The Effect of Aptitude on Iranian EFL Learners' Attainment Scores: An Investigation into Meara's (2005) LLAMA Aptitude Tests

Shokouh Rashvand Semiyari
Department of English Language Teaching
Islamic Azad University, East Tehran Branch
Tehran,Iran
Email: Sh.Rashvand@iauet.ac.ir
Email: Sh_Rashvand@yahoo.com

Abstract. Although the various aptitude measures have widely been explored in the literature, the LLAMA Aptitude Tests have rarely been examined in an Iranian context to-date. Thus, this study was carried out drawing on Meara's (2005) LLAMA Aptitude Tests to investigate the contribution of aptitude construct on Iranian EFL learners' attainment scores. By conducting a quantitative study, this research attempted to examine to what extent aptitude was a good indicator of Iranian EFL learners' attainment scores. To this end, 284 pre-intermediate EFL learners with age range 18-25 studying in IAU East Tehran Branch participated in the study. They were asked to take the LLAMA Aptitude Tests at the given time. The predictive power of aptitude was analyzed through multiple linear regression. The findings showed aptitude could purly predict 5% of variance in students' attainment scores. Among the LLAMA Aptitude subtests, LLAMA E had the greatest impact. It can be said that sound-symbol correspondence did predict 29% of variance of EFL learners' attainment scores. The implications and suggestions for future studies were also postulated.

Keywords: Aptitude, LLAMA aptitude tests, attainment scores, individual differences, EFL learners

1. Introduction

It is assumed that some people are more successful at performing an action like painting, driving, language learning, etc. These people usually achieve to a high level of mastery without making much effort or

devoting adequate time to learn those skills. It sounds they have inborn capability (aptitude) for such activities (Wen et al., 2019). Kiss and Nikolov (2005) believe aptitude is a talent for language learning that is rather stable. They emphasize aptitude is different from other cognitive features and it enhances the rate and ease of L2 learning in most of cases. Drnyei (2005) views aptitude as the most important predictor of learners' success in academic settings. Elmechta (2016) views language aptitude as a particular ability which plays a significant role in foreign or second language learning. Reiterer, Hu, Sumathi, and Singh (2013) state that learners are distinct due to cognitive and affective features as well as capabilities and aptitudes they bring to the learning context. That's why the way they learn is subject to constant change and variation (Drnyei, 2010). The affective and cognitive features have to do with inside the individuals and may refer to language aptitude, learning style, personality, etc. while the social dimensions include socioeconomic status of learners including parental education, involvement, job, and so on (Nitta, 2006). Moreover, individuals learn a foreign or second language differently in terms of rate, route, and level of attainment. These differences specify their success or failure in language learning (Li, 2015).

2. Literature Review

2.1. Individual differences (IDs)

The fact that learners display considerable variation in language learning has been scrutinized by many scholars to-date. Almost all the researchers came to conclusion that individual differences (IDs) bear the dominant share in predicting students' attainment (Drnyei, 2005). In essence, IDs give rise to different levels of attainment in most of cases. Such differences have been attributed to various factors including aptitude. As confirmed by Gardner (1985), IDs arise due to cognitive and affective features as well as learners' personality traits. Cognitive features assumed as the salient indicators of learners' success in language learning are aptitude (Carroll, 1981), intelligence (Skehan, 1986) and working memory (Juffs & Harrington, 2011). Skehan (1989) believed that aptitude is more related to naturalistic rather than instructional setting. Li (2016) highlights that aptitude does not have any correspondence with other

effective and cognitive factors. Aptitude was conventionally regarded as invariant and constant entity (Singleton, 2017). Recent studies however view aptitude as a componential construct that is composed of various abilities (Granena, 2013; Ellis, 2015; Doughty, 2018).

2.2. Aptitude: definitions and backgrounds

Aptitude bears various meanings among which we can refer to inclination, appropriateness, liability and disposition (Snow, 1992). He views aptitude as a dynamic rather than a stable capacity that is constantly influenced by the environment in which learning occurs. Skehan (1998) asserts that aptitude is rather a stable construct that is unaffected by instruction and/or background knowledge. Dekeyser (2000) postulates that aptitude is a pre-requisite to acquire a good level of attainment. He argued that while younger students learn implicitly, older ones learn explicitly and therefore have to resort more to language aptitude. Grigorenko et al. (2000) claim that aptitude is not a fixed concept that has been predetermined at birth. Sternberg (2002) perceives aptitude as a dynamic feature that can be taught to students. Kiss and Nikolov (2005) view aptitude as an intuition for language learning which is distinguished from general cognitive abilities. They add aptitude is not a preconditioned term for second language acquisition; however, it can enhance the rate and ease of learning. Language aptitude is a cognitive ability leaners use to process information (Robinson, 2007). Rysiewicz (2008) sees language aptitude as "the ability to segment and identify distinct foreign sounds to form association between them and graphemic symbols representing them for later use" (p. 572). Drnyei (2010) emphasized the dynamic nature of the aptitude construct which is affected by various internal and external factors. Dekeyser and Koeth (2011) view aptitude as a complex construct which is composed of different cognitive parameters and should not be regarded as a stable personality trait. Van Patten and Smith (2015) believe that the importance of aptitude acquisition might be limited only to explicit rules' learning. Drnyei (2010), on the contrary, emphasized the dynamic nature of aptitude which is influenced by various internal and external factors. Skehan (2016) considers aptitude as one of the salient features playing an important role in acquisition process. He emphasizes it is not to be treated solely as a predictor

