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The relationship between foreign language ability and achievement in other school subjects

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THE RELATIONSHIP BETWEEN FOREIGN LANGUAGE ABILITY AND ACHIEVEMENT IN OTHER SCHOOL SUBJECTS

by
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A Thesis

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Master of School Psychology Degree
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Approved by

_____
Professor

Date Approved _____5-/-02_____

ABSTRACT

Samantha J. Chabotar
THE RELATIONSHIP BETWEEN FOREIGN LANGUAGE ABILITY AND
ACHIEVEMENT IN OTHER SCHOOL SUBJECTS
2001-2002
Dr. John Klanderman / Dr. Roberta Dihoff
Master of School Psychology

The purpose of this study was to examine the relationship between the ability to learn

a foreign language and abilities in other school subjects at the high school level. The sample

included 134 tenth grade students recruited through their English classes. Foreign language

ability was measured by an Artificial Language test. Students completed a one-page

questionnaire about their experience and exposure to foreign languages. Then they were

given a set of new vocabulary and grammar rules. They were asked to translate phrases and

complete fill-in-the-blank questions, utilizing the new grammar rules. These test scores were

then correlated with various sub-sections of the nationally standardized 9th grade *Terra Nova*

test and conclusions were based on significance levels for each variable considered. The

results show a significant relationship between scores on the Artificial Language test and all

sub-sections of the *Terra Nova* test. There were other factors, such as number of years in a

foreign language classroom, which seemed to affect performance on the Artificial Language

test.

MINI-ABSTRACT

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THE RELATIONSHIP BETWEEN FOREIGN LANGUAGE ABILITY AND
ACHIEVEMENT IN OTHER SCHOOL SUBJECTS
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The purpose of this investigation is to examine the relationship between the ability to learn a foreign language and how that relates to achievement in other school subject areas. In addition, the study focuses on the kinds of factors that contribute to success on an artificial language test. It was determined that those students who performed well on the Artificial Language test also performed well on the *Terra Nova* test.

TABLE OF CONTENTS

Chapter 4 – Analysis of Results

Chapter 5 – Summary and Conclusions

Tables and Figures

CHAPTER 1
THE PROBLEM

The Need

Language is the fundamental and most common form of communication used by humans. Spoken language is the essential element that distinguishes humans from other species. An extensive amount of research has been done on the subject of language. The studies range in topic from the way an infant learns to distinguish between its native language and a foreign language to the affects of brain injuries on language. The study of human language and the brain is such a complex process that researchers are only skimming the surface when it comes to understanding language processing. Furthermore, when one considers a person who is trying to learn and process more than one language, the situation is compounded greatly.

There have been countless studies done to determine the manner in which an individual acquires a second language and how that compares to the acquisition of a native language. Other research has focused more specifically on language aptitude and the *ability* to learn a foreign language. All of this research has provided valuable insight into the processes involved in language acquisition. However, times are changing and so is the research.

In recent years some of the educational research on foreign language learning has expanded to include factors such as individual learning styles, teaching styles, immersion programs, and brain research. All of these issues are important when considering the ability to acquire a foreign language.

In terms of scientific exploration, any type of research that examines the learning

process is valuable. When considering such a complex matter as learning a foreign language, the research becomes even more useful. However on the practicality end of the issue, thousands and thousands of non-native speakers of English enter the United States everyday. With this in mind, the ability to learn a foreign language isn't just a neat thing to have anymore. It is a necessity.

The exploration of quesitons related to foreign language education will provide insight into factors that contribute to success in this area. This research can also lead to changes in foreign langauage instruction based on the motivation, learning styles, and aptitudes of individuals and groups of students. Testing foreign language ability is also useful academically, in predicting success in foreign language and also in the placement of students into specific language classes.

In some areas throughout the United States, foreign language education is becoming mandatory. In New Jersey, the study of a foreign language is required starting in elementary school. In addition, every 9th grader entering high school this year is required to study a foreign language for two years in order to graduate. This requirement also includes students in the special education population. With this vast and diverse group of children expected to study a foreign language, there is a great need for more information relating to foreign language ability.

The Purpose

The purpose of this study is to examine the relationship between the ability to learn a foreign language and abilities in other school subjects at the high school level. In this particular situation, foreign language students are not exposed to a total immersion language program and therefore, the learning process is going to vary greatly from that of a person learning to speak a second language in the native country. The objective is not to assess their performance in a particular foreign language. The goal here is to look at the connection between the ability to learn a foreign language and aptitude in other school subjects.

