

Linguistic Intelligence and Foreign Language Learning: Investigating the Effects of Language Aptitude and Verbal Reasoning as Factors of Linguistic Intelligence on Foreign Language Learning Achievement

M^{lle} ELMECHTA Lamia

4ème année des études doctorales
Université de Constantine 1 –Algérie
Faculté des Lettres et Langues
Département des Lettres et
Langue Anglaise

تاريخ الارسال: 2017-08-01 تاريخ القبول: 2018-12-12 تاريخ النشر: 2018-12-30

Abstract

This paper investigates the impact of a cognitive linguistic ability that referred to as 'linguistic intelligence' on foreign language learning. The study addresses the relationship between two predicted aspects of linguistic intelligence, namely language aptitude and verbal reasoning, and foreign language learning achievement. A measure of each of the two aforementioned capacities was, in effect, administered to a sample of sixty subjects majoring in English at University of Constantine 1. Correlations were made between the obtained scores in these measures as well as between the score of each measure and the students' language learning achievement. The results substantiated significant results between all the variables.

Keywords: linguistic intelligence, language aptitude, verbal reasoning, foreign language learning achievement.

Résumé

La présente étude explore la relation entre un type d'intelligence qui s'appelle « l'intelligence linguistique » et la réalisation de la langue étrangère. Cette capacité cognitive elle-même a été supposée d'inclure deux autres capacités: aptitude linguistique et raisonnement verbal. De ce fait, deux tests de ces capacités cognitives ont été remis à un échantillon de 60 étudiants de première année, apprenant l'Anglais à

l'université de Constantine 1. Des corrélations ont été établies entre les scores obtenus dans ces tests ainsi que entre le score de chaque capacité cognitive et le score de la réalisation linguistique. Les résultats montrent des relations significatives entre tous les variables.

Mots clés: intelligence linguistique, aptitude linguistique, raisonnement verbal, réalisation de la langue étrangère.

ملخص

يسعى هذا المقال الى تسليط الضوء على صنف من القدرات الفكرية المعروف بالذكاء اللغوي حيث افترضنا أن هذا النوع من الذكاء يشمل معيارين أساسيين ألا وهما "الاستعداد اللغوي" والاستنتاج المنطقي اللفظي، و على هذا الأساس قمنا بدراسة العلاقة بين هذين الأخيرين والنجاح في اكتساب اللغة الإنجليزية كلغة أجنبية. حيث قمنا بإجراء اختبارين فكريين للقدرتين السابقتين الذكر لعينة تتكون من 60 فردا من طلبة السنة الأولى للغة الإنجليزية بجامعة قسنطينة 1، ثم أجريت دراسة عوامل الترابط بين نتائج هتين القدرتين بالإضافة إلى معدلات النجاح في اكتساب اللغة الإنجليزية حيث تم إيجاد علاقة ملحوظة بين الثلاث متغيرات.

الكلمات المفتاحية: الذكاء اللغوي، الاستعداد اللغوي، الاستنتاج المنطقي اللفظي، النجاح في اكتساب اللغة الأجنبية

Introduction

The spheres of Individual Differences (ID) and Second Language Acquisition (SLA) call attention to a number of factors that influence learning in general and language learning in particular. Topics like aptitude, working memory, and intelligence, have attracted the attention of SLA and ID experts, and have been incorporated under the cognitive factor. The aim of the present investigation is to explore the role of a cognitive capacity that is referred to as 'linguistic intelligence' in foreign language learning. From the linguistic perspective, linguistic intelligence refers to the capacity to learn a language. The concept 'language aptitude' is designated when referring to this ability (Carroll and Sapon, 1959). In psychology, on the other hand,

linguistic intelligence denotes the ability to reason with the use of words (e.g. tests of intelligence like Binet test and Wechsler test). To this end, we have opted for these two cognitive skills, i.e. language aptitude and verbal reasoning, as distinct factors of the overall capacity 'linguistic intelligence', and come to scrutinize their effects on success in foreign language learning. Two main hypotheses are, hence, examined: the first one is that language aptitude and verbal reasoning would be closely related and would accordingly make the main constituent factors of linguistic intelligence, and the second one is that these abilities would have a noticeable impact on foreign language learning achievement.