variable. He put forward two approaches with regard to language learning aptitude including differential and experiential. The former treats aptitude as a variable that needs to be measured in natural settings while the latter focused on instructional settings (Skehan, 1991). Wen, Biedron, and Skehan (2017) conceptualize language aptitude as the most salient factor in second language learning. Considering Skehan's (1991) perspective, research in the realm of aptitude has directed towards the interventionist approach (Celik-Yavas & Yavuz, 2020). Ellis (1994) highlights that confirmatory studies bearing an interventionist nature is more suitable than naturalistic ones as far as individual differences are concerned. Nowadays research on aptitude has been drawn towards the relationship between the language aptitude and other individual differences as well as various types of instruction. It implies that the predictive power of aptitude is not the main and sole issue that shall be taken into account by researchers (Celik-Yavas & Yavuz, 2020). To wrap up, aptitude is viewed as the substantial component in the process of language learning. However, the researchers should keep in mind that aptitude cannot be studied in separate without explaining its relationship with other IDs and types of instruction as already confirmed by Celik-Yavas and Yavuz (2020).

2.3. Different aptitude test batteries

Aptitude is an individual-specific talent towards foreign languages' learning (Drnyei & Skehan, 2003). What facets comprising language learning aptitude are still questioned among different scholars. Such disagreement has led to the development of different aptitude test batteries including MLAT, PLAB, DLAB, and LLAMA in the course of time. These tests are distinct due to their aims and objectives. In what follows, each has been described in-brief:

2.3.1 Modern language aptitude test (MLAT)

Language aptitude investigations are generally associated with initial studies carried out by Carroll and Sapon (1959). They view language as a fixed and monolithic construct consisting of smaller components including phonemic coding ability, grammatical sensitivity, inductive language learning ability, and associative memory. However what they mean by

memory, whether the aptitude remains stable over time, how it can be related to intelligence, etc. were among ambiguities toward such classifications (Kormos, 2013; Wen, 2016). Linck et al. (2013) carried out a study on MLAT and found that aptitude specific features are related to different ages. Li (2016) conducted a validation study on aptitude test. He found that aptitude was distinct from other affective features including personality, anxiety, etc. He also emphasized that aptitude construct was a good indicator of learners' achievements.

2.3.2 Pimsleur modern language aptitude battery (PLAB)

The PLAB was developed by Pimsleur (1966) to anticipate students' attainments and diagnose their disabilities. Language learning aptitude does not refer to whether or not an individual can or cannot learn a foreign language (it is assumed that virtually everyone can learn a foreign language given an unlimited amount of time). The PLAB was designed to administer to native English speaking students in grades 7-12. In this test, vocabulary size in English is taken as a measure of overall verbal ability, sound discrimination measures auditory skills and sound-symbol association, and general interest in language (motivation) is taken into account.

2.3.3 Defense language aptitude battery (DLAB)

The Defense Language Aptitude Battery (DLAB) was developed to measure the learners' capabilities to learn a foreign language and thus determine who may pursue training as a military linguist. It is composed of both audio and visual sections. The test was not intended to measure fluency in a certain language, but rather to determine learners' potential to learn a language. The test will give the individuals some examples of what a selection of words or what a portion of a word means, then asks the test takers to create a specific word from the samples given.

