										
				Mazes										
				Verbal IQ										
				Non-verbal IQ										
				General IQ										
				Raven IQ										

Mazes		Digit symbols			Object assembly		Block design		Picture arrangement		Picture completion	
.267	-.092	.093	.194	**Grammar**	.306	-.075	.114	-.178	.231	.109	.119	.173
.457	-.016	.190	.130	**Vocabulary 2**	.086	.201	.398	.038	.026	.281*	.004	.373**
.152	.151	.007	.350**	**Reading Comprehension**	.011	.328*	.150	.153	.030	.274*	.055	.234
.033	.268*	.100	.188	**Information**	.007	.356**	.000	.470**	.004	.382**	.113	.178
.398	-.038	.050	.241*	**Similarities**	.103	.186	.039	.257*	.075	.211	.079	.207
.134	.163	.060	.228	**Arithmetic**	.225	.112	.027	.281*	.268	.092	.080	.206
.060	.227	.016	.311*	**Vocabulary**	.039	.256*	.012	.327*	.018	.304*	.117	.175
.125	.169	.006	.362**	**Comprehension**	.002	.400**	.004	.382**	.000	.497**	.041	.254*
.267	.092	.004	.382**	**Digit span**	.350	.057	.147	.154	.475	.009	.004	.375**
.005	.366**	.039	.258*	**Picture completion**	.005	.371**	.004	.378**	.003	.388**		1
.009	.339**	.027	.280*	**Picture arrangement**	.002	.404**	.001	.440**		1		
.000	.507**	.006	.359**	**Block design**	.000	.730**		1				
.019	.299*	.022	.293*	**Object assembly**		1						
.002	.400**		1	**Digit symbols**								
	1			**Mazes**								
				Verbal IQ								
				Non-verbal IQ								
				General IQ								
				Raven IQ								

Raven IQ	.168	.127	**General IQ**	.074	.309	**Non-verbal IQ**	.000	.498	**Verbal IQ**	.128	.193										
	.109	.230		.284*	.025		.221	.066		.529**	.000										
	.373**	.004		.399**	.002		.297*	.020		.616**	.000										
	.425**	.001		.706**	.000		.499**	.000		.571**	.000										
	.307*	.017		.502**	.000		.310*	.016		.419**	.002										
	.210	.076		.418**	.002		.264*	.035		.431**	.001										
	.306*	.017		.526**	.000		.325*	.012		.406**	.002										
	.342**	.009		.715**	.000		.500**	.000		.689**	.000										
	.236	.053		.421**	.001		.265*	.034		.303*	.018										
	.254*	.041		.567**	.000		.706**	.000		.364**	.006										
	.253*	.042		.646**	.000		.675**	.000		.449**	.001										
	.680**	.000		.747**	.000		.831**	.000		.301*	.019										
	.622**	.000		.628**	.000		.750**	.000		.320*	.013										
	.393**	.003		.524**	.000		.507**	.000		.374**	.004										
	.436**	.001		.425**	.001		.533**	.000		.133	.184										
	.334*	.010		.731**	.000		.501**	.000		1											
	.604**	.000		.889**	.000		1														
	.623**	.000		1																	
	1																				

*. Correlation is significant at the 0.05 level (1-tailed).

**. Correlation is significant at the 0.01 level (1-tailed).

Regarding table one which focuses mainly on IQs and language elements:

There is a significant correlation between vocabulary test of English scores and their reading comprehension scores ($p<0.01$). There is also significant correlation can be found between students scores of grammar and their scores of vocabulary of English and their reading comprehension scores ($p<0.05$). Significant correlation can be found between students scores of reading comprehension and their verbal intelligence, non-verbal intelligence and raven matrices scores ($p<0.05$). Significantly strong correlation has been found between vocabulary of English scores and verbal intelligence ($p<0.01$). There is a significant correlation between the scores of Raven progressive Matrices and verbal and non-verbal IQs elicited by WSIC-R ($p<0.01$).

Regarding the second table which focuses mainly on the relationships between sub-tests and language data, the following interesting data was found out. There is a significant correlation between Reading Comprehension and the WSIC-R subtests including General Information, Vocabulary of L1, Comprehension, Picture Arrangement, Object Assembly and Digit Symbols.

There is a significant correlation between Vocabulary of second language and WSIC-R sub-tests including Comprehension, Picture Arrangement and Picture Completion. Also, there is a significant correlation between Grammar and WSIC-R subtest of Digit Span.

