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The Effects of Working Memory, Intelligence and Personality on English Learners' Speaking Ability

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This study explored the role of Working Memory (WM), introversion vs. extroversion personality types, and verbal and interpersonal intelligences in English as a Foreign Language (EFL) learners' speaking ability. In addition, the role of WM in extroversion/introversion personality was investigated. Sixty EFL learners participated in the study. They took a WM task, an intelligence and a personality test, and engaged in an oral interview. Results of the independent samples t-test indicated that extroverts performed significantly better than introverts in the oral interview. In addition, results of the binomial logistic regression failed to show any role of WM in the likelihood of being extroverted or introverted. In addition, WM significantly predicted 33.4% of variation in verbal intelligence. Additionally, personality type, WM, and interpersonal intelligence significantly predicted 53.6% of variation in speaking ability, with personality (58.6%) and WM (47.7%) making the biggest contribution. These findings provide evidence on the role of personality and WM on learners' speaking ability.

Keywords: working memory, verbal intelligence, interpersonal intelligence, extroversion, introversion

Introduction

Speaking ability in second language has attracted a great deal of attention ever since communicative and meaning-oriented approaches to language teaching came into vogue. As a result of this shift from traditional to communicative approaches to language teaching, speaking has been recognized as a branch of language teaching and learning in its own right (Bygate, 2001). Furthermore, as noted by Richards and Renandya (2002), it cannot be denied that the goal of the majority of English language learners is to develop their speaking ability since it is used for a wide variety of purposes in real life communications.

Second language (L2) speaking, as Lee and Carrasquillo (2006) stated, is regarded as the most difficult skill to learn in language acquisition since, if it is looked at from a psycholinguistic point of view, the ability to speak fluently and accurately involves very complex processes in mind (Swain, 1985), and it is cognitively demanding. In addition, different purposes of speaking and the various contexts where we engage in language production require language users to master different skills for a linguistically and pragmatically appropriate communication, rather than knowing grammatical and semantic rules. Therefore, it may be a truism to assert that a variety of factors interact in interpersonal communication and the speaking process; factors that may impinge on acquiring successful speaking abilities. Such

factors, as Shumin (2002) noted, can be individual differences in age, memory, aptitude, maturational constraints, listening comprehension ability, sociocultural factors, affective and personality factors such as emotions, anxiety, motivation, and attitude. Oxford (1990) believes that these factors may play significant roles in language learning and speaking success and failure.

Such being the case, the goal of the present study is to examine the possible role of three factors, namely complex working memory (WM), personality type (i.e., extroversion vs. introversion), and intelligence (i.e., verbal vs. interpersonal intelligence) on speaking ability. Furthermore, the potential role of WM in the two types of intelligence as well as the personality types were intended to be explored.

The rationale behind conducting this study is the fact that multiple factors may play significant roles in the development of speaking ability and may result in its success or failure (Dimitracopoulou, 1990; Lee, 2005; Oxford, 1990; Scarcella & Oxford, 1992). Therefore, exploring the possible role of these factors such as individual differences in WM, extroversion and introversion as two types of personality, and verbal and interpersonal intelligences, on learners' oral proficiency, and the extent to which these factors influence this important language skill gains importance in research. Since speaking in a foreign language is a cognitively demanding task, involving the application of various resources (e.g., linguistic knowledge, world knowledge, etc.), it may be true to claim that it draws on speakers' individual differences such as working memory. In addition, individuals with differing personality types (e.g., extroverts vs. introverts), as well as various degrees of intelligences may show different speaking ability.

Literature Review

A multitude of factors may influence how well language learners speak in L2. Among such factors, learners' differences in working memory, personality and intelligence are issues that need further investigation. The importance of knowing such differences and their effects on oral ability may help teachers decide about more appropriate strategies to teach speaking ability and help learners develop. The factors considered within the framework of this study are two personality types of introversion vs. extroversion, two intelligence types of verbal and interpersonal, and complex working memory.