1. Review of the literature

1.1. Intelligence and linguistic intelligence

“Discussions concerning the theory, nature, and measurement of intelligence historically have resulted more in disagreement than in agreement, more in smoke than in illumination” (Eysenck, 1986, in Miyake & Shah, 1999, p. 2). This quotation quite reveals the controversy of the issue of intelligence. As early as the beginning of the 20th century, debates have raged back and forth for the correct definition and the accurate measurement of intelligence. Psychometricians have concurred that intelligence is what intelligence (IQ) tests measure; however, they have differed on the nature of this capacity. While some of them (e.g. Spearman, 1904) have perceived it as a general ability, others (e.g. Thurstone, 1938; Guilford, 1956) have speculated that it is a set of mental capacities; yet again, other psychometricians (e.g. Vernon, 1961; Horn and Cattell, 1966) have come to assemble between the two views. Modern theories of intelligence (e.g. Gardner, 1983; Sternberg, 1985) have gone beyond psychometric

assessment, and shifted attention to a set of capacities that are required in real-life situations in order to describe intelligent behaviour. Despite this, modern experts have themselves disputed the number of capabilities underlying intelligence. Gardner (1983), for example, has identified seven distinct capacities; Sternberg, instead, (1985) asserted the existence of three distinguished abilities.

Despite the controversy of this construct, a number of experts (Neisser et al., 1996) sought to provide a common definition. According to them, intelligence is “(the) ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, [and] to overcome obstacles by taking thought” (p. 01)

The history of intelligence testing has recognized two prevalent measures, namely Binet’s measures and Wechsler’s measures. Binet’s first intelligence test developed in the early years of the 20th century in France and was adapted for the first time in 1916 in the U.S.A. This test includes a number of subtests that measure human general cognitive ability: vocabulary, understanding, differentiation between objects, items completion, and drawings. Wechsler tests started to develop in the thirties to become widely used for several decades. Unlike Binet, Wechsler felt the need to develop a test that exceeds verbal skills resulting in a measure that involves two major scales: verbal scale and performance scale. Examples of items used in the former scale are: comprehension, vocabulary, etc., and those used in the latter scale are picture completion, matrix reasoning, etc..

Human intelligence has long been argued to have a great impact on the ability of an organism to learn. All definitions of intelligence, whether early (e.g. Spearman, 1904; Binet &

Simon, 1905; Thurstone, 1938; Horn & Cattell, 1967) or modern (Gardner, 1983; Sternberg 1985), have centered learning capacity as an underlying aspect. However, when it comes to language learning, which is a facet of learning, things become different. SLA research evidence (e.g. Carroll, 1993) has revealed a weak association between general intelligence (IQ scores) and success in foreign language learning. A set of cognitive skills have been, in turn, favored and claimed to have an influence on foreign language learning. These abilities have been referred to as phonemic ability, grammatical sensitivity, inductive language learning ability, and memory ability, and have been identified as the main components of the umbrella capacity 'language aptitude' (Carroll & Sapon, 1959). A clarification of the term aptitude is provided later in the section.

As far as linguistic intelligence is concerned, although this ability has been indicated by all psychologists in general and intelligence scholars in particular (e.g. Spearman, 1904; Thurstone, 1938; Vernon, 1961; Horn and Cattell, 1967) to be a crucial aspect of intelligence, the term per se has not been explicitly deployed until the emergence of Gardner's Multiple Intelligences (MI) theory. The contemporary researcher Howard Gardner (1983) identified seven distinct types of intelligence, namely linguistic, logical mathematical, spatial, bodily kinesthetic, musical, interpersonal, and intrapersonal. Despite the wide popularity of MI theory mainly in pedagogy (e.g. Armstrong, 1994), there has been, up to now, no empirical evidence to prove any of these intelligences. As a consequence, the current study has come to provide an empirical evidence of one type of intelligence proposed by Gardner that is known as linguistic intelligence. To this end, two major cognitive

linguistic abilities have been selected as the main constituent factors of this broad capacity: language aptitude and verbal reasoning. Before going further in this investigation, a clarification of these concepts is first required.

1.2. Language aptitude

Language aptitude refers to the ability to learn a foreign language (Carroll & Sapon, 1959). Researchers have disagreed on the nature of this construct. Some linguists (e.g. Dörnyei, 2005) have asserted that aptitude is a general capacity associating it with the general cognitive ability intelligence (IQ), while others (e.g. Carroll & Sapon, 1959; Skehan, 1998) have emphasized its componential nature through highlighting a set of distinct capacities that underlie it: phonemic ability, grammatical sensitivity, inductive language learning ability, and memory ability.