6. Regression Analysis Results

Table.3. ANOVA[a]

	Sum of Squares	df	Mean Square	F	Sig.
Regression	1138.411	3	379.470	19.314	.000[b]
Residual	864.495	44	19.648		
Total	2002.905	47			

a. Predictors: (Constant), Vocabulary2, Verbal IQ, Raven IQ;

b. Dependent Variable: Reading Comprehension

R Square=.568 Adjusted R Square=.539

Table.4. Coefficients[a]

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-17.032	5.774		-2.950	.005
Vocabulary2	.567	.142	.469	4.002	.000
Verbal IQ	.144	.061	.293	2.371	.022
Raven IQ	.113	.053	.224	2.126	.039

a. Dependent Variable: Reading Comprehension

The results showed a highly significant linear correlation at 99 percent level ($p<0.01$) between Reading Comprehension variable and Verbal IQ, Raven Scores and, also, scores of Vocabulary of L2 of students. Regarding the standardized amounts of Beta, the function of Vocabulary of L2 in determining the Reading Comprehension, dependent variable is much more than the function of verbal IQ and the non-verbal IQ measured by Raven Progressive Matrices. The related coefficient, also, shows that 56.8 of the variance in the scores of Reading Comprehension is due to Verbal IQ, the non-verbal IQ measured by Raven Progressive Matrices and the L2 vocabulary knowledge of students and the remaining variance is due to the other variables. The resulted model is as follows:

Reading=-17.032+0.567 (vocab.2) +0.14 (verbal IQ) +0.113 (Raven IQ)

Table.5. ANOVA[b]

	Sum of Squares	df	Mean Square	F	Sig.
Regression	484.807	1	484.807	14.690	.000[a]
Residual	1518.099	46	33.002		
Total	2002.905	47			

a. Predictors: (Constant), Comprehension

b. Dependent Variable: Reading Comprehension

R Square=.242 Adjusted R Square=.226

Table.6. Coefficients[b]

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	5.985	2.607		2.295	.026
Comprehension	1.029	.268	.492	3.833	.000

a. Dependent Variable: Reading Comprehension

The results of ANOVA, also, show the significance of the regression and the linear relationship between the Comprehension sub-test of WSIC-R and

Reading Comprehension variables and the resulted significance level of (sig=0.000) shows its significance at 99 percent level. Regarding the resulted values of B which represents regression equation of values is properly defined as: Reading (Comprehension) =5.985+1.029. Also, the standardized value of Beta shows that 49 percents of the variance of the Reading Comprehension dependent variable is due to the students' scores of the Comprehension sub-test of WSIC-R.

Table.7. ANOVA[a]

	Sum of Squares	df	Mean Square	F	Sig.
Regression	325.289	2	162.645	7.019	.002[b]
Residual	1042.746	45	23.172		
Total	1368.035	47			

a. Predictors: (Constant), Comprehension, Picture completion

b. Dependent Variable: Vocabulary 2

R Square=.238 Adjusted R Square=.204

Table.8. Coefficients[a]

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	6.937	2.403		2.887	.006
Comprehension	.561	.233	.324	2.411	.020
Picture completion	.502	.232	.291	2.161	.036

a. Dependent Variable: Vocabulary 2

The results of the ANOVA table 7 shows the significance of regression and the linear relationship between Comprehension and Picture Completion sub-tests of WSIC-R and students performance on L2 vocabulary test and the resulted significance level approves its significance up to 99 percents.

Regarding the resulted coefficients, the equation which represents regression coefficients is as follows: Vocabulary of L2 =6.937+0.561 (Comprehension) +0.502 (picture completion). Also, the standardized value of Beta shows that the most effect on the Vocabulary of L2 dependent variable is due to Comprehension WSIC-R subtest results.

Table.9. ANOVA (L2 Vocabulary)

	Sum of Squares	df	Mean Square	F	Sig.
Regression	612.611	2	306.305	18.246	.000[b]
Residual	755.424	45	16.787		
Total	1368.035	47			

a. Predictors: (Constant), Reading Comprehension, Verbal IQ

b. Dependent Variable: Vocabulary 2

R Square=.448 Adjusted R Square=.42

Table.10. Coefficients[a] (L2 Vocabulary)

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	1.709	3.966		.431	.669
Reading Comprehension	.429	.116	.520	3.694	.001
Verbal IQ	.085	.057	.209	1.488	.144

a. Dependent Variable: Vocabulary 2

The results of ANOVA table 9 shows the significance of regression and the linear relationship between the results of Vocabulary of L2 variable and Reading Comprehension and Verbal IQ of WSIC-R variables (sig=0.000). The standardized value of Beta shows that 52 percents of the variance of L2 Vocabulary dependent variable is due to the students' scores of Reading