Extroversion vs. Introversion

Extroversion vs. introversion is one of the personality characteristics measured in Myers-Briggs Personality Type Indicator (Myers, 1962). Extroversion is defined as the extent to which the person requires to receive self-esteem and ego-enhancement from others (Brown, 2007). In other words, they need to be affirmed by the outside world. Hence, they tend to enjoy interactions and social gatherings, and may be energized when in a group or around others. On the other hand, introversion refers to obtaining "a sense of wholeness and fulfillment" from the inside words (Brown, 2007, p. 167). As a result, introverts may tend to enjoy solitary activities such as reading or writing, and they do not need others to receive a sense of wholeness and self-esteem. These two features of personality are believed to have potential effects on the process and outcome of language teaching (Brown, 2007). In general, extroverted individuals are thought of as having a better speed in speaking and a strong long-term memory; however, unlike introverts, they are believed to be weak in reasoning tasks and verbal ability (Chamorro-Premuzic, Furnham, & Petrides, 2006; Graham & Lachman, 2012; Moutafi, Furnham, & Paltiel, 2005). In addition, extroversion and introversion, as Eysenck & Chan (1982) noted, is concerned with the extent to which individuals attain energy from the outside world, while introverts have a preference for doing solitary tasks, and receive their energy from their inner world; extroverts get such energy from the outside world. In fact, extroverts frequently need other people to feel satisfied in doing their daily communicative activities (Brown, 2007).

The potential influence of extroversion/introversion on different aspects of language learning has been the subject of quite a few investigations; however, a review of such studies reveals that they have shown

inconsistent findings. Personality types such as introversion/extroversion have been previously examined in general language learning success (Busch, 1982; Naiman, Frohlich, Stern, & Todesco, 1996; Poropat, 2009), L2 writing ability (Baradaran & Alavi, 2015; Hemmatnejad, Jahandar, & Khodabandelou, 2014), listening comprehension (Alavinia & Sameei, 2012), and more relevant to the present study in L2 speaking ability (Dewaele & Furnham, 1999; Graham & Lachman, 2012; Hasirchin, 2014; Lightbown & Spada, 2006; Souzandehfar, Soozandehfar, Farsi, & Sharif, 2014; Wakamoto, 2000), producing inconclusive results. While Graham and Lachman (2012) indicated that introverts were more proficient in verbal ability than extroverts, Yusef-Hasirchin (2014), comparing the differential effects of extroversion and introversion on EFL male and female learners' speaking fluency, showed that extroverts had higher speaking fluency. Souzandehfar et al., (2014), however, found no significant relationship between introversion/extroversion and IELTS speaking on the one hand, and no meaningful difference between the two personality types on IELTS speaking test, on the other. Lack of sufficient research on this particular topic, as well as the mixed findings of previous studies suggest the need for more research in this area to shed light on the potential positive or negative effects of extroversion/introversion on L2 learners' speaking ability. Other personality types (e.g., sensing/ intuition, thinking/feeling, judging/perceiving) may be also influential in speaking ability. However, the rational for selecting the extroversion/introversion pair was that, by definition, they can be more relevant to speaking. As shown by previous research, extroverts tend to be generally more sociable, and have a higher self-esteem (Brown, 2007), while introverts prefer solitary activities and perform more reasoning tasks. Tending to participate in social gatherings and engage in interactions with others, extroverts may show a better ability to communicate with people and understand them. Furthermore, previous findings revealed that extroverts are generally be better at the rapidity with which they talk, as well as their long-term memory (Graham & Lachman, 2012; Moutafi et al., 2005). Such differences between the two personality traits, may differentially influence the quality with which they speak, an issue which was explored within the context of the present study.

Intelligence

Intelligence has traditionally been defined as a unitary concept, which was highly related to individuals' linguistic and mathematical abilities. Such a notion of intelligence became manifest in Intelligence Quotient (IQ) tests originated in Alfred Binet's study in the twentieth century (Brown, 2007). However, it is generally accepted that a unitary concept of intelligence trivializes its complexity by being too simplistic (Carter, 2005). The traditional unitary concept of intelligence, however, is now being increasingly challenged by Multiple Intelligences (MI) theory proposed by Gardner (1993).

On the basis of MI theory, as Gardner (1983, 1993) noted, human intelligence comprises multiple dimensions or types, which are independent of one another (Carter, 2005); but all are possessed by individuals with different strengths (Richards & Rodgers, 2001). Gardner (1983), initially identified seven types of intelligences; however, later, other types (e.g., naturalist, spiritual, existential, and moral) were added to the list (Gardner, 2004).