Due to the rudimentary need to learn foreign languages for military purposes, language aptitude measures flourished mainly between the 1950s and 1960s. Two tests have emerged to become recognized as prominent measures of language aptitude: the Modern Language Aptitude Test (MLAT) (Carroll & Sapon, 1959), and the Pimsleur Language Aptitude Battery (PLAB) (Pimsleur, 1966). The MLAT test comprises five subtests that are language-bound: number learning, phonetic script, spelling clues, words in sentences, and paired associates; while the PLAB subcomponents are not entirely linked to the assessment of language aspects but also psychological factors such as motivation. The PLAB components are, hence, the following: grade point average, interest in foreign language learning, vocabulary, language analysis, sound discrimination, and sound-symbol association.

The role of language aptitude in foreign language learning has long been an intriguing issue in SLA research. A debate has been between whether or not this ability has an impact on learning an L2. Some researchers (e.g. Ehrman, 1998; Bowden, Sanz & Stafford, 2005; Sáfár & Kormos, 2008) have affirmed that aptitude tests are only associated with traditional methods of language teaching, mainly the audio-lingual method, and that they have no influence on communicative language teaching method. Other experts, on the other hand, have contended that language aptitude remains to play a role in communicative language teaching classrooms. For instance, Skehan (1998) and Ellis (2003) have emphasized that language aptitude components have a noticeable impact on the learning of different aspects of the foreign language (e.g. phonetics, grammar, and vocabulary). Similarly, Krashen (1981) and Robinson (2005) have stressed the impact of this ability in different contexts of foreign language learning. For example, Krashen speculated that aptitude functions more under formal settings, i.e. when attention is required, whereas Robinson advocated that it functions more under informal settings when learning takes place unconsciously.

In addition to the examination of its role in foreign language learning, thorough studies have been directed to the link between language aptitude and other cognitive capacities. Among these studies is the relationship between aptitude and intelligence. The association between the two constructs have varied from weak (Skehan, 1998), indicating a complete separation, to rather strong (Dörnyei, 2005), considering the former as a specific ability and an aspect of the latter.

1.3. Reasoning and verbal reasoning

The term reasoning is defined as “an aspect of thinking that is involved not only in drawing inferences but in making decisions and solving problems as well” (Nickerson, in Leighton & Sternberg, 2004, p. 3). Kenneth (in Leighton & Sternberg, 2004) adds that this process goes either inductively or deductively. The concepts of inductive and deductive reasoning will be clarified later.

Nickerson’s definition reveals that the ability to reason is an aspect of intelligence. Engaging in higher cognitive actions, such as decision making and problem solving, requires an essential aspect of thinking that is referred to as reasoning. Nickerson is not the only psychologist who has addressed the association between reasoning skill and intelligence. Rather, all intelligence experts have highlighted this ability when dealing with the issue of intelligence. For example, Spearman’s g factor (1904) has been characterised by the ability to reason. Similarly, Thurstone (1938) has identified three aspects of reasoning (spatial reasoning, inductive reasoning, and deductive reasoning) in his Primary Mental Abilities theory. In addition, Vernon (1961) has demonstrated reasoning capacity as a specific ability in his Factor Analysis Theory. Furthermore, Horn and Cattell fluid and crystallized intelligence (1967) have distinguished between verbal and non-verbal reasoning skills. Add to that, all intelligence measures (e.g. Binet’s measures and Wechsler’s measures) assess different aspects of reasoning.

We have stated earlier, in the definition, that the process of reasoning goes deductively and inductively. This implies the existence of two distinguishable types, namely inductive reasoning and deductive reasoning. In the former type, the

mind goes from general to specific when drawing a conclusion following the top-down approach (i.e. from rule to examples); in the latter type, however, it goes from specific to general following the bottom-up approach (i.e. from examples to rule). The former type can be illustrated by syllogisms (Manktelow, 1999) and the latter by analogies (Rips, 1990).

Human beings cannot learn without the ability to think. Thinking and reasoning are two interrelated constructs in which one cannot function in the absence of the other (Leighton & Sternberg, 2004). Learning, in general, and language learning, in particular, cannot take place without reasoning activities. Research in linguistics (e.g. Carroll and Sapon, 1959) has demonstrated how this ability functions basically in internalizing foreign language structures.