The Hypothesis

There are many elements that might affect one's ability to learn a foreign language. In the present situation, all native speakers of English are learning the foreign language through very traditional methods. These students are exposed to the language for only 41 minutes each day, have limited interaction with native speakers, and have no experience in a total immersion situation. They are learning the foreign language in a very systematic and analytical manner. With this in mind, one could assume that students who perform well on an artificial language test will demonstrate greater proficiency in areas that require the same kind of processing such as math and science, rather than social sciences and reading. More specifically, in this situation a positive relationship would exist between the ability to learn a foreign language, as measured by an artificial language test, and proficiency in mathematics and science, as measured by the 9th grade

3

Terra Nova test.

There are also several other questions that will be examined in relation to foreign language aptitude. For example, the differences between males and females on the artificial language test will be considered. The relationship between experience with languages other than english and performance will be assessed. These are other minor links that might provide additional information about the ability to learn foreign languages.

Theory

As previously stated, research on second language acquisition has been going on for many decades. Much of the research has focused on the brain and the specific regions that are responsible for native as well as second language acquisition. By using functional magnetic resonance imaging, one can pinpoint different areas of the brain that are active during first and second language conditions. Other researchers have used patients with brain injuries to observe how language is affected by damage to certain areas of the brain.

The brain is considered the most complex and remarkable organ in the human body. As a result, the body of research on learning and the brain is never-ending. The debate over left hemisphere – right hemisphere involvement in language acquisition has been a hot topic for years. It has been established that the left hemisphere is indeed responsible for most of the language learning process. However some have found evidence suggesting greater participation of the right hemisphere for certain components

of first and second language acquisition. Most studies have found greater left hemisphere activation when a second language is learned early in life, and greater right hemisphere activation when learned later in life. This is consistent with the idea that the first stages of learning any new skill are dominated by the right hemisphere of the brain. This would then lead to the question of how proficiency in the second language affects differential involvement of the brain. Again, such studies claim that the right hemisphere is most active in the early stages of language acquisition and as the individual gains mastery of the language, right hemisphere participation weakens significantly.

Other researchers have considered the way in which a language is acquired and how that affects where language is represented in the brain. Those who learn a second language in a formal manner, in a school setting, are more likely to use the analytical capabilities of the left hemisphere. While those who learn in an informal setting, perhaps at home with a native speaking parent, are more likely to use the holistic capabilities of the right hemisphere.

This leads right into the question at hand. The ability to learn a foreign language in the traditional classroom setting requires many of the left brain capabilities. Students need to develop the skills involved in analyzing the small parts of a language and manipulating those parts based on a set of rules. This is not to say that hearing the language used in class everyday isn't valuable. However, less than an hour per day is not sufficient time to implicitly learn the rules of a new language.

In order to acquire a second language as we do our first language, a person must be surround constantly by the language. It would require attending a school where only

the target language is spoken, or living in a country where the target language is spoken. This learning process is dominated by the right hemisphere of the brain. This is the side that processes information holistically then breaks it down from there, rather than starting with the parts and moving toward the whole.

This theory can be applied to other school subjects as well. Take for instance mathematics and sciences, these subjects require a much more analytical thought process in order to comprehend the material. Whereas in subjects such as social studies, the material presented requires a more subjective approach to learning. The latter being dominated by the right hemisphere of the brain.

In recent years, there has been a resurgence in the study of both learning and teaching styles. This is important because language learning includes a wide variety of abilities. Learning a second language requires verbal skills, logical/analytical skills, and the ability to employ various learning strategies. This would include strategies such as vocabulary flash cards, rote memorization (at times), grouping similar kinds of material for easier learning, repeated exposure, practice (outside of the classroom), pnemonic devices, and other self-created ways of remembering vocabulary and grammar structures. These techniques will not look the same for every person. Research is showing that some children prefer to learn through music, others may need to repeat things verbally over and over, others may want to organize the material into meaningful groups, and yet another group may need to use the material in a real-life situation in order for the information to be stored permanently.

Now that schools are starting to recognize so many different learning styles, the

teachers are now responsible for identifying each students' strengths and weaknesses. This becomes particularly important when kids are older. A high school student has already established many of his/her study and learning habits by the time they get to the high school level. Therefore, with such a wide variety of students, abilities, and learning styles, it is difficult to effectively reach every child. Gathering more information about foreign language aptitude will help to better predict what kinds of students will be successful in the foreign language classroom. For a student who has never studied a foreign language, this type of measure would be very useful for placing students in the appropriate class level.