2.3.4 The LLAMA aptitude test

The LLAMA is a computer-based aptitude test battery that is easily accessible through the website (www.lognostics.co.uk/tools/llama/index.htm). It was first designed by Meara (2005) and has grown in popularity due to the fact it is free and also language and gender independent. Language independence is a vantage point as it may remove any limita-

tions imposed by individuals' language backgrounds, proficiency levels, etc. It also decreases the effect of long-term memory and reduces the chance of making meaningful constructions out of verbal stimuli (Meara, 2012). Moreover, it can be administered to speakers of all languages without the need of translation. As inappropriate translation may endanger the reliability and validity of the test and confound the generalizability of the findings. The LLAMA consists of four components including LLAMA B, LLAMA D, LLAMA E, and LLAMA F. LLAMA B deals with the vocabulary learning. It evaluates the learners' ability to relate unknown names to unknown objects. This ability is being assessed through paired associates' task in MLAT. LLAMA D has to do with sound recognition and implicit learning. This part is absent in MLAT. LLAMA E refers to sound-symbol correspondence. This part is the adaptation of MLAT's phonetic manuscript section. LLAMA F relates to grammatical inferencing and cares for explicit inductive learning ability.

2.4. Empirical studies

Language aptitude tests have been widely applied in different studies (Granena, 2012; Yilmaz, 2013). The researchers found meaningful relationships between different aptitude tests' results and learners' achievements almost in all studies. Robinson (2002) examined the relationship between working memory and aptitude. He found a fairly strong correlation between learners' aptitude test scores and their working memory. Sfr and Kormos (2008) found a positive correlation between the students' backward digit span scores and total aptitude scores. Abrahamsson and Hyltenstam (2008) found a meaningful correlation between students' aptitude test and the scores of written and auditory grammaticality judgment test (GJT). Bylund et al. (2010) found a meaningful link between aptitude and the proficiency scores of learners. Granena (2012) found a meaningful relationship between learners' LLAMA scores and their morphosyntactic achievements. Serrano and Lianes (2012) investigated the influence of learning environments and vocabulary skill assessed by LLAMA B on the learners' scores. They found although the influence of leaning context was minute, the learners with higher scores in LLAMA

B performed better in performing the tasks they were assigned to and finally achieved greater scores. Yalcin (2012) found a meaningful relationship between LLAMA scores and learners' writing performance. Yet, he did not find any meaningful links between LLAMA test scores and learners' attainment.

Yilmaz (2013) found a positive correlation between learners' achievement and grammatical inferencing (LLAMA F) when the overt feedback was provided. He highlighted that the reverse was true when implicit feedback was given to students. He came to conclusion that explicit feedback was more influential for learners who achieved higher scores in LLAMA F. Granena and Long (2013) indicated there was a meaningful correlation between students' LLAMA scores and their attainments in collocations and pronunciation areas. Winke (2013) carried out a study on a model of language aptitude test including cognitive and affective variables as strong predictors of language learning. He used structure equation modeling (SEM) in his study to show how the features influence each other within the model. He finally proposed a model of language aptitude test comprising of cognitive and affective features. Ellis and Shintani (2014) found a strong correlation between language aptitude and language attainment. Moskovsky, Alshahrani, Ratcheva, and Paolini (2015) carried out a study on first-year Saudi university pre-service language teachers to determine the degree to which aptitude forecasts students' language attainments. They found pre-service language teachers with high aptitude test scores were more successful than those with low aptitude test scores in literacy skills. Elmechta (2016) examined the effect of aptitude and working memory on level of attainment. The outcomes indicated that there was a substantial correspondence between aptitude and students' attainment. Celik-Yavas and Yavuz (2020) conducted the research on the relationship between language aptitude, self-reported strategy use and language achievement of the Turkish EFL learners. The findings indicated that the relationship between language aptitude and students' level of attainment was significant in LLAMA B and LLAMA D measures. It implies that students who gain relatively high scores in these two tests might be considered as high achievers in their learning context. They also showed that LLAMA

E and LLAMA F did not yield any significant correlation with students' level of attainment.

3. Research Questions

Drawing on Meara's (2005) LLAMA aptitude tests, the current study was conducted to address the following research questions:

RQ1: To what extent can the LLAMA aptitude tests predict the Iranian EFL learners' final scores?

RQ2: Which LLAMA aptitude subtests are influential in predicting the Iranian EFL learners' final scores?

4. Method

4.1. Participants
A total of 284 university male and female students were voluntarily participated in this study from IAU East Tehran Branch through convenience sampling technique. They were studying in different fields of study and all studied English as the ESP. Their age range was between 18-25 years old. The researcher gave them clear explanations and instructions on how to do at each stage of the test. They were assured that their responses would be used for the research purposes only. The time allocated for completing the whole test was between 20-25 minutes.