We have stated in the literature review how intelligence, aptitude, and reasoning play an important role in learning in general, and particularly in language learning. In the coming section, we will investigate whether there is a significant relationship between the two proposed factors of the general cognitive ability 'intelligence'; we will also examine the role of these abilities in foreign language learning.

2. The study

2.1. Method

2.1.1. Subjects

Sixty participants incorporating fifty females and ten males were enrolled in this study. The subjects were drawn randomly from a population of 300 freshman students at the department of Letters and the English Language, Faculty of Letters and Languages, University of Constantine 1. Their age ranged between 19 and 20 with the mean ($M=19.61$).

2.1.2. Measures and procedures

2.1.2.1. Language aptitude measure

Language aptitude measure was a paper-and-pencil measure that included four subtests assessing phonemic ability, memory ability, grammatical sensitivity, and inductive language learning ability, respectively. This test was taken from the MLAT measure (Stansfield, 2013), with making some adaptations.

a. Phonemic ability subtest

In this subtest, the subjects were given six tasks to solve. These tasks measure sensitivity to the different sounds of the foreign language as with memory ability. In the first task, which measured the individuals' awareness of different pronunciations, the subjects were asked to cross the differently-pronounced word. In the second task, which was a multiple choice task, they were instructed to select the correct spelling of the given words in order to evaluate their recognition of the form of these words. In the third task, which assessed the ability to associate sounds with symbols, they were given phonetic transcriptions and were told to write corresponding words. In the fourth task, they were asked to write transcriptions for given pseudowords (a pseudoword is a made up word, that is, a string of letters resembling a real word in terms of its phonological structure but doesn't really exist in the language) to assess their ability to distinguish between long vowels, short vowels, and diphthongs. In the fifth task, which was also a measure of sound-symbol association, the participants were instructed to read words that were not spelled in a usual way (i.e., they were written approximately as they were pronounced). It is worth mentioning that this task measured the students' vocabulary as well. In the sixth task, which measured primarily auditory memory ability, the subjects listened,

individually, to a set of sentences produced by a native speaker; then, after each sentence, they were asked to write down what they could remember. This task was also a measure of vocabulary skill.

b. Grammatical sensitivity subtest

This subtest was a multiple choice task that measured the individuals' sensitivity to foreign language structures. The subjects were asked to select the correct grammatical function of the given words. Here a variety of grammatical functions were presented: subject, verb, object, conjunctions (coordinating and subordinating), simple past tense, interrogatives, perfect tenses, conditional, Prep+ noun, Not+ infinitive, and discrimination between "wh" questions and between relative pronouns, etc..

c. Inductive language learning subtest

This subtest assessed the subjects' sensitivity to foreign language structures as well as their inductive reasoning skills. A set of words and sentences were given in the foreign language (an invented language in this case), and the subjects were told to infer their corresponding counterparts in English or do the opposite task.

Time allocation for this test was 60 minutes. Concerning the scoring procedure, the score 100 was given as the score of perfection and was distributed on the three subtests. Phonemic ability subtest received the highest score (i.e. 50) for encompassing a large number of tasks in comparison with the other subtests. The second subtest was scored out of 30 and the third out of 20 as it contained the least number of tasks.

2.1.2.2. Verbal reasoning measure

Verbal reasoning test was the second pencil-and-paper measure comprising five subtests that assessed both inductive and deductive reasoning skills. The five subtests

were: analogies, similarity, knowledge, understanding relations, and syllogisms. These subtests were found to be the major components of verbal intelligence measures. The questions were taken from online Wechsler Intelligence Adult Scale (WAIS) with making some adaptations to fit the Algerian socio-cultural context, and the participants' cognitive abilities, i.e. the findings of the pilot study aided us in the choice of challenging questions.

In the first subtest, the participants were given a list of jumbled letters to make a meaningful word, and were asked to infer what the obtained word represented. In the second subtest, they were provided with a list of words sharing a similar relationship with the addition of an odd word and were instructed to deduce the odd one out. In the third subtest, they were presented with statements (premises) to read and were told to infer the right conclusion from these statements. In the fourth task, they were instructed to understand the relation between people or their arrangement, and then they were asked to deduce the right position. In the fifth subtest, the participants were given a pair (two items) to understand the relationship between its constituent items and were asked to induce the same relationship to the second pair.

