Pinpointing the classifiers of English language writing ability: A discriminant function analysis approach

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Abstract
The major aim of this paper was to investigate the validity of language and intelligence factors for classifying Iranian English learners` writing performance. Iranian participants of the study took three tests for grammar, breadth, and depth of vocabulary, and two tests for verbal and narrative intelligence. They also produced a corpus of argumentative writings in answer to IELTS specimen. Several runs of discriminant function analyses were used to examine the classifying power of the five variables for discriminating between low and high ability L2 writers. The results revealed that among language factors, depth of vocabulary (collocational knowledge) produces the best discriminant function. In general, narrative intelligence was found to be the most reliable predictor for membership in low or high groups. It was also found that, among the five sub-abilities of narrative intelligence, emplotment carries the highest classifying value. Finally, the applications and implications of the results for second language researchers, cognitive scientists, and applied linguists were discussed.

Keywords: L2 writing; narrative intelligence; depth and breadth of vocabulary; grammar; verbal intelligence; discriminant function analysis

Introduction

Deciding on priorities in teaching L2 writing is a pedagogical necessity recognized by many TEFL (Teaching English as a Foreign Language) experts (e.g. Collins, 1998; Crossley & McNamara, 2011; DeVillez, 2003; Ferris, 2004). Numerous studies have been concerned with identification (e.g. Crossley & McNamara, 2011) or re-evaluation (Weston, Crossley, McCarthy, & McNamara, 2011) of the factors affecting L2 learners' writing performance. Various factors such as lexical proficiency (Nakamaru, 2011), syntactic proficiency (Truscott, 1999), cohesion (McNamara, Louwerse, McCarthy, & Graesser, 2010), coherence (McNamara, Kintsch, Butler-Songer, & Kintsch, 1996), cognitive mechanisms (Bourke & Adams, 2010), and higher-order processes (Sparks & Gonschow, 2001) have been considered in

debates over the primary predictors of success in achieving L2 writing proficiency.

In addition, another line of research in applied linguistics has been growing over the last decade, which has placed its focus on the study of cognitive aspects of language perception and production. Cognitive science is considered as the legitimate interdisciplinary paradigm that can cover and re-examine many research problems in applied linguistics and TEFL (Segalowitz, 2010). The study of intelligence is a prolific research paradigm in cognitive psychology. One of the factors which seem to be of great importance in dealing with the writing ability is narrative intelligence (Pishghadam, Baghaei, Shams, & Shamsaee, 2011). As the name implies, narrative intelligence deals with the narrative capabilities of individuals, which can be a potential factor for writing effectively.

Another type of intelligence which seems to be relevant to writing is verbal intelligence. It is defined as the ability to express what one has in mind. There is evidence that verbal intelligence has a meaningful relationship with academic achievement (Fahim & Pishghadam, 2007), writing achievement (Abiodun & Folaranmi, 2007), and writing fluency (Pishghadam, 2009).

All in all, we are facing two dimensions dealing with the nature of writing ability: linguistic and cognitive. With this in mind, this paper attempts to connect the literature available on linguistic features of L2 writing into studies concerned with high-order processes or intelligence factors in language production. Linguistic features under investigation include knowledge of grammar, breadth, and depth of vocabulary; high-order capacities included in the study are verbal and narrative intelligences.

A set of discriminant function analyses (DFA) has been used to explore the relative validity of the above five variables and the five sub-abilities of narrative intelligence for classifying Iranian English learners' writing performance. The research questions of the study are:

1. Which of the language or intelligence factors can classify the L2 writers into low and high groups more significantly?
2. Which of the sub-abilities of narrative intelligence can classify the L2 writers into low and high groups more significantly?

The review of the related literature is meant to provide a brief introduction to the sequence of studies and insights that led to the present research. A combination of theoretical frameworks and empirical findings are presented to set the ground for analyzing the data and discussing the results.

