

Differential Study of Language Aptitude and Working Memory of Extrovert and Introvert Iranian EFL Learners

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Abstract: Interest and research in foreign language aptitude in the last three decades has portrayed a strong passion across various disciplines of applied linguistics, psycholinguistics and behavioral studies, especially concerning working memory. Moreover, extroversion and introversion as personality traits are among the most important personality dimensions that can affect language learning to a great extent. This study investigated the significance of differences between language aptitude and working memory of extrovert and introvert Iranian EFL learners. For this purpose, 47 ninth grade Iranian EFL learners were selected randomly from five different high schools in Sistan and Baluchestan province. The instruments used in this study were a LLAMA test for measuring language aptitude, an N-back test for measuring working memory, a Myers-Briggs Type Indicator for dividing participants into extrovert and introvert categories. In order to check the normality assumption of the obtained scores, Kolmogorov-Smirnov test was run. To answer the research questions both the Mann-Whitney U test and independent-samples t-test were used. The results depicted that there was not any significant difference between working memory of extrovert and introvert Iranian EFL learners. Furthermore, no statistical significant difference in the language aptitude of extrovert and introvert Iranian EFL learners was identified. Current research addresses some theoretical and practical insights for teachers and researchers especially interested in psycholinguistics research.

Keywords: Language Aptitude, Working Memory, Extrovert, Introvert, Iranian EFL Learners

1. Introduction

Without any doubt, it has been confirmed that various individual learner variables significantly contribute to learning outcomes. Nevertheless, according to Zafar and Meenakshi [45], some English language learners are proved to learn the language at a faster rate than others; they are considered to be furnished with some special capacity that can foster language learning in them. In contemporary decades this latent capacity has been proved to be connected with the concept of language aptitude which was a demanding effort to be described by the scholars [9]. Additionally, the impact of working memory in second language learning has been cumulatively identified [40]. At the present, the concept of working memory is regarded as one of the most important differential variables among individuals which not only regulates but also correlates

with different facets of language [1]. Erham and Oxford [15] showed that various factors including personality, effective, motivational and external factors have a major impact on language aptitude besides cognitive factors that play a role in successful second language learning. Based on research on the long term and the short term memories, it is discovered that introvert learners possess better long term memory and extrovert learners own better short term memory [13]. Taking all of this into the consideration, this study was conducted to investigate the differences in language aptitude and working memory of extrovert and introvert Iranian EFL learners.

2. Literature Review

2.1. Language Aptitude

Among the most important identity documentation which

conforms to success to in EFL learning is language aptitude [41]. The notion Foreign Language Aptitude (FLA) is one standpoint on this issue. Initially, the concept of foreign language aptitude was regarded as a comparatively stable ability in learning a foreign language which was different amid individuals [14]. Certainly the speed of foreign language learning among people is not the same. However some have troubles in this operation regardless of their motivation level and amount of attempts they undergo [10]. Golden span of research and development on language aptitude was in 1950s and 1960s [39] and Carroll was among the pioneers in the field who identified the distinction between cognitive abilities including intelligence and language aptitude. In his viewpoint aptitude was regarded to be componential and also a static trait which was hard to modify [42]. His research findings in the area of language aptitude can be divided into two categories. The first category represents quarter-componential view of language aptitude and second category depicts measures of language aptitude.

Carroll [11] mentioned that there are four principal elements to language aptitude:

- 1) Phonetic coding ability: the ability to make distinctions between sounds, to associate sounds and symbols representing them and keep them in mind.
- 2) Grammatical sensitivity: the ability needed for recognizing grammatical functions of words in sentences.
- 3) Rote learning ability for foreign language materials: the ability to distinguish sounds and meanings at a fast rate and to retain them.
- 4) Inductive language learning ability: a talent to induce both explicit and implicit rules from the chaos of language material [3] and to be able to produce language based on the generalizations [42].

As previously mentioned, there are a great number of papers and research works have been published on language aptitude. In a recent attempt by Kocic [29] provided a short review of the previous studies on aptitude as an important element which played role in language teaching and offered different insights on this issue. Several recent research projects on language aptitude were scrutinized in order to connect aptitude with second language acquisition theory.