The time allocated for this test was 45 minutes. As for the scoring procedure, the same score of perfection was given to this measure (i.e. 100). This score was distributed on the five items. Analogies subtest, for instance, received the highest score (30) as it contained more tasks. Similarity subtest, knowledge subtest, and understanding relations subtest were equally scored (20). Syllogisms subtest was given the lowest score (10) as it contained fewer items. For the challenging nature of intelligence tests, and because reasoning is considered an aspect, the questions in this test

were ordered in increasing difficulty with a gradual increase in scoring.

2.1.2.3. Language learning achievement

The subjects' language learning achievement was assessed through taking their average in the modules they were taught during a whole year in learning English as a foreign language. The overall average gave insights about general linguistic and communicative skills of the students at specific proficiency levels. This means that the students were assessed according to the standards and objectives of learning. The students overall achievement was, hence, the sum of the obtained average in both semesters of learning EFL. As far as scoring is concerned, similar to the previous variables, the highest average point (20) was converted into the value 100 and the individuals scores were also converted and explained according to this value.

2.2. Results and interpretations

2.2.1. The correlation between language aptitude and verbal reasoning

The first step we have gone through in our analysis is examining whether there has been a linear relationship between the two predicted factors of the overall dimension 'linguistic intelligence' (language aptitude and verbal reasoning). In doing so, a correlation between these variables has been required. In measuring this correlation, we have adopted the technique of the Pearson Product Moment Coefficient of Correlation between aptitude scores and verbal reasoning scores.

Having used the formula $r = \frac{\sum xy}{\sqrt{(\sum x^2)(\sum y^2)}}$, the results have revealed a correlation of (.56). The critical value of r for one-tailed test at (0.05) level of significance and with 59 degrees of freedom is (.25). As the obtained value for the

correlation between language aptitude and verbal reasoning (.56) is higher than the critical value (.25), we would say that the results are indeed significant. This means that language aptitude and verbal reasoning are interrelated and would, hence, be considered as distinct factors of linguistic intelligence.

Having proved a significant relationship between the two predicted factors of linguistic intelligence, we have moved to the investigation of their influence on foreign language learning achievement. The coming sections are mainly concerned with the analysis of the relationship between aptitude and achievement and verbal reasoning and achievement.

2.2.2. The correlation between language aptitude and foreign language learning achievement

Similar to the previous step, the same statistical technique for measuring the correlation has been used between language aptitude scores and foreign language learning achievement scores. The Pearson correlation results reveal that $r = (.43 > .25)$. The correlation is then significant. As a result, language aptitude would be considered as a good predictor of success in foreign language learning. This recommends that teachers should pay attention to individual differences in language aptitude and its different aspects (phonetic ability, grammatical sensitivity, and inductive language learning ability) when teaching English as a foreign language (EFL). Implementing a language aptitude test in teaching EFL and making it as an entry test would be a useful aid to uncover learners' areas of strength and weakness. The test allows teachers to place learners in similar-ability groups and design corresponding courses that go with their abilities. Learners' areas of weakness might be

enhanced if using appropriate strategies by the teacher, which would in turn affect their learning outcomes.

2.2.3. The correlation between verbal reasoning and language learning achievement

Concerning the link between verbal reasoning and foreign language learning achievement, we have adopted the Pearson correlation technique as well. The obtained r for this correlation has also been found significant ($.28 > .25$). We would, subsequently, conclude that verbal reasoning and language learning achievement are interrelated constructs as well. The significant relationship between verbal reasoning and language aptitude adds evidence on the role of this cognitive linguistic ability in foreign language learning. In addition to language aptitude measure, a measure of verbal reasoning would also be a helpful support when teaching EFL. Placing the learners with similar reasoning skills together will allow for better learning outcomes. These results would also allow for the application of some reasoning strategies to enhance reasoning skill and accordingly enhance foreign language learning outcomes.

Conclusion

This article has provided theoretical and empirical evidence on the influence of language aptitude and verbal reasoning, as cognitive linguistic abilities, on foreign language learning achievement. The close relationship that has been revealed between these capacities might allow us to consider them as distinct aspects of the overall capability 'linguistic intelligence'. Having proved a significant association between each predicted ability of linguistic intelligence (i.e. language aptitude and verbal reasoning) and foreign language learning achievement, we would recommend the implementation of a measure incorporating both of the constructs. The measure might work as useful

aid to classify learners according to their cognitive and linguistic skills so to design corresponding courses that overcome their areas of weaknesses which would, thus, enhance success.