Theoretical background

A purposeful review of the literature accumulated in writing research can unveil the evidence pointing to the possible role of intelligences and their interaction with cognitive mechanism involved in L2 writing. Concepts such as syntactic and lexical processing, coherence, and organizational skills are frequently discussed in L2 writing research. It can be argued that these concepts overlap with cognitive abilities which are labeled as multiple intelligences. A deeper look into the nature of language-related intelligences and cognitive processes involved in L2 writing can shed more light on the possible interactions between the two. It is fair to assume that one's ability to express oneself through language (verbal intelligence) can have a role in managing and directing language-related cognitive abilities. The most recent type of intelligence is dubbed

narrative intelligence. It is the ability to perceive and reproduce narrative patterns (Randall, 1999). If a broad interpretation of narrative is adopted (see Bruner, 1987), it is no longer limited to stories and recounting but will cover a wide range of organizational skills in the human mind. Many scholars consider narrative intelligence as a very important cognitive ability which governs many mental processes (Bers, 2002; Bruner, 1987, 1991; 1998). Some even consider it as the main evolutionary advantage of human over animals (e.g. Dautenhahn, 2002). Given the prominent place assumed for narrative intelligence in human mental activities, it is hard to resist the idea that narrative intelligence might have a meaningful role in developing one's writing ability. The possible relationships between intelligence and language skills can be reviewed under two major headings: Micro and macro factors in L2 writing. Micro factors refer to writing components which are usually learned, produced, and assessed in isolation from other parts of the text, macro factors refer to more general abilities that govern L2 writing in a scope that goes well beyond words and sentence, and is manifested throughout the whole text.

Micro factors in L2 writing

Two main micro factors which are frequently referred in the L2 writing literature are knowledge of vocabulary and knowledge of grammar. Lexical and syntactical processing has always been considered as two cornerstones of language proficiency, and their mastery is often believed to play a vital role in language production. This is evident from the bulk of studies on the role of vocabulary and grammar in L2 writing (e.g. Ferris, 2004, 2010; Nakamaru, 2011; Truscott, 1996, 1999). The controversy arises when it comes to prioritization. While some scholars emphasize the primary importance of lexical knowledge in language learning (de la Fuente, 2002; Ellis, 1995), another group considers grammatical range and accuracy as the best predictor of successful L2 production (see Kenkel & Vates, 2009).

According to Crossley and McNamara (2009), there are two ways to study the role of lexical items in L2 writing. Most of the studies only focus on surface indexes such as lexical density, accuracy, and diversity (e.g. Polio, 2001) while there is a smaller group of researchers who look into deeper measures of L2 lexical proficiency such as lexical networks (e.g. Schmitt, 1998). Polio (2001) studied lexical diversity as one of the measures of breadth of vocabulary. The disadvantage of such studies is that they do not consider depth of vocabulary knowledge. Breadth of vocabulary is concerned with how many words a learner knows whereas depth of vocabulary is concerned with to what degree a learner knows a word. The latter is usually examined through collocation tests (e.g. Schmitt, Schmitt, & Calpham, 2001). Some of the other measures of depth of vocabulary which are mostly based on connectionist models of lexical acquisition are conceptual knowledge, sense relations, word associations, and word correctness (Haastrup & Henriksen, 2000).

MacrofFactors in L2 writing

Coherence and cohesion are two central themes in evaluations of L2 writing, (see Crossley & McNamara, 2010). According to many scholars (e.g. Collins, 1998; DeVillez, 2003) both cohesion and coherence are significantly correlated with writing quality. However, McNamara, Crossley, and McCarthy (2010) found no evidence that cohesion cues are positively related to writing quality. In a later study, Crossley and McNamara (2010) investigated the role of coherence and cohesion in the evaluations

of writing quality; they found that expert raters evaluate coherence based on the absence of cohesive ties not their presence. As they emphasize, this finding has important contributions to our understanding of the dynamics of coherence and how they are implemented in a text.

Another important macro factor in L2 writing quality is learners' higher-order processing. This has been reflected in many studies describing the ways in which L2 learners' L1 can influence their written production (e.g. Connor, 1984; Jarvis, 2010; Reid, 1992). A group of these cross-linguistic studies focus on higher-order processes involved in L2 writing including planning and text evaluation (Cumming, 1990). Crossley and McNamara (2011) believe that these high-order processes are strongly linked to one's L1 and must be incorporated into any explanation of L2 writing proficiency. Stallard (1974) believed that successful writers are not overwhelmed by syntactic and lexical features of L2 and stay focused on the general organization of their writing. The study of cognitive aspects of writing covers one aspect of the role of higher-order processes in language production. Hall (1990) found evidence for the existence of the same cognitive behaviors in L1 and L2. Kobayashi and Rinnert's (2008) findings show that non-linguistic cognitive factors play an important role in writing and transfer from L1 to L2 or even vice versa. The study of cognitive processes involved in L2 writing found greater momentum as the process-oriented paradigm in writing research flourished (see Pennington & So, 1993).