Definitions

Brain lateralization- this refers to the idea that each side of the human brain is responsible for process different kinds of information. For example, the left side of the brain is associated with verbal information, sequential processing, rational thinking, and tends to look at the parts rather than the whole. In contrast, the right side of the brain is associated with intuitive thinking, holistic processing, impulsivity, and visual stimuli.

Field Independence – the ability to analyze, organize, or reorganize information and experience (Bean 1990)

Field Dependence – both field dependence and field independence are measured on an 18-point scale. Field dependence is considered to be the absence of field independence (Bean 1990). In other words, the inability to analyze, organize, or reogranize information.

7

Second language – generally used to characterize languages acquired, in natural or instructional settings, by immigrants or professionals in the country of which that language is the national language. (Kramsch 2000)

Terra Nova test – a proficiency test given to 9th graders that assesses ability and knowledge in the following areas: mathematics, science, social studies, reading, and language arts. Each subject is also broken down into smaller topics.

Foreign language – used to describe a language that is learned traditionally, in a school that is removed from any natural context of use (Kramsch 2000)

Total immersion- refers to a method of learning a foreign language in which the student is exposed to the target language continuously. For example, a native speaker of one language attending a school in which the language of instruction is not their first.

Assumptions

In the field of psychological research, in which the participants are human beings, there are several variables that must be addressed in order to accurately interpret any data that is gathered. There are many circumstances that can affect the results of an experiment. For instance when administering any type of test, one must assume that the participant will take the test seriously and be motivated to do his/her best. This is particularly important in the present study because their language learning ability is going to be determined by their performance on an artificial language test. In addition, their abilities in the other school subjects are predetermined by their scores on a standardized proficiency test. It is assumed that the students were motivated to do well on that

8

particular test and will also be motivated to perform well on the artificial language test.

Limitations

The vast majority of research studies conducted have some degree of limitation in their use and applicability to the general population. In the present study there are several areas of concern that should be considered. One such issue here is the sample that is being used. The participants are 10th graders from one high school. It is not exactly a random sample of the population. However, you could assume that 10th graders in a high school with similar demographics would also share similar experiences.

In regards to the actual tools being used to assess foreign language ability and aptitude in the other school subjects, one has to assume that these tests actually measure what they intend to measure. It raises the question, does an artificial language test really test the ability to learn a foreign language, or does it test logic and/or problem-solving skills? If it does indeed test these other abilities, it's not necessarily a negative outcome. Especially considering that logic and problem-solving might be an integral part of second language acquisition in the traditional classroom setting.

Overview

The chapters that follow will contain all of the necessary information to make this picture of foreign language aptitude complete. In chapter 2, much of the literature pertaining to second language acquisition and the learning processes involved will be discussed. Next, the design of the study will be presented. Included in this section will

be a description of the sample size and the tools that will be used to measure the

characteristic or behavior in question. The hypothesis will also be restated at this point as

well as any assumptions about the nature of the data being collected. Then, in chapter 4,

the analysis of results will be presented. In this section, findings from the data collected

will be shared and the hypothesis will be either rejected or accepted. Finally, in chapter

5, the entire study will be pulled together from beginning to end. A discussion of the

results will be presented along with a list of conclusions that can be drawn from the

findings. This section will also include some suggestions and implications for future

research such as improvements and/or changes to the present study.

CHAPTER 2
REVIEW OF LITERATURE

When it comes to the study of human languages and the processes by which they are learned, the amount of research is tremendous. This particular chapter will present and summarize the literature that is relevant to the current research question. It would be unreasonable to try to discuss every topic of research related to the field of second language acquisition and foreign language aptitude. Therefore, the review will be broken down into several sections in order to provide the most logical and applicable presentation of research that has already been done. The necessary background information will be provided so that there is a better understanding of important theories that surround the current study.

The organization of the chapter will begin with the most general topics concerning second language learning and move toward more specific issues associated with assessing foreign language aptitude. First, the general learning strategies used in second language acquisition will be considered. There are numerous learning strategies available to an individual when presented with new information. This section will highlight some of the similarities and differences among strategies used by second language learners. Then, the issue of cognition and second language acquisition will be evaluated. This area will contain information about the cognitive process involved in learning a second language, as well as how cognitive development affects foreign language proficiency. Next, the recently revitalized area of brain research will be

11

discussed. The focus here will be on topics such as brain lateralization and hemispheric specialization. This type of research can