Multiple intelligences role in second language learning has been the subject of extensive studies (Ahmadian & Ghasemi, 2017; Diaz-Posada, Varela-Londono, Rodriguez-Burgos, 2017; Tejeddin & Chiniforoushan, 2011); however, little research has thus far investigated the differential role of intelligence types on second language learners' speaking ability. The impact of linguistic and emotional intelligences on reading comprehension of EFL learners was explored by Rahimi, Sadighi, and Hosseiny-Fard (2011), the findings revealed that linguistic intelligence positively influences reading ability. On the other hand, the role of emotional intelligence on reading ability was not corroborated. The role of linguistic intelligence in written output production was also examined by Ahmadian and Hosseini (2012), who indicated that a significant positive relationship existed between linguistic intelligence and writing ability of learners. In addition, linguistic intelligence was found to be a strong predictor of vocabulary knowledge criterion in writing ability.

While previous studies showed positive roles of intelligence in writing and reading abilities in EFL learners (Ahmadian & Hosseini, 2012; Dobbs, 2002; Fahim & Nejad-Ansari, 2006; Rahimi et al., 2011), there are still other aspects of L2 proficiency and learning that are less explored, among which speaking ability can be mentioned. Therefore, one of the objectives of the present study is to address this gap, and using Gardner's (1999) multiple intelligences theory, to investigate the potential effects of two types of intelligences, namely verbal and interpersonal on learners' speaking ability.

Verbal or linguistic intelligence is defined as the intelligence of words, grammatical rules, as well as syntactic analyses to produce meaningful language (Gardner, 1993, 1995). It is generally known as the ability to use language in creative ways (Richards & Rodgers, 2001), and, by definition, is referred to the specific language-based human ability to solve problems and to reason (Volkmar, 2013). Interpersonal intelligence pertains to the ability to understand others, interact and work with them, and understand their personalities (Gardner, 2003; Richards & Rodgers, 2001). Although other types of intelligences can be influential in interactions and speaking, these two intelligences were selected for the purpose of the present study since we believe, they, by definition, can be more relevant to one's speaking ability. Verbal (linguistic) and interpersonal intelligences, compared with other types of intelligences, are directly linked to communication. When it comes to speaking in a second or foreign language, as was the case in this study, the link between one's linguistic knowledge and ability (i.e., verbal intelligence) and L2 speaking becomes more robust.

In addition, since one of the objectives of the study was to examine the role of cognitive factors like working memory (WM) in the intelligences, a more vigorous theoretical link could be established between WM and verbal/interpersonal intelligences than with others intelligence types on account of the fact that both variables involve a great deal of dependence on linguistic ability. Complex WM is an individual's ability to simultaneously store and process information (Baddeley & Hitch, 1974), which is linguistic information in this case; therefore, one's verbal or interpersonal intelligences, by definition, may tap into WM and be affected by it.

Working Memory (WM)

The role of WM in different cognitive activities has been studied by a myriad of research studies, and its role in carrying out complex activities such as different aspects of language learning is now undeniable. WM is defined as the ability to concurrently maintain and process information in memory (Conway, Jarrold, Kane, Miyake, & Towse, 2007); hence, by definition, it can predict a variety of human cognitive activities. Of the various conceptualizations of WM (Baddeley & Hitch, 1974; Cowan, 2008; Daneman & Carpenter, 1983; Engle, 2002; Towse & Hitch, 1995), the multicomponent model (Baddeley 2000; Baddeley & Hitch, 1974) attracted a lot of attention in research. Based on this model, WM is fractionated into 4 components, a central executive, and three slave systems, i.e., the phonological loop, visuo-spatial sketchpad, and episodic buffer (EB). Central executive is an attentional-control system responsible for the control of the WM system by allocating attention, as well as retrieval of information from long-term memory (LTM) (Baddeley, 2010). The phonological loop handles phonological or acoustic information, and the sketchpad stores visual and spatial information. The recent component, i.e. the EB, is responsible for the binding of information from different sections of the WM system, and the temporary linking of storage systems with LTM.