Intelligence and organizational writing skills

To organize written discourse properly, L2 writers must rely on their cognitive capabilities. Multiple intelligences (Gardner, 1983) cover various aspects of cognitive processing. As the most recent type of intelligence proposed by Randall (1999), narrative intelligence is defined as the ability to perceive and reproduce narrative constructions and consists of five sub-abilities namely emplotment, characterization, narration, genre-ation, and thematization. Randall argues that narrative intelligence is a complex cognitive capacity which includes elements from interpersonal, intrapersonal, and verbal intelligence. The interpersonal aspect of narrative intelligence is concerned with communicative skills and is related to genre-ation and thematization; the intrapersonal aspect deals with the ability to express one's thoughts and feelings and is manifested via narration and characterization; the verbal aspect deals with the linguistic articulation of concepts and their relationships and is mostly reflected in the dynamics of emplotment.

Verbal intelligence was introduced long before narrative intelligence (see Wechsler, 1981) and has an independent measurement scale which examines one's ability to explain the meaning of lexical items (see Wechsler, 1997). Although verbal intelligence is manifested via linguistic performance, its nature goes beyond measures of vocabulary. While breadth and depth of vocabulary examine one's perceptive knowledge of the target words, verbal intelligence reflects one's productive knowledge when dealing with various concepts. The productive nature of verbal intelligence makes it relevant to the cognitive processes involved in language production. The place of verbal intelligence in language learning has recently received more attention from the scholars. For example, Fahim and Pishghadam (2007) found a significant relationship between the verbal intelligence and academic achievement of university students majoring

in English; L2 writing was one of the components of academic achievement in their study. Abiodun and Folaranmi (2007) found that verbal intelligence has a meaningful effect on L2 learners' writing performance. Pishghadam (2009) found causal relationships between verbal intelligence and L2 writing ability. These results show that the place of verbal intelligence in L2 writing should not be overlooked.

Classifiers of L2 writers

Crossley and McNamara (2010) used DFA to study the classifying effect of cohesion indices versus complexity indices for low quality and high quality L2 writings. Their results show that cohesion indices cannot classify the writers into low ad high groups whereas complexity indices do so well above chance. In other words, lexical diversity, word frequency, and syntactic complexity of the produced language can predict the quality of the writings, as perceived by expert raters and reflected through writing scores, better than cohesion scores. In a later study (see Crossley & McNamara, 2011), they delved more deeply into the nature of the raters' understanding of coherence and the rubrics based on which they operationalize it. They found out that raters' perception of coherence is considerably different from many intuitive notions of it. This was reflected in the significant relationship found between the absence of cohesive devices and a more coherent representation of the text in the raters' mind. They argued that as advanced readers with high topical and background knowledge, the raters develop a more coherent mental representation of the text when it includes less cohesive devices such as word overlap, resolved anaphors, causal cohesion, and connectives. This is because advanced readers are inclined to make inferences that connect different parts of the text to each other as well as to bits of their background knowledge; therefore, the overuse of explicit cohesive connectors does not contribute to the coherence of their mental image of the text.

Another discriminant study was conducted by McNamara, Crossley, and McCarthy (2010) to explore the linguistic differences between L2 writings rated as high or low by experts. They examined four linguistic indices: 1) cohesion; 2) syntactic complexity; 3) diversity of words; and 4) characteristics of words. According to the DFA results the three most predictive indices of writing quality are syntactic complexity, lexical diversity, and word frequency. None of the 26 validated indices of cohesion used in this study showed any meaningful difference between low and high ability L2 writers. Those writings rated by the experts to be of higher quality were more difficult to read and used sophisticated language.

Method

Participants

Participants of the present study comprised 346 Iranian learners of English as a foreign language from four cities of Iran: Mashhad, Kashan, Lahijan, and Tehran. The age of the participants ranged from 17 to 33. The sample included 267 university students majoring in English Language and Literature, Engineering, and Basic sciences, and the rest were high school students out of which 201 participants were females and 145 were males. All the participants were learners of English attending private English institutes (223 participants) or passing university ESP courses (123 participants). Each participant attended 6 test sessions. All the participants were informed about the general objectives of the project, gave their consent to participate in the study and were assured of the confidentiality of any

personal information they revealed during the study. It should be mentioned that sampling was based on accessibility and major was not controlled.