The current article might also provide suggestions for future investigations through exploring the impact of further cognitive abilities on foreign language learning as well as their relationship with the so examined capacities so to enrich the present linguistic intelligence measure.

References

- Armstrong, T. (1994). *Multiple Intelligences in the classroom*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Binet, A., & Simon, T. (1905). *Methodes Nouvelles pour le Diagnostic du Niveau Intellectuel des Abnormaux*. [New Methods for the Diagnosis of the Intellectual Level of Subnormals.] *L'Année Psychologique*, 11, 191–244. In A. Binet & T. Simon (E. S. Kite, Trans.). *The development of intelligence in children (The Binet-Simon Scale)* (pp. 37–90). Baltimore: Williams & Wilkins (1916).
- Bowden, H.W., Sanz, C. & Stafford, C. (2005). Individual differences: Age, sex, working memory, and prior knowledge. *Mind and Context in Adult Second Language Acquisition: methods, theory, and practice*. In C. Sanz (Ed.) (pp. 105-140). Washington: Georgetown University.
- Carroll, J.B., & Sapon, S. (1959) *Modern Language Aptitude Test: Form A*. New York: Psychological.
- Carroll, J. B. (1993). *Human cognitive abilities: A survey of factor analytic studies*. New York: Cambridge University Press.
- Dörnyei, Z. (2005). *The psychology of the language learner: Individual differences in second language acquisition*. Mahwah , NJ : Lawrence Erlbaum.
- Ehrman, M. (1998). The modern language aptitude test for predicting learning success and advising students. In L. Woytak (Ed.). *Applied Language Learning*, 9 (1 & 2), 31-70.
- Ellis, R. (2003). *Second Language Acquisition*. Oxford : OUP.
- Gardner, H. (1983). *Frames of Mind: The Theory of Multiple Intelligences*. London: Paladin Books.
- Guilford, J. P. (1956). The structure of intellect. *Psychological Bulletin*. 53(4), pp. 267-293
- Horn, J. L. & Cattell, J. B. (1967). Age differences in fluid and crystallized intelligence. *Acta Psychologica*, 26, 107-129.

- Krashen, S. (1981). *Second language acquisition and second language learning*. South California: Pergamon.
- Leighton, J. P., & Sternberg, R.J. (Eds.). (2004). *The nature of reasoning*. New York, NY: CUP.
- Manktelow, K. (1999). *Reasoning and Thinking*. UK: Psychology Press.
- Miyake, A. & Shah, P. (1999). *Models of Working Memory: Mechanisms of Active Maintenance and Executive Control*. Cambridge : CUP, pp. 01-27
- Neisser, U., Boodoo, G, Bouchard, T., Boykin, A., Brody,N., Ceci,S., Halpern, D., Loehlin,J., Perloff, R., Sternberg, R. & Urbina, S. (1996). Intelligence: Knowns and Unknowns. *American Psychologist Vol. 51, N. 2* , pp. 77-101
- Online adult Wechsler intelligence scale test. Retrieved October, 10. 2013). From: <http://wechsleradultintelligencescale.com/>
- Pimsleur, P. (1966). *Language Aptitude Battery*. New York: Harcourt Brace.
- Rips, L. J. (1990). Reasoning. *Annual Review of Psychology*, 41, 321-53.
- Robinson, P. (2005). Aptitude and second language acquisition. *Annual Review of Applied Linguistics*, 25, 45-73.
- Sáfár, A. & Kormos, J. (2008). Revisiting problems with foreign language aptitude. *International Review of Applied Linguistics in Language Teaching*, 46 (2), 113-136.
- Skehan, P. (1998). *A Cognitive Approach to Language Learning*. Oxford: Oxford University Press.
- Spearman, C. (1904). General Intelligence Objectively Determined and Measured. *The American Journal of Psychology*, 15 (2), pp. 201-299.
- Stansfield, C. (2013). Modern Language Aptitude Test. *Language learning and testing foundation*. (Retrieved October, 8, 2013). From: <http://lftf.net/aptitude-tests/language-aptitude-tests/modern-language-aptitude-test-2/>.
- Sternberg, J. R. (1985). *Beyond IQ: A Triarchic Theory of Human Intelligence*. Cambridge: CUP.
- Thurstone, L. L. (1938). *Primary mental abilities*. Chicago, IL: University of Chicago Press.
- Vernon, P. E. (1961). *The structure of human abilities* (2nd ed.). London: Methuen.