A large bulk of studies in the field of cognitive psychology and language acquisition have corroborated the significant role of WM in complex mental activities, such as language learning. In other words, complex WM, i.e. the simultaneous storage and processing of information, is a powerful predictor of successful cognitive tasks, acting as a bottleneck for the learning mechanism (Gathercole, 2004). WM has been found influential in general intellectual abilities and general intelligence (Colom, Flores_Mendoza, & Rebollo, 2003; Conway, Kane, & Engle, 2003; Salthouse & Pink, 2008), foreign language aptitude (Yuncai, 2013), learning of grammar (Wright, 2013), vocabulary learning (Baddeley & Atkins, 1998; Verhagen & Leseman, 2016), reading comprehension (Joh, 2018; Walter, 2004) language comprehension

(Just & Carpenter, 1992; Swanson & Berninger, 1995), language processing (Ellis, 2005; Nowbakht, 2018; Robinson, 2002), corrective feedback and output (Goo, 2012; Mackey, Adams, Stafford, & Winke, 2010; Shahnazari, Adams, & Ketabi, 2013), proficiency (Van den Noort et al., 2006), writing processes and quality (Gathercole & Alloway, 2008; Olive, 2004, 2012; Piolat, Olive, & Kellogg, 2005; Ransdell, Arecco, & Levy, 2001), and several other aspects of language; however, few (if any) studies have focused on the role of complex WM as well as its separate components in EFL learners' speaking ability.

Considering the above review of previous studies, and lack of research on the role of cognitive and personality factors in L2 speaking competency, the present study is designed to investigate the potential influence of individual differences in complex WM, verbal and interpersonal intelligences, as well as extroversion/introversion on learners' L2 speaking ability. In addition, the study seeks to examine whether WM can predict learners' categorization into extroverted and introverted, as well as their verbal and interpersonal intelligences. Such being the case, this study sought to answer the following research questions:

1. Are there any differences between introverts and extroverts in terms of their speaking ability?
2. Does complex WM predict EFL learners' being introverted and extroverted as well as their verbal and interpersonal intelligences?
3. To what extent can WM, verbal intelligence, interpersonal intelligence, and introversion/ extroversion predict learners' speaking ability?

Method

Participants

The participants were 60 upper-intermediate EFL male and female students (N = 60), studying at the Iran Language Institute (ILI), Tehran, Iran. All the participants had studied English at the institute for approximately 45 months prior to taking part in this study. Their ages ranged from 18 to 23 (*M* = 21.08). The participants were selected out of a larger population of 164 upper-intermediate students based on the results of the Myers-Briggs Personality Type Indicator (MBTI) test. Results indicated that out of 164 students, 93 students (56.70%) were recognized as introverts, and 71 students (43.29%) as extroverts. Subsequently, in order to have two equal groups, 60 students (30 introverts and 30 extroverts) were randomly selected and assigned to the two groups of introverts and extroverts. Since the study involved assessment of WM, prior to entering the experiment, the participants were screened for any attentional or sensory issues by asking them questions regarding their previous medical issues, and whether or not they were taking any medicine.

Instruments

Myers-Briggs personality type indicator (MBTI)

MBTI (Myers, 1962) is a popular questionnaire designed to identify personality types in individuals. The test borrows from some of Jung's (1923) personality types, and consists of four dichotomous styles, namely, introversion/extroversion, sensing/intuition, thinking/feeling, and judging/perceiving. The first personality type dichotomy, i.e. introversion/extroversion was used to identify learners who fall within either of these two types of categories.

The MBTI used in the study comprised 70 two-choice items to which the learners were supposed to reply in 15 minutes. The reason for administering the test in such a short time was that learners had to provide answers to the questions as quickly as possible so that they didn't get the opportunity to over-analyze the questions, which would jeopardize the validity of the test. The test was accompanied with an

answer sheet designed to identify participants' personality types with high precision by indicating which one of the above-mentioned dichotomies was stronger in a learner's personality. Since the test could also detect other strong personality types, only the introversion vs. extroversion dichotomy was focused on to find learners who had either of these characteristics.