Instrumentation

The measures utilized in this study consist of scales for measuring narrative intelligence, verbal intelligence, knowledge of grammar, depth and breadth of knowledge of vocabulary, and writing skill.

Pishghadam, et al. (2011) developed and validated (using Rasch analysis) a scale of narrative intelligence. This scale which comprises 23 items assessing participants' performance on several dynamics of narrative intelligence (Randall, 1999) was employed to measure participants' narrative intelligence. The scale has 5 subsections: emplotment, characterization, narration, genre-ation, and thematization. The reliability (internal consistency) of this measure is 0.72 (Pishghadam et al., 2011). The inter-rater reliability of the scale was 0.83. The Alpha Cronbach for this instrument in the present study was 0.85.

To measure verbal intelligence of the subjects, the verbal scale of Wechsler's Adult Intelligence Scale (III) (1981) was used. The Farsi version of the WAIS Vocabulary subsection used in the present study consists of 40 words. This translated version was developed by Azmoon Padid institute (1993) in Tehran, Iran. The Alpha Cronbach for the vocabulary subsection in the present study was 0.68. The reliability coefficient (internal consistency) for the Verbal IQ is .97. The vocabulary subtest correlates highly (.91-.95) with the Verbal scale of the WAIS-III. The concurrent validity of WAIS-III was established based on high correlation with other valid intelligence scales, ranging from 78 to 89 (Silva, 2008).

The structure module of TOEFL PBT (ETS, 2005b) was used to measure participants` knowledge of English grammar. Since the validity of this scale has already been tested, the researchers found the scale appropriate to be used in the present study. This module contains 40 items. Fifteen items present a sentence with one part replaced by a blank. In the next 25 items, each sentence has four underlined words or phrases. It was required that the participants identify the wrong parts and mark them on the answer sheets. The Alpha Cronbach for this instrument in the present study was 0.80.

To measure the depth of participants' vocabulary knowledge, the Depth of Vocabulary (DVK) scale was used. The test contains 40 items. Each item consists of a stimulus word (adjectives) and eight choices. In each item, the first four choices (A-D) are in one box and the second four choices (E-H) are in another box. Among the choices of the left box, one to three choices could be synonymous to the stimulus, whereas among the four choices in the right box, one to three co-occurring words could be matched with the stimulus (collocations). The overall reliability of this test is alpha: .91 (Qian, 1999), and for this study is alpha: 0.76.

The second version of Vocabulary Levels Test (VLT) was used to measure the breadth of participants' vocabulary knowledge. The validity of the five sections of this test reported as Rasch ability estimates is as follows: 42.5 (2000), 45.9 (3000), 51.0 (5000), 55.2 (Academic), and 61.7 (10000). It measures the meaning of the content words via matching the definitions with the choices. For each three definitions, six choices are available, but each definition should be associated with only one choice. The measure is composed of five frequency levels (2000, 3000, 5000, academic, 10000)

and thus is called the levels test. The first two levels (2000 and 3000) are composed of high frequency words. The 5000 level is considered a boundary level and the next two levels consist of words that generally appear in university texts (academic) and low frequency words (10000). The reliability of the different levels of this test was reported as follows; 2000 (.92); 3000 (.92); 5000 (.92); academic (.92); and 10000 (.96) (Schmitt et. al, 2001). The Alpha Cronbach for this instrument in the present study was 0.81. Schmitt et al. (2001) estimated the validity of the Levels Test by "establishing whether learners do better on the higher frequency sections than on the lower frequency ones." (p. 67). They found that out of 30 as the maximum, the mean for the frequency levels were as follows: 25.29 (sd 5.80) for the 2000 level, 21.39 (7.17) for the 3000 level, 18.66 (7.79) for the 5000 level and 9.34 (7.01) for the 10 000 level. According to them, analysis of variance plus Scheffe ´ tests showed that the differences were all statistically significant ($p < .001$). The validity of the Academic level section needs more explanation. The mean score of this section in the profile research done by Schmitt et al. (2001) was found to be 22.65 which apparently places it somewhere between the 2000 level and 3000 level. However, they argue that the words in this section are different from the other levels, and therefore should not be included in the profile comparison. The validity of this section is then justified by analyzing the facility values of individual items and Rasch item difficulty measures. According to Schmitt et al. (2001), "the figures suggest that the words in the academic level fit in a broad range between the 2000 level and the 10 000 level." (p. 68).

