

**THE RELATIONSHIP BETWEEN INTELLIGENCE, LANGUAGE
APTITUDE AND SECOND LANGUAGE ACHIEVEMENT**

Abstract

The aim of the study is to reveal the importance in language learning of such individual differences as the level of intelligence and language aptitude in the case of bilingual and monolingual language learners. To measure the participants' intelligence the Cognitive Abilities Test was used, and in order to make judgments about the level of the participants' language aptitude, the other test administered was the Hungarian Language Aptitude Test (MENYÉT) a test developed to measure native Hungarians' language aptitude.

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CHAPTER 1: INTRODUCTION

Differences exist in students' language learning success and speed, even if they learn the language under the same circumstances. Several factors are regarded to have an impact on students learning achievement. Among them are: age, gender, personality, cognitive style, intelligence and language aptitude. Besides them, bilingualism is also claimed to have an impact on foreign language learning. The study of such individual differences is of crucial importance, as students in classes may be very different from each other, with different strengths and weaknesses, however they are all taught in the same way, which may cause difficulties for some of them.

The topic of the paper is the relationship of several components of intelligence with language aptitude, and their impact on second language achievement.

The aim of the research is to reveal if there is any relation between the studied variables; what the difference is in the relation of the selected variables in monolingual and bilingual students, if any. In the research the means and correlations of the selected variables are compared between the bilingual and monolingual group and between the group of boys and girls. The other aim of the study is to find an answer to the question, whether bilingual students have any cognitive advantages over monolingual ones. The research tries to find some patterns of differences and similarities in monolingual and bilingual students' and of boys' and girls' on the basis of the data that comprise students' scores in an intelligence test and a language aptitude test and students' last midterm grade of the foreign language they learnt.

CHAPTER 2: LITERATURE REVIEW

There are differences in how children and adults acquire languages. Children acquire language (one or even more than one) naturally if the adequate conditions are given, i.e. a child does not need to be formally taught a language to acquire it, just has to be exposed to it regularly in a social environment. However, people start to lose this natural ability at the age of 12-14. *Nažnean* (2009) claims that language acquisition of adults is in fact language learning, that is “a deliberate, thorough, intellectual process that rarely if ever results in the level of native fluency” (p. 717). Every child is equally capable to acquire any language “regardless of intellectual stage” (p. 717), the same is not completely true for adults. Any adult can learn a second language but not with the same speed and results. Some may learn a language relatively easily and rapidly and are able to achieve a native-like level, while others have difficulties in the process of language learning and never reach such a high level of proficiency (*Nažnean* 2009).

2.1 Individual differences in second language acquisition

According to most authors, age, motivation and attitude, learning style or strategy and attitude or intelligence are the factors that mostly determine an individual’s potential language achievement, however some researchers suggest that personality and cognitive style play an important role too (*Teepen* 2004).

Bond (2002) defines the following dimensions that affect achievement in second language acquisition in which individuals may differ: 1. age, 2. exposure to foreign language in infancy, 3. immersion, 4. intelligence, 5. personality, 6. attitude and motivation, 7. relationship between first and target language, 8. sensory style, 9. learning strategies, and 10. other factors (mimicry, musical ability etc.) (according to *Eddy* 2011. p. 10). *Ellis* (1985) mentions the following factors that may affect a person’s language learning success: (1) age, (2) aptitude, (3) cognitive style, (4) motivation, and (5) personality.

According to *Lightbown* and *Spada* (2008) regarding motivation, it is a complex issue in foreign language learning as it involves the “learners’ communicative needs” and their “attitudes towards the second language community” (p. 63). *Robert Gardner* and *Wallace Lambert* (1972, according to *Lightbown and Spada* (2008)) proposed the terms 1. instrumental motivation: “language learning for more immediate and practical goals” and 2.

integrative motivation “language learning for personal growth and cultural enrichment” (pp. 63-64). *Brown* (1981, according to *Eddy* 2011) identifies three types of motivation:

1. “global motivation, which consists of a general orientation to the goal of learning a foreign language;
2. situational motivation, which varies according to the situation in which learning takes place;
3. task motivation, which is the motivation for performing particular learning tasks” (2011. pp. 13-14).

Dörnyei (2001a, as mentioned in *Lightbown* and *Spada* (2008)) constructed a “process-oriented” model of motivation consisting of three stages: 1. “choice motivation” – setting goals; 2. “executive motivation” – carry out tasks to maintain motivation; 3. “motivation retrospection” – students’ reaction (p. 64).

The following variable mentioned and extensively investigated by researchers is personality. Extroversion is one of the components which are tied to good language learning capacity by a number of researchers. Although researches do not seem to prove the existence of this kind of correlation (*Lightbown* and *Spada* (2008), *Dörnyei* and *Skehan* (2003)), but such characteristics as assertiveness and adventurousness (which are related to extroversion) are found to correlate with language learning success (*Lightbown* and *Spada* 2008. p. 60).

Inhibition is another aspect of personality which has been studied. Researchers suggest that inhibition discourages risk-taking, which is necessary for language learning. *Lightbown* and *Spada* (2008) mention *Alexander Guiora’s* researches, which prove that “inhibition is negative force, at least for second language pronunciation performance” (p. 61).

The following aspect investigated by researchers is anxiety. Many students experience nervousness and worry in a second language class. Here the authors claim that some questionnaires do not measure anxiety in an appropriate way, for they do not take into account that anxiety can be “temporary” and “context specific” (*Lightbown* and *Spada* 2008. pp. 61-62). The authors also mention that a kind of anxiousness can even facilitate language learning as “it can provide the right combination of motivation and focus” (p. 61) in order to succeed on a written or oral examination. A more neutral term is used by a number of researchers: tension that involves both meanings. Some other characteristics have been investigated such as self-esteem, empathy, dominance, talkativeness, and responsiveness (p. 62).

Learning style is a “general approach to language learning” (*Oxford* 1995. p. 59.). According to *Reid* (1995) the term describes “an individual’s natural habitual and preferred

way of absorbing, processing, and retaining new information and skills” (*Lightbown and Spada* 2008. p. 59). From a general viewpoint *Reid* (1995) differentiates between:

“ 1. analytical (field independent) – students who concentrate on grammatical details but feel less safe in communicative activities. They tend to learn the rules and principles of a language and do not like improvisation or taking guesses if an unfamiliar language situation occurs. 2 .global (field dependent) – students who are more sociable, like interaction and communication. They are not keen on grammatical rules and often use compensation strategies to avoid blocks in communication” (*Eddy* 2011. p. 15).

It is suggested by researchers that there is a strong relationship between field independence and success in second language learning. *Dörnyei and Skehan* (2003) claim that when the importance of factors as field dependence/independence were measured, these correlations lowered when intelligence was partialled out, from which they came to the conclusion that “this interpretation of cognitive style is simply a disguised measure of intelligence” (p. 603).

Based on sensory preference of an individual learner, the following learning styles have been identified:

1. “Visual – students who prefer to use their sight to receive information;
2. Auditory – students who prefer to use their hearing to receive information;
3. Kinaesthetic – students who need active movement and involvement to learn;
4. Tactile – students who like handling objects and use their touch to receive information” (*Eddy* 2011: 16).

According to *Dörnyei and Skehan* (2003), most of the researches on individual differences of language learning concentrated on the study of the correlation between aptitude and motivation with second language achievement. *Sasaki* (1996) found a relationship between intelligence and the “central” component of aptitude language analytic ability, but according to his findings the more peripheral components of aptitude (e.g. phonemic processing and memory) were more weakly related to intelligence (*Dörnyei and Skehan* 2003. p. 596). Foreign language aptitude and cognitive style are claimed to have some kind of relationship, because each are in relation with intelligence (*Dörnyei and Skehan* 2003). *Skehan* (1998) argues that the connection comes from the assumption that within aptitude two types can be defined, as is general, two kinds of learners exist: 1. an analytic learner type and 2. a memory-oriented learner type, which is claimed to related to the analytic-holistic contrast, but according to the author, it is not identical with that.

Nažnean (2009) argues that differences in adult ability to master the grammar of a second language are only partially connected to individual differences in general intelligence. As for him the ability to learn languages by adults is a kind of talent which cannot be associated with general intelligence. He suggests that “in rather rare cases some adults may possess childlike abilities to master languages” (p. 718). This ability is referred to by him as language aptitude, which is defined by him as a separate aptitude, like musical or artistic talent. Other individual factors which need to be taken into account exceptional memory, which is an inborn talent, separate from general intelligence. Motivation is a significant aspect in language learning.

Lightbown and *Spada* (2008) point out that while studying individual differences several problems occur. As the variables i.e. motivation, extroversion or intelligence cannot be directly observed. These variables are not independent of each other. It cannot be detected which one caused the other. Another difficulty is how second language proficiency is measured. They claim that the ambiguity of results concerning with the correlation of intelligence and language proficiency are due to the fact that different researchers studied different aspects of language proficiency. As IQ may be less closely related to conversational fluency than to metalinguistic knowledge. The authors call attention on that researchers must also take into account some social and educational variables when studying individual differences (pp. 56-57).

2.2 The relationship between aptitude and intelligence

Authors as *Skehan* (1989) and *Pimsleur* (1966) claim that intelligence is part of language aptitude, while *Carroll* and *Sapon* (1959) and *Gardner* and *Wallace* (1959) suggest that intelligence and aptitude are co-ordinated. According to *Neufield*, *Oller* and *Perkins*, intelligence and aptitude are identical, and they conclude, there is not such a factor as aptitude (*Bonar* 2005).

Eddy (2011) acknowledges that however intelligence is concerned to be a variable of successful language acquisition, rather controversial results have been found in relation to how much, in fact, intelligence can be an influencing factor in second language learning. She also says that there is no clear evidence whether aptitude and intelligence are separate issues, as the two terms are often used interchangeably by researchers.

Ellis (1985.) argues that ‘aptitude’ is to be contrasted with ‘intelligence’, as the first refers to the special ability involved in language learning and its effects are “measured in terms of proficiency scores achieved by classroom learners”. ‘Intelligence’, on the other hand,

refers to the “general ability that governs how well we master a whole range of skills, linguistic and nonlinguistic” (p.111).

Most authors believe intelligence being one of the factors influencing foreign language acquisition. *Bogaards* (1996. p.45) states that many studies have shown the existence of a positive correlation between intelligence and foreign language learning, but also that the relation of them is relatively controversial and is “subject to significant variations” (*Eddy* 2011. p.17). He also adds that links have, for instance, been found between the ‘working memory’ and some forms of intelligence (*Eddy* 2011. p.18). In 1962, Pimsleur, Mosberg and Morrison discussed intelligence in connection with foreign language acquisition. On the basis of 40 articles, they stated there is a “positive correlation between intelligence and foreign language achievement. Intelligence, they said, is a significant factor” (*Lambert*, 1993. p.2 as cited in *Eddy* 2011). According to *Gardner’s* model (as cited in *Norris-Holt*, 2000. p.2) “in a formal setting intelligence and aptitude play a dominant role in learning.” He also introduces four individual differences which are believed to be the most influential in second language acquisition. These are the variables of intelligence, language aptitude, motivation and situational anxiety. *Genesee* (1976) found that “intelligence was strongly related to the development of academic L2 French language skills (reading, grammar, and vocabulary), but was in the main unrelated to ratings of oral productive skills by native speakers” (*Eddy* 2011. p. 18). *Ekstrand* (1977) found high correlation while measuring proficiency on tests of reading comprehension, dictation and free writing (*Eddy* 2011). There are some authors who express their opinions on intelligence in connection with learning in more general terms. *Barton, Dielman and Cattell* (1972) (as quoted in *Eddy* 2011. p. 18) declare that IQ together with the personality factor predicts achievement in all areas.

There are some psycholinguists who argue against the existence of positive correlations between intelligence and language aptitude. *Pinker* (1995) mentions that even individuals having a serious language loss may have normal degrees of nonverbal intelligence. He also says that there are syndromes showing the opposite situations, where intact language coexists with various kinds of mental retardation. From these he concludes that “language development does not depend on fully functioning general intelligence” (p.140).

Gorzalanczyk et al. (1998) have been looking for patterns in learning process, and tried to find correlates between the parameters of the learning process and various components of intelligence. Their results show that “no significant correlates have been found” *Gorzalanczyk et al.* (1998. p.2, as cited in *Eddy* 2011). They also state that memory-

related components of intelligence do not play a more significant role in the learning process than other components. Some findings make the issue even less clear. *Eddy* mentions *Spoerl's* study (1939), according to her study significant correlations between language learning and intelligence have been found for women but not for men, which can be explained according to *Eddy* (2011) by the fact that the study was conducted long time ago, when the social positions of men and women were different, and these differences may have influenced the results.

On the basis of previous researches, it is acknowledged by most of the scholars that there is a correlation between linguistic and mathematical-logical intelligence and acquisition of a foreign language but only as far as academic skills are concerned. However they also point out that it is not just intelligence that can explain these differences. *Nažnean* (2009) claim that besides intelligence, students need aptitude which is defined by him as “some specific abilities, which are responsible for learning languages” (p.718). The first tests that measured aptitude are *Carroll and Sapon's* Modern Language Aptitude Test (1959) and *Pimsleur's* Language Aptitude Battery (1966). According to *Carroll and Sapon* (1959. p.5) aptitude is “a stable factor, which cannot be trained”; and it is separate from motivation, achievement and intelligence. It is an ability that allows learning a second language faster and with less effort. They identify four factors within language aptitude:

1. “phonemic coding ability,
2. grammatical sensitivity,
3. inductive language learning ability and
4. rote learning ability” (p. 5).

Later studies conducted by *Skehan* (1989) were concentrated on the complexity of language aptitude and its relation to first language acquisition and second language learning. He has shown two predictors of language aptitude:

1. “a general language processing capability” and
2. an “ability to use language in a decontextualized way” (p. 6).

It is still not known whether intelligence is a part of aptitude or they are separate notions. *Cummins* (1983) distinguishes two kinds of language ability:

1. cognitive/academic language proficiency (CALP)
2. basic impersonal communication skills (BICS). He assumed CALP to be related to general intelligence while BICS to aptitude.

Teepen (2004) tries to clarify the ambiguity in the usage of the terms intelligence and aptitude in SLA through the examination of the articles: *Skehan* (1989), *Miyake* and *Friedman*

(1989) and *McLaughlin* (1990). *Carroll* (1965) (as referred to in *Teepen* 2004) defines four independent components of aptitude that are likely to vary within an individual, these are:

- “1. phonetic coding,
2. associative memory,
3. grammatical memory,
4. and inductive language learning ability” (p. 2).

Teepen (2004) claims, that according to previous findings, intelligence plays little or no role in determining success in oral communication, so the study of intelligence seems useless. According to the Chomskyan agenda, individual differences within a speech community can be ignored (p. 3). Some researchers regard intellectual ability as something that can be defined on the basis of performance on a standardized test (*Genesee*, 1976 as referred to in *Teepen* 2004), others combine IQ with other tests in their analyses (*Obler* 1989), as they suggest that IQ represents only one of several valid intelligence indicators (according to *Teepen* (2004)). The term aptitude is preferred by a number of researchers, in contradiction to IQ. They regard aptitude as something independent of IQ.

Aptitude sometimes appears in places of intelligence. According to *Skehan's* (1989) definition aptitude is a “talent for learning languages that is independent of intelligence” (p. 276). *Miyake* and *Friedman* (1989) regard aptitude as working memory (WM) (according to *Teepen* 2004). They tried to determine, what components aptitude consists of. According to their model of WM, the parts of it are: 1.” language analytic capacity,

2. memory ability, and
3. phonetic coding ability” (p. 3).

WM is assumed to be the primary common determinant of both L1 and L2 proficiency. *Teepen* (2004) argues that *Miyake* and *Friedman's* definition of aptitude is not sufficient (p. 3), as they claim that “WM plays a central role in all forms of higher-level cognition” (p. 341), and if it does, then it is more likely to refer to intelligence. Language analytic capacity and memory are aspects of intelligence; both are tested in traditional IQ tests. *Teepen* argues that intelligence and aptitude are distinct concepts as IQ tests measure individual performance on a number of different areas; they test spatial understanding, memory, pattern recognition, and linguistic knowledge of various sorts.

Researchers agree that performance on reading and language usage tests correlate strongly with IQ level. *Skehan* (1989) investigated the correlation between L1 and L2 language acquisition performance, and found a significant correlation between the two.

An important issue is the innateness of language, whether aptitude is fixed or it can be improved. Most of the researchers regard aptitude as a fixed entity, while others claim that it can develop (*Teepen* 2004).

Researches show that higher intelligence plays little or no role in many communicative tasks, among them are: 1. interpersonal communication, 2. pronunciation, and 3. listening comprehension (*Genesee*, 1976; *McLaughlin*, 1990), no significant differences occurred in any of the different IQ groups with regard to listening comprehension, grammar, vocabulary, and communicativeness (*Teepen* 2004: 6). According to *Teepen* the results of *Genesee* (1976) are unacceptable. He has some objections against the appropriateness of the communicative tests. He also points out some errors in connection with the data collection and analysis (*Teepen* 2004: 7).

General intelligence and first language acquisition are claimed to be separated, as there is no relation between them, which is demonstrated through some case studies. The case of *Laura* was reported by *Yamada* (1990). *Laura* is a retarded young woman (e.g. she cannot count, give her age or tie her shoes, she does not know her name). Her IQ is around 40 however she can detect and correct grammar, she can use complex sentences, passive constructions, etc. but there are discrepancies between her language production and comprehension, she can use these constructions in spontaneous speech but she fails to respond to questions related to these constructions on comprehension tests. She has difficulties in conveying a clear message in conversations, and her utterances are pragmatically inappropriate. This case shows that various aspects of language are separable and they may relate in different ways to non-linguistic abilities.

The case of *Christopher* was presented by *Smith* and *Tsimpli* (1995). He is a person with serious disabilities (he cannot tie his shoes, cannot button his shirt or cut his fingernails) but he knows about 15 foreign languages, in spite of his intellectual deficit (p. 10). The study reveals that he has an exceptional talent for the acquisition of lexical items and of morphology, whereas his ability to learn some syntactic structures is limited, he cannot deal with disambiguation, metaphors, jokes or metalinguistic negation and his conversation is repetitive. According to *Smith* and *Tsimpli* (1995) this case clearly provides evidence for the domain-specificity of language, it also raises the question whether language may be only partially autonomous.

The case of *Williams Syndrome* patients can also be mentioned. These patients show some mental retardation, their IQ scores is about 50 (they cannot tie their shoes, they have difficulties finding their way, distinguish right from left), their arithmetic, reading, writing

and drawing skills are limited, but they are claimed to be very good conversationists. They are more fluent than other children for their age they can use low-frequency words properly. They can understand complex sentences, use and understand passives, relative clauses, etc. According to researchers it proves that linguistic knowledge and cognitive functions can be dissociated. But it is found that English speaking Williams Syndrome children have difficulties with irregular inflection. This dissociation between different areas of linguistic knowledge (in particular morphological and syntactic knowledge) supports the distinction between a computational system and an associative memory system for language (Karmiloff-Smith et al 1997).