Multiple intelligence inventory (MII)

Multiple Intelligence Inventory (McKenzie, 1999), is a test which borrows its rationale from Gardner's (1999) MIs theory. The test consisted of 9 sections, each dealing with one of the nine types of intelligences. MII consisted of 90 items, with 10 items in each section. While taking the test, participants had to put the number "1" next to the items they thought could best describe them in each section. By counting the number of statements that were true about each learner (i.e., the number of 1's) in each separate section, his/her strongest and the weakest intelligences, as well as their scores were assessed. The scores of each type of intelligence were calculated and placed on a scale ranging from zero to 100. The closer a participant's score to 100, the higher intelligence he/she possess.

Oral proficiency interview (OPI)

An OPI taken from the IELTS exam speaking section (Cambridge University Press, 2006) was used to assess the participants' speaking ability. OPI is a highly valid and reliable assessment method which, through a standardized procedure, can measure how well a learner can use the language by determining their strengths and weaknesses. The interview lasted for 10 to 15 minutes for each participant and was rated by two raters simultaneously in order to ensure the reliability of ratings.

To evaluate the speaking skill, the American Council on the Teaching of Foreign Languages (ACTFL) guidelines and descriptors (ACTFL, 2012) were used. The ACTFL Guidelines are descriptors of what language learners and speakers can and cannot do with language with regards to speaking ability in a spontaneous context. The Guidelines consist of five major proficiency levels, namely, Superior, Advanced, Intermediate, and Novice. All the major levels, except Superior, are subdivided into High, Mid, and Low levels. Therefore, for the Novice level for instance, there are three sublevels of Novice High, Novice Mid, and Novice Low. Accordingly, the interview had 10 sublevels totally.

During the actual interview, each participant engaged in an interaction with the examiner (one of the raters), while two raters simultaneously and separately evaluated the participants' performance. The raters assessed the quality of the participant's speech on the basis of three criteria, namely, grammar range and accuracy, vocabulary range and accuracy, and fluency. The raters agreed upon 41 out of the 60 participants' ratings. There were disagreements on 19 individuals; therefore, after reconsidering their performances, the two raters agreed upon their final ratings. The ratings on the basis of the ACTFL are nominal; hence, in order to make the process of data analysis possible, these ratings were converted into numerical values (interval scale), from Superior being 100, to Novice Low being 10. Therefore, the speaking scores were placed on a continuum ranging from 10 to 100.

It, however, needs to be noted that the language proficiency level selected for the study (i.e. upper-intermediate) was merely based on the proficiency level system of the language school from which the data were collected. The language proficiency of the participants at the institute was simply determined on the basis of the length of their study in that context. Therefore, it does not necessarily mean that all the students were homogeneous in terms of their proficiency, in general, and speaking ability, in particular. In other words, despite our participants' length of study prior to the experiment (i.e. about 45 months), we did not expect them to perform similarly in the oral interview. Our expectation can be affirmed on account of the fact that the rates received by the participants in their oral interview ranged from novice high (score 30) to advanced low (score 70).

Working memory test

To assess the participants' complex WM, an Operation Span Task (OSPAN) taken from Unsworth, Heitz, Schrock, and Engle (2005) was employed. OSPAN is considered a complex WM measurement tool tapping verbal WM (Unsworth & Engle, 2007). When taking the test, participants were required to process simple arithmetic equations (i.e., 2+(3-1) = ?), while concurrently maintaining Persian consonants in memory for later recall. The OSPAN used in this study composed of 42 mathematical operations distributed in sets of 2, 3, 4, and 5. Each set was repeated 3 times; hence, there were 3 sets of 2, 3 sets of 3, 3 sets of 4, and finally 3 sets of 5, presented in a random fashion so that participants would not guess the order of the sets. The test was designed in Microsoft Power Point software and presented to the participants in slides.