To measure the participants writing ability, the researchers used an original specimen of the writing module of the IELTS exam (ETS, 2005a). Half-band scores were included. Task 2 of the General Training Writing Module was assessed based on 1) coherence and cohesion; 2) lexical resource; and 3) grammatical range and accuracy. The task requires the candidates to formulate and develop a position in relation to a given prompt in the form of a question or statement. The inter-rater reliability of the scale was 0.87.

Procedure

The data collection phase comprised the administration of six tests; this phase started in July, 2010 and ended in May, 2011. During this period, the samples were gathered across the five cities used as the sampling pool. Other than the narrative intelligence test which was administered via a movie session and recording participants' voice, the other five tests were given to them in traditional setting of paper and pencil exams. At the first phase of the study, the participants took the writing test and their performance was rated based on IELTS scoring criteria. This produced a set of writing scores on a scale of 1 to 9 with half-band scores. Then, the test of grammar was taken by participants and each person received a score out of 40. In the next step, the depth of vocabulary test was administered and the participants were asked to mark four choices altogether for each item. This test produced a set of scores ranging from 0 to 100. Then the depth of vocabulary test was given to the participants. The participants' scores on this test were given on a scale of 0 to 160. After that the Verbal Intelligence Test was administered during which each participant was presented with 1 word at a time and asked to explain each word's meaning verbally. The examiner rates the responses with a 0, 1, or 2 depending on how well the participant defines the word. Therefore, the scores can range from 0 to 80 (Wechsler,

1997). The last phase was the administration of the narrative intelligence test. The participants watched the first 10 minutes of a movie (*Defiance*) and then, were asked to recount the story. They were also asked to tell their story of the first day of the elementary school. The two narratives produced by each participant were then rated by two raters using the NIS (Narrative Intelligence Scale). The average score for the five sub-abilities of narrative intelligence in the above narrative tasks were taken as the participants' narrative intelligence score.

First of all, the internal reliability of the tests used in the study was calculated using the Alpha Cronbach Method. After ensuring the reliability of the scores, all the data were imported into SPSS 18.0 and linked to AMOS 16.0 to be analyzed through DFA.

Results

In the present study, six sets of data were collected through the administration of the tests. The descriptive statistics of the scores obtained by all 346 participants on these tests is presented in Table 1.

Table 1: The descriptive stat. of the six tests administered in the study

	Mean	SD	SEM	Min.	Max.
Gram.	57.51	16.17	0.89	23	98
Depth of Vocab.	41.04	14.19	0.76	7	88
Breadth of Vocab.	44.54	18.91	1.01	12	100
Verbal Intel.	73.20	6.91	0.37	54	93
Narr. Intel.	56.07	10.09	0.54	36	90
Writ.	43.56	13.17	0.70	17	89

The standard deviations show that "breadth of vocabulary" scores have the highest diversity whereas verbal intelligence scores are the most homogeneous among others. In general, macro factors namely verbal and narrative intelligences show less deviation from the mean, as opposed to micro factors. The widest range is found in "breadth of vocabulary" scores while the narrowest range is associated with verbal intelligence. Breadth of vocabulary has the highest standard error of measurement.

Classifying L2 writers based on language and intelligence factors

To answer the first research question, a set of DFAs were run with L2 writing ability as the groping variable, and language and intelligence factors as model predictors. The statistics of Table 2 reflect the viability of running DFA for analyzing the classifying validity of language and intelligence factors. Box's M is non-significant in all cases except verbal intelligence; this means that the null hypothesis of equal population covariance matrices is not rejected. In other words, there is no significant difference between the covariances of model predictors across low and high groups. This ensures the validity of the comparisons made between the statistics of low and high groups.

Table 2: Efficiency indexes of language and intelligence factors

Model Predic.	Grouping Variable: L2 Writing Ability						
	Eigenvalue		**Box's Test**		**Wilks' Lambda**		
	Eig.	Can Cor.	Box	P	Wil.	Chi-Squ.	P
Gram.	**.05**	**.23**	**2.70**	**.1**	**.95**	**19.2**	**.00**
Depth of Vocab.	**.16**	**.37**	**.27**	**.6**	**.86**	**51.0**	**.00**
Bread. of Vocab.	**.04**	**.21**	**.05**	**.8**	**.96**	**15.5**	**.00**
Verbal Intel.	**.04**	**.21**	**.00**	**.9**	**.95**	**15.9**	**.00**
Narr. Intel.	**.26**	**.46**	**36.3**	**.0**	**.79**	**92.4**	**.00**