Children with normal cognitive abilities can also have certain kinds of speech impairment. These children's IQ scores are within the normal range (around 85 or higher) but show some deficit in their linguistic ability. The degree of impairment are claimed to derive from one individual to another, but they all begin to speak later than normal children and they do not correct themselves as often as normal children do, even if they try to correct themselves it mostly results in a less grammatical utterance. They have problems with morphophonemic rules. These children's language impairment is dissociated from their general cognitive abilities, as well as from their social-emotional or auditory behaviour. The cases presented evidence in favour of the view that the process of language acquisition does not rely on general intelligence (Karmiloff-Smith et al 1997).

Fodor (1983) introduces the modularity hypothesis, which suggests that cognitive processes fall into 2 groups:

1. "domain specific processes (sight, hearing, touch, taste, smell), also called input systems (because their role is to turn representations into more accessible information to the central processors) and
2. general cognitive processes (thought, problem-solving, etc.)" (*Fodor* 1983. p. 16).

According to this hypothesis, the human mind consists of a general-purpose central processing system and a set of domain-specific "modules" which function largely independent from one another. Language is one of these modules, i.e. it is a genetically determined independent system (*Fodor* 1983).

Eddy (2011) conducted a research where correlations of several aspects of grammar and cognitive processes were examined. The participants were 143 students (83 girls and 60 boys), aged 14 to 15, whose L1 was Slovak. I. With regard to grammar, the research focused on 1. active verb forms, 2. passive voice, 3. countability of nouns and 4. use of prepositions. II. Within cognitive processes 1. creativity, 2. associative thinking, 3. working memory, 4.

generalization and 5. analogy were tested. Data was obtained from 2 tests: 1. a test measuring grammatical performance and 2. another was constructed to determine the level of cognitive processes. Correlation analysis was used to process the data.

The grammar tests consisted of four sections: 1. the first section dealt with *active verb forms*. The respondents were given 4 dialogues where verbs had to be put into the correct forms. Which were the following: present simple and continuous, past simple and continuous, present perfect simple and continuous, future simple and continuous. 2. In the second section participants were requested to rewrite 8 sentences using *passive voice*. 3. The third section was dedicated to test *countability*; participants were asked to fill in the blanks in 20 sentences, choosing between a/an and some. 4. In the last section, participants had to provide 15 sentences with the correct *prepositions*.

The test of cognitive processes included 5 subtests, testing 5 cognitive processes and general intelligence, often referred to as g-factor. 1. *General intelligence* was tested through a subtest, in which participants were given a number sequence, and they had to find the rule by which the numbers are organized. 2. In the second section in which *creativity and associative thinking* were measured, participants had to form sentences using a group of words provided. 3. The third part tested *working memory*: students were given 5 word sequences (each formed a category of common nouns). They were given time to memorize the sequences, then they had to answer questions e.g. which category a given word belonged to. 4. In the fourth section in which *generalization* was measured, participants were given 6 words, out of which they had to choose 3 elements and put them in meaningful groups (e.g.: gold, clay, silver, wood, copper, stone – gold, silver, copper: they are all metals). 5. *Analogy* was tested in the fifth section, where respondents were asked to recognize the relationship between certain words (e.g.: lose = remember: a) keep b) recall c) forget d) think e) dream; the correct answer is c)).

The results show that when completing the task regarding *active verb forms*, creativity, associative thinking and working memory were the most important, followed by generalization, while general intelligence and analogy seemed to be less important. With regard to *passive voice*, lower correlations were found than at active verb forms. Here the order was the same, but general intelligence proved to be more important than generalization. As the author points out, that a different order was found in the case of *countability*, as here working memory was proved to be the most important, then came general intelligence, creativity and associative thinking. The last two were generalization and analogy. According to the findings, the correct *use of prepositions* was most closely related to creativity and associative thinking; although working memory also played an important role. Intelligence

turned out to be as important as in cases of the other aspects tested, similarly to the other aspects, analogy and generalization were the least important (pp. 67-68).

According to the results, there was a significant interconnection between students' performance on the grammar tests and the level of cognitive processes tested. Creativity and associative thinking turned out to be of the highest importance (0.36), followed by working memory (0.32), and after it came general intelligence (0.32), then generalization (0.21) and the last one was analogy (0.17) (p.68).

Sarani and Lotfi (2010) investigated the relationship between g-factor scales (general intelligence) and Iranian high school students' reading comprehension, grammar, and vocabulary was examined. Raven Progressive Matrices (RPMs) and Weschler Intelligence Scale for Children were used to measure students' general intelligence; to test language proficiency standard tests of grammar and vocabulary and Cambridge Key English Test (KET) were used. Weschler Intelligence Scale for Children is composed of 12 subtests, measuring a wide range of verbal and non-verbal abilities, such as arithmetic and abstract reasoning, the power of conceptualization, social awareness, attention, auditory short-term memory, visual perception, and visual spatial capabilities. Raven Progressive Matrices (RPMs) contains simple matrices with 60 questions which have to be answered in 45 minutes. This test was designed to measure only non-verbal skills.

The language proficiency test consisted of a multi-choice test including 25 vocabulary items and another multi-choice test including 30 grammar items. Participants were 48 first-grade high school male students aged between 14 and 16, randomly selected for the tests.

The authors found a significant relationship between students' level of reading comprehension and their L2 vocabulary knowledge, L2 grammar knowledge, verbal IQ, WSIC-R measured non-verbal and Raven measured non-verbal IQs. Reading comprehension was in significant relationship with the kinds of intelligences measured by WSIC-R. According to the results verbal intelligence, vocabulary and non-verbal intelligence were determining factors in reading comprehension. Verbal intelligence was found to have an important role in vocabulary knowledge. Only grammar didn't show any correlation with intelligence on the language knowledge measuring test.

Gardner and Lambert found a correlation (0,41) between intelligence and the 'words in sentences' part of MLAT in 1972. *Skehan* also found a relationship (0.39) between the two variables in 1980. Between IQ and language aptitude he also found a relation (0,60) which shows that there is a relationship and a considerable independence between intelligence and

language aptitude. Between analytic capacity and aptitude there was found a stronger relationship (*Eddy* 2011).

Skehan found a positive correlation of intelligence and learning success: 0.3-0.6 (1989:13). There was found a positive correlation of IQ and school marks 0.20-0.60. *Larsen-Freeman* and *Long* (1991, according to *Eddy* 2011) found that intelligence less strongly correlated with second language learning achievement of young learners than with older ones. *Spolsky* (1995, according to *Eddy* 2011) found that IQ correlated with language learning success, with school marks and with L2 proficiency test.

2.3 What is intelligence? The theory of multiple intelligences

Gardner (2002) calls our attention on the importance of distinguishing three different meanings of intelligence. He demonstrates this distinction through the following sentences:

1. “In view of the close resemblance between chimpanzee and human genetic material, it has become challenging to delineate the defining characteristics of human intelligence.
2. On most dimensions of interest, Susan simply displays more intelligence than John.
3. What distinguishes Alfred Brendel’s piano playing is not his technique per se, but the sheer intelligence of his interpretations.” (*Gardner* 2002. p. 3).

The word ‘intelligence’ in the first sentence refers to the “a general characterization of human (non-human) capacities” (p. 3). The second meaning of intelligence is that psychologists are mostly interested in: “the examination of individual differences on trait of interest” (p. 4). The third meaning of intelligence refers to “the manner in which a task is executed” (p. 4).

On the basis of his previous findings he concludes that a “simple, unitary, indecomposable intelligence cannot be correct” (*Gardner* 2002. p.5). MI theory relies on biological evidence. The mind consists of many modules.

Gardner claims that one shouldn’t speak about one single intelligence, instead he proposes the theory of multiple intelligences which means that each person possesses a set of intelligences. *Gardner* states that “there are a series of relatively independent cognitive capacities of which logical-mathematical thought – which is often referred to as general intelligence – is only one” (p. 6). Other dimensions also exist, e.g.: creativity, leadership, the ability to change the minds of other persons.

According to the traditional view general intelligence is something we are born with, it is biologically determined, thus it is stable and cannot be altered significantly, as it is not influenced by environmental factors, and through IQ tests and shape of our brain waves it can be measured (*Gardner* 2011).

Although *Gardner* acknowledges that the idea of differentiation between various kinds of intelligence does not belong to him, since there were already other attempts for it even before he published his book titled *Frames of mind* in 1983, and after it there emerged also other approaches. He mentions *Thronrdike* (1920), who defines three parts of intelligence: abstract, mechanical, social, *Guilford* (1967) who identifies 7 primary abilities and 150 different intellectual faculties (*Gardner* 2008: 16).

Gardner views intelligences as a set of “relatively independent computers” (*Gardner* 2005: 6), thus according to him, we have one computer for language another for spatial information and another for coping with other people.

Gardner defines 8 (or 8 and a half) kinds of intelligences, these are:

1. Linguistic intelligence by which the intelligence of a writer, orator or journalist is meant by *Gardner*.
2. Logical-mathematical intelligence is the “intelligence of a logician, mathematician, scientist” (p. 7) most of the intelligence test are measuring it. As *Gardner* (2005) argues Piaget also focused merely on this particular intelligence.
3. Musical intelligence is claimed by *Gardner* as not being just a “talent” as it is mostly regarded. It means the “ability to create, perform and appreciate music” (p. 7).
4. Spatial intelligence is the capacity to “form mental imagery of the world and manipulate those mental images” (p. 8). This is the intelligence of a navigator, a chess player, a surgeon.
5. Bodily-kinesthetic intelligence is defined by *Gardner* as “the capacity to solve problems or fashion products using your whole body, or parts of your body, like your hands or mouth” (p. 8). This is the intelligence of athletes, dancers, actors, crafts persons and surgeons.
6. Interpersonal intelligence is the ability to understand the other person. It involves skills as how to interact with others, how to motivate people and understand their personalities. This kind of intelligence is important for businessmen, teachers, clinicians, and for those who deal with politics or is involved in religion.
7. Intrapersonal intelligence is “the capacity to understand oneself – one’s strengths, weaknesses, desires, fears” (p. 8).
8. Naturalist intelligence “involves the capacity to make consequential distinctions in nature” (p. 9), e.g. between plants, animals, etc.

9. Existential intelligence is an additional type of intelligence given by *Gardner*. He calls it the “intelligence of big questions” (p. 9), questions e.g. about the size of the universe and alike.

Each of these intelligences is relatively independent, and can be further separated into components. Boundaries between them can be blurred. *Gardner* claims that all of us have all these 8-9 intelligences, but he also states that people vary according to the proportions they possess of these intelligences, and having an intelligent does not mean that one behave “intelligently”, as intelligences are “simply computers that can be put to work” (p. 9). A skill can be used either well or foolishly, and also both for good or bad purposes.

The “five minds for the future” the minds that have to be cultivated according to him are: 1. disciplined mind, 2. synthesizing mind, 3. creative mind, 4. respectful mind, 5. ethical mind (*Gardner* 2008. pp. 8-12).

MI theory is also used in education to individuate it, in order to increase student’s learning potential and to develop students’ various kinds of intelligence. Two intelligences (linguistic and logical-mathematical) have been valued and tested in schools, language-logic combination is thought as “academic” or “scholarly” intelligence. MI theory suggests that “individuals who demonstrate a peculiar aptitude in one intelligence will not necessarily demonstrate a comparable aptitude in another intelligence” (*Gardner* 2005. p.5).

It is said by scholars that students have different learning profiles. *Gardner* argues for the holistic nature of learners. He claims that it is not satisfactory if educationists merely concentrate on the cognitive capacities of students as they must take into account their physical, artistic and spiritual abilities. These skills also need to be developed. He calls attention on the dangers of the “narrowness” of education as it may result in serious social consequences. According to him humanistic psychology and MIT recognize that “learning involves the physical and affective sides of the individual, as well as the cognitive” (*Gardner* 2011. p.17). Neurobiologist *Damasio* (1994: XIX): emotional life is “an integral component of the machinery of reason” (as cited by *Gardner*). *Schumman* (1994. p.232) propose a brain-based model of language acquisition, he states that “in the brain, emotion and cognition are distinguishable but inseparable. Therefore, from a neural perspective, affect is an integral part of cognition” (*Gardner* 2011).

“Meaningful learning” is said to facilitate students’ attentiveness. Scholars distinguish between reference and sense meaning (surface and deep felt meaning). *Gardner* includes to this relevance, emotional connection, pattern-making and context. According to *Gardner* “as no interaction is context-free, to memorize any verbal information appropriately, its

correspondent context has to be stored as well, and this context needs to interact with the learner's knowledge of the world" (cited in *Arnold and Forseca* 2004. p.121). It is the interaction of all these different elements that meaningful learning emerges. *Caine and Caine* (1994. p.47) claim that meaningful learning "refers to storage of items that have so many connections, and are of such quality, that they can be accessed appropriately in unexpected contexts" (cited in *Arnold and Forseca* 2004. p.121). Although *Gardner* was "less persuaded" that MIT can be useful in mastering a foreign language (*Gardner* 2005). Foreign language teachers and researchers report that learning can be supported by bringing in the musical, visual-spatial, bodily-kinesthetic, interpersonal, intrapersonal, mathematical and naturalistic abilities "as they constitute distinct frames for working on the same linguistic content" (*Arnold and Forseca* 2004. p.125). It also helps to reduce boredom. MI theory suggests an interesting way of conceptualizing the term intelligence; however it does not offer methods of testing the different intelligences. It can be integrated in education, and methods of language teaching, but in this sense it is mostly tied to interest.

2.4 How can intelligence be measured?

Raven Progressive Matrices Test (RPM) measures nonverbal intelligence. The test is typically used in educational settings. *John C. Raven* created it in 1936. It contains of 60 multiple choice questions. The test measures reasoning ability i.e. the 'meaning making' component of Spearman's g, i.e. general intelligence. In each test item the subject is asked to identify the missing element that completes a pattern. Different versions of the test exist, these are: Standard Progressive Matrices, Coloured Progressive Matrices, Advanced Progressive Matrices (*Sarani and Lofti* 2010). Recently a new version of the test has been developed the Standard Progressive Plus.

Another well known and widely used intelligence test is the Wechsler Intelligence Scale for Children (WISC) developed by *David Wechsler*. It is designed for children aged between 6-16 and can be completed without reading or writing. The completion requires 65-80 minutes; general cognitive abilities are measured. The test has the following sections: Verbal Comprehension Index (VCI), Perceptual Reasoning Index (PRI), Processing Speed Index (PSI) and Working Memory Index (WMI). WISC is not solely an intelligence test it is also a clinical tool (*Sarani and Lofti* 2010).

2.5 Testing Language Aptitude

The two widely known language aptitude tests for native English speakers are: the Modern Language Aptitude Test MLAT (*Caroll and Sapon 1959*) and the Pimsleur Language Aptitude Battery PLAB (*Pimsleur 1966*).

John Carroll and *Stanley Sapon*, the authors of MLAT claim that although each individual is capable of learning a foreign language, it can be predicted, 'how well, relative to other individuals, an individual can learn a foreign language in a given amount of time and under given conditions' (p. 5). The development of the test is a result of a 5-year research study at Harvard University. MLAT was designed for adults and students graded 9-12 and also for university or college students. It is used by schools and psychologists. MLAT has the following sub-tests: 1. Number Learning, 2. Phonetic Script, 3. Spelling Clues/Hidden Words, 4. Words in Sentences, 5. Paired Associates. MLAT-E is an adaptation of the adult version of the MLAT for younger students, for children in grades 3-6.

The results of the test show students' strengths and weaknesses, and offer a help to place students with similar learning rates in the appropriate class. It can also be used for diagnosing foreign language learning disability. The limitation of MLAT is that it does not include any measure of motivation, although it is a powerful factor. According to *Ottó István* and *Nikolov*, in the case of MLAT the testing of inductive learning ability receives more emphasis (*Hild 2007*).

An advantage of Pimsleur Language Aptitude Battery (PLAB) is that it measures motivation. The test is the result of 8- years of research between 1958-1966. According to Pimsleur's findings, the most important factors contributing to success at foreign language learning are: motivation and verbal intelligence (*Pimsleur 1966*). That is why he includes a section that measure motivation, and two other sections to measure verbal intelligence were also included in the test. The four factors contributing language learning ability on the PLAB are: verbal ability, auditory ability, motivation and grade point average. It is designed for students of 7-12 grades. PLAB contains 6 sections (*Pimsleur, et al. 1966*), where each tests different aspects of the forum main predictive factors: Grade Point Average, Interest, Vocabulary, Language Analysis, Sound Discrimination, Sound-Symbol Association. PLAB is used for program placement, program assessment and planning and for diagnosis of learning abilities. MLAT can be used for selection, placement and diagnosis of learning disabilities. As far as language learning aptitude is claimed to be relatively stable over an individual's lifetime, there are not any suggestions, of how it could be improved. It is mostly claimed that it cannot be. Tests as MLAT or PLAB can only help in finding the most appropriate strategy.

CHAPTER 3: DESCRIPTION OF RESEARCH

3.1 Aims

The aim of the study is to examine the relationship between intelligence and language aptitude, and their impact on foreign language achievement in monolingual and bilingual foreign language learners. Yet another aim is to compare the results of the two groups and to compare the results of girls and boys, and find out, if any differences exist between the relationship of the measured variables and the average scores of the groups.

3.2 Research questions and hypotheses

The following questions are to be answered in the paper:

1. How does language learning achievement correlate with intelligence and with different components of intelligence? Is there any correlation between language learning achievement and intelligence?

Hypothesis 1,

General intelligence correlates with language learning achievement i.e. with students' midterm marks of foreign language, as on the basis of 40 articles *Pimsleur, Mosberg and Morrison* (1962, *Eddy* 2011) stated that intelligence is a significant factor in foreign language acquisition. According to *Skehan* (1989) the correlation of intelligence and school marks is around 0.20-0.60. According to *Spolsky* (*Eddy* 2011), IQ correlates with language learning success, with school marks and also with L2 proficiency. *Eddy* (2011) also found a positive correlation between students' performance on the grammar tests and on the intelligence test ($r=0.32$).

Verbal intelligence is more strongly related to language learning achievement than nonverbal and quantitative intelligence, but nonverbal and quantitative intelligence also correlate with second language achievement to some extent, as all aspects of intelligence correlate with each other.

2. How does language learning achievement correlate with language aptitude and with the different aspects of language aptitude? Does language learning achievement correlate with language aptitude at all?

Hypothesis 2,

There is a correlation between language learning achievement and language aptitude. As *Skehan* argues that on the basis of previous research a correlation of mostly between 0.3-

0.6 was found (Skehan 1989). All aspects of language aptitude correlate well with midterm results, as all are important in foreign language learning.

3.How does general intelligence correlate with language aptitude?

Hypothesis 3,

There is a relationship between intelligence and the parts of language aptitude *Sasaki* (1996) suggested being the more central ones, i.e. those that are tied to analytic ability, however the more peripheral parts of language aptitude as phonemic processing and memory are more weakly related to intelligence (*Dörnyei and Skehan* 2003: 596). *Gardner and Lambert* found a correlation of 0.41 between IQ and the fourth part of the Modern Language Aptitude Test, namely the ‘Words in sentences’ part. Skehan also found a correlation between the two, but a less strong one, 0.39. However on the basis of previous research he concludes that there is a strong relationship between IQ and language aptitude about 0.60.