During the actual test, the participants were displayed the first slide with the mathematical operation for 3000 ms. This slide was followed by the second slide which suggested a number as a possible answer to the previous slide operation with a 'YES' and 'NO' choice. Participants had another 3000 ms to decide if the answer is correct or not and mark their choice on the answer sheet. Immediately, on the third slide, displayed for 1000 ms, a Persian consonant would appear. This was the recall item, which participants had to maintain in memory until they were asked to recall and write it. This procedure was repeated depending on the size of the set (i.e. for example for a set size of 4, this procedure was repeated 4 times). At the end of each set, a recall cue sign (i.e., ???) would appear on the screen, signaling the participants that they had to write the Persian consonants in the order of presentation on their answer sheet. They were given limited time for writing the consonants, i.e. 4000 ms for a set of 2, 6000 ms for a set of 3, 8000 ms for a set of 4, and 1000 ms for a set of 5.

To score the OSPAN, the partial-credit load scoring method (Conway, Kane, Bunting, Hambrick, Wilhelm, & Engle, 2005) was used, in which 1 point was given to each correctly recalled consonant in its correct serial position only if the corresponding processing item was correct. Therefore, the possible scores ranged from 0 to 42, and the maximum time allotted for the OSPAN was 12 minutes.

Procedure

On the basis of the results of the MBTI, the participants were divided to two groups of introverts (N = 30) and extroverts (N = 30). To control the effects of intervening variables that could jeopardize the reliability of the results, variables such as language proficiency, exposure time to English language instruction, first language background, and the language institute context in which they had learned the language so far, were controlled meticulously in selecting the sample of the study. The two groups were then given the MII and the OSPAN to assess their verbal and interpersonal intelligences scores and their complex WM respectively. In the next step, the participants attended the OPI, and their final ratings and scores were evaluated by two raters simultaneously.

Results

To address the first research question, an independent sample t-test was run to determine if there were differences in speaking ability between introverts and extroverts. No outliers were found in the data, as assessed by inspection of the boxplot. Speaking scores for each personality group were normally distributed, as assessed by Shapiro-Wilk's test ($p > .05$). Results indicated a significant difference between introverts and extroverts in speaking ability, $t(58) = 4.676$, $p < .0005$. The extroverts outperformed introverts in speaking. Table 1 displays the descriptive statistics for verbal and interpersonal intelligence as well as speaking scores.

TABLE 1
Descriptive Statistics for Verbal, Interpersonal, and Speaking Scores

Group	N	Verbal intelligence		Interpersonal intelligence		Speaking	
		M	SD	M	SD	M	SD
Extroverts	30	66.333	9.994	67.000	18.597	56.000	11.328
Introverts	30	64.666	12.521	45.000	20.299	42.000	13.491

Note. M = mean, SD = standard deviation

To address the second research question concerning the effect of WM on the likelihood that participants be categorized as extroverted or introverted, a Binomial Logistic Regression Analysis was run, with scores on WM as the independent variable, and the two types of personality as the dichotomous dependent variable. Results indicated that the logistic regression model was not statistically significant, $\chi^2(1) = 1.237$, $p = .266$, and WM failed to predict participant's being extroverted or introverted.

In addition, two linear regression analyses were conducted to examine the extent to which WM can predict participants' verbal and interpersonal intelligences. The assumption of linearity was established by the visual inspection of Verbal intelligence by WM, and interpersonal intelligence by WM scatterplots. Data were normally distributed and no outliers were found in any of the variables. There was also independence of residuals for both verbal and interpersonal intelligences, assessed by a Durbin-Watson statistic of 1.934 and 1.761 respectively. Finally, the assumption of homoscedasticity was met, checked by the inspection of the plot of standardized residuals versus standardized predicted values. Results indicated that WM significantly predicted verbal intelligence, $F(1, 58) = 29.083$, $p < .0005$, accounting for 33.4% of variation in the dependent variable (adjusted R square = 32.2%); however, it failed to predict variability in interpersonal intelligence, $F(1, 58) = 2.967$, $p = .09$.

To deal with the third research question concerning the extent to which WM, personality type, and verbal/interpersonal intelligences predict participants' speaking ability, a multiple regression analysis was run, with learners' WM, personality types and their scores of verbal and interpersonal intelligences as predictors, and their speaking scores as the outcome variable. There was independence of residuals, assessed by a Durbin-Watson statistic of 1.628, and homoscedasticity. In addition, the tolerance values for all predictors were greater than 0.1, indicating that no evidence of multicollinearity was found. Results of the regression analysis revealed that the model significantly predicted learners speaking ability, $F(4, 55) = 15.867$, $p < .0005$, accounting for 53.6 % (adjusted R square = 50.2%) of variation in speaking scores. Moreover, regression coefficients results (Table 2) indicated that WM, personality types, and interpersonal intelligence added statistically significantly to the prediction (p < .05).