4.2. Instruments

4.2.1. LLAMA aptitude tests
All the participants took part in the four LLAMA sub-sections. Each section was rated automatically and the results were recorded by the researcher. LLAMA B presents the examinees with twenty number of pictures that do not have the specific names but can conveniently be explained in any language. They are all shown to the examinees at the same time. By clicking on one picture its name is displayed. Examinees have two minutes to check all twenty pictures and learn their names. The score range for this part is 0-100. Figure 1 depicts some pictures used in LLAMA B.
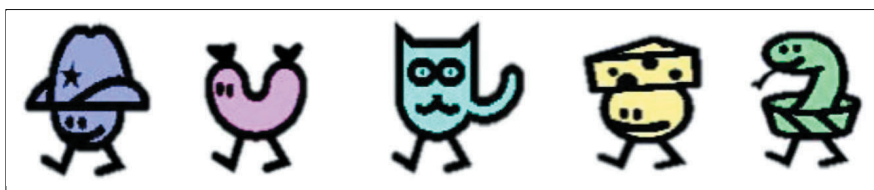
Figure 1: Examples of pictures used in LLAMA B

LLAMA D has two stages: the examinees first hear a number of brief sound clips in an odd language. Then, they hear another series of sound clips. Some of them are repeated and some of them are novel. The examinees need to state whether they have heard the sound before. Each correct response has 5 points and it almost takes 5 minutes to complete this part.

In LLAMA E, there are 24 labelled buttons in a Roman alphabets. By clicking on a button, the related syllable would be represented. Examinees have two minutes to recognize such articulation. They hear a combination of two syllable word afterwards and should determine which of the spellings is true. Each true answer has 5 points and five points are subtracted for any wrong response. Figure 2 illustrates the syllabary used in LLAMA E.

Figure 2: Examples of syllabary used in LLAMA E

LLAMA F has two steps: at the first step, the examinees are presented with a series of pictures displaying shapes and objects and a brief sentence relating to the pictures. Figure 3 depicts an example of the same. The examinees need to determine the relationship between the descriptions and the pictures. To do this, they have to recognize the grammatical and morphological features of the language including singular/plural nouns, prepositions, etc. in five minutes. At the next step, they are exposed to another set of pictures comprising novel components. Each picture is followed by two sentences and the examinees need

to choose the one bearing the accurate description. Five points would be regarded for each correct response and five points would be reduced for each incorrect answer in return. Figure 3 depicts an example used in first step. The pictures illustrate the grammatical features.
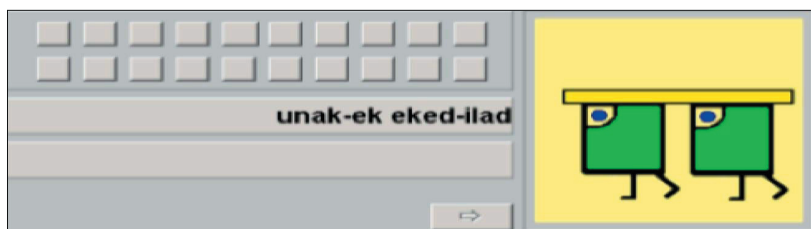

Figure 3: An example of stimuli used in the first step of LLAMA F

4.2.2. Attainment test

This test was designed to assess the approximate levels of students' attainments at the end of their academic semester. It consisted of structure, word expression, and reading comprehension. All the items were constructed based upon the students' textbook. The grammar part included 42 multiple-choice items; the vocabulary part consisted of 22 multiple-choice items and the reading comprehension part consisted of 2 different parts along with 10 multiple-choice items. The total number was 40.

4.3. Procedures

LLAMA tests were administered once at the end of the semester and then the scores for each participant was computed. The respondents were asked to answer each part at the given pace. They were given clear instructions beforehand for any ambiguities. Once all the required data were collected, they were transformed into codes and then entered into SPSS v. 24 program. Then the analyses were conducted through multiple linear regression analyses to investigate the predictive power of each section of the LLAMA aptitude test.

5. Results

To answer the raised research questions, a multiple linear regression was conducted, and LLAMA B (vocabulary learning), LLAMA D (sound

recognition and implicit learning), LLAMA E (sound-symbol correspondence), and LLAMA F (grammatical inferencing) were entered to a regression model to investigate whether they could predict students' attainment scores (Mean = 16.36, SD = 7.38). Table 1 showed the descriptive statistics of all the predictors (LLAMA B, LLAMA D, LLAMA E, and LLAMA F) and the criterion variable (students' attainment scores) in the regression model. Each multiple regression should just conducted providing that its required statistical assumptions would be tenable. The results of evaluation of the assumptions here did not show any violations regarding normality, linearity and homogeneity of variance of residuals (see Plonsky & Ghanbar, 2018). As it was displayed in Table 4, the Durbin-Watson test of autocorrelation of residuals showed their independence (it is between 1.5 and 2.5). Also, no collinearity was found in the data with the condition index lower than 15, as recommended by Tabachnick and Fidell (2013). Also, no sign of multicollinearity was identified as all the VIF values were less than the recommended value of 10 (Plonsky & Ghanbar, 2018). Moreover, all the skewness and kurtosis measures are between -2 and +2, so the normality assumption was met (see Table 1 for the descriptive of predictors and the criterion variable in accompanying with the skewness and kurtosis values).