According to my hypothesis, there will be a stronger relationship between IQ and the results of the second and third parts of the aptitude test, namely at the ‘Language analysis’ and ‘Words in sentences’ subtests, as these measure grammatical aspects of language processing and require good analytic skills.

4.Is there any difference in the correlation of language achievement, language aptitude and intelligence in bilinguals as opposed to monolinguals?

Hypothesis 4,

There is no reason to suppose that any difference in strength of correlation would exist between the mentioned factors in bilingual as opposed to monolingual foreign language learners. Intelligence is equally related to language aptitude and foreign language success in both groups.

5.Is there any difference in the correlation of language achievement, language aptitude and intelligence in girls and boys?

Hypothesis 5,

According my hypothesis, gender factor does not play a role in the strength of correlation between foreign language learning achievement, language aptitude and intelligence. General intelligence and all its aspects correlate with the parts of language aptitude, and both general intelligence and language aptitude are in connection with the students’ marks of foreign language.

6.Are bilinguals intellectually superior to monolinguals? Do bilinguals have higher IQs and better language aptitude? Do they have better midterm results?

Hypothesis 6,

In general, bilinguals may score better in intelligence tests. They have better results at school subjects. They are said to be better at activities requiring creativity. According to the expectations, bilingual learners would have higher IQ-s. They would cope with the different tasks of the tests more easily than monolinguals.

According to my hypothesis, bilinguals tend to have better language aptitude, as they have certain cognitive benefits of being bilingual, and intelligence and language aptitude are closely related.

7.What are the differences between boys' and girls' test results?

Hypothesis 7,

It is a general conception that girls are better language learners. According to my hypothesis, they get better marks of foreign language. They are more successful language learners. As language learning success is closely tied to language aptitude and different aspects of intelligence, it follows that girls have higher IQs (especially, if verbal intelligence is concerned, as it is the most closely related to foreign language learning success).

3.3 Research design

Data were collected with the help of a questionnaire, an intelligence test and a language aptitude test.

3.4 Method

3. 4. 1 Participants

Overall, 70 participants' test results were included in the statistic analyses. Participants who claimed themselves to be bilingual but had a midterm grade of Hungarian language worse than 6 (out of 12) were not given the intelligence test. Participants who scored below 70 or above 120 in the intelligence test were not given the aptitude test. Out of the 70 participants who filled in both tests 51 were monolingual (29 female and 22 male) and 19 (13 female and 6 male) were bilingual. The participants were 9-11 grade students of two Hungarian schools in Ukraine. Participants were aged between 15-17. Each of the 70 participants claimed Hungarian to be at least one of his/her mother tongue. Besides Hungarian, 17 participants regarded Ukrainian as his/her native language and 2 participants spoke Romanian on a native level. The majority of the participants started learning a foreign language (English, German or French) at the age of 7.

3.4.2 Research Instruments

For testing verbal, non-verbal and quantitative intelligence the Cognitive Abilities Test was used. For testing subjects' foreign language aptitude the Hungarian Language Aptitude Test was administered. Both of the tests and the questionnaire also were in Hungarian.

The questionnaire is available in Appendix 1.

3. 4. 2. Hungarian Language Aptitude Test (MENYÉT)

The test was designed to predict second language learning success of native Hungarian speakers. The test was developed by István Ottó on the basis of the most widely used English-based aptitude tests: MLAT and PLAB. MENYÉT consists of 4 sections (Ottó, 2002):

The first one is called: Hidden sounds ('Rejtőző hangok'). It is an adaptation of MLAT 'Phonetic script'. The second part is: Language analysis ('Nyelvi elemzés') an adaptation of Pimsleur's 'Language analysis'. The third part of the test is an adaptation of MLAT 'words in sentences' and the fourth part is called: Learning words: 'Szótnulás'.

In the first sub-test participants heard several phonetic scripts and their task was to choose the transcription of the sounds out of 4 possibilities, the fifth option was: none. The sub-test consisted of 20 items.

In the second sub-test participants were presented an artificial language. A list of words and constructions in the artificial language and their Hungarian translation was given. With the help of the list participants had to find the correct translation of simple Hungarian sentences (e. g.: A kutya nézi a macskát) out of 4 possibilities. The sub-test contained 20 similar items.

In the third section participants were given a sentence in Hungarian. One of the words of it was typed in capitals. A second sentence with a completely different meaning was also given below the first one. Participants had to find the word in the second sentence (out of 5 possibilities) that performed the same function in the sentence as the word typed in capitals in the first sentence.

In the fourth sub-test participants had to learn 24 words in Swahili in 5 minutes. The word and its Hungarian translation were given. After 5 minutes participants had to find the Hungarian equivalent of 20 Swahili words out of 5 possibilities. Due to copyright issues, the test questions cannot be attached.

3.4.2.Cognitive Abilities Test (C.A.T.)

The final version was made in the USA in the 70-s. It is widely used to measure cognitive abilities of learners between 10-18, and to predict their progress at school. The test

is claimed to be highly reliable, the correlation of results was between 0,85-0,95 in different years (*Thorndike & Hagen*, 1971). The Hungarian translation an adaptation of the test was made in the Institute of Pedagogical Psychology of the University of Debrecen by Imre Dávid (for the test see Appendix 2). The original test consists of the following parts:

V1: Vocabulary Test

V2: Sentence Completion

V3: Verbal Classification

V4: Verbal Analogy

NV1: Figure Analogy

NV2-Q3 Sequence of numbers

NV3: Figure Synthesis

The version used here did not include: NV2- Figure Classification. Q1-Quantitative Relation Test: forming equality.

In the V1 test, participants had to choose the word which was a synonym of or had similar meaning as the word typed with bold in the left side of the row. The exercise contained 25 of items similar to the example given below. E.g.:

rózsa A zene B virág C étel D kilátás E lasszó.

In V2 test, participants were asked to complete word combinations with words given to create a meaningful sentence. V2 also contained 25 items. E.g.:

A tűz ...

A nedves B zöld C forró D folyékony E erős

In V3, participants were given 3 words typed in bold that had something in common. Participants had to choose the word appropriate out of 5 possible answers. V3: 25 items. E.g.:

egér, farkas, medve

A rózsa B oroszlán C fut D éhes E barna

V4 test was the last exercise of the verbal part. In this exercise a word pair was given. There was some kind of relationship between the words; they could be synonyms or antonyms. There was a third word given too. Participants had to find out, how the two words related to each other. The third word was the first part of a second word pair. Participants were required to find the word out of 5 possibilities that matched to the third word like the second to the first word. E.g.:

nagy-óriási, kicsi

A fiú B felnőtt C apró D kevés E több

The nonverbal part of CAT was broken down to 3 sections. In NV1 each exercise began with a sequence of figures that were in a sense identical. Subjects had to figure out what was identical in all the figures, and choose a figure out of 5 possibilities that belonged to the given sequence of figures. The sub-test consisted of 8 items (See Appendix 2).

NV3 was similar to V4. There were 3 figures given. Between the first and the second there was a kind of relationship. Participants had to find out what the relationship was. The third figure was the first part of the second pair. Participants had to choose (out of 5 possibilities) the figure that fitted to the third one like the second to the first one (See Appendix 2).

NV2 measured mathematical reasoning. In this exercise there were numbers or letters arranged in a logical order. The participants were required to find out the rule according to which the numbers or letters were arranged, and had to figure out which number (out of the 5 possibilities) would come after the last one in the row according to the rule (See Appendix 2).

3.5 Research Procedure

As the first step, participants filled in a questionnaire, where they had to answer questions related to some personal information and the participants' language background. The questionnaire can be found in Appendix 1. The testing session took place in 5 classes, and lasted for 2 weeks roughly. Each class filled in the questionnaire. Those bilinguals who had a midterm mark of Hungarian language worse than 6 (12 is the maximum according to the Ukrainian grading system) were not given the intelligence test neither the aptitude test as both were in Hungarian, and were developed for Hungarian native speakers. It does not mean that individuals who claim themselves being a native speaker of two languages know these languages at the same level, so this is why I decided to exclude these students from the testing, in order to avoid having distorted results from the bilingual group. The test sheets were filled in in the same order by each class, beginning with CAT V continuing with CAT NV ending with MENYÉT. As the tests contained a relatively great number of items and some of the questions were quite complex, there was a 1-2 days pause after each test, to make sure, participants would not feel tired of testing. The completion of CAT V and CAT NV separately took for about 45 minutes. The completion of MENYÉT required 60 minutes roughly in each class. The task sheets students received, contained instructions to all subtests, and some examples were given too. Students could ask questions if they did not understand something.

3.6 Data analysis

Correlations between certain variables were calculated with Spearman correlation coefficient, which is the non-parametric equivalent of Pearson's correlation coefficient. For comparing means of the scores of certain groups, Mann-Whitney U test was used, which is a non-parametric test too. For statistic calculations SPSS Version 20 software was used. Most of the results are demonstrated in the Appendices. Results of the correlation test (Spearman correlation coefficient) can be interpreted as follows: the r value is between -1 and 1, where -1 indicates a perfect negative (downhill) linear relationship, -0,70 – a strong negative linear relationship, -0,50 – a moderate negative linear relationship, -0,30 – a weak negative linear relationship. If the r value equals 0, it means that there is no relationship between the given variables. +1 indicates a perfect positive (uphill) relationship between the variables, +0,70 – strong positive linear relationship, +0,50 – moderate positive linear relationship, +0,30 – weak positive linear relationship. The results of the whole sample are visually demonstrated with the help of diagrams in Appendix 4. The correlations and the degrees of their significance are shown in Appendices 5, 8, 9, 10 and 11. The results of the Mann-Whitney U test (mean ranks and significance) are shown in Appendices 6 and 7.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Research question 1

The first research question asks about how language learning achievement correlates with intelligence and different components of intelligence separately, and if there is any kind of correlation between the mentioned variables.

After the data analysis it is seen that there is a correlation between students' midterm grades and their scores in the intelligence test (Appendix 4: Figure 2) (Appendix 5: Table 2). There is a statistically significant correlation between the midterm grades and students' total score in the intelligence test ($r=465$, $p<0.01$). There is also a statistically significant correlation found between students' midterm grades and their verbal intelligence ($r=472$, $p<0.01$) (Appendix 4: Figure 4; Appendix 5: Table 3). Nonverbal intelligence and quantitative intelligence also correlated with midterm grades of foreign language however these correlations are somewhat weaker (0.369 and 0.377, $p<0.01$) (See Appendix 4: Figures 6 and 9; Appendix 5 Table 3).

As hypothesized, each type of intelligence correlates with the midterm grades (and also with each other) and it was the verbal part of the CAT that showed the strongest correlation with the midterm grades of foreign language. The results suggest that there is a moderate relation between students' level of intelligence and their language learning success. Intelligence is a significant factor but other factors also affect students' language learning. My findings proved to be similar to those reported by *Skehan* (1989) and *Spolsky*.

4.2 Research question 2

The second research question concerned with the correlation of language aptitude and students' midterm mark of foreign language.

The results of the correlation test show that the total scores of the language aptitude test correlate with midterm grades ($r=0.597$, $p<0.01$) (Appendix 4, Figure 1, Appendix 5 Table 2). It can be concluded that language learning achievement seems to be more strongly related to language aptitude than to verbal intelligence (Figure 4). Each part of the aptitude test correlates with students' midterm marks. The most closely related is the second subtest of the aptitude test, the 'Language analysis' subtest ($r=503$, $p<0.01$) (Appendix 5: Table 5). The third part of the test, which also measures language analytic skills, correlates with midterm marks too ($r=461$, $p<0.01$) (Appendix 5: Table 6). The two memory-related sections of the aptitude test also show a correlation with language learning achievement (Figure 10; Tables 4 and 7). Although students' language learning success seems to be more closely related to their

phonetic coding ability ($r=0.462$, $p<0.01$) than to the ability of learning words quickly ($r=0.285$, $p<0.05$) (See Tables 4 and 7).

My hypothesis is supported by the results, as language aptitude seems to be the most important factor in language learning success. My findings are similar to that of *Skehan* (1989). Each aspect of aptitude correlates with language learning to some extent, but the most memory-related part is quite weakly related to it as opposed to the other aspects of language aptitude.

4.3 Research question 3

The third research question was related to the degree of correlation of general intelligence and language aptitude.

Language aptitude seems to be closely related to intelligence, as I found a strong degree of correlation between the two variables, i.e. between students' overall scores in the two tests ($r=0.729$, $p<0.01$) (Appendix 4: Figure 3; Appendix 5: Table 2). As far as the different aspects of intelligence are concerned, these also correlate with language aptitude (Appendix 4: Figures 5, 7, 8). Language aptitude correlates the most strongly with verbal intelligence ($r=0.675$, $p<0.01$), but it is almost as strongly related to nonverbal intelligence ($r=0.644$, $p<0.01$) and it is even related to quantitative intelligence ($r=0.495$, $p<0.01$) (Appendix 4: Figures 3, 5, 7, 8, Appendix 5: Table 3).

Out of the four parts of the aptitude test three correlate with intelligence, namely the first three sections. The 'Language analysis' and the 'Words in sentences' subtests show the highest correlations with intelligence ($r=0.692$, $p<0.01$, $r=0.685$, $p<0.01$). These are proved being related to each type of intelligence (Appendix 4: Figures 13-15, Appendix 5: Tables 5-6). It means, that based on my findings, phonemic coding ability and the 'more central' parts of language aptitude seem to be related to intelligence but the most memory-related part of the aptitude test (Appendix 4: Figures 10-12, Figures 13-15, Figures 16-18), the 'Vocabulary learning' part does not seem to correlate with intelligence at all (it is not surprising as the intelligence test used here does not contain sections measuring memory-related abilities, it concentrates on the measurement of linguistic-, spatial- and quantitative-analytic reasoning abilities; memory and analytic reasoning are two distinct abilities) (Appendix 4: Figure 19, Appendix 5: Table 7). My findings are similar to the ones that can be found in the literature (*Gardner and Lambert 1959, Skehan 1989*).

4.4 Research question 4

The fourth research question dealt with the potential differences in the degree of correlation between aspects of intelligence and parts of language aptitude as well as students' midterm marks.

It was hypothesized that there would be no differences in the degrees of correlations in the two groups. However there seem to be some differences in the degree of correlations between the bilingual and monolingual group. There is not a statistically significant correlation between bilingual students' midterm grades and their language aptitude (Appendix 9: Table 16). Within the bilingual group, midterm grades only showed a significant correlation with verbal intelligence ($r=0.551$, $p<0.05$; see: Appendix 9: Table 17). Language aptitude correlated with intelligence well in both groups (Appendix 8: Tables 14, 15; Appendix 9: Tables 16, 17).

4.5 Research question 5

The following research question enquired about the differences or similarities in the correlations of the measured factors among boys and girls.

I found similar degrees of correlation in the two groups, however some differences also exist. Namely, general intelligence have not shown a correlation with midterm marks in boys (Appendix 10: Table 18), however intelligence is quite closely related to language learning achievement in the group of girls ($r=0.507$, $p<0.01$) (Appendix 11: Table 24). It is only verbal intelligence that correlated with language learning success in the group of boys ($r=0.400$, $p<0.05$) (Appendix 10: Table 19). Although, language aptitude seems to correlate with language learning achievement in both boys and girls, it shows a higher correlation in girls (in boys: $r=0.501$, $p<0.01$, in girls: $r=0.597$, $p<0.01$) (Appendix 10: Table 18; Appendix 11: Table 24). The subtests of the aptitude test correlated differently in the two groups, except for the fourth one the 'Vocabulary learning' part, as it does not correlate with other variables measured in the research in none of the groups (Appendix 10: Table 23; Appendix 11: Table 29). Phonemic coding ability does not correlate with intelligence in the group of boys (Appendix 10: Table 20), however it does in girls ($r=0.647$, $p<0.01$) (Appendix 11: Table 26). The 'Language analysis' part correlates with each type of intelligence in the group of girls but it only correlates with nonverbal and quantitative intelligence in boys ($r=0.700$, $p<0.01$, $r=0.442$, $p<0.05$) (Appendix 10: Table 21; Appendix 11: Table 27). The 'Words in sentences' part correlates the most strongly with verbal intelligence in girls ($r=0.703$, $p<0.01$) but in

boys, it is the most closely related to quantitative intelligence ($r=0.616$, $p<0.01$) (Appendix 10: Table 22; Appendix 11: 28).

As opposed to my hypothesis that there would not be any differences in the correlations between the measured variables in boys and girls, there seem to be discrepancies between the two groups' results. A relationship between general intelligence and language learning achievement proved to exist only in the group of girls.

4.6 Research question 6

Within the sixth research question, the following sub-questions had to be answered: if bilinguals had higher IQs, and if they had better language aptitude and better results of foreign language.

After the analysis, it is seen that monolinguals have better marks from the foreign language they learn, however the difference between the two groups is not statistically significant. Overall, monolinguals scored better in all the tests. But the differences between the two groups' results are not always statistically significant (See Appendix 6: Tables 8-10). It is found that monolinguals have higher IQ-s (the difference is statistically significant, see Table 9). Monolinguals' verbal and nonverbal intelligence are proved to be higher (the differences are statistically significant, see Table 9). Monolinguals also gained higher scores on the subtest that measured quantitative reasoning (however this result is not statistically significant, see Table 9) (Figure 20).

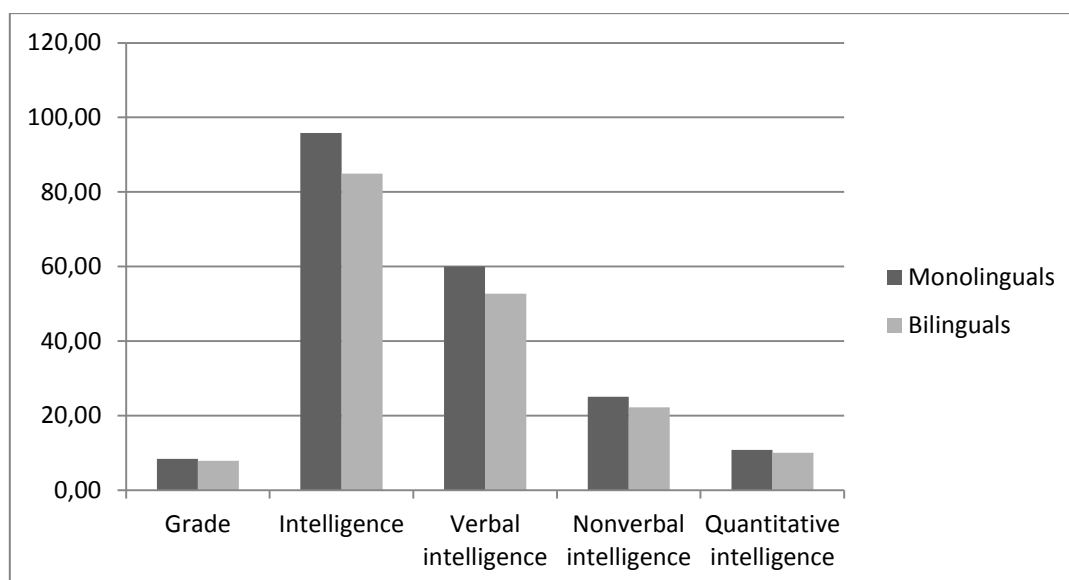


Figure 20. *Difference between monolingual and bilingual learners' intelligence and midterm grades*

Monolinguals have scored better in the language aptitude test as well (Figure 21). Monolinguals have significantly better results in each sub-test of the aptitude test except for the fourth one, the ‘Vocabulary learning’ subtest (Appendix 6: Table 8, Table 10).