TABLE 2
Summary of Multiple Regression Analysis Results

Predictors	Unstandardized B	Standardized Coefficients Beta	Sig.
Working Memory	.978	.477	.000
Personality	-15.670	-.586	.000
Verbal Intelligence	.057	.047	.680
Interpersonal Intelligence	-.163	-.269	.017

It was found that 47.7% of variation in speaking ability was predicted by learners' WM, each one-point increase in WM leads to a .978-point increase in speaking scores (95% CI, .511, 1.444). In addition, interpersonal intelligence predicted 26.9% of variation in speaking scores, a one-point increase in interpersonal intelligence leads to a -.163-point decrease in speaking scores (95% CI, -.295, -.031). Finally, the types of personality (i.e. extroversion and introversion) could predict 58.6% of variation in learners' speaking ability, being introverted leads to a 15.670-point decrease in speaking scores (95% CI, -21.377, -9.963).

In sum, results indicated that speaking ability was significantly different between extroverts and introverts. In addition, WM neither affected the likelihood of being categorized in either of the personality

groups, nor predicted interpersonal intelligence; however, it significantly predicted verbal intelligence scores. Finally, multiple regression analysis results revealed that WM, personality type, and interpersonal intelligence significantly predicted the participants' speaking scores; however, verbal intelligence failed to do so.

Discussion

This study examined the potential roles of EFL learners' WM, two types of intelligence (i.e., verbal & interpersonal), and extroversion/introversion, as two types of personality, on learners' speaking ability. The first research question was concerned with the differences between extroverts and introverts in terms of their speaking ability. Speaking ability was found to be significantly different between introverts and extroverts, with extroverts showing a better speaking ability. A review of previous literature reveals that the few research studies examining the role of personality in speaking ability produced contentious results. The findings of this study with regard to the role of personality in speaking ability are in line with those of Yousef-Hasirchin (2014), both of which showed higher speaking ability for extroverts. However, these findings are not consistent with those of Graham and Lachman (2012), where introverts were reported to be more proficient in speaking ability than extroverts, and with the findings of Souzandehfar et al. (2014), in which extroversion and extroversion did not play any roles in learners' speaking ability.

One plausible explanation of this finding resides in the nature of the personality traits under query. Extroverts were previously found to be more sociable and receive "self-esteem and ego enhancement" from others (Brown, 2007, p. 166). Hence, they may show a better ability to communicate with people, understand others, and talk with more confidence. Introverts, on the other hand, are more independent of others, and prefer reasoning tasks, which might make them more sluggish in language production (Brown, 2007). In addition, extroverts were previously found to be better at speed and long-term memory (Graham & Lachman, 2012; Moutafi et al., 2005). Such advantages may be influential in making extroverts generally better second language speakers, since some of the characteristics of a good speaker are fluency and selection of a wide variety of vocabulary items while speaking.

Another explanation, justifying the superior performance of extroverted learners in the speaking test can be the selection of strategies, on the part of the learners, while talking in a second language. Previous research has supported the fact that extroverts and introverts' preferences in using compensatory strategies are different (Ahmadian & Yadegari, 2011; Ehrman, Leaver, & Oxford, 2003; Kiany, 2001). While extroverts were found to use more interactional strategies, introverts prefer to use more conceptual strategies (Ahmadian & Yadegari, 2011). Furthermore, as Gan (2008) asserted, extroverts generally use communication strategies more excessively. In addition, research (Omaggio-Hadley, 2003) has indicated that the use of communicative and compensatory strategies results in an increase in learners' language proficiency. Such differences in the amount and use of communication strategies between extroverts and introverts can explain the superior performance of extroverts in speaking ability.