The eigenvalues provide information about the relative efficacy of each discriminant function. As it can be seen, the efficacy of

depth of vocabulary and *narrative intelligence* as the grouping variables is considerably higher than the other measures. This means that one's *depth of vocabulary* (collocational knowledge) and *narrative intelligence* (discourse management ability) can predict one's membership in low or high groups of L2 writing ability more efficiently than one's *knowledge of grammar*, *breadth of vocabulary* (vocabulary size), and *verbal intelligence*. In other words, the probability of the correctness of one's prediction about learners' L2 writing ability based on the information available about these two variables will be stronger than the other variables. The canonical correlation is the most useful measure in the table, and it is equivalent to Pearson's correlation between the discriminant scores and the groups (low and high). Here the results show that the correlation between discriminant scores produced by the grouping variable (L2 writing) and the scores within the low and high groups is 0.37 for *depth of vocabulary* and 0.46 for *narrative intelligence*. Therefore the predictions made based on these two variables for L2 writing ability are more realistic than the predictions made based on the scores obtained for the other three predictors.

Wilks' Lambda shows how well the model predictors separate cases and assign them into groups. This measure is actually equal to the proportion of the variance in the discriminant scores which cannot be explained by differences among the groups. Smaller values of Wilks' Lambda indicate greater discriminatory power of the function. The chi-square statistic tests the hypothesis that the means of the functions listed are equal across groups. As it can be seen, the discriminatory power of two model predictors (*depth of vocabulary* and *narrative intelligence*) is more (smaller Lambdas: 0.67 and 0.79 respectively) when predicting L2 writing ability compared with the other three predictors (*grammar*, *breadth of vocabulary*, and *verbal intelligence* (greater Lambdas: 0.95, 0.96, and 0.95 respectively). The main discriminant function coefficients are shown in Table 3.

Table 3: Results of discriminant function analysis – model predictors: Language and intelligence factors

Predictor	**Original**		**Predicted Group Membership**		**Percentage of Writing Scores Correctly Classified**
			Low	High	
Grammar	#	L	93	80	57.2
		H	68	105	
	%	L	53.8	46.2	
		H	39.2	60.7	
Depth of Vocab.	#	L	113	60	64.5
		H	63	110	
	%	L	65.3	34.7	
		H	36.4	63.6	
Breadth of Vocab.	#	L	108	65	57.8
		H	81	92	
	%	L	62.4	37.6	
		H	46.8	53.2	
Verbal Intel.	#	L	96	77	59.0
		H	65	108	
	%	L	55.5	44.5	
		H	37.6	62.4	
Narrative Intel.	#	L	137	36	70.5
		H	66	107	
	%	L	79.2	20.8	
		H	38.2	61.8	

The participants of the study were divided into low and high ability groups based on their L2 writing scores. The statistics presented in Table 3 show how well the scores obtained on language and intelligence tests can classify the participants into low and high ability groups. The frequencies represent overlapping areas between original and predicted L2 writing scores. The number of cases in Low and High groups is 173. When L gets closer to Low or when H gets closer to High, the probability of making correct predictions about L2 writing ability increases. For example, the frequency

"137" in the section titled "narrative intelligence" means that a function extrapolated based on narrative intelligence scores, can predict 137 out of 173 cases in the low ability group correctly. That is to say, 79.2% of the participants predicted as having low L2 writing ability based on their narrative intelligence overlap with the participants which were put into that category based on their original L2 writing scores. In other words, every prediction made about one's membership in the low L2 writing ability group based on one's narrative intelligence is correct by 79.2 percent. The same explanation applies to all of the frequencies shown in Table 3. However, none of these numbers and percentages can show the total discrimination power of the model predictors. This is presented by classification percentages.

The numbers shown in the last column of Table 3 indicate how well each of the predictors can discriminate between high and low L2 writing ability learners. According to the results of DFA, the highest classification coefficient is produced by narrative intelligence with 70.5 percent. It means that any prediction about the membership of a participant in low or high L2 writing ability groups is correct by 70.5 percent. The second best classifier is depth of vocabulary with 64.5 percent. Verbal intelligence, breadth of vocabulary, and grammar have similar classifying validity that is 59.0, 57.8, and 57.2 percent respectively.