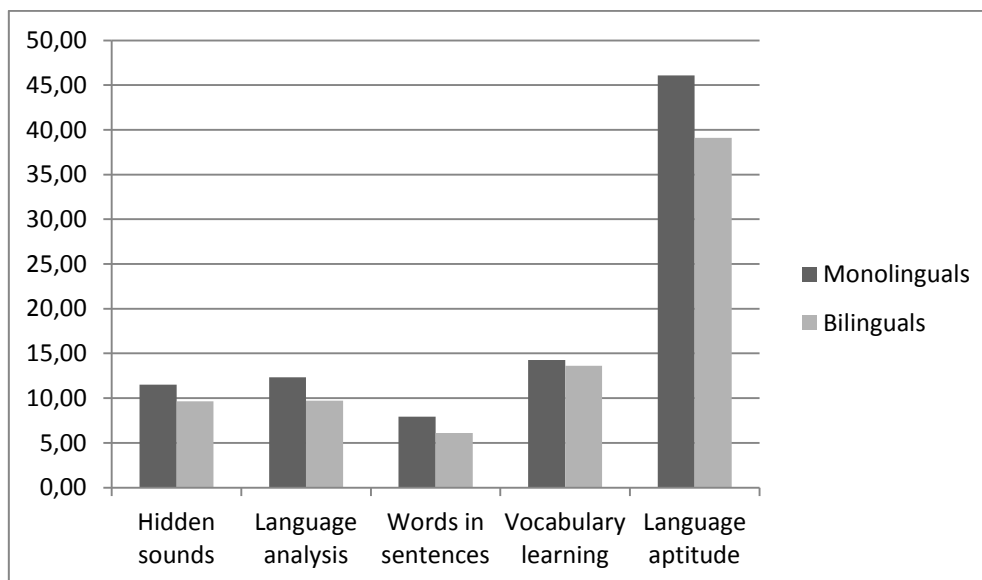


Figure 21. *The difference between monolingual and bilingual learners’ language aptitude*

Results do not support my sixth hypothesis, as bilinguals do not seem to have any cognitive advantages. They even scored worse in each test and gained lower marks (see Figure 20 and Figure 21).

4.7 Research question 7

The following research question enquired about the differences between boys’ and girls’ level of intelligence, level of language aptitude and foreign language learning success.

If we compare the results of girls and boys in the monolingual group it appears that girls got better marks of the foreign language they learnt (see Figure 22; and Appendix 7: Table 11, 12), they gained higher scores in the tests (see Figure 22 and 23; Appendix 7: Table 11-13) but as far as intelligence is concerned, the differences found in the verbal subtest can only be interpreted as being statistically significant (Table 12).

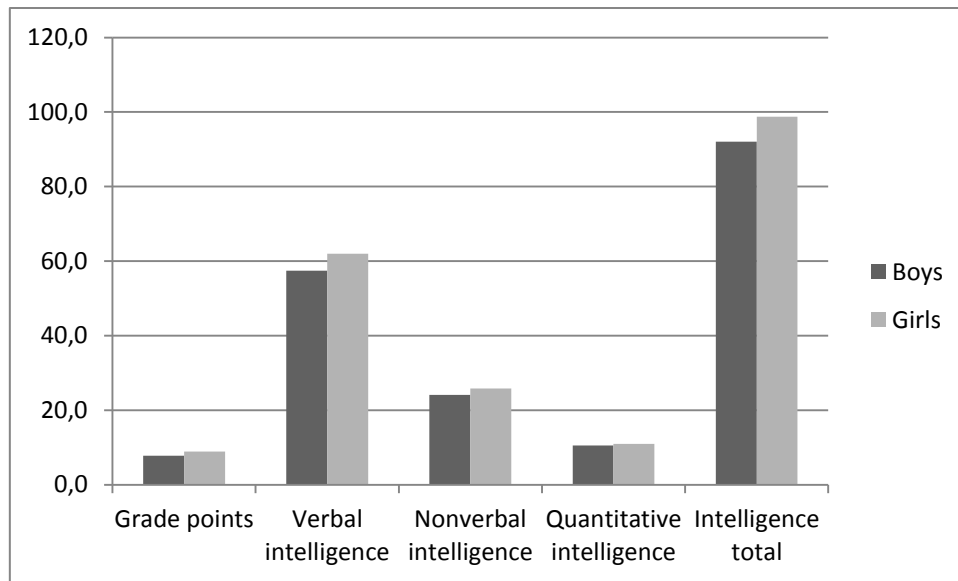


Figure 22. *The difference between monolingual boys' and girls' IQs and midterm marks from foreign language*

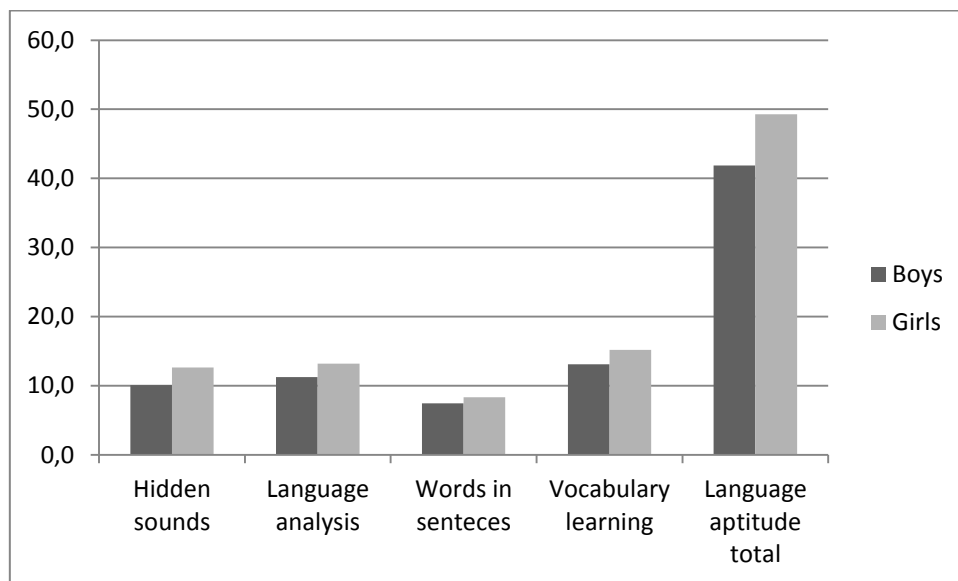


Figure 23. *The difference between monolingual boys' and girls' language aptitude*

Girls are proved to have significantly higher scores in three, out of the four parts of the aptitude test (Table 13). Girls scored significantly better in all subtests except for the 'Words in sentences' subtest (Table 13). The difference between the two groups is the most marked in the first part which measures phonemic coding ability (Table 11, 13). Overall, girls' language aptitude is proved to be better than that of boys' (Appendix 7, Tables 11, 13). There cannot be found any statistically significant difference between boys' and girls' results in the bilingual

group. However on the basis of such a small sample statistically reliable conclusions cannot be made.

As girls turned out to be better at all test, results support my seventh hypothesis, namely, that girls are better language learners. From the results it is seen that girls tend to gain better marks of foreign language, they have higher verbal intelligence and better language aptitude.

CHAPTER 5: CONCLUSIONS

5.1 Summary of the findings

The aim of the research was to examine, if there were any correlations between parts of intelligence, language aptitude and foreign language learning achievement. The sample contained 70 high school students, aged between 15-17, attending two Hungarian schools in Ukraine. 51 participants reported themselves being monolingual, while 19 participants regarded themselves as bilingual, as they reported that they spoke Ukrainian or Romanian (besides Hungarian) on a native level. It was the other aim to compare the means of test scores between mono- and bilinguals. As the sample contained girls and boys, yet another aim was to compare the means of boys and girls, both between and within the monolingual-bilingual groups.

As hypothesized, each type of intelligence correlated with language learning achievement (and at the same time, with each other). Verbal intelligence correlated the most strongly with foreign language marks. Among the measured variables, language aptitude seemed to be the most essential one in language learning, as the total scores of the language aptitude test showed the highest correlation with students' marks of foreign language. Aspects of language aptitude requiring analytic abilities were more closely related to language learning achievement.

Language aptitude was proved to be closely related to general intelligence. Language aptitude related to each aspect of intelligence measured in the present study.

When the sample was split into two, i.e. when scores of bilinguals and monolinguals or boys and girls were treated separately, the degrees of correlations seemed to alter. Discrepancies were found in the results. Further research is needed to be carried out in the topic.

As far as the scores of different groups are concerned, it turned to be the case that, in general, monolinguals scored better at the test than bilinguals; among the two genders, these were girls, who overall scored better in the tests, and girls were proved to have higher marks as well. Results do not prove bilinguals being cognitively more advantaged; however it proved girls having higher verbal intelligence and better language aptitude.

5.2 Limitations and suggestions for further research

The research has a number of limitations. Among them is the relatively small number of participants. Statistically reliable conclusions cannot be made on the basis of data of such a small sample.

It would also be important to clarify the case of bilingualism, i.e. who is regarded as bilingual. However those who indicated at the beginning that were not native Hungarian speakers, were excluded from the research, they did not even get the tests. Those who had a bad mark of Hungarian language were also excluded. It was not controlled, whether the participants' stronger language was Hungarian or Ukrainian. The knowledge of the two native languages can be asymmetric. Some of the bilingual participants might have been better at Ukrainian which could also cause distorted results. However the fact that they had worse results even in those parts of the tests that did not require good Hungarian language skills itself questions their cognitive benefits of being bilingual over monolinguals. Further research should be done in the topic.

Besides intelligence and language aptitude, the importance of other variables as motivation, attitude, personality, cognitive style, gender, age is also needed to be investigated. It would be of crucial importance to define more precisely what the nature of intelligence and language aptitude is. Can they be developed, and how? What is the relationship between the different intelligences? Answering these questions can lead to methodological issues, and it can make language teaching more effective.

It is not known, whether language aptitude is fixed or it can be improved but, as far as tests developed to measure language aptitude include sections e.g. where participants have to analyse sentences in their native language, it is possible that metalinguistic knowledge can improve participants' performance in such tests. Question is, whether those individuals who learn to analyse sentences in their native language, are better foreign language learners.

04. 05. 2014.

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Appendix 1

Questionnaire

1.Név: _____

2.Évfolyam: _____

3.Életkor: _____

4.Nemed: fiú; ☐ lány ☐

5.Mi az anyanyelved?

☐ ukrán

☐ magyar

☐ magyar és ukrán (vagy egyéb).

6.Milyen idegen nyelvet tanulsz/tanultál eddig?

☐ angol

☐ német

☐ francia

☐ egyéb, éspedig: _____

7.Hányadik osztályban kezdted tanulni az adott nyelvet/ nyelveket?

1. angol: _____

2. német: _____

3. francia: _____

8.Félévvégi jegyed idegen nyelvből:

9.Félévvégi jegyed magyar nyelvből:

Appendix 2

Cognitive Abilities Test (Kognitív képességvizsgáló teszt): V-1 teszt

26. nehéz	A	B	C	D	E
	könnyű	masszív	kövér	tekintélyes	gyenge
27. részlet	A	B	C	D	E
	rész	biztosítás	egyes dolog	jegyzet	ellenkezője valaminek
28. küldött	A	B	C	D	E
	képviselő	szóvivő	udvarmester	elnök	fogoly
29. semleges	A	B	C	D	E
	közömbös	mérsékelt	tárgyilagos	pártatlan	passzív
30. revideál	A	B	C	D	E
	visszajön	javít	rebellál	beszámol	változtat
31. univerzum	A	B	C	D	E
	földgolyó	világmindenség	planetárium	Tejút	csillagos ég
32. diagnózis	A	B	C	D	E
	besugárzás	gyógyítás	meghatározás	kezelés	rendelet
33. kedvezés	A	B	C	D	E
	óvás	előrejutás	megvesztegetés	elősegítés	kegyeltség
34. intakt	A	B	C	D	E
	eltört	megsérült	sértetlen	gyűrött	zavart
35. szolgálat	A	B	C	D	E
	utasítás	megakadályozás	gondozás	érdem	kiegyenlítés
36. meghiúsít	A	B	C	D	E
	megszépít	megakadályoz	elpazarol	megbocsát	megpróbál

37.	A	B	C	D	E
együttes	kiegészítés	színjátszó	team	színpad	színház
38.	A	B	C	D	E
elítélés	gyanúsítás	felmentés	remény	vétkesnek nyilvánítás	rábizonyítás
39.	A	B	C	D	E
prezent	ajándék	elnök	minta	jelenlét	jelenkor
40.	A	B	C	D	E
váratlanul	különösen	hirtelen	észrevétlen	nemkívánt	evidens
41.	A	B	C	D	E
emigráns	menekült	szökevény	utazó	kalandor	kivándorló
42.	A	B	C	D	E
eltorzít	maszkíroz	elváltoztat	elcsúfít	megrémül	átalakít
43.	A	B	C	D	E
rangbeli	parancsnok	beosztás	honfitárs	alkalmazott	azonos gondolkodású
44.	A	B	C	D	E
alak	lány	figura	fickó	külső	test
45.	A	B	C	D	E
féktelen	hiányos	könyörgő	türelmetlen	heves	kényszerítő
46.	A	B	C	D	E
álnév	valótlan	gúnyvers	könyvhamisítás	titkosírás	fedőnév
47.	A	B	C	D	E
túlragyog	süt	tútesz valamin	ragyog	fényesít	legyőz
48.	A	B	C	D	E
kormányfő	prédikáló	énekes	miniszter	képviselő	ügyvéd elnök

	A	B	C	D	E
49. hitelező	üggyvéd	becsüs	pénztáros	részvényes	kölcsönt ad
	A	B	C	D	E
50. titkos	sötét	lopott	elleplezett	profán	összeesküdött

V-2-teszt

26. Ezkell legyen, gyerekkoromtól fogva így teszem.

A helyes B hamis C fontos D jelentéktelen E kellemes

27. A gyógyulás első lépése, hogy felismerjük

A a receptet B a betegséget C az orvost D a nyugalmat E a beteget

28. Habeszélünk, ez azt jelenti, hogy jól beszélünk.

A kétértelműen B humorosan C homályosan D mesterkélten E érthetően

29. Évekkel ezelőtt volt,utoljára láttam.

A mert B hol C amíg D hogy E mialatt

30. A munkába fektetett a siker ára.

A energia B öröm C állandó D túlzott E idő

31. Az egyetlen időtálló államforma az, amelyben a törvény előtt minden ember.....

A igazságos B jó C egyenlő D ártatlan E becsületes

32. A természettudomány alapja a

A megfigyelés B kitalálás C tudás D elmélet E szorgalom

33. A "gyávaság" ellentéte a.....

A erény B árulás C okosság D bátorság E vakmerőség

34. Ha a polgárok becsületesek, aligha leheta kormányzat.

A rossz B demokratikus C tartós D elégséges E öreg

35. mások vagyonával nagyvonalúan bánni.

A kíváncsú B szükséges C jó D fontos E könnyű

36. Vádaskodásaidat korlátozd kevesekre, még havannak is!

A sportszerűtlen B igaziak C jogosan D számosan E kritikusan

37. **Bár a válasz nincs világosan megfogalmazva, ismereteid segítségével**

A feltárhatod

B tagadhatod

C előre megmondhatod

D igenelheted

E kiválaszthatod

38. **A kereslet megszabja egy dologde nem az értékét.**

A alkalmazhatóságát

B árát

C eladását

D hasznát

E jelentőségét

39. A tudomány tényekkel dolgozik, arra van beállítva, hogy a "hogyan kérdésre adjon választ, de sokszor tehetetlen, ha a? kérdésével találja szembe magát.