Table 1: The Descriptive Statistics of Predictor and Criterion Variables in Regression Equation (N = 284)

	Mean	Std. Deviation	Skewness		Kurtosis	
				Std. Error		Std. Error
LlamaB	48.0	21.9	.49	.14	-.41	.29
LlamaD	28.8	14.9	.11	.14	-.22	.29
LlamaE	72.7	23.1	-.93	.14	.42	.29
LlamaF	36.4	22.2	.23	.14	-.60	.29

Note: LLAMA B = vocabulary learning, LLAMA D= sound recognition and implicit learning, LLAMA E = sound-symbol correspondence, LLAMA F = grammatical inferencing

Table 2: Test of Significance of Regression Equation

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	716.56	4	179.14	3.30	0.01
Residual	15138.57	279	54.26		
Total	15855.13	283			

Table 3: R, R2, adjusted R2, and Test of Independence of Residuals

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
Estimates	.213[a]	.05	.04	7.37	1.848

As can be seen in Table 2 and Table 3, R for regression was significantly different from zero, $F (4, 279) = 3.30$, p = .01, with R2 at .05 , suggesting the significance of this regression model. The adjusted R2 value of .04 indicated that 4% of variability in final scores was predicted by LLAMA B, LLAMA D, LLAMA E and LLAMA F (Plonsky & Ghanbar, 2018), when they were entered into a regression model at the same time. In fact, it can be said that apptitude, as whole, purly predicted 5% of variance in students' attainment scores.

    As can be seen in Table 4, only LLAMA E (sound-symbol correspondence) was found to be the significant predictor of students' attainment scores, B = .05, S.E = .02 , β = .17, t = 2.72, p = .01. It can be said that sound-symbol correspondence (LLAMA E) did predict 29% of variance of students' attainment scores. In conclusion, it can be claimed that among all LLAMAs (vocabulary learning, sound recognition and implicit learning, sound-symbol correspondence, and grammatical inferencing) just sound-symbol correspondence can be a significant contribution in predicting the students' attainment scores (see Table 4 for other non-significant predictors, i.e., LLAMA B, LLAMA, D, and LLAMA F).

Table 4: Regression Coefficients of Regression Analysis

		Unstandardized Coefficients		Standardized Coefficients				Collinearity Statistics	
	Predictors	B	Std. Error	Beta	t		Sig.	Tolerance	VIF
Regression	LlamaB	0.02	0.02	0.05	0.86		0.39	0.91	1.10
	LlamaD	0.02	0.03	0.04	0.74		0.46	0.93	1.07
	LlamaE	**0.05**	**0.02**	**0.17**	**2.72**		**0.01**	**0.89**	**1.13**
	Llama F	0.01	0.02	0.03	0.47		0.64	0.89	1.12

Note: LLAMA B = vocabulary learning, LLAMA D= sound recognition and implicit learning, LLAMA E = sound-symbol correspondence, LLAMA F = grammatical inferencing

The relationship between individuals' aptitude and their level of attainment has been investigated in many studies. However, the findings are contradictory due to multi-components nature of aptitude. Most studies highlighted the correlation between individuals' aptitude and their level of attainment (e.g., Wang & Wu, 2017). There have been some studies which yielded contradictory results though (e.g., Kaiser, 1983). Askak and Cubukcu (2020) state that there is not a linear correspondence between learners' aptitude and their level of attainment. Singleton (2014) found a strong correlation between students' language aptitude and their learning outcomes. Bernard (2015) reports that there is not any relationship between students' aptitude and their attainment. He concludes that aptitude is not the sole facet which deals with students' attainment. There are many other factors including personality, learning strategies, anxiety, etc. contributing to students' attainments simultaneously. Celik-Yavas and Yavuz (2020) show that LLAMA B, E, and F are somehow correlated to each other, while LLAMA D scores are different; when LLAMA B, E, and F scores are high, LLAMA D is low. The same as the findings of the study. Granena (2013) attributed such correlation to practice time given to students to complete the tests which is different in LLAMA B, E, and F. Such practice time that ranges from 2 to 5 minutes might cause students to perform differently. LLAMA D does not offer any time to students to manage and gain control over the task. It means that LLAMA B, E, and F evaluate the explicit language aptitude