The second research question was concerned with the role of WM in the likelihood of being an extrovert or introvert, as well as the verbal and interpersonal intelligence. In other words, it was intended to find out whether WM can predict the type of personality students had and their intelligence, and if so, to what extent. Results indicated that WM neither predicted the likelihood of being categorized as extroverted or introverted, nor interpersonal intelligence; however, it did predict verbal intelligence. The very few previous studies on the role of cognitive factors, such as working memory, in personality have produced inconsistent results. The findings of this study are in line with those of Lieberman and Rosenthal (2001); however, it is not in line with Gray and Braver (2002). Lieberman and Rosenthal (2001), for instance, indicated that extroversion, as measured by the Eysenck Personality Questionnaire (Eysenck & Eysenck, 1968) was not related to WM. A reason for the differences between the findings of the present study and previous ones may be the type of tasks used to measure WM. In many of the previous studies, the *n*-back task was used to measure WM, while this study employed the OSPAN. The

n-back task taps short-term memory, and unlike OSPAN, fails to tap attentional control mechanisms; hence, it is regarded as a weak measure of WM (Kane, Conway, Miura, & Colflesh, 2007).

As with the role of WM in intelligence, previous studies found a relationship between WM and general fluid intelligence (Conway, Cowan, Bunting, Therriault, & Minkoff, 2002; Conway, Kane, & Engle, 2003); however, they did not investigate its role in multiple intelligences. Our findings indicated that WM predicted verbal intelligence variation; however, it did not explain variations in interpersonal intelligence. These results are consistent with those of Hashemian and Adibpour (2012), in which verbal intelligence and memory were found to be positively correlated. To find possible reasons for this finding, it may be useful to consider the definition given to verbal and interpersonal intelligences by Gardner (1983, 1993, 1995). Verbal or linguistic intelligence refers to the intelligence of words to produce meaningful spoken or written language, of following grammatical rules, syntactic analysis, and generally language learning (Gardner, 1993, 1995). Interpersonal intelligence, on the other hand, is the intelligence and ability to understand others, interact with them, and understand their personalities (Gardner, 2003). Verbal intelligence, by definition, may be affected largely by WM, because in previous research, WM was found influential in vocabulary learning (Martin & Ellis, 2012; Verhagen & Leseman, 2016), grammar learning (Sagarra, 2007; Wright, 2013), language processing (Erlam, 2005; Juffs, 2005; Nowbakht, 2018; Palladino & Cornoladi, 2004), and language comprehension (Alptekin & Ercetin, 2011; Andersson, 2010).

The third research question dealt with the extent to which WM, personality characteristics of extroversion and introversion, verbal intelligence, and interpersonal intelligence could predict learners' speaking ability. Results indicated that personality types, WM, and interpersonal intelligence significantly predicted learners' variation in speaking ability. However, Verbal intelligence was not predictive of speaking ability. Personality types accounted for 58.6%, WM accounted for 47.7%, and interpersonal intelligence explained 26.9% of variation in speaking. A plausible explanation for this finding may be the superiority of extroverts and those with higher interpersonal intelligence in speaking scores over introverts and those with low interpersonal intelligence. To examine the relationship between the intelligences and speaking ability, two Pearson correlation analyses were run. We found that interpersonal intelligence is significantly positively correlated with speaking ability ($r = .304$, $p = .01$), whereas no significant correlation was found between verbal intelligence and speaking scores ($p > .05$). That being the case, it may be rational to expect personality types and interpersonal intelligence influence students' speaking ability. WM is also a predictor of success in a multitude of cognitive complex tasks such language learning, in general, and L2 speaking, in particular.

Conclusions

The findings of this study revealed that personality types associate with students' speaking ability in L2, showing that extroverts were superior to introverts in second language speaking. As with the relationship between personality types and cognitive factors such as WM, it was found that WM did not have any roles in the likelihood of being categorized as an extrovert or introvert. In other words, both introverts and extroverts may have high or low WM spans. On the contrary, WM significantly predicted verbal intelligence since the two can represent similar processes and abilities. In addition, WM, personality types, and interpersonal intelligence significantly predicted learners' speaking ability, with personality and WM spans making a more contribution than the interpersonal intelligence. The findings of the preset study provide evidence on the role of learners' individual differences in WM, as well as their personality and multiple intelligences in their success or failure in second language speaking. In addition, when teaching speaking to EFL learners, teachers need to take into account the significant role of such factors in their students' speaking skill in language classrooms.

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