A miért B mikor C hol D ki E mi

40. Az ember, aki ebben a szakmában sikeres akar lenni,.....kell, legyen emberekkel bántani.

A képzettsége B energiája C képessége D eszköze E ideje

41. A siker azt jelenti, hogy azt kapjuk meg, amit kívánunk. A boldogság azt jelenti, hogy.....amit kapunk.

A kitaláljuk B visszautasítjuk C kívánjuk D megkapjuk E elfelejtjük

42. Az egészséges életmódteszi az orvost.

A beteggé B gondterheltté C gazdaggá D elégedetté E szegénnyé

43. E győzelem története az egyik legizgalmasabb, ami avalaha hallott.

A társaság B világ C futurologia D szépirodalom E akadémia

44. Ha nem kapunk adóértesítést, az még nem jelenti, hogy nem kellfizetni.

A büntetést B kutyaadót C jelzalogot D adót E kártérítést

45. Ahol gyalulnak, ott

A zaj van B forgács is hull C faragnak D egyszerű E simulnak

46. Sok ember azért képes, mert azt hiszi, hogy ő.....

A buta B ügyes beszédű C képes D szeretetreméltó E szerény

47. Az emberek nem mindig azok, aminek

A gondolják B vélik C akarnak D látszanak E hisznek

48. Az ősz haj legtöbbször a kor jele, nem a

A hiúságé B betegsége C bánaté D kétségbeesése E bölcsességé

49. Komputerek megkönnyítik az ember számára a nehéz számolási munkát, de mégsem képesek.....

A túlszámolni B pótolni C kielégíteni D boldoggá tenni E megjavítani

50. A bizottság elnöke.....hívott össze egy találkozót, ezért nem történt semmi.

A néha B állandóan C szándékosan D váratlanul E soha

V-3-teszt

26. **autó, vonat, teherautó, busz**

A kocsi B taxi C jármű D motor E tandem

27. **kacsa, tyúk, pulyka**

A héja B papagáj C liba D kanári E fecske

28. **dió, mandula, mogyoró**

A bokor B spárga C bab D borsó E gesztenye

29. **csokornyakkendő, nyakkendő, nyakravaló**

A előke B nyaklánc C sál D szalvéta E öv

30. **egyenes, sík, sima**

A könnyű B puha C szilárd D lapos E folyékony

31. **font, méter, fok, perc**

A mérték B kvantum C érték D liter E pénz

32. **borjú, bárány, malac**

A tehén B csikó C oroszlán D állat E öleb

33. **mindenek előtt, elvileg, főként**

A alapvetően B ideális esetben C legkorábban D kiemelkedő E okos

34. **Párizs, Brüsszel, Madrid, Amszterdam**

A Belgium B Hamburg C London D Dánia E New York

35. **kétségtelen, vitathatatlan, cáfolhatatlan**

A nem mérlegelendő B ellenállhatatlan C tagadhatatlan D felelőtlen E elképzelhetetlen

36. **karikatúra, bohózat, szatíra, komédia**

A reflexió B echo C paródia D szimuláció E papagáj

37. **lucfenyő, tiszafa, jegenyefenyő**

A tölgy B bükk C nyírfa D pálma E vörösfenyő

38.	homár, pezsgő, fácán, praliné								
A	grapefruit	B	kaviár	C	keksz	D	bor	E	pisztráng
39.	erkölcsös, morális, jól nevelt								
A	művelt	B	erényes	C	szorgalmas	D	törvényes	E	példás
40.	betű, szó, mondat								
A	könyv	B	írásjel	C	történelem	D	fejezet	E	szótag
41.	kapa, gereblye, ásó, sarló								
A	sövény	B	borona	C	olló	D	seprű	E	lapát
42.	fa, ág, gally								
A	virág	B	törzs	C	faanyag	D	kéreg	E	korona
43.	tollaslabda, golf, tenisz								
A	sport	B	csapat	C	futball	D	játék	E	labda
44.	titokban, rejtve, titkosan								
A	visszafogottan	B	lopva	C	rejtélyesen	D	privát	E	misztikusan
45.	csal, becsap, hazudik (csal)								
A	elkótyavetyél	B	irritál	C	alkuszik	D	hamisít	E	rászed
46.	Merkur, Vénusz, Jupiter, Szaturnusz								
A	Minerva	B	Zeusz	C	Juno	D	Mars	E	Orion
47.	óceán, tengeröböl, öböl								
A	tenger	B	áradat	C	víztároló	D	tó	E	delta-torkolat
48.	farkas, róka, sakál, dingó								
A	medve	B	jávorszarvas	C	oroszlán	D	prérifarkas	E	borz
49.	vonal, útírány, sín, útvonal								
A	széle valaminek	B	csík	C	vasút	D	sugár	E	útszakasz
50.	valcer, polka, tangó, charleston								
A	balett	B	maskarádé	C	bál	D	zenekar	E	menüett

V-4-teszt

-
21. **tea – kávé,** **kenyér -**
A zsömlé B vaj C lekvár D tej E keksz
-
22. **eladás – előállító,** **vásárlás -**
A kiskereskedelem B nagykereskedő C használó D kereskedő E áruk
-
23. **minden egyes – mindenki,** **senki -**
A egyik B semmi C egyes D kevés E senki sem
-
24. **rádió – doboz,** **hegedű -**
A vonó B fogó C húrok D vonósnégyes E tok
-
25. **grapefruit - narancs** **citrom -**
A sav B alma C őszibarack D pici, édesebb citrom E C-vitamin
-
26. **baklövés – ügyetlen,** **találat -**
A ügyes B jártas C leleményes D okos E szellemes
-
27. **céloz – puska,** **talál -**
A megsebesít B vérzik C labda D golyó E ütés
-
28. **dob – verő,** **hegedű -**
A fogó B kolofónium C húrláb D húrok E vonó
-
29. **anekdota – elbeszélő,** **portré -**
A színész B művész C regényíró D festő E kép
-
30. **piros – zöld,** **veszély -**
A jel B tűz C biztonság D stop E baleset
-

31. **vonós hangszer - pengetős hangszer, brácsa -**

A tuba B hárfa C kontrabasszus D gamba E fagott

32. **kvadrát – terület, köbméter -**

A oldal B űrtartalom C él D tér E gömb

33. **lökés – mozgás, inger -**

A báj B reakció C impulzus D következmény E ösztönzés

34. **orvos – ember, állatorvos -**

A veterán B kólika C tanya D állat E medicina

35. **botanika – flóra, zoológia -**

A állattan B ökológia C menazséria D fauna E biológia

36. **pikkely – hal, héj -**

A korallszirt B osztrigatelep C gyöngy D osztriga E mag

37. **költemény – líra, elbeszélés -**

A költemény B irodalom C próza D novella E regény

38. **kérelem – kibocsátás, törvényjavaslat -**

A szövetségi
parlament B többség C törvény D óvás E szavazat

39. **analízis – szintézis, differenciálás -**

A kutatás B szisztematika C szervezet D integráció E szegregáció

40. **törvényhozás – parlament, végrehajtás -**

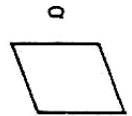
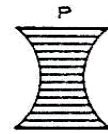
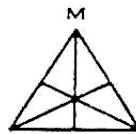
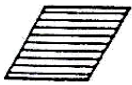
A parlament B önkormányzat C kabinet D alkotmány E kormányzat

... ..

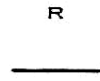
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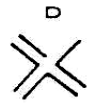
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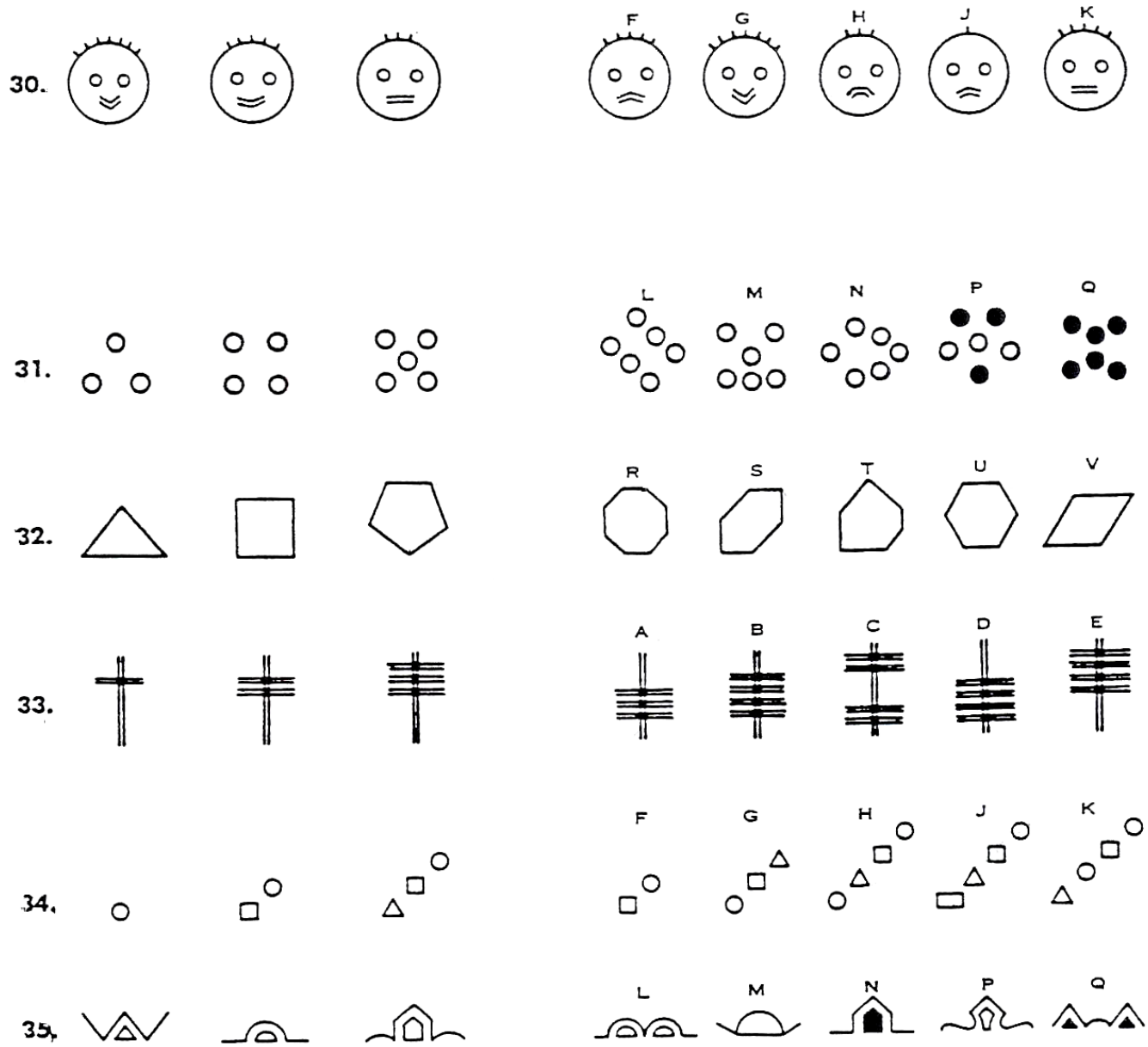


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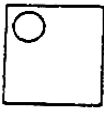
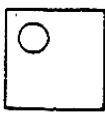
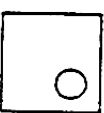
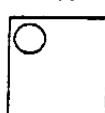
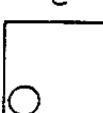
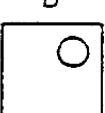
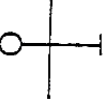
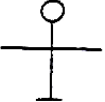
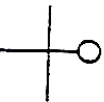
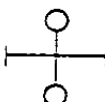
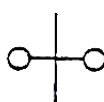
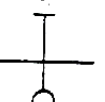
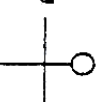
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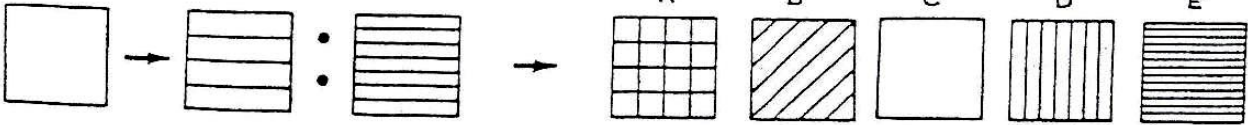
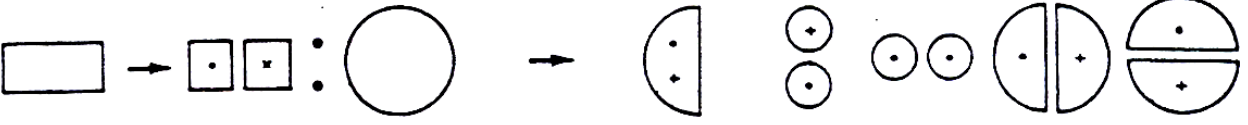
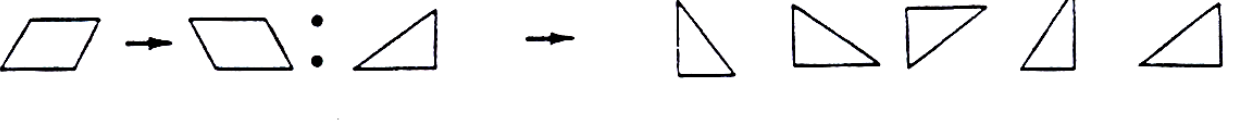
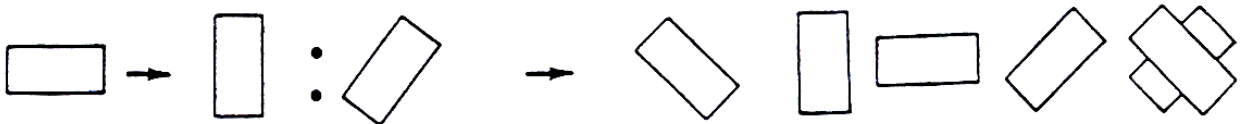


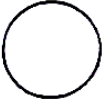
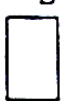
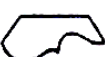
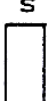
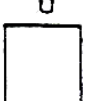


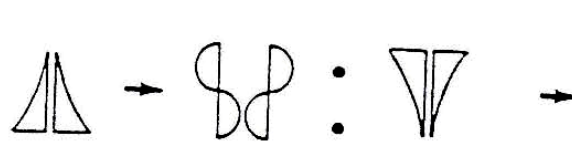
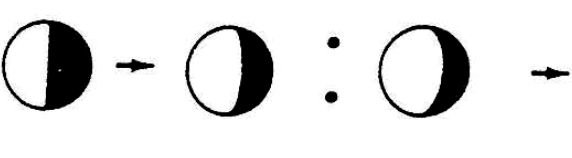
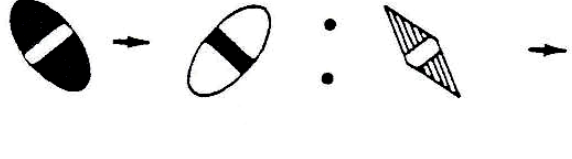
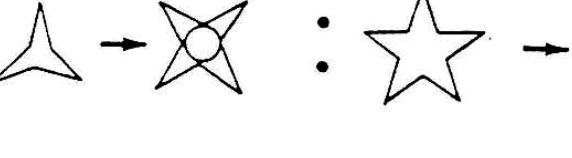
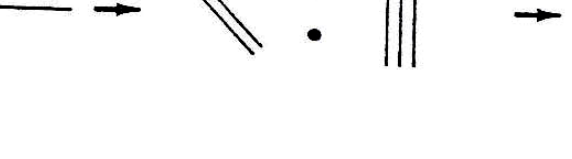
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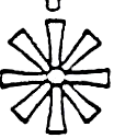
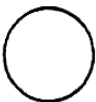
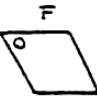
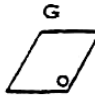
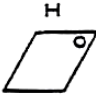
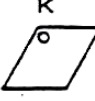
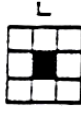
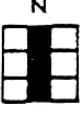
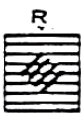
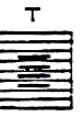
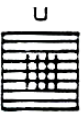
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27.	8b	7d	6f	5h	→	L	4i	M	4j	N	4k	P	3j	Q	3k				
28.	806	617	826	637	→	R	648	S	826	T	827	U	846	V	856				
29.	$\frac{1}{2}$	$\frac{3}{2}$	$\frac{3}{4}$	$\frac{5}{4}$	$\frac{5}{6}$	→	A	$\frac{5}{8}$	B	$\frac{6}{5}$	C	$\frac{6}{8}$	D	$\frac{7}{6}$	E	$\frac{7}{8}$			
30.	16	21	23	24	29	31	32	→	F	34	G	35	H	36	J	37	K	38	
31.	ax	bw	cv	du	et	→	L	fu	M	ft	N	fs	P	eu	Q	es			
32.	7	13	9	15	11	17	13	→	R	11	S	13	T	15	U	17	V	19	
33.	a+c	b+d	c+e	d+f	→	A	d+g	B	e+f	C	e+g	D	f+g	E	f+h				
34.	30	36	22	28	15	21	9	→	F	4	G	6	H	10	J	12	K	15	
35.	129	257	385	413	→	L	451	M	531	N	533	P	541	Q	542				
36.	16	28	8	14	4	7	→	R	$\frac{1}{2}$	S	1	T	$\frac{3}{2}$	U	2	V	$\frac{7}{2}$		
37.	2	2	5	4	4	10	6	6	→	A	3	B	8	C	12	D	14	E	15
38.	135	45	180	60	240	80	→	F	$\frac{1}{3}$	G	20	H	40	J	80	K	320		
39.	2	6	4	12	6	18	→	L	8	M	10	N	12	P	24	Q	54		
40.	2	8	5	20	17	68	65	→	R	61	S	62	T	65	U	195	V	260	
41.	36	35	32	27	26	23	18	→	A	13	B	14	C	15	D	16	E	17	
42.	4	2	10	8	40	38	190	→	F	93	G	95	H	188	J	192	K	950	
43.	42	38	35	34	30	27	26	→	L	22	M	23	N	24	P	25	Q	26	
44.	3s-2t	5t+3s	7u-4r	9v+5q	→	R	11w+6p	S	11w-6p	T	11v-6q	U	11x-6q	V	11x+6q				
45.	$\frac{1}{2}$	$\frac{2}{3}$	$\frac{3}{5}$	$\frac{4}{6}$	$\frac{5}{8}$	$\frac{2}{3}$	→	A	$\frac{6}{11}$	B	$\frac{7}{10}$	C	$\frac{7}{11}$	D	$\frac{8}{11}$	E	$\frac{8}{13}$		
46.	5	12	9	16	13	20	→	F	14	G	17	H	20	J	21	K	24		
47.	0	3	8	15	24	35	→	L	40	M	42	N	44	P	46	Q	48		
48.	40	6	32	8	24	10	→	R	12	S	14	T	16	U	18	V	20		
49.	6	7	9	8	12	9	→	A	10	B	12	C	14	D	15	E	18		
50.	54	81	18	27	6	9	→	F	2	G	3	H	4	J	12	K	15		

31.  →  :  →     
32.  →  :  →     
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59.  →  :  →     
60.  →  :  →     

Appendix 3 (Table 1. Results (the table continues on the following page))

Name	Monolingual/Bilingual (1/2)	Gender: Male/Female 1/2	Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Intelligence total	Hidden sounds	Language analysis	Words in sentences	Vocabulary learning	Language aptitude total
1.	1	2	8	62	30	18	110	13	14	10	15	52
2.	1	1	10	66	34	18	118	13	16	16	11	56
3.	1	1	10	52	23	14	89	11	10	10	13	44
4.	2	1	9	50	15	12	77	10	10	5	20	45
5.	2	2	11	58	26	9	93	11	11	6	16	44
6.	1	2	10	74	25	18	117	14	15	9	18	56
7.	2	2	8	43	17	10	70	5	8	4	4	21
8.	2	2	7	42	23	12	77	6	5	4	20	35
9.	2	2	6	62	28	20	110	14	15	12	10	51
10.	1	2	11	72	23	14	109	14	16	10	16	56
11.	1	2	9	72	25	11	108	13	15	8	15	51
12.	2	2	10	69	29	22	120	12	12	12	13	49
13.	2	2	9	48	25	7	80	14	11	4	15	44
14.	1	1	7	49	21	5	75	12	11	6	13	42
15.	1	2	9	70	25	18	113	12	16	12	9	49
16.	1	1	7	47	20	8	75	4	6	4	20	34
17.	1	1	11	68	32	20	120	7	14	12	10	43
18.	1	1	7	68	23	8	99	7	13	9	14	43
19.	1	2	9	68	26	12	106	17	15	7	20	59
20.	1	2	9	73	20	14	107	9	12	8	20	49
21.	1	1	9	73	29	12	114	10	11	8	20	49
22.	2	2	7	50	21	5	76	6	8	3	19	36
23.	1	1	4	60	34	14	108	12	14	10	14	50
24.	1	1	6	48	20	13	81	8	8	7	12	35
25.	2	2	6	47	21	9	77	7	8	5	7	27
26.	2	1	6	45	20	10	75	8	11	8	16	43
27.	1	2	5	47	20	11	78	9	6	3	14	32
28.	1	1	7	52	16	11	79	10	10	6	6	32
29.	1	2	10	64	30	15	109	12	15	7	17	51
30.	1	2	7	50	27	5	82	11	14	6	20	51
31.	2	2	8	58	24	12	94	13	13	8	14	48
32.	1	2	8	58	26	4	88	12	14	7	16	49
33.	1	1	6	45	24	4	73	8	10	4	17	39
34.	2	2	8	48	21	5	74	8	8	3	20	39
35.	1	1	7	60	24	13	97	10	13	6	8	37
36.	1	2	5	60	27	9	96	11	7	5	13	36
37.	1	1	6	68	17	12	97	9	11	5	10	35
38.	1	1	7	70	23	5	98	7	7	4	8	26
39.	1	2	8	42	23	5	70	8	12	6	3	29
40.	1	2	10	70	28	10	108	12	14	10	17	53
41.	1	2	8	64	19	9	92	13	8	10	8	39