which sounds necessary for analytic skills while LLAMA D measures implicit language aptitude demanding students' efficiency. Granena (2013) sees such disparity in scores of the subtests as evidence on existence of different levels of aptitude among the learners. This study attempted to determine whether aptitude was a good predictor of students' attainment scores. By taking the findings into account, it could (be argued that there was a weak correspondence between aptitude and students' attainment scores on the whole. Only LLAMA E was proved to be the significant predictor of students' attainment scores according to the findings. As far as the deep structure of the exam was concerned, the findings showed that there was a negative correlation between LLAMA D and the other section while there was a positive link between the other subtests in reverse. These findings are consistent with previous studies' outcomes highlighting each learner has unique aptitude patterns (Skehan, 2002). It implies learners' scores on LLAMA D are different from those obtained on LLAMA B, E, and F. In other words, those who gained high scores in LLAMA D, obtained low scores on other subtests. The other subtests including LLAMA B, E, and F all have a stage that give the participants adequate time to perceive and practice those parts in advance. It would also enable them to adopt their own strategies in performing the tasks efficiently. The point which is quite evident in three subtests of LLAMA B, E and F is that in all of them, analytical abilities along with association and rote learning play a key role. Two subtests of LLAMA E and F require the participants to task on the associations and make sense out of the formal structures. LLAMA B wants participants to explore the name of objects and understand the names and objects associations. It deals with memory function and cognitive features.

The findings also confirmed that LLAMA E was associated with the strongest loading in the analyses. As mentioned earlier, the participants were asked to induce the rules governing the presented tasks visually. Therefore, the test is assessing inductive language learning ability. This subtest invites participants to deal with the novel language structure through a set of pictures and brief sentences. LLAMA D deals with participants' ability to distinguish some parts of spoken language through analogy. LLAMA D does not provide participants with any op-

portunities to learn, practice or use their own strategies against the other parts of the test. This part has nothing to do with analytical abilities. In this part of the test, the participants are exposed to a series of examples they have to memorize. As Granena (2012) put forward, LLAMA D is related to the assessment of the implicit cognitive abilities comparing to LLAMA B, E and F.

LLAMA D which is associated with sound recognition is assumed to be related to implicit language learning as confirmed by Granena (2012). It refers to automatic use of L2 knowledge including lexical mastery relying on item-based learning for upper intermediate students (Granena & Long, 2013). LLAMA aptitude tests were intended to assess two aptitude related aspects: explicit language aptitude (ELA) and implicit language aptitude (ILA) according to Granena (2012). The former deals with cognitive features that are more appropriate for explicit language learning like analytical abilities and the latter refers to the cognitive features which are closely related to implicit language learning like sequence learning abilities.

7. Conclusions and Suggestions for further Research

This paper was an attempt to examine the predictive ability of LLAMA aptitude tests put forward by Meara (2005). The findings show that LLAMA aptitude tests can fairly predict students' attainment scores and they are totally independent of respondents' gender and their proficiency levels. The amount of variance of LLAMA E subtest, having the most influence in predicting students' attainment scores, was 29%. The analyses also indicated that the measurements dealt with two distinct aspects of aptitude: analytic ability referring to explicit language learning and sequence learning ability dealing with implicit language learning. As stated by Granena (2012), the latter can account for language learning variation.

Although LLAMA D is assumed to deal with implicit language learning, further measures of implicit cognitive features are suggested for future research. Replicability of study with taking different personality traits and backgrounds into account is also recommended for further studies. Since all these differences could influence the tests' results

proportionately. Further research is also recommended to examine how LLAMA aptitude tests interact with other cognitive features including memory, intelligence, etc. as already confirmed by Wen et al. (2019).

References

[1] Askak, K. and Cubukcu, F. (2020). A comparison between academic achievement and language aptitude among pre-service language teachers. *Lenguaje, 48*(1), 143-159.

[2] Bernad, M. (2015). *The role of aptitude in FLL (Foreign Language Learning) at university (Bachelor's Thesis).* Retrieved from https: ddd.uab.cat/record/137418.

[3] Brown, J. D. (2001). *Using surveys in language programs.* Cambridge: Cambridge University Press.

[4] Carroll, J. B. (1981). *Twenty-five years of research on foreign language aptitude.* In K. C. Diller (ed.), Individual differences and universals in language learning aptitude. MA: Newbury House.

[5] Carroll, J. B. and Sapon, S. M. (1959). *Modern language aptitude test.* New York: Psychological Corporation.

[6] Celik-Yavas, G. and Yavuz, F. (2020). The role of the language aptitude and self-reported strategy use on the achievement of EFL learners. *Global Journal of Foreign Language Teaching, 10*(1), 032-048.

[7] DeKeyser, R. M. (2000). The robustness of critical period effects in second language acquisition. *Studies in Second Language Acquisition, 22*(4), 499-533.

[8] DeKeyser, R. M. and J. Koeth (2011). *Cognitive aptitudes for second language learning.* In E. Hinkel (ed.), Handbook of research in second language teaching and learning. NY: Routledge.