Classifying l2 writers based on sub-abilities of narrative intelligence

To answer the second research question, another set of DFAs were run with L2 writing ability as the grouping variable, and the five sub-abilities of narrative intelligence. Having found narrative intelligence as the best classifier of L2 writing ability, the researchers then explored it further by looking into the classifying coefficients of the sub-abilities to see which of the dynamics defined for narrative intelligence by Randall (1999) plays a greater role in predicting low or high L2 writing ability. The statistics in Table 4 reflect the viability of running DFA for analyzing the classifying validity of the sub-abilities of narrative intelligence.

Table 4: Efficiency indexes of the sub-abilities of narrative intelligence

Model Predic.	Grouping Variable: L2 Writing Ability						
	Eigenvalue		**Box's Test**		**Wilks' Lambda**		
	Eig.	Can Cor.	Box	P	Wil	C hi	P
Emplot.	**.20**	**.41**	**19.0**	**.00**	**.83**	**64.**	**.00**
Charac.	**.04**	**.20**	**2.25**	**.13**	**.96**	**14.**	**.00**
Narra.	**.07**	**.27**	**.11**	**.74**	**.93**	**26.**	**.00**
Genre.	**.13**	**.34**	**2.63**	**.10**	**.88**	**43.**	**.00**
Them.	**.16**	**.37**	**1.23**	**.27**	**.86**	**52.**	**.00**

As it can be seen in Table 4, among the sub-abilities of narrative intelligence, emplotment has the highest relative efficacy since it has the biggest eigenvalue (0.20); however, the significance of 0.00 in Box's test shows that the validity of the comparisons made between low and high groups based on emplotment scores cannot be ensured. The significance levels of the Box's test for the other four sub-abilities show that there is no significant difference between the covariances of model predictors across low and high groups; therefore, the validity of all the comparisons related to them can be ensured. The minimum relative efficacy is reported for characterization with en eigenvalue of 0.04. As already mentioned, smaller Wilks' Lambdas signal greater discriminatory power. Regarding this

index, after emplotment, thematization, and genre-ation can assign cases into low and high groups better than characterization and narration. The main DFA results for the sub-abilities of narrative intelligence are shown in Table 5. The results show that the correlation between discriminant scores produced by the grouping variable (L2 writing) and the scores within the low and high groups is 0.41 for *emplotment*, 0.37 for *thematization*, and 0.34 for *genre-ation*. Therefore the predictions made based on these three sub-abilities of narrative intelligence are more realistic than the predictions made based on the scores obtained for the other two predictors.

Table 5: Results of discriminant function analysis – model predictors: Sub-abilities of narrative intelligence

Predictor	Original		Predicted Group Membership		Percentage of Writing Scores Correctly Classified
			Low	High	
Emplot.	#	L	125	48	67.6
		H	64	109	
	%	L	72.3	27.7	
		H	37.0	63.0	
Character.	#	L	100	73	57.8
		H	73	100	
	%	L	57.8	42.2	
		H	42.2	57.8	
Narration	#	L	112	61	64.2
		H	63	110	
	%	L	64.7	35.3	
		H	35.4	63.6	
Genre.	#	L	118	55	67.3
		H	58	115	
	%	L	68.2	31.8	
		H	33.5	66.5	
Them.	#	L	126	47	67.3
		H	66	107	
	%	L	72.8	27.2	
		H	38.2	61.8	

As Table 5 shows, L2 writing ability group memberships predicted based on emplotment scores (67.6) are more valid than the other sub-abilities of narrative intelligence. Genre-ation and thematization have identical classifying validity; however, they differ from each other in the number of cases they can correctly assign to low and high groups. In fact, thematization can assign more correct cases to the low L2 writing ability group (126 > 118) while genre-ation can predict high group membership more efficiently than thematization (115 > 107). The lowest case predicting power for both low and high L2 writing ability groups is reported for characterization (57.8%).

Discussion

The present study was launched to see how well language and intelligence factors can classify L2 writers. Language factors include knowledge of grammar, depth of vocabulary (collocational knowledge), and breadth (size) of vocabulary. Intelligence factors include verbal and narrative intelligence. The secondary aim of the study was to see how well each of the sub-abilities of narrative intelligence can do the classification.