Name	Monolingual/Bilingual (1/2)	Gender: Male/Female 1/2	Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Intelligence total	Hiding sounds	Language analysis	Words in sentences	Learning words	Language aptitude total
42.	1	2	9	64	25	12	101	10	12	7	17	46
43.	1	1	7	44	27	11	82	12	12	4	6	34
44.	1	2	8	60	27	5	92	12	13	10	14	49
45.	2	1	6	49	17	5	71	9	5	4	6	24
46.	1	2	10	69	35	15	119	13	18	9	13	53
47.	2	1	6	47	16	7	70	7	5	6	5	23
48.	2	1	9	52	30	12	94	12	14	7	8	41
49.	1	2	10	64	21	9	94	12	10	9	15	46
50.	1	2	11	62	33	16	111	13	15	11	13	52
51.	2	2	10	68	33	16	117	12	16	5	14	47
52.	1	2	9	58	21	8	87	14	16	4	11	45
53.	1	1	10	60	26	20	106	10	11	11	20	52
54.	1	2	10	75	30	11	116	16	14	15	20	65
55.	1	2	11	73	32	15	120	18	19	10	20	67
56.	1	2	10	44	19	8	71	10	8	4	20	42
57.	1	2	11	55	25	10	90	18	19	13	17	67
58.	1	1	10	50	19	5	74	13	12	6	7	38
59.	1	1	9	50	27	7	84	9	12	5	20	46
60.	1	1	10	61	22	9	92	13	11	10	15	49
61.	1	2	7	52	18	4	74	9	10	7	11	37
62.	2	1	8	66	21	8	95	13	8	8	19	48
63.	1	1	7	48	21	5	74	10	9	6	13	38
64.	1	2	8	70	32	17	119	15	18	12	18	63
65.	1	1	8	64	22	8	94	14	12	8	14	48
66.	1	1	7	60	26	9	95	13	14	7	17	51
67.	2	2	7	47	20	4	71	9	9	6	15	39
68.	1	2	8	44	31	6	81	13	8	6	12	39
69.	2	2	9	52	15	6	73	7	8	6	18	39
70.	1	2	9	62	25	8	95	13	9	6	18	46
Mean:			8,27	58,03	24,29	10,56	92,87	11,01	11,63	7,44	14,1	44,19
Total:			12	95	40	25	160	20	20	20	20	80
Max:			11	75	35	22	120	18	19	16	20	67
Min:			4	42	15	4	70	4	5	3	3	21
SD:			1,69	9,83	5,03	4,63	16,19	2,96	3,45	2,96	4,68	9,93

Appendix 4

Correlations between measured variables in the whole sample (Figures 1-19)

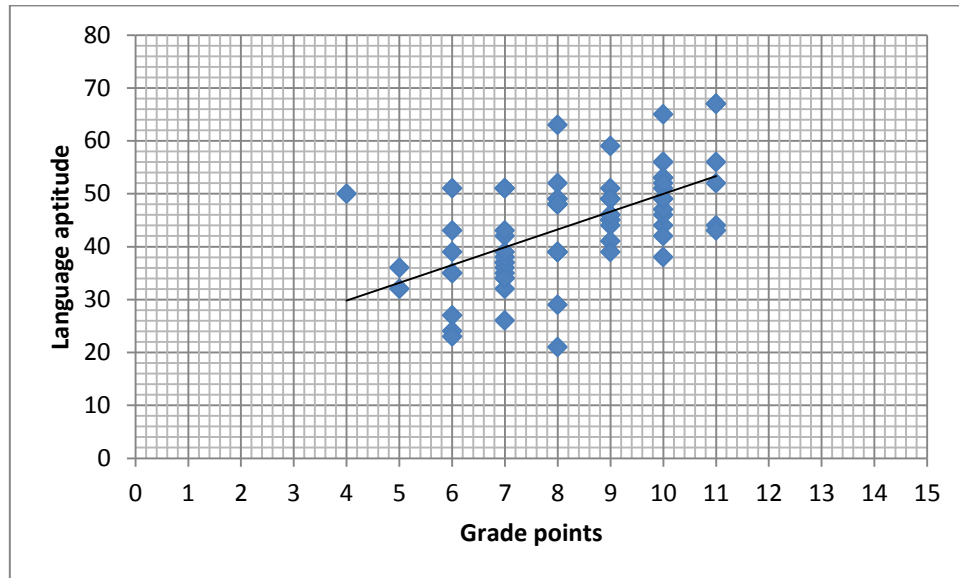


Figure 1. *The relationship between language aptitude and midterm marks of foreign language in the whole sample ($r=0.597$)*

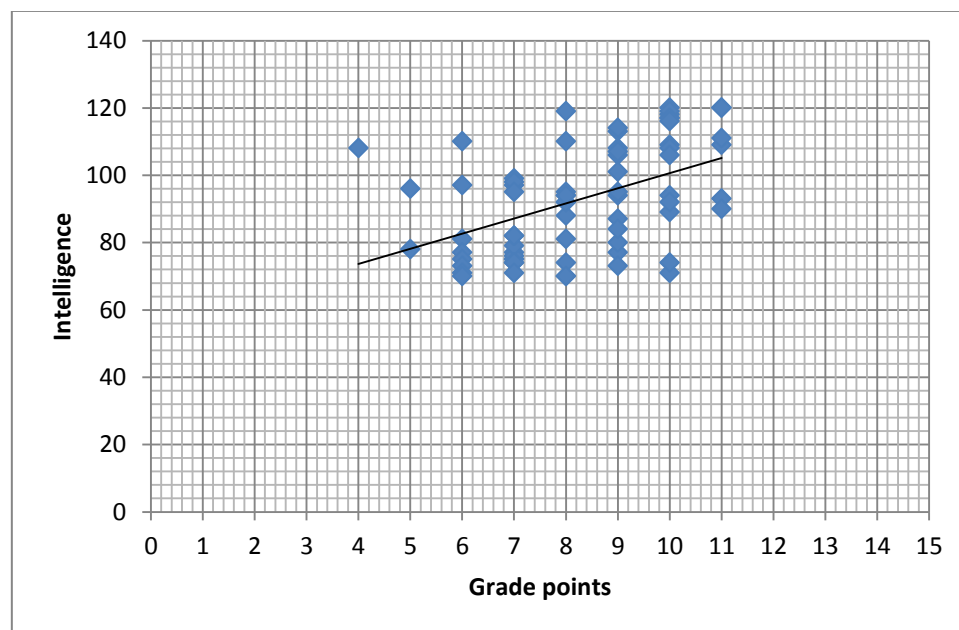


Figure 2. *The relationship between general intelligence and mid-term marks of foreign language in the whole sample ($r=0.465$)*

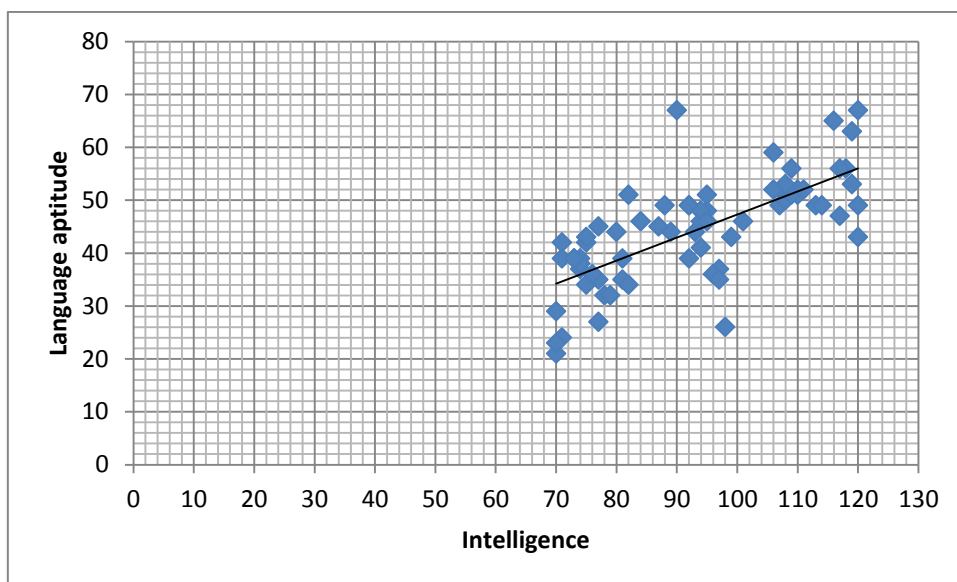


Figure 3. *The relationship between language aptitude and general intelligence in the whole sample ($r=0.729$)*

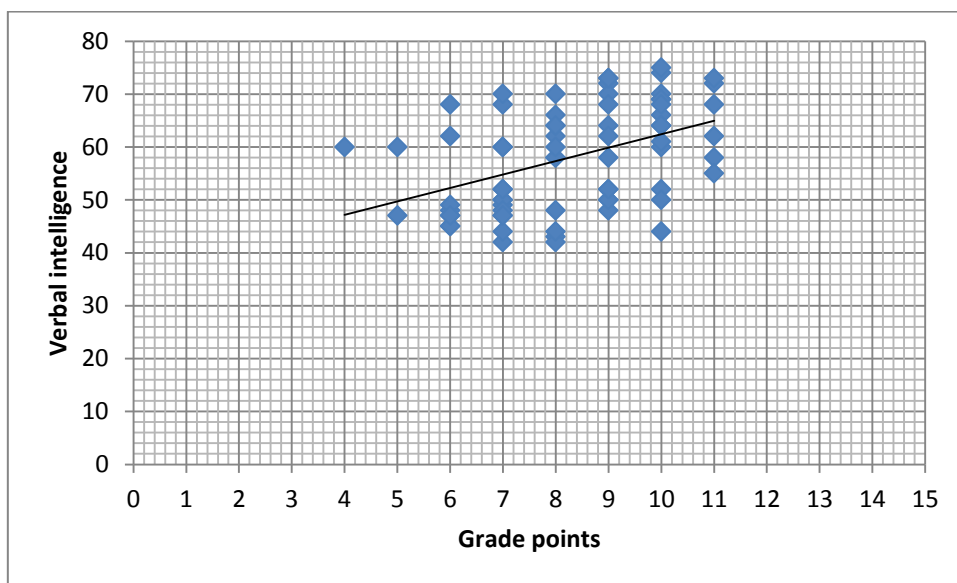


Figure 4. *The relationship between verbal intelligence and mid-term marks of foreign language in the whole sample ($r=0.472$)*

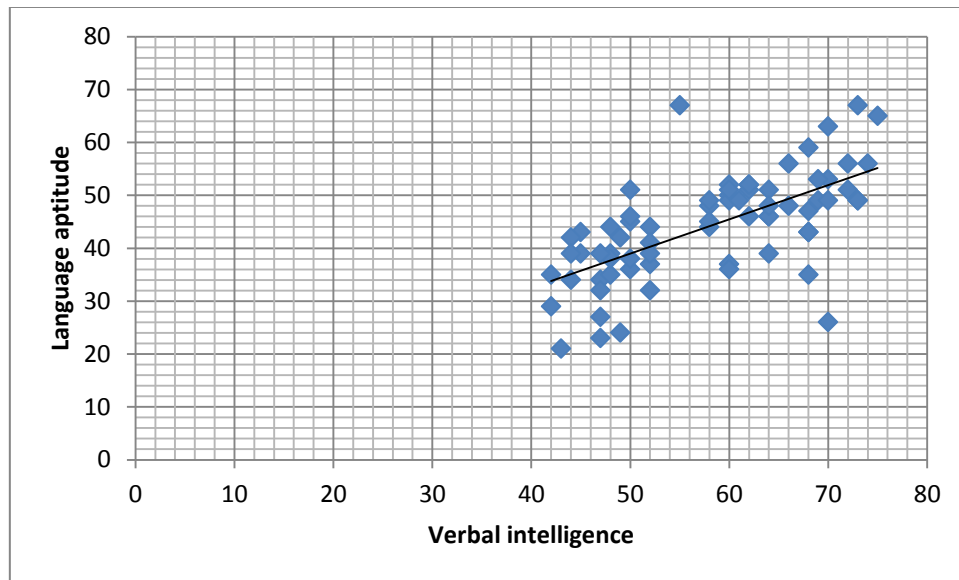


Figure 5. *The relationship between language aptitude and verbal intelligence in the whole sample ($r=0.675$)*

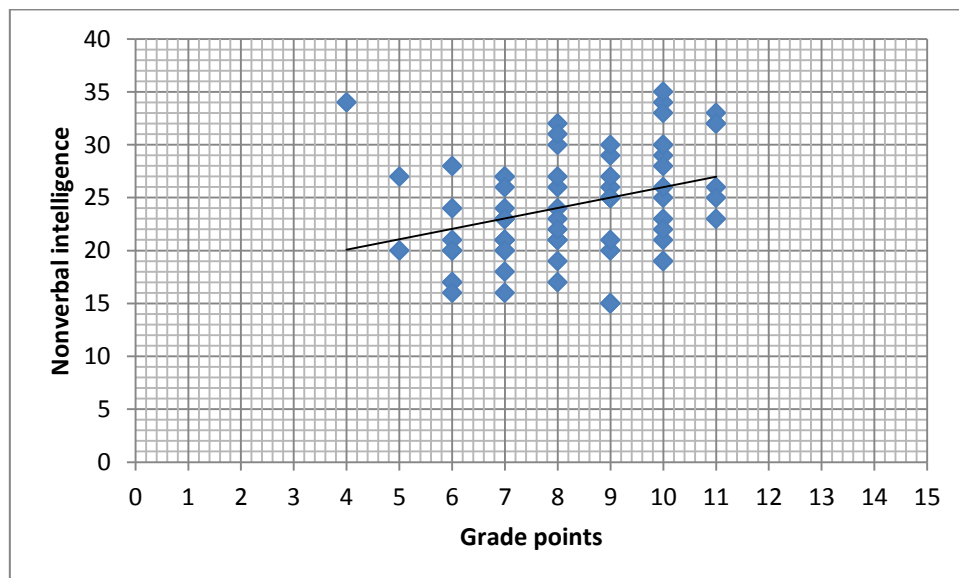


Figure 6. *The relationship between nonverbal intelligence and midterm results ($r=0.369$)*

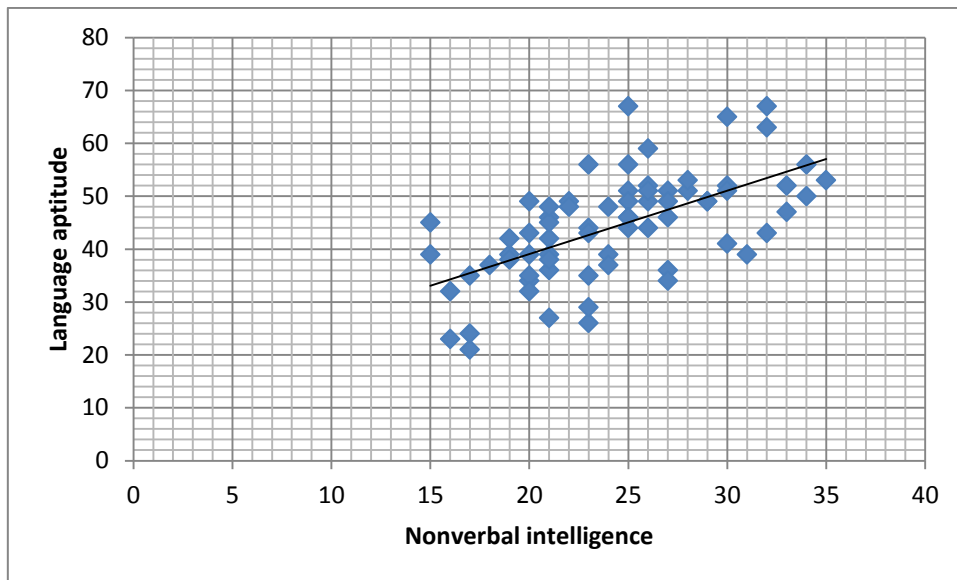


Figure 7. *The relationship between language aptitude and nonverbal intelligence ($r=0.644$)*

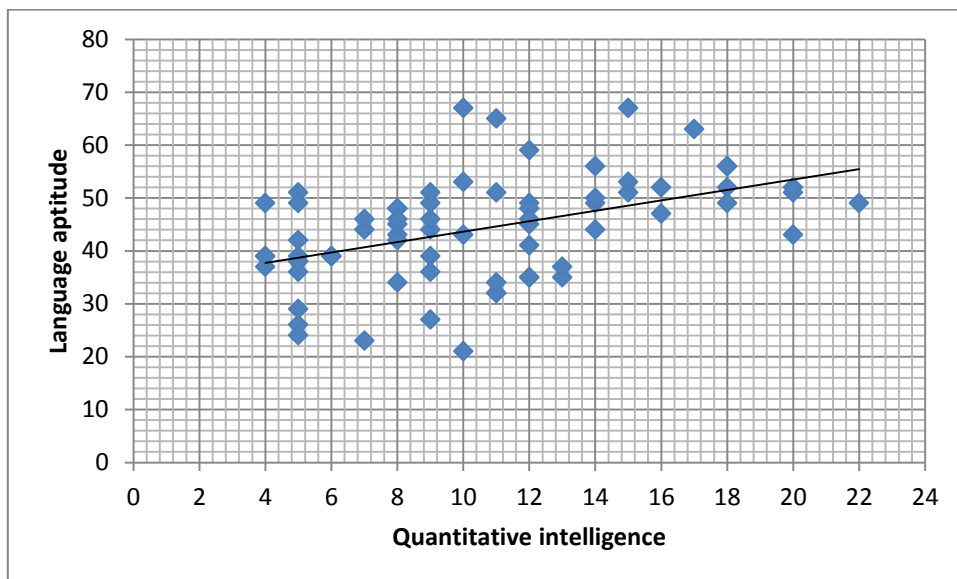


Figure 8. *The relationship between language aptitude and quantitative intelligence ($r=0.495$)*