In another effort, Smith and Stansfield [43] examined the language aptitude concept, its measurement methods and the link between SLA theory and aptitude. They provided valuable insights about the measurement of this construct. In the same vein Li [30] discussed summary of the studies on language aptitude and application of these achievements in classroom teaching context. Also, language aptitude has been discussed in relation to sensitive periods in second language acquisition [33]. The researchers were focused just on two views: on the first hand the possible power of maturational constraints on language learning and on the second hand use of language aptitude within the boundaries of sensitive period.

2.2. Working Memory

A change in the notion of short-term memory was necessary to create a tangible discrimination amid principal functions of the brain. As a result, first Baddeley and Hitch [6] offered the modern notion of working memory. Seminal theory claims that working memory operates as a system with various elements including the central executive, the episodic buffer, the visuo-spatial sketchpad and the phonological loop [5]. Furthermore, the attentional control part of the working memory structure has been linked to the central executive section [23]. According to Henry [23], short-term phonological details are being saved by a phonological loop which creates an opportunity to remember the heard facts for a short time. On the other hand, the visuo-spatial sketchpad is responsible for operations and preserves the observable and spatial details and also enciphers verbal materials as different types of imagery [20]. In other words, the visuo-spatial sketchpad eases the path to remember “what” and “where”: which furthermore refer to the visual qualities of an object and the place of the object [23]. As stated, the working memory model was supplied with the episodic buffer as its most recent development. Episodic buffer offers short-term preservation of details in a multimodal code and it can also bind information from the subsidiary systems [4]. A review of previous studies indicates that there is ample empirical evidence that differences in working memory are related to EFL.

In a late probe, Nowbakht [36] plumbed the depth of the role of working memory, age and language proficiency of a group of English learners with the processing and understanding of English anaphoric sentences. In a study by Barker [7], the importance of working memory in a classroom setting was shown. He was also successful in offering a review on the connection of working memory with the educational setting. Another experiment has been conducted by a group of researchers [17] into the possible connection amid spatial and linguistic working memory resources and language comprehension in verbal and signed languages. According to the linguistic serial recall tasks, the findings showed that there was not any extension between complicated working memory tasks and advantage for speakers on linguistic short-term memory. The interaction of inter-individual variations in working memory capacity with task-based careful online planning has been investigated by Ahmadian [2]. He found that careful online planning is impacted by the individual differences in working memory capacity since it is believed to require planning what to mention and in how to mention while performing a task [16]; which in turn signifies planning speech while doing another cognitively demanding task. The achievements of this study portrayed that accuracy and fluency with careful online planning conditions correlate with working memory capacity to a great extent.

2.3. Extroversion and Introversion

Extroversion and introversion were defined by Eysenck

[18] as personality traits that lie on a continuum and have a profound effect on human behavior. The inclination of individuals with extrovert qualities is regarded towards the outside world yet the inclination of individuals with introvert characteristics is directed inside upon themselves. To clarify more, extroverts can become preoccupied and their mind becomes alert towards marginal issues while studying in some measure owing to their conviviality and partly due to their fragile capacity to concentrate for longer time spans. Nonetheless, introverts are seemed to be quiet, would rather read than meet other people and talk to others. They also have a smaller circle of companions and like to escape from excitement and adventure [19]. Studies on the role of personality traits including extroversion and introversion and their relationship with language learning abound. Specifically, these traits have been studied in relation to language learning. Hamed, Akbari, Hamed, and Hamed [22] checked out the connection among the amount of extroversion and speaking anxiety in the English as a Foreign Language (EFL) setting and to verify the association among the amount of extroversion with spoken fluency and accuracy. The results depicted a powerful negative association between the amount of extroversion and public speaking anxiety. They also found a strong positive connection between extroversion level and spoken fluency in the qualitative stage. Spoken accuracy didn't reveal any significant correlation with the extroversion degree. Jafarpour Boroujeni, Roohani and Hasanimesh [26] analyzed the possible available effects of extrovert and introvert personality traits of Iranian EFL learners on their writing performance in connection with its different subsets (i.e., content, organization, language, mechanics, and vocabulary). More careful inspection of the findings showed that participants with introvert qualities were superior to those with extrovert qualities significantly in all subsets but for the organization. It is believed the reason for those findings was due to the presence of some qualities which are unique to introverts, for instance being more careful, focusing more on their loneliness and brainstorming ability while being in isolation. Zafar and Meenakshi [45] considered the numerous research conducted to study the association among the extroversion level, introversion elements and second language learning. Findings revealed that extrovert individuals took full advantage of opportunities that resulted in language-use as they were outgoing and more likely to find friends, easily engaged in discussions inside and outside their educational environment and classroom. Nevertheless, the findings also showed that introverts were better fitted into classroom learning, particularly in writing and reading skills. Oz's research [38] indicated that extroverts, with qualities such as sociability, talkativeness and friendliness, were more likely to engage in conversation in second language classrooms. The findings clearly showed that there was a statistically significant positive association between level of extroversion and willingness to communicate. Furthermore, extroversion was regarded as the most powerful predictor of second language willingness to

communicate between the rest of the variables including openness to experience, agreeableness, neuroticism, conscientiousness. Considering the abovementioned theoretical and empirical studies this article aims to address the following research questions:

Research Question 1: Is there any significant difference between the working memory of extrovert and introvert Iranian EFL learners?

Research Question 2: Is there any significant difference between the language aptitude of extrovert and introvert Iranian EFL learners?

3. Method

3.1. Participants

The participants in this study were 47 ninth grade students studying English at five high schools in Saravan, in Sistan and Baluchistan province in Iran. There were 22 males and 25 females and all of them spoke Persian and Baluchi as their mother tongues. Like other EFL learners they had limited opportunity to use English for communicative purposes outside the context of classroom. The proficiency level of the participants were elementary according to the teacher's knowledge. The participants were selected randomly from above-mention school and their ages varied from 12 to 14.

3.2. Myers-Briggs Type Indicator

The Myers-Briggs Type Indicator (MBTI) developed by Myers and her mother, Myers and Briggs [35], is a well-known and widely used personality inventory based on the psychological theories of Carl Gustav Jung. It is often used as a tool for discovering and understanding different normal human personalities and can be utilized in multiple purposes such as academic counseling, career development, conflict resolution, leadership training and relationship counseling. However, it should be noted that MBTI is not in fact a test as there are no right or wrong answers and it does not reveal everything about person. Based on Jung's psychoanalytical theories, Myers deduced that there were four dichotomies in their type indicator. It contains sixty multiple choice questions, which makes people differ from one another and they referred to them as type preferences. The four dichotomies and their brief descriptions are presented below:

- 1) Extroversion or Introversion: this dichotomy indicates whether people prefer to acquire their personal energy from the outer world of people and activities, or from the inner world of ideas and thoughts.
- 2) Sensing or Intuition: this dichotomy describes how people take in information, whether they focus on what is actual and real (factual-based) or prefer to interpret what they see.
- 3) Thinking or Feeling: this dichotomy indicates how people prefer to make decisions, whether it is based on logical thinking or influenced by their concerns for themselves and others.
- 4) Judging or Perceiving: this dichotomy describes the

way you manage your life and how you deal with the outer world, whether in an orderly manner or spontaneously.

The four scales of the MBTI can be scored by computing a continuous preference score indicating the net preference for the two poles of each scale. The categorical trait value can be obtained by dichotomizing this preference score. For calculating the internal reliability of the questionnaire, the KR-21 formula was used. The reliability index for this test was estimated to be 0.78. The MBTI was used in order to divide students into extrovert and introvert groups.

3.3. Language Aptitude Test

Language Learning and Modern Aptitude (LLAMA) is a computerized aptitude test developed by Meara [34], based on the theoretical underpinnings of the Modern Language Aptitude Test (MLAT). The test comprises four subtests. The LLAMA B is a test of vocabulary learning, which measures the ability to learn large amounts of vocabulary in a relatively short time. Also, it is considered to be a measure of memory. The LLAMA D is designed to test the ability of participants to recognize short pieces of spoken language that they were exposed to a short while earlier. The LLAMA E is a test of sound-symbol correspondence. It presents a set of 24 recorded syllables, along with a transliteration of these syllables in an unfamiliar alphabet. The task is to work out the relationship between the sounds and the writing system. This component can be said to measure the phonetic coding ability of Carroll's model. Finally, the LLAMA F is a test of grammatical inference. The test is to use the time available to learn as much as possible about a new language. The learners see a sentence and a picture for each button they click. They have five minutes for this study phase of the program, and they can take notes. This test is considered to be equivalent to the grammatical sensitivity test of the Modern Language Aptitude Test. At the end of the test, participants' scores are displayed on the bottom panel. The scores for LLAMA range between 0 to 100. The rating scale ranges from very poor to outstanding. An exploratory validation study that assessed the reliability of the LLAMA test which was done by Meara [34] showed the internal reliability of test. The LLAMA test was used for measuring language aptitude of the participants.

3.4. N-Back Test

The N-back test is a computer-based cognitive test [21, 24, 25] that presents a finite set of stimuli in a continuous stream, where the participant is required to respond to that stimulus which matches stimuli delivered N positions previously. The stimuli are usually visual or auditory. The visual stimuli include shapes, images, letters, words and numbers either displayed individually or located in spatial arrays. At specific points, the participant is asked to repeat the stimulus that occurred N presentation back. For example, the subject might be asked to repeat the digit that occurred 1 back so the participant has to press a button every time the number is the same as it was 1 trial back. That means when

the same number appears twice in the row. The N-back software presents the score automatically after finishing the test. The result shows the matches, right answers, failed answers and the score. The rating scale ranges from poor to excellent. For checking the internal reliability of the test, a pilot study had been done with a group of twenty five participants in Hazrat Fatemeh high school. The KR-21 formula was used. The reliability index for this test was estimated to be 0.62. The N-back test has face validity as a WM test since it seems to require maintaining continuous updating and processing of information. Since at least two tasks, maintaining and manipulating information, have to be processed simultaneously, it apparently matches the criteria of domain-general executive attention [28]. The N-back test was used in order to measure working memory of the participants.

3.5. Data Collection Procedure

Myers-Briggs type indicator, Language aptitude test and N-back test were administered to 47 EFL learners at five high schools in Saravan. These tests were administered in three periods at each high school. At the first session Myer-Briggs type indicator, at the second session the language aptitude, at the third session, the N-back test were administered to the participants at each school.

The students were absolutely assured that their answers would remain anonymous. The researchers also kept an eye on the informed consent. A written informed consent was given to all subjects. In a plain language briefly the principal aim of the research was revealed along with a statement expressing participants voluntarily and freely taking part in the study. Furthermore due to the age of participants which were between 12-14 years the researchers decided to take an oral consent from participants too. In a conversation the researchers expressed that the data will be used solely for research purpose and they are free to withdraw at any time, without giving a reason. All subjects agreed to participate in this study.

Before the distribution of the tests, some information about the tests, from how to fill out them, how to take the tests, along with an example, was given to participants orally in Persian and they were requested to select the most appropriate answers. For completing the tests and questionnaire, every participant spent approximately 15-20 minutes.

4. Result

In order to find out the differences of the working memory and language aptitude of extrovert and introvert Iranian EFL learners the Statistical Package for Social Sciences (SPSS) version 23 was used to analyze the data. The first research hypothesis was "there is no significant difference between the working memory of extrovert and introvert Iranian EFL learners". To test it, first of all, the obtained scores of the participants regarding their working memory were examined with a Kolmogorov-Smirnov test to check the assumption of normality distribution.

Table 1. Tests of normality for working memory scores.

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Working Memory	.176	47	.001	.855	47	.000

The results of the Kolmogorov-Smirnov test indicated that the assumption of normality of the distribution of the scores for the working memory was not met, since the Sig. value turned out to be 0.001, which is smaller than 0.05. As a result, the researcher decided to conduct a Mann-Whitney U Test, which is a non-parametric equivalent of an independent-samples t-test.

Table 2. Descriptive statistics for working memory scores in introvert and extrovert groups.

Personality Type	N	Median	Mean	Std. Deviation	% of Total N
Introvert	22	88.00	74.14	26.063	46.8%
Extrovert	25	81.00	73.64	25.134	53.2%
Total	47	83.00	73.87	25.294	100.0%

Table 2 displays descriptive statistics for working memory scores in introvert and extrovert groups. The median and mean for the introvert group were 88 and 74.14 and for the extrovert group were 81 and 73.64 respectively.

Table 4. Tests of normality for language aptitude scores.

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Language Aptitude	.085	47	.200	.950	47	.043

As stated before, an independent-samples t-test was run to see whether there was a significant difference between the extrovert and introvert EFL learners in terms of their language aptitude scores.

Table 5. Descriptive statistics for language aptitude scores in introvert and extrovert groups.

Personality Type	N	Median	Mean	Std. Deviation	% of Total N
Introvert	22	88.00	40.50	12.363	46.8%
Extrovert	25	81.00	46.08	14.253	53.2%
Total	47	83.00	43.47	13.553	100.0%

According to table 6 the results of Levene's Test [$F=0.323$; $p=0.573$] indicated equality of variances.

Table 1. Results of independent samples t-test language aptitude among introvert and extrovert groups.

Levene's Test for Equality of Variances			t-test for Equality of Means							
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Language Aptitude	Equal variances assumed	.323	.573	-1.424	45	.161	-5.580	3.918	-13.472	2.312
	Equal variances not assumed			-1.437	44.99	.161	-5.580	3.882	-13.400	2.240

The results of the t-test [$t(45)=-1.424$; $p=0.161$] indicated that there was no significant difference in the language aptitude of the extroverts ($M=46.08$, $SD=14.25$) and introverts ($M=40.50$, $SD=12.36$). Furthermore, the second research hypothesis was also confirmed.

5. Discussion of the Findings

The first question of the study was formulated to find out

Table 3. Independent-Samples Mann-Whitney U Test for working memory across introvert and extrovert groups.

Total N	47
Mann-Whitney U	262.500
Wilcoxon W	587.500
Test Statistic	262.500
Standard Error	46.774
Standardized Test Statistic	-.267
Asymptotic Sig.(2-sided test)	.789

A Mann-Whitney U Test revealed no significant difference in working memory extrovert ($Mdn=81$) and introvert ($Mdn=88$) personality traits ($U=262.5$, $Z=-0.267$, $p=0.789$, $r=0.03$). The r value is calculated by dividing the observed z by the square root of N and is used for determining the effect size. Consequently, the research hypothesis is confirmed. According to Cohen [12], this effect size would be considered a very small one.

In order to test the second hypothesis, which was "there is no significant difference between the language aptitude of extrovert and introvert Iranian EFL learners", first, the scores of the language aptitude of the participants were checked for normality distribution. The scores were normally distributed, as it is evident from the Sig. value of Kolmogorov-Smirnov test turned out to be 0.200 which is larger than 0.05. Thus the researcher used an independent-samples t-test.

the difference between the working memory of extroverts and introverts Iranian EFL learners. The findings demonstrated that there was not any significant difference between the working memory of extrovert and introvert Iranian EFL learners. This might be due to the fact that there is no close relationship between these two variables (WM and extroversion-introversion). In addition, another possible reason for this result might be the similarity of the working memory performance in the two groups of extroverts and introverts.

To the researcher's knowledge, there was a dearth of research about the difference between the working memory of extrovert and introvert learners. The findings of the present study are in harmony with the results of Waris, Soveri, Lukasik, Lehtonen and Laine [44], who investigated the associations between the three WM composites (numerical-verbal WM, visuo-spatial WM, N-back) and the big five personality types including extroversion-introversion in a large-scale study on adults ($N=503$). The study failed to show any robust relationships between WM performance and the big five personality traits. Researchers also studied the findings of over 20 previous studies related to working memory and personality types. As Waris et al. [44] stated "The relationship between extroversion and WM performance was investigated in 20 of the included samples. Two (8%) of them showed statistically significant associations that were all positive, indicating that higher extroversion was related to better WM performance". However, the results are in contrast with the findings of a few studies. Lieberman [31] studied the relationship between introversion and working memory. Results indicated that introverts were slower than extroverts in comparing the contents of working memory to an external target. In a similar vein, Lieberman and Rosenthal [32] also reported extroversion was found to correlate with central executive efficiency ($r=0.42$) but not with storage capacity ($r=0.04$). Additionally, Johann and Karch [27] reported that there was a sophisticated interplay between personality traits, executive functioning and intelligence in both children and young adults. Considering the limited number of previous studies about the variables in this study, the limited number of the participants, the participants' age, the context and the instruments used to collect the data, the results of the present research should be generalized with caution.

The second question of the study was formulated to find out the difference of language aptitude of extrovert and introvert Iranian EFL learners. The results revealed that there was no statistical significant difference in the language aptitude of the two groups. Therefore, the second null hypothesis which was "there is no significant difference between language aptitude of extrovert and introvert Iranian EFL learners" was retained. One reason for this result might be that there was no close relationship between these two variables (language aptitude and extroversion-introversion). In addition, another possible reason for this result maybe the similarity of language aptitude performance in the two groups of extroverts and introverts. The results might also be due to the very homogenous conditions of the participants. Since all the participants live in a small city in southeast of Iran, despite small differences in their language aptitude, the socioeconomic similarity of the families and mostly the dominant Baluch cultural norms might have caused the participants to show very similar psychological behaviors. Based on the background of the study, previous studies did not shed light on the differences between the language aptitude of extrovert and introvert Iranian EFL learners to the best of the researcher's knowledge. The results are similar to

the findings of Oktriani, Damayanti and Hardiah [37] who discovered whether there was a significant difference in achievement scores amid extrovert and introvert language learners in speaking ability in the English conversation classes. They found that there were no significant differences between introvert and extrovert personalities in English conversation achievement scores.

However, the present findings are in contrast with the findings of Biedron [8], who concluded that extroversion had a consistent negative effect on foreign language aptitude components. It affected phonetic script, discourse and vocabulary learning. Generalizability of the findings should be dealt with care, since the number of the participants, the participants' age, the context and the instruments used to collect the data were limited.

6. Conclusion

The aim of the present study was to investigate the differences between working memory and language aptitude of extrovert and introvert Iranian EFL learners. The answer to the first research question showed that extrovert and introvert have probably similar working memories. Therefore, providing extrovert and introvert learners with a situation in which they consider their personality trait may not be very useful for comparing their working memory. Concerning the second research question, the results showed that extroverts and introverts show similarity in their language aptitude. Accordingly, language aptitude is not likely to be very appropriate variable for obtaining distinction between extrovert and introvert learners. Therefore, concerning the results of the first and the second research questions, the working memory and language aptitude of extrovert and introvert learners seem to be alike. Therefore, providing extrovert and introvert learner with different classroom setting may not construct a reasonable difference of the learners' working memory and language aptitude. As a result, teachers can provide similar atmosphere with regard to working memory and language aptitude for the extrovert and introvert learners in the class.

The results of the present study along with its limitations and delimitations raise several questions that could be the subject of further research. First of all, there was a limited number of participants. Some results may be influenced by the size of the sample and it would be more sensible to carry out the study with a larger sample. Secondly, this study was done in Saravan, a city in Sistan and Baluchestan, and it would be useful to do a similar study with participants from other contexts. Moreover, the instruments which were utilized to collect the data in the present study were three tests and one checklist. Also, the process of gathering data lasted for a long time. Therefore, it is possible that some of the participants who completed the tests and checklist have answered the items untruthfully and dishonestly. In addition, other kinds of research instruments such as interviews, other kinds of tests and observations can also be employed to gain different kinds of data, which might yield different and more

reliable and valid results. Finally, a similar research can be done with Iranian EFL learners at other educational levels, for example university students.

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