Comprehension. Regarding the values of the resulted coefficients, the equation which represents regression values is, also, as follows:

voc.2 =1. 709+0.429 (reading) +0.085 (verbal IQ)

7. Conclusions

Our study confirms largely the results of previous efforts. The null hypothesis for the first question is rejected because we found out that there is a significant relationship between students' level of reading comprehension and their L2 vocabulary knowledge, L2 grammar knowledge, verbal IQ, WSIC-R measured non-verbal and Raven measured non-verbal IQs. Also reading comprehension enjoys significant relationships with the kind of intelligences measured by WSIC-R sub-parts including General Information, L1 vocabulary, Comprehension, Picture Arrangement, Picture Completion and Digit Symbols. These interesting information shows that reading comprehension is a complex process and combination of all these variables (intelligences) which are functioning simultaneously, collaboratively, and collectively but with different portions of effect on the students' reading comprehension ability. But these relationships are not strong enough to dominate or predict the students' reading comprehension ability alone. For example, WSIC-R Object Assembly sub-test which checks students' visual spatial capabilities, an ability to understand the whole by collecting and processing parts but not sufficient to predict it alone.

L2 vocabulary knowledge correlates with Comprehension WSIC-R sub-test. The importance of comprehension in both reading comprehension and vocabulary of L2 knowledge may be because of the willingness of students to interact and sympathize with society which leads to more exposure to an L1 or L2 society which leads to more knowledge about them either cultural or

linguistic knowledge. Picture Completion and Picture Arrangement show correlations but it is not very significant to predict alone.

Grammar shows significant relationship only with Digit Span WSIC-R sub-test which assesses students' auditory short memory, concentration and attention. We should pay attention that we are speaking about a formal setting in which the method of teaching grammar and vocabulary is based on deductive methods. It is what really goes on in formal schools. Such a result, that shows almost, no relationship between grammar and intelligence is due to the fact that students are provided with grammatical rules and don't need any exploration or intellectual effort to find the grammatical patterns of L2 in a deductive atmosphere and instead, they rely on rote learning and memorization.

But referring to regression analysis of the relationship of these variables, we notice that although these intelligences bear significant correlations, they don't show equal impacts on language learning related variables. Reading Comprehension is mostly impacted by L2 vocabulary knowledge, and verbal IQ and non-verbal IQ measured by RPMs. The other intelligences effect on reading comprehension but, as we previously mentioned, they have marginal effects. Many language items may be really unrelated to many kinds of intelligences. For example, mazes check, some kind of intelligence, which may be really not related to reading comprehension or vocabulary or grammatical knowledge in a formal deductive setting. The second question of the study aimed finding the type of intelligences that help students learn linguistic elements of grammar, L2 vocabulary and reading comprehension. It was shown that in a deductively oriented setting no kind of intelligence can overwhelm the role of rote learning and memorization. But Verbal IQ is dealing with both

vocabulary learning and reading comprehension. Non-verbal IQ measured by RPMs can have some function in reading comprehension.

Our third question deals with the function and efficacy of RPMs in language teaching. Although both WSIC-R and RPMs are checking non-verbal intelligence, the WSIC-R non-verbal intelligence doesn't show any correlation with reading comprehension, grammatical knowledge and L2 vocabulary knowledge while RPMs although bearing no relationship with grammar and L2 vocabulary shows a significant correlation in both correlation analysis and regression analysis with reading comprehension. In Iranian high schools the school counselor has to collect the intellectual information of students using only RPMs as the standard scale. So the useful data of such tests is taken for granted for language teachers in distinguishing problematic students because the data is available.

The last but the basic question of the study was dealing with using any kind of both RPMs and WSIC-R as intelligence scale and reading comprehension, grammar or vocabulary test as a predicting device. In fact, we as language teachers in a governmental setting are equipped with five mentioned scales.

Two of them are dealing with intelligence and three of them are dealing with mere language. It is clear that a combination of them can work better rather than using them in isolation. The gifted and successful students should be distinguished in the beginning of the curricular year to have special programs to increase their abilities. The problematic students should also be distinguished. The material presenting and even the order of presenting materials should be based on intellectual and linguistic background of the students at the same time. The content of books should be oriented toward increasing the exposure to reading, increasing L2 vocabulary and inductive and intellectual learning of grammar. A pack checking students verbal IQ according

to WSIC-R and non-verbal IQ measured by RPMs and a reliable vocabulary test can be advised at the beginning of every language program in Iranian high schools to distinguish the real learning situation of every class and the future programs which should be planned according to the picture which is presented by this combined language learning facilitating scale.

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