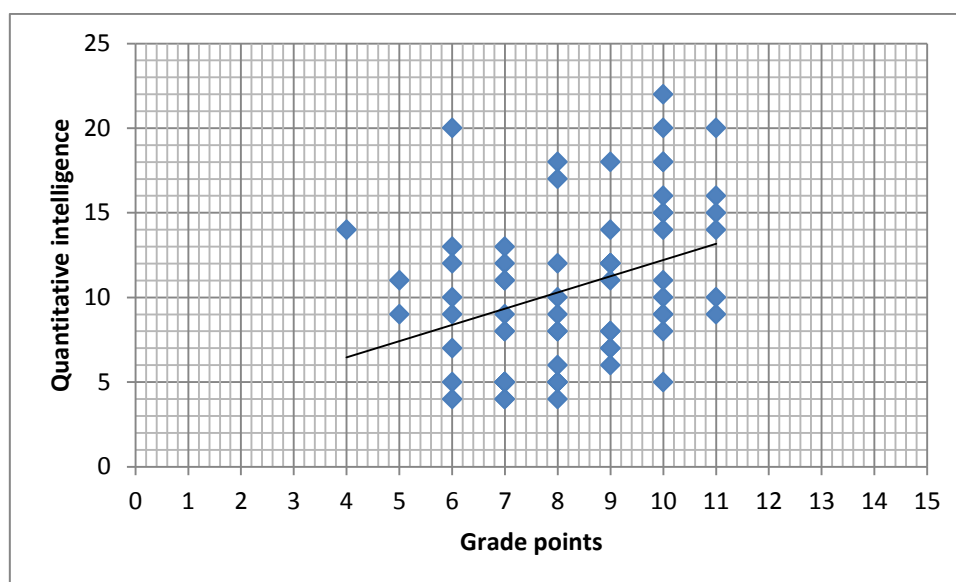


Figure 9. *The relationship between quantitative intelligence and midterm results ($r=0.377$)*

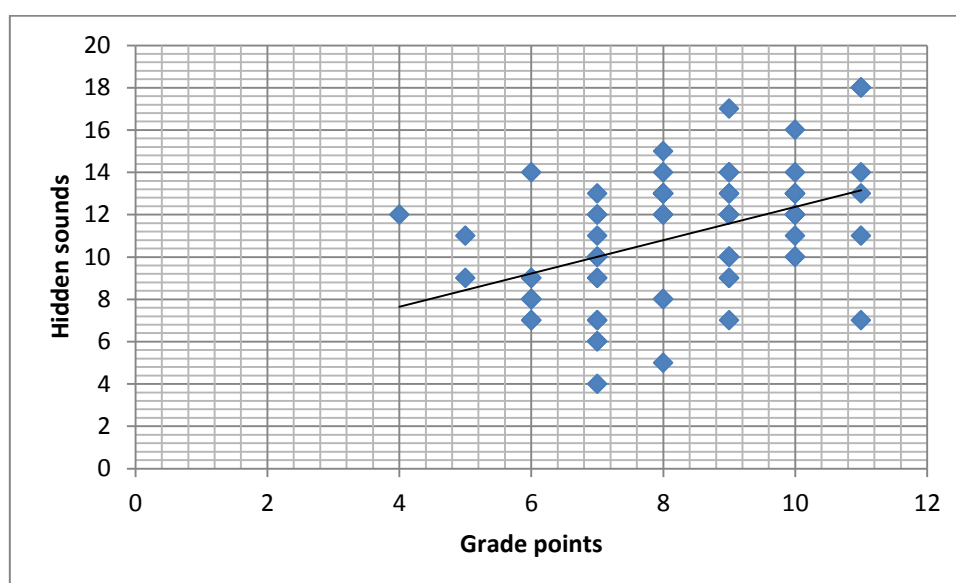


Figure 10. *The relationship between phonetic coding ability and midterm results ($r=0.462$)*

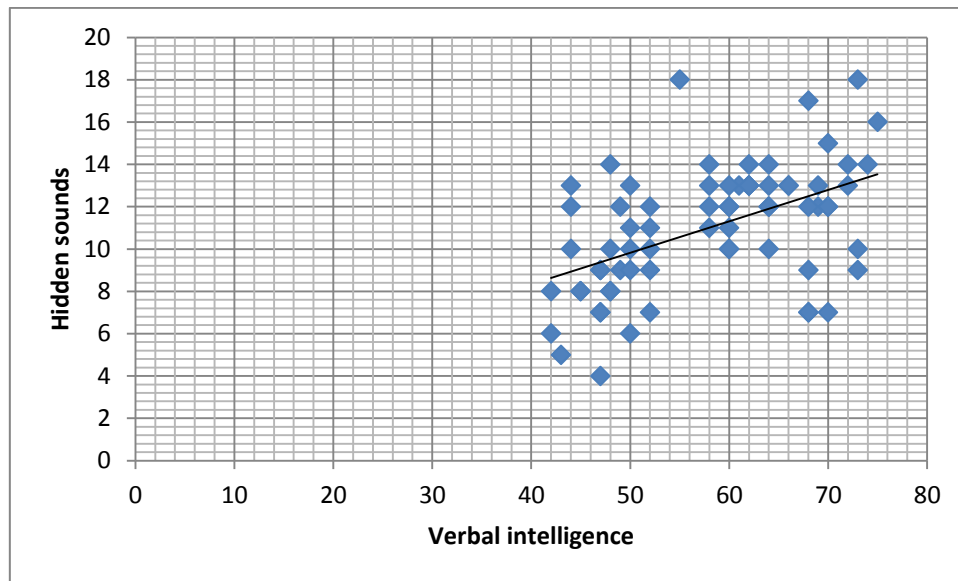


Figure 11. *The relationship between phonetic coding ability and verbal intelligence ($r=0.488$)*

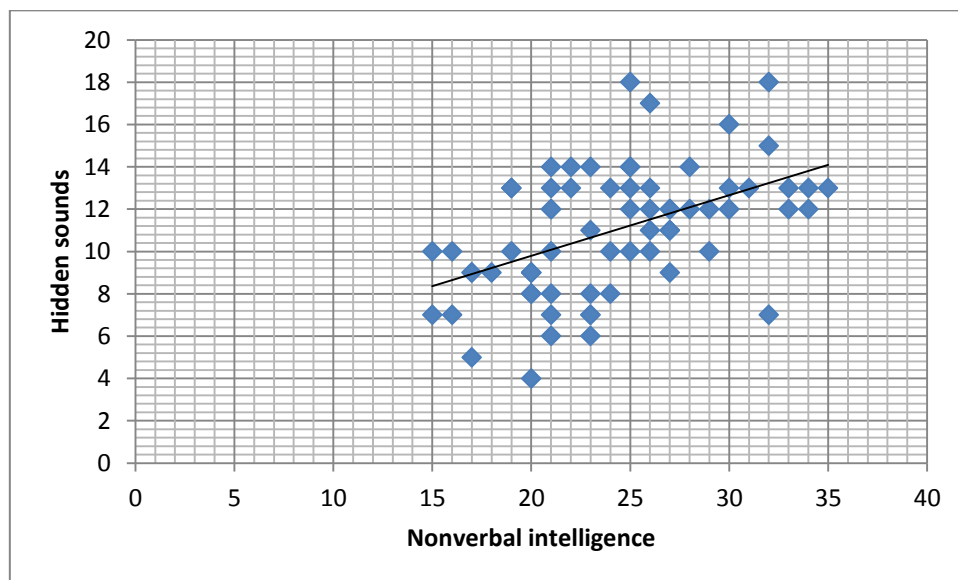


Figure 12. *The relationship between phonetic coding ability and nonverbal intelligence ($r=0.486$)*

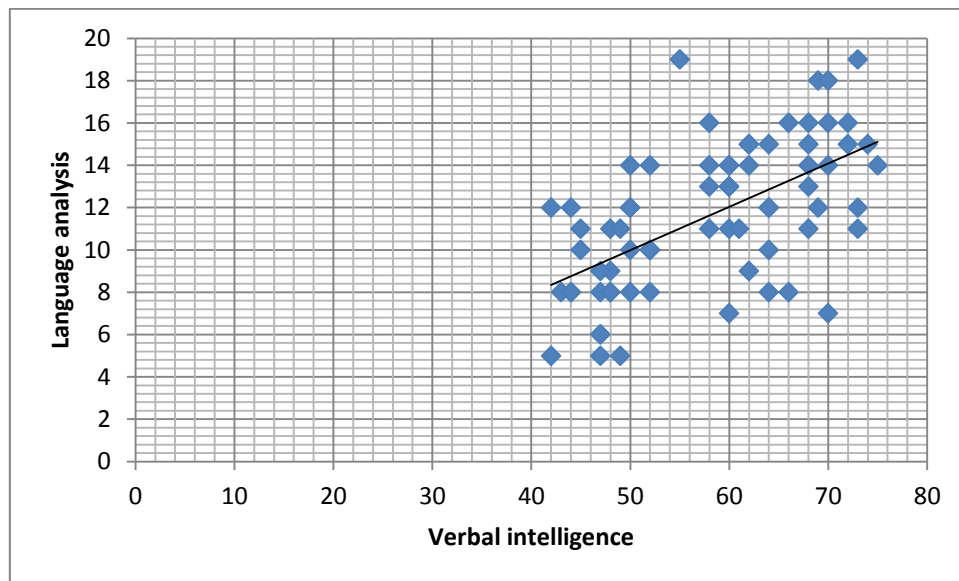


Figure 13. *The relationship between the Language analysis part of the aptitude test and verbal intelligence ($r=0.588$)*

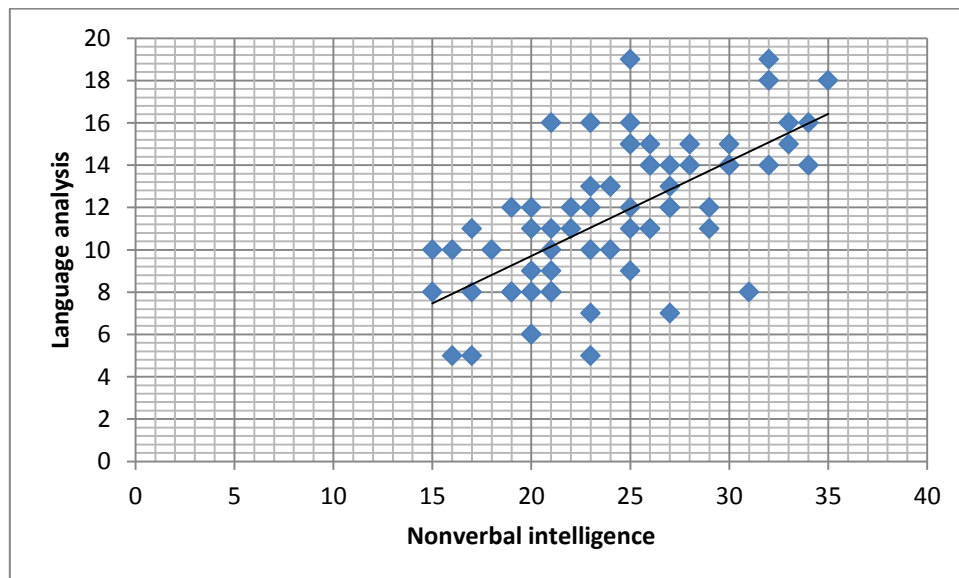


Figure 14. *The relationship between the Language analysis part of the aptitude test and nonverbal intelligence ($r=0.660$)*

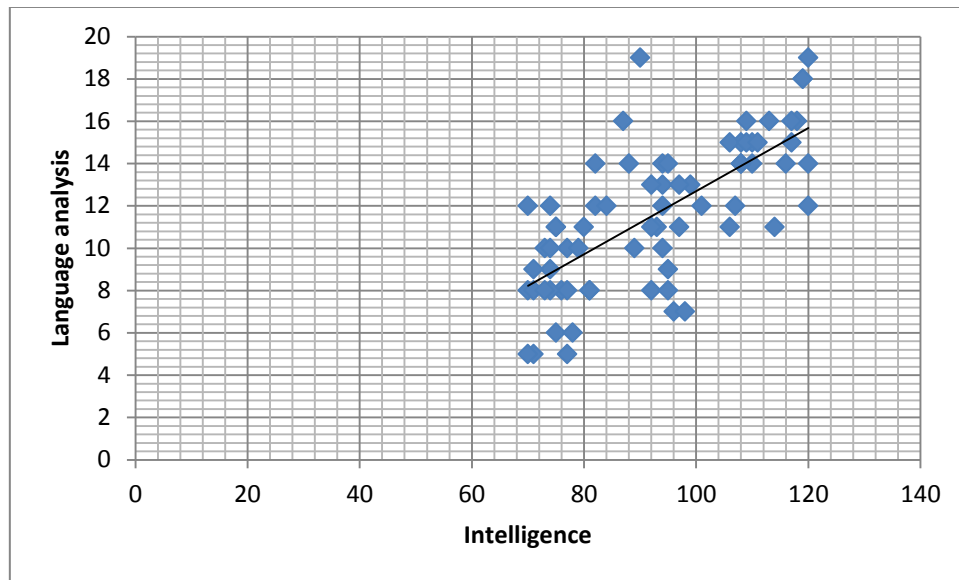


Figure 15. *The relationship between the Language analysis part of the aptitude test and general intelligence* ($r=0.692$)

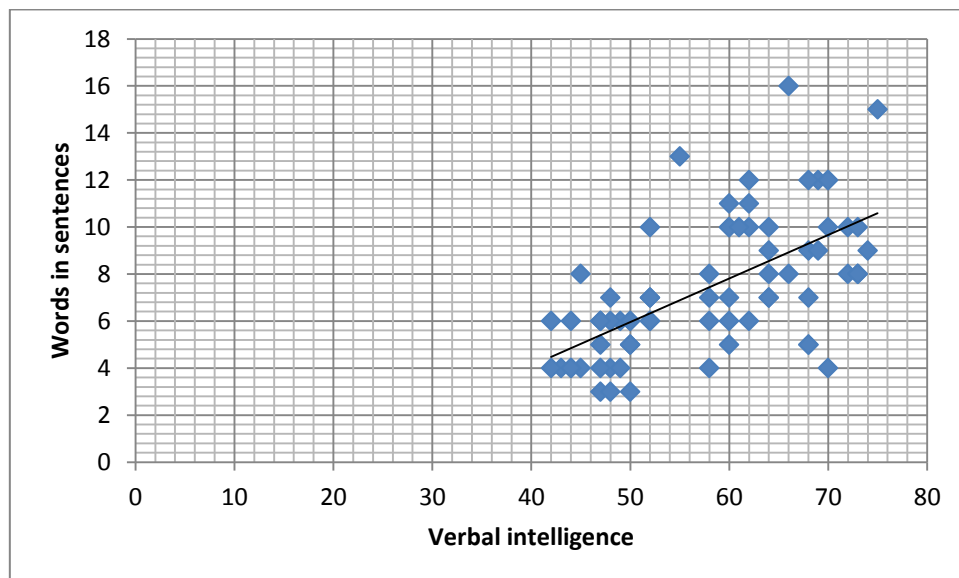


Figure 16. *The relationship between the Words in sentences part of the aptitude test and verbal intelligence* ($r=0.643$)

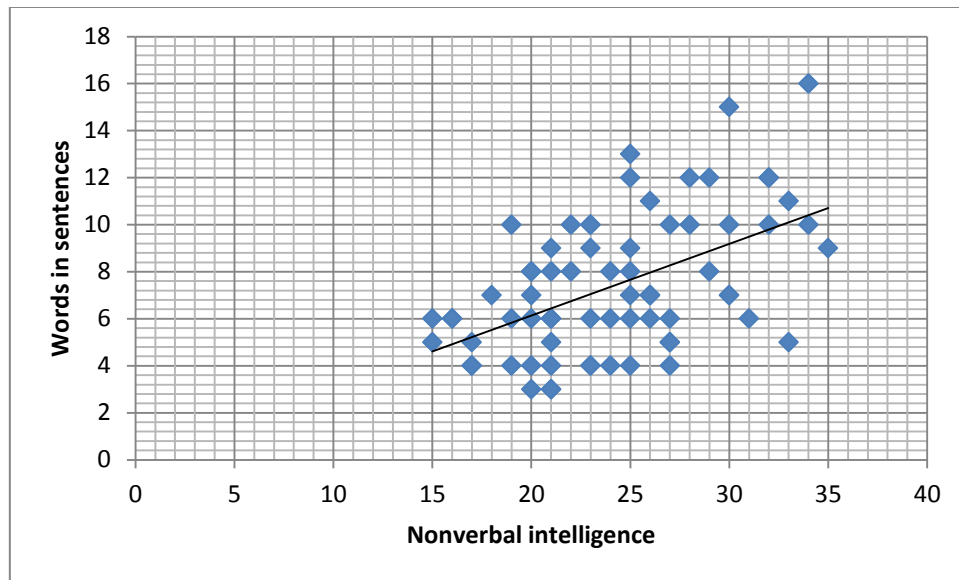


Figure 17. The relationship between the Words in sentences part of the aptitud test and nonverbal intelligence ($r=0.486$)

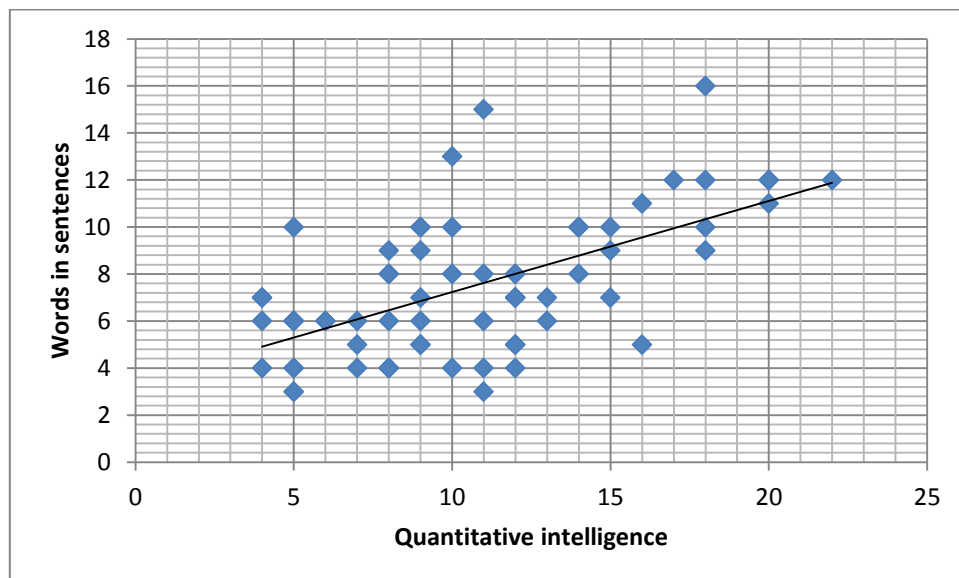


Figure 18. The relationship between quantitative intelligence and the Words in sentences part of the aptitude test ($r=0.566$)