[9] Drnyei, Z. (2005). *The psychology of the language learner: Individual differences in second Language acquisition.* New Jersey: Lawrence Erlbaum Associates, Inc.

[10] Drnyei, Z. (2010). *The relationship between language aptitude and language learning motivation: Individual Differences from a dynamic systems perspective.* In E. Macaro (Ed.), Continuum companion to second language acquisition (pp. 247-267). London: Continuum.

[11] Drnyei, Z. and Skehan, P. (2003). *Individual differences in second language learning.* In Doughty, C. J., & Long, M. H. (Eds.), The handbook of second language acquisition, 589-630. Oxford: Blackwell.

[12] Doughty, C. (2018). Cognitive language aptitude. *Language Learning: A Journal of Research in Language Studies, 69*(S1), 101-126.

[13] Ellis, R. (1994). *The study of second language acquisition.* Oxford: Oxford University Press.

[14] Ellis, R. and Shintani, N. (2014). *Catering for learner differences through instruction.* In Exploring language pedagogy through second language acquisition research (pp. 285- 317). New York: Routledge.

[15] Ellis, R. (2015). *Understanding second language acquisition (2nd ed).* Oxford: Oxford University Press.

[16] Elmechta, L. (2016). *The impact of language aptitude, working memory and verbal reasoning as aspects of linguistic intelligence on language learning achievement (Master's thesis).* Retrieved from https://bu.umc.edu.dz/theses/anglais/ELM1425.pdf.

[17] Field, A. (2013). *Discovering statistics using SPSS (4th ed.).* London: SAGE publication.

[18] Gardner, R. C. (1985). *Social psychology and second language learning: The role of attitudes and motivation.* London: Edward Arnold.

[19] Granena, G. (2012). *Age differences and cognitive aptitudes for implicit and explicit learning in ultimate L2 attainment.* Languages, literatures, and cultures theses and dissertations UMD theses and dissertations. URL: http://hdl.handle.net/1903/12743.

[20] Granena, G. (2013). *Re-examining the robustness of aptitude in second language acquisition.*

[21] Granena, G. and Long, M. H. (eds.), *Sensitive periods,* language aptitude, and ultimate L2 attainment, 179-204. Amsterdam: John Benjamins.

[22] Grigorenko, E. L., Sternberg, R. J., and Ehrman, M. E. (2000). A theory based approach to the measurement of foreign language learning ability: The CANAL-F theory and test. *The Modern Language Journal, 84*(3), 390-405.

[23] Juffs, A. and Harrington, M. (2011). Aspects of working memory in L2 learning. *Language Teaching, 44*(02), 137-166.

[24] Kaiser, J. (1983). *The differential predictive validity of the GRE aptitude test for foreign students.* Paper presented at the Annual Meeting of the Eastern Educational Research Association, Baltimore, MD. Retrieved from https://files.eric.ed.gov/fulltext/ED227174.pdf.

[25] Kiss, C. and Nikolov, M. (2005). Developing, piloting, and validating an instrument to measure young learners' aptitude. *Language Learning, 55*(1), 99-150.

[26] Kormos, J. (2013). *New conceptualizations of language aptitude in second language attainment.* In: Granena, G., & Long, M. H. (Eds.), Sensitive Periods, Language Aptitude and Ultimate Attainment, 131-152. Amsterdam: John Benjamins.

[27] Li, S. (2015). The associations between language aptitude and second language grammar acquisition: A meta-analytic review of five decades of research. *Applied Linguistics, 36*(3), 385-408.

[28] Li, S. (2016). The construct validity of language aptitude. *Studies in Second Language Acquisition, 38*(4), 801-842.

[29] Linck, J. A., Hughes, M. M., Campbell, S. G., Silbert, N. H., Tare, M., Jackson, S. R., Doughty, C. J., and et al. (2013). Hi-lab: A new measure of aptitude for high level language proficiency. *Language Learning, 63*(3), 530-566.

[30] Meara, P. (2005). *LLAMA language aptitude tests: The manual (Tech. Rep.).* Swansea: Lognostics.

[31] Meara, P. (2012). The bibliometrics of vocabulary acquisition: An exploratory study. *RELC Journal, 43*(1), 1-26.

[32] Moskovsky, C., Alshahrani, M., Ratcheva, S., and Paolini, S. (2015). Aptitude as a predictor of second language achievement: An investigation in the Saudi Arabian context. *Arab World English Journal, 6*(1), 3-21. doi: 10.2139/ssrn.2834408.