According to the results, among the micro factors, depth of vocabulary is the best classifier of L2 writers. It can predict a learner as a low or high ability L2 writer better than grammar and breadth of vocabulary. That is to say in producing L2 writing, knowing word collocations is more important than the size of vocabulary or the knowledge of grammar. This is in accordance with the results of some previous studies. For example, the results of the study conducted by Crossley and McNamara (2009) show that indexes of vocabulary dealing with the depth of knowledge provide a more meaningful insight into the lexical aspects of L2 writing. Appropriate collocations can have a positive effect on the cohesion and coherence of writing which are both important markers of writing quality.

This finding can be used to promote the idea that teaching word collocations in L2 writing classroom is more important than expanding the vocabulary circle or focusing on grammar.

Among all the model predictors, narrative intelligence has the highest classifying validity when it comes to L2 writing ability. It even surpasses depth of vocabulary. This finding can be analyzed against the background literature available on the role of micro and macro factors in second language writing. For example, our results are in accordance with Hirose's (2006) emphasis on the role of mental macro processes in determining the organizational patterns in L2 writing. In the present study verbal and narrative intelligence represent macro organizational skills used in writing. The fact that narrative intelligence is even a better predictor than collocational knowledge supports the view that favors the superiority of macro skills over micro components. The prominent role of narrative intelligence in predicting L2 writing ability was analyzed further by looking into the classifying power of the its five dimensions. Among the sub-abilities of narrative intelligence, emplotment is the most valid classifier of L2 writers. This finding has useful implications for the study of factors affecting L2 writing ability from another perspective. To understand the nature of the role played by emplotment in increasing the quality of writing, one has to look into the dynamics of this sub-ability as defined by Randall (1999) and operationalized by Pishghadam et al. (2011). Emplotment entails skills such as recognizing the difference between important and trivial points, and maintaining a sold line of argument thought produced discourse. These are high-order mental skills that mostly contribute to the organization of the written discourse. There is a solid literature on the place of higher-order processes in L2 writing (e.g. Bitchener & Knoch, 2010; Murphy & Roca de Larios, 2010).

It is interesting to note that depth of vocabulary, as a micro factor is even stronger than verbal intelligence (which is a macro factor) in classifying L2 writers. One reason for this may lie in the mode of testing. The test used for measuring depth of vocabulary is written while the test of verbal intelligence was administered orally. In addition, the assumption that a translated version of the verbal intelligence test is as reliable as the original test might be problematic. Of course, it should be noted that verbal intelligence is still the second best classifier of L2 writers after narrative intelligence. This supports Randall's (1999) proposal which emphasizes the proximities between narrative and verbal intelligence.

These findings have useful applications in teaching English as a foreign or second language. One of the controversial issues in L2 writing research is the problem of prioritization. Identifying and attending to the highest teaching priorities in writing courses have concerned many scholars (Ferris, 2004; Nakamaru, 2011; Truscott, 1999). According to the results of the present study, collocational knowledge and narrative intelligence must receive the focal attention from L2 writing teachers. Syllabi designed based on this finding can help L2 learners improve the quality of their writings more efficiently. Of course, paying attention to the role of collocation in writing is not new; however, combining this with a focus on narrative competence is another matter that can lead to a better framework for managing the writing classrooms. From another perspective, this finding can contribute to the testing to L2 writing and increasing the construct validity of writing modules designed for language proficiency

exams. The definitions provided by Randall (1999) for the dynamics of narrative intelligence can be used to reformulate and revise the rating criteria of the writing tests. Raters need clear instructions to examine L2 writings; whereas, identifying lexical and syntactic aspects of writing by expert raters is an objective and traceable process, unraveling the complexities of their understating of notions such as coherence and writing fluency is a very demanding task. It can be argued that incorporating the concept of narrative intelligence into the rating frameworks used by the experts sheds more light on the unexplored aspects of the testing of L2 writing.

The results of this study generated a number of questions which can be investigated in further research. The impact of a narrative intervention program which is merged into an L2 writing course on L2 learners' writing performance can be investigated through an experimental study. Since depth of vocabulary and narrative intelligence were found to be the best classifiers of L2 writers, it would be useful to explore the relationship of these two variables via qualitative research. This study can also be extended by using a more diverse set of writing topics which may affect the interaction between narrative intelligence and language factors specially collocational knowledge. Another line of research to pursue can deal with the rating processes and the possible role of the dynamics of narrative intelligence for developing the mental representations of coherence in the mind of raters. Last but not least, the neuroimaging techniques offered by cognitive scientists can be used to complement the instruments of the present study with neural correlates of lexical processing and narrative intelligence in L2 writing.

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