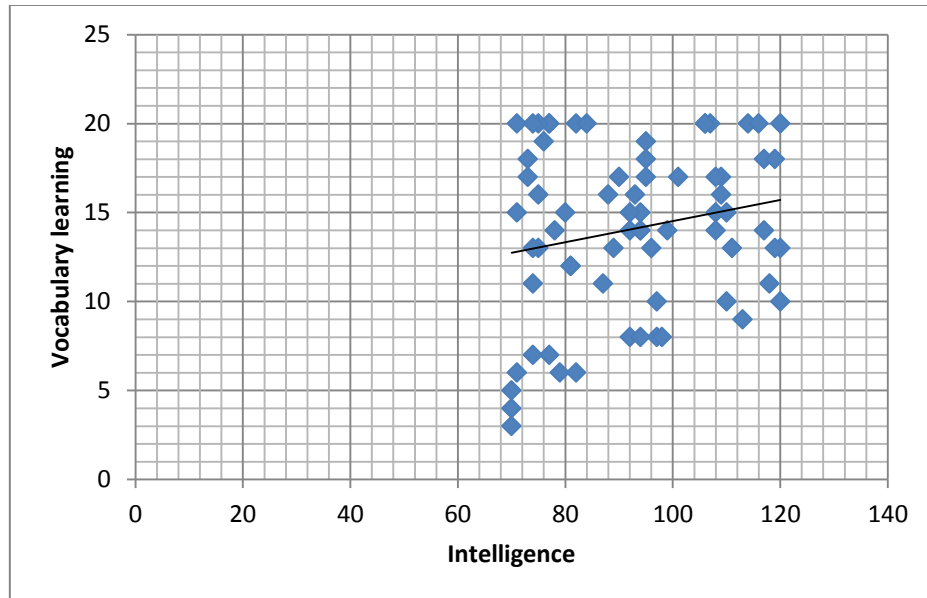


Figure 19. *The relationship between intelligence and vocabulary learning (there is not a statistically significant correlation between the two variables)*

Appendix 5

Results of the correlation test in the whole sample (Tables 2-8)

Table 2. *The relationship between students' language learning achievement and scores in the intelligence and language aptitude tests*

			Grade points	Intelligence total	Language aptitude total
Spearman's rho	Grade points	Correlation Coefficient	1,000	,465**	,597**
		Sig. (2-tailed)		,000	,000
		N	70	70	70
	Intelligence total	Correlation Coefficient	,465**	1,000	,729**
		Sig. (2-tailed)	,000		,000
		N	70	70	70
	Language aptitude total	Correlation Coefficient	,597**	,729**	1,000
		Sig. (2-tailed)	,000	,000	
		N	70	70	70

** Correlation is significant at the 0.01 level (2-tailed).

Table 3. *The relationship between students' scores in the subtests of CAT, their scores in the aptitude test and their midterm grade*

			Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Language aptitude total
Spearman's rho	Grade points	Correlation Coefficient	1,000	,472**	,369**	,377**	,597**
		Sig. (2-tailed)		,000	,002	,001	,000
		N	70	70	70	70	70
	Verbal intelligence	Correlation Coefficient	,472**	1,000	,447**	,531**	,675**
		Sig. (2-tailed)	,000		,000	,000	,000
		N	70	70	70	70	70
	Nonverbal intelligence	Correlation Coefficient	,369**	,447**	1,000	,476**	,644**
		Sig. (2-tailed)	,002	,000		,000	,000
		N	70	70	70	70	70
	Quantitative intelligence	Correlation Coefficient	,377**	,531**	,476**	1,000	,495**
		Sig. (2-tailed)	,001	,000	,000		,000
		N	70	70	70	70	70
	Language aptitude total	Correlation Coefficient	,597**	,675**	,644**	,495**	1,000
		Sig. (2-tailed)	,000	,000	,000	,000	
		N	70	70	70	70	70

** Correlation is significant at the 0.01 level (2-tailed).

Table 4. *The relationship of students' scores at the Hidden sounds subtest and other variables*

		Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Intelligence total
Spearman's rho						
Hidden sounds	Correlation Coefficient	,462**	,488**	,486**	,307**	,528**
	Sig. (2-tailed)	,000	,000	,000	,010	,000
	N	70	70	70	70	70

**.

Table 5. *The relationship of students' scores at the Language subtest and other variables*

		Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Intelligence total
Spearman's rho						
Language analysis	Correlation Coefficient	,503**	,588**	,660**	,513**	,692**
	Sig. (2-tailed)	,000	,000	,000	,000	,000
	N	70	70	70	70	70

**.

Table 6. *The relationship of students' scores at the Words in sentences subtest and other variables*

		Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Intelligence total
Spearman's rho						
Words in sentences	Correlation Coefficient	,461**	,643**	,486**	,566**	,685**
	Sig. (2-tailed)	,000	,000	,000	,000	,000
	N	70	70	70	70	70

**.

Table 7. *The relationship of students' scores at the Vocabulary learning subtest and other variables*

		Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Intelligence total
Spearman's rho						
Vocabulary learning	Correlation Coefficient	,285*	,188	,139	,026	,149
	Sig. (2-tailed)	,017	,119	,250	,832	,219
	N	70	70	70	70	70

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Appendix 6

The differences between the means of monolinguals' and bilinguals' test scores (Tables 8-10)

Table 8. Mean ranks (Mann-Whitney test)

Monolingual/Bilingual (1/2)		N	Mean Rank	Sum of Ranks
Grade points	1	51	37,40	1907,50
	2	19	30,39	577,50
	Total	70		
Verbal intelligence	1	51	39,59	2019,00
	2	19	24,53	466,00
	Total	70		
Nonverbal intelligence	1	51	38,49	1963,00
	2	19	27,47	522,00
	Total	70		
Quantitative intelligence	1	51	36,55	1864,00
	2	19	32,68	621,00
	Total	70		
Intelligence total	1	51	39,33	2006,00
	2	19	25,21	479,00
	Total	70		
Hidden sounds	1	51	38,78	1978,00
	2	19	26,68	507,00
	Total	70		
Language analysis	1	51	39,48	2013,50
	2	19	24,82	471,50
	Total	70		
Words in sentences	1	51	39,12	1995,00
	2	19	25,79	490,00
	Total	70		
Vocabulary learning	1	51	35,89	1830,50
	2	19	34,45	654,50
	Total	70		
Language aptitude total	1	51	39,07	1992,50
	2	19	25,92	492,50
	Total	70		

Table 9. Singificance of the differences (1.)

	Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Intelligence total
Mann-Whitney U	387,500	276,000	332,000	431,000	289,000
Wilcoxon W	577,500	466,000	522,000	621,000	479,000
Z	-1,300	-2,758	-2,019	-,709	-2,583
Asymp. Sig. (2-tailed)	,193	,006	,043	,478	,010
Exact Sig. (2-tailed)	,198	,005	,043	,483	,009
Exact Sig. (1-tailed)	,098	,003	,022	,242	,005
Point Probability	,001	,000	,000	,002	,000

a. Grouping Variable: Monolingual/Bilingual (1/2)

Table 10. Singificance of the differences (2.)

Test Statistics

	Hidden sounds	Language analysis	Words in sentences	Vocabulary learning	Language aptitude total
Mann-Whitney U	317,000	281,500	300,000	464,500	302,500
Wilcoxon W	507,000	471,500	490,000	654,500	492,500
Z	-2,230	-2,694	-2,455	-,266	-2,407
Asymp. Sig. (2-tailed)	,026	,007	,014	,791	,016
Exact Sig. (2-tailed)	,025	,006	,013	,795	,015
Exact Sig. (1-tailed)	,013	,003	,007	,397	,008
Point Probability	,000	,000	,000	,003	,000

Grouping Variable: Monolingual/Bilingual (1/2)

Appendix 7

Comparing the means of monolingual girls and boys (Tables 11-13)

Table 11. Mean ranks (Mann-Whitney test)

Gender: Male/Female 1/2		N	Mean Rank	Sum of Ranks
Grade points	1	22	20,77	457,00
	2	29	29,97	869,00
	Total	51		
Verbal intelligence	1	22	21,89	481,50
	2	29	29,12	844,50
	Total	51		
Nonverbal intelligence	1	22	22,86	503,00
	2	29	28,38	823,00
	Total	51		
Quantitative intelligence	1	22	24,91	548,00
	2	29	26,83	778,00
	Total	51		
Intelligence total	1	22	22,55	496,00
	2	29	28,62	830,00
	Total	51		
Hiding sounds	1	22	18,93	416,50
	2	29	31,36	909,50
	Total	51		
Language analysis	1	22	20,59	453,00
	2	29	30,10	873,00
	Total	51		
Words in sentences	1	22	23,00	506,00
	2	29	28,28	820,00
	Total	51		
Learning words	1	22	21,80	479,50
	2	29	29,19	846,50
	Total	51		
Language aptitude total	1	22	19,39	426,50
	2	29	31,02	899,50
	Total	51		

Table 12. *Singificance of the differences (1.)*

	Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Intelligence total
Mann-Whitney U	204,000	228,500	250,000	295,000	243,000
Wilcoxon W	457,000	481,500	503,000	548,000	496,000
Z	-2,224	-1,725	-1,316	-,458	-1,446
Asymp. Sig. (2-tailed)	,026	,085	,188	,647	,148
Exact Sig. (2-tailed)	,025	,085	,192	,653	,151
Exact Sig. (1-tailed)	,013	,043	,096	,327	,075
Point Probability	,000	,001	,002	,003	,001

a. Grouping Variable: Gender: Male/Female 1/2

Table 13. *Singificance of the differences (2.)*

	Hidden sounds	Language analysis	Words in sentences	Vocabulary learning	Language aptitude total
Mann-Whitney U	163,500	200,000	253,000	226,500	173,500
Wilcoxon W	416,500	453,000	506,000	479,500	426,500
Z	-2,987	-2,275	-1,266	-1,771	-2,772
Asymp. Sig. (2-tailed)	,003	,023	,206	,077	,006
Exact Sig. (2-tailed)	,002	,022	,209	,077	,005
Exact Sig. (1-tailed)	,001	,011	,105	,039	,002
Point Probability	,000	,000	,002	,001	,000

a. Grouping Variable: Gender: Male/Female 1/2

Appendix 8

Correlations in monolinguals (Tables: 14-15)

Table 14. *Correlations between monolingual students' language learning achievement, general intelligence and language aptitude*

			Grade points	Intelligence total	Language aptitude total
Spearman's rho	Grade points	Correlation Coefficient	1,000	,468**	,624**
		Sig. (2-tailed)		,001	,000
		N	51	51	51
	Intelligence total	Correlation Coefficient	,468**	1,000	,692**
		Sig. (2-tailed)	,001		,000
		N	51	51	51
	Language aptitude total	Correlation Coefficient	,624**	,692**	1,000
		Sig. (2-tailed)	,000	,000	
		N	51	51	51

** . Correlation is significant at the 0.01 level (2-tailed).

Table 15. *Correlations between monolingual students' language learning achievement, language aptitude and different aspects of intelligence*

			Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Language aptitude total
Spearman's rho	Grade points	Correlation Coefficient	1,000	,432**	,299*	,413**	,624**
		Sig. (2-tailed)		,002	,033	,003	,000
		N	51	51	51	51	51
	Verbal intelligence	Correlation Coefficient	,432**	1,000	,320*	,541**	,594**
		Sig. (2-tailed)	,002		,022	,000	,000
		N	51	51	51	51	51
	Nonverbal intelligence	Correlation Coefficient	,299*	,320*	1,000	,422**	,619**
		Sig. (2-tailed)	,033	,022		,002	,000
		N	51	51	51	51	51
	Quantitative intelligence	Correlation Coefficient	,413**	,541**	,422**	1,000	,486**
		Sig. (2-tailed)	,003	,000	,002		,000
		N	51	51	51	51	51
	Language aptitude total	Correlation Coefficient	,624**	,594**	,619**	,486**	1,000
		Sig. (2-tailed)	,000	,000	,000	,000	
		N	51	51	51	51	51

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Appendix 9

Correlations in bilinguals (Tables 16-17)

Table 16. *Correlations between bilingual students' language learning achievement, general intelligence and language aptitude*

			Grade points	Intelligence total	Language aptitude total
Spearman's rho	Grade points	Correlation Coefficient	1,000	,472*	,451
		Sig. (2-tailed)		,041	,053
		N	19	19	19
	Intelligence total	Correlation Coefficient	,472*	1,000	,850**
		Sig. (2-tailed)	,041		,000
		N	19	19	19
	Language aptitude total	Correlation Coefficient	,451	,850**	1,000
		Sig. (2-tailed)	,053	,000	
		N	19	19	19

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 17. *Correlations between bilingual students' language learning achievement, language aptitude and different aspects of intelligence*

			Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Language aptitude total
Spearman's rho	Grade points	Correlation Coefficient	1,000	,551*	,397	,291	,451
		Sig. (2-tailed)		,015	,093	,227	,053
		N	19	19	19	19	19
	Verbal intelligence	Correlation Coefficient	,551*	1,000	,531*	,393	,782**
		Sig. (2-tailed)	,015		,019	,096	,000
		N	19	19	19	19	19
	Nonverbal intelligence	Correlation Coefficient	,397	,531*	1,000	,550*	,567*
		Sig. (2-tailed)	,093	,019		,015	,011
		N	19	19	19	19	19
	Quantitative intelligence	Correlation Coefficient	,291	,393	,550*	1,000	,565*
		Sig. (2-tailed)	,227	,096	,015		,012
		N	19	19	19	19	19
	Language aptitude total	Correlation Coefficient	,451	,782**	,567*	,565*	1,000
		Sig. (2-tailed)	,053	,000	,011	,012	
		N	19	19	19	19	19

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Appendix 10

Correlations in boys (Tables 18-23)

Table 18. *Correlations between boys' language learning achievement, language aptitude and general intelligence*

			Grade points	Intelligence total	Language aptitude total
Spearman's rho	Grade points	Correlation Coefficient	1,000	,373	,501**
		Sig. (2-tailed)		,050	,007
		N	28	28	28
	Intelligence total	Correlation Coefficient	,373	1,000	,565**
		Sig. (2-tailed)	,050		,002
		N	28	28	28
	Language aptitude total	Correlation Coefficient	,501**	,565**	1,000
		Sig. (2-tailed)	,007	,002	
		N	28	28	28

** . Correlation is significant at the 0.01 level (2-tailed).

Table 19. *Correlations between boys' language learning achievement, language aptitude and different aspects of intelligence*

			Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence
Spearman's rho	Grade points	Correlation Coefficient	1,000	,400*	,332	,312
		Sig. (2-tailed)		,035	,084	,106
		N	28	28	28	28
	Verbal intelligence	Correlation Coefficient	,400*	1,000	,356	,344
		Sig. (2-tailed)	,035		,063	,073
		N	28	28	28	28
	Nonverbal intelligence	Correlation Coefficient	,332	,356	1,000	,404*
		Sig. (2-tailed)	,084	,063		,033
		N	28	28	28	28
	Quantitative intelligence	Correlation Coefficient	,312	,344	,404*	1,000
		Sig. (2-tailed)	,106	,073	,033	
		N	28	28	28	28
	Language aptitude total	Correlation Coefficient	,501**	,434*	,549**	,413*
		Sig. (2-tailed)	,007	,021	,002	,029
		N	28	28	28	28

*. Correlation is significant at the 0.05 level (2-tailed).

** . Correlation is significant at the 0.01 level (2-tailed).

Table 20. *The relationship of boys' scores at the Hidden sounds subtest and other variables*

		Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Intelligence total
Spearman's rho						
	Hidden sounds					
	Correlation Coefficient	,384*	,176	,225	,116	,158
	Sig. (2-tailed)	,043	,371	,251	,556	,421
	N	28	28	28	28	28

*. Correlation is significant at the 0.05 level (2-tailed).

Table 21. *The relationship of boys' scores at the Language analysis subtest and other variables*

		Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Intelligence total
Spearman's rho						
	Language analysis					
	Correlation Coefficient	,341	,364	,700**	,442*	,598**
	Sig. (2-tailed)	,075	,057	,000	,018	,001
	N	28	28	28	28	28

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 22. *The relationship of boys' scores at the Words in sentences subtest and other variables*

		Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Intelligence total
Spearman's rho						
	Words in sentences					
	Correlation Coefficient	,462*	,490**	,440*	,616**	,606**
	Sig. (2-tailed)	,013	,008	,019	,000	,001
	N	28	28	28	28	28

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

Table 23. *The relationship of boys' scores at the Vocabulary learning subtest and other variables*

		Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Intelligence total
Spearman's rho						
	Vocabulary learning					
	Correlation Coefficient	,206	,104	,179	,062	,183
	Sig. (2-tailed)	,293	,599	,363	,756	,352
	N	28	28	28	28	28

Appendix 11

Correlations in girls (Tables 24-29)

Table 24. *Correlations between girls' language learning achievement, language aptitude and general intelligence*

			Grade points	Intelligence total	Language aptitude total
Spearman's rho	Grade points	Correlation Coefficient	1,000	,507**	,597**
		Sig. (2-tailed)		,001	,000
		N	42	42	42
	Intelligence total	Correlation Coefficient	,507**	1,000	,781**
		Sig. (2-tailed)	,001		,000
		N	42	42	42
	Language aptitude total	Correlation Coefficient	,597**	,781**	1,000
		Sig. (2-tailed)	,000	,000	
		N	42	42	42

** . Correlation is significant at the 0.01 level (2-tailed).

Table 25. *Correlations between girls' language learning achievement, language aptitude and different aspects of intelligence*

			Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence
Spearman's rho	Grade points	Correlation Coefficient	1,000	,548*	,326	,379*
		Sig. (2-tailed)		,000	,035	,013
		N	42	42	42	42
	Verbal intelligence	Correlation Coefficient	,548**	1,000	,460**	,638**
		Sig. (2-tailed)	,000		,002	,000
		N	42	42	42	42
	Nonverbal intelligence	Correlation Coefficient	,326*	,460**	1,000	,485**
		Sig. (2-tailed)	,035	,002		,001
		N	42	42	42	42
	Quantitative intelligence	Correlation Coefficient	,379*	,638**	,485**	1,000
		Sig. (2-tailed)	,013	,000	,001	
		N	42	42	42	42
	Language aptitude total	Correlation Coefficient	,597**	,765**	,639**	,552**
		Sig. (2-tailed)	,000	,000	,000	,000
		N	42	42	42	42

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

Table 26. *The relationship of girls' scores at the Hidden sounds subtest and other variables*

		Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Intelligence total
Spearman's rho						
Hidden sounds	Correlation Coefficient	,468**	,586**	,553**	,427**	,647**
	Sig. (2-tailed)	,002	,000	,000	,005	,000
	N	42	42	42	42	42

** . Correlation is significant at the 0.01 level (2-tailed).

Table 27. *The relationship of girls' scores at the Language analysis subtest and other variables*

		Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Intelligence total
Spearman's rho						
Language analysis	Correlation Coefficient	,549**	,652**	,588**	,525**	,703**
	Sig. (2-tailed)	,000	,000	,000	,000	,000
	N	42	42	42	42	42

** . Correlation is significant at the 0.01 level (2-tailed).

Table 28. *The relationship of girls' scores at the Words in sentences subtest and other variables*

		Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Intelligence total
Spearman's rho						
Words in sentences	Correlation Coefficient	,418**	,703**	,473**	,542**	,708**
	Sig. (2-tailed)	,006	,000	,002	,000	,000
	N	42	42	42	42	42

** . Correlation is significant at the 0.01 level (2-tailed).

Table 29. *The relationship of girls' scores at the Vocabulary learning subtest and other variables*

		Grade points	Verbal intelligence	Nonverbal intelligence	Quantitative intelligence	Intelligence total
Spearman's rho						
Vocabulary learning	Correlation Coefficient	,264	,210	,053	-,013	,088
	Sig. (2-tailed)	,092	,181	,740	,936	,580
	N	42	42	42	42	42