[33] Mueller, R. O. and Hancock, G. R. (2008). Best practices in structural equation modeling. *In J. W. Osborne (Ed.),* Best practices in quantitative methods (pp. 488-508). Thousand Oaks, CA: Sage.

[34] Nitta, T. (2006). *Affective, cognitive and social factors affecting Japanese learners of English in Cape Town.* M.A. Thesis: University of the Western Cape. Retrieved from https://core.ac.uk/download/pdf/58913168.pdf.

[35] Plonsky, L. and Ghanbar, H. (2018). Multiple regression in L2 research: A methodological synthesis and guide to interpreting R2 values. *The Modern Language Journal, 102*(4), 713- 731. https://doi.org/10.1111/modl.12509.

[36] Reiterer, S. M., Hu, X., Sumathi, T. A., and Singh, N. C. (2013). Are you a good mimic? Neuro- Acoustic signatures for speech imitation ability. *Frontiers in Psychology (cognitive science), 782*(4), 1-13.

[37] Robinson, P. (2007). Aptitudes, abilities, contexts, and practice. *In Practice in a second language: Perspectives from applied linguistics and cognitive psychology* (pp. 256-286). UK: Cambridge University Press.

[38] Rysiewicz, J. (2008). Measuring foreign language learning aptitude. Polish adaptation of the modern language aptitude test by Carroll and Sapon. Pozna? *Studies in Contemporary Linguistics, 44*(4), 569-595.

[39] Serrano, R. and Llanes, . (2012). *Examining L2 gains in three learning contexts: Study abroad, Summer camp and intensive English courses.* Paper presented at the Asociacin Espaola de Lingstica Aplicada (AESLA) 30th Conference, Universitat de Lleida, Lleida, Spain.

[40] Singleton, D. (2014). Apt to change: The problematic of language awareness and language aptitude in age-related research. *Studies in Second Language Learning and Teaching, 4*(3), 557-571.

[41] Skehan, P. (1986). The role of foreign language aptitude in a model of school learning. *Language Testing, 3*(2), 188-221.

[42] Skehan, P. (1989). *Individual differences in second-language learning.* London: Arnold.

[43] Skehan, P. (1991). Individual differences in second language learning. *Studies in Second Language Acquisition, 13*(2), 275-298.

[44] Skehan, P. (1998). *A cognitive approach to language learning.* Oxford, UK: Oxford University Press

[45] Skehan, P. (2002). Theorizing and updating aptitude. In P. Robinson (Ed.), *Individual differences and instructed language learning* (pp. 69-93). Amsterdam: John Benjamins Publishing Company.

[46] Skehan, P. (2016). Foreign language aptitude, acquisitional sequences, and psycholinguistic processes. In G. Granena, D.O. Jackson, & Y. Yilmaz (Eds.), *Cognitive individual differences in second language processing and acquisition* (pp. 17-40). Amsterdam: John Benjamins Publishing Company.

[47] Snow, R. E. (1992). Aptitude theory: Yesterday, today, and tomorrow. *Educational Psychologist, 27*(1), 5-32.

[48] Sternberg, R. J. (2002). The theory of successful intelligence and its implications for language aptitude testing. In P. Robinson (Ed.), *Individual Differences and Instructed Language Learning.* Amsterdam: John Benjamins Publishing Company.

[49] Tabachnick, B. G. and Fidell, L. S. (2013). *Using multivariate statistics (6th Ed.).* Boston: Allyn and Bacon.

[50] VanPatten, B. and Smith, M. (2015). Aptitude as grammatical sensitivity and the initial stages of learning Japanese as a L2: Parametric variation and case marking. *Studies in Second Language Acquisition, 37*(1), 135-165.

[51] Wang, K. and Wu, J. (2017). The influence of language aptitude on EFL learners in SLA. *Higher Education of Social Science, 12*(2), 1-10. doi: 10.3968/9754.

[52] Wen, Z. E. (2016). *Working memory and second language learning: Towards an integrated approach.* Bristol: Multilingual Matters.

[53] Wen, Z., Biedron, A., and Skehan, P. (2017). Foreign language aptitude theory: Yesterday, today and tomorrow. *Language Teaching, 50*(1), 1-31.

[54] Wen, Z., Skehan, P., Biedron, A., Li, S., and Sparks, R. (Eds.). (2019). *Language aptitude: Advancing theory, testing, research and practice.* UK: Routledge.

[55] Winke, P. (2013). An investigation into second language aptitude for advanced Chinese language Learning. *The Modern Language Journal, 97*(1), 109-130.

[56] Yilmaz, Y. (2013). The role of working memory capacity and language an-
alytic ability in the Effectiveness of explicit correction and recasts. *Applied
Linguistics, 34*(3), 344-368.

Appendix A: LLAMA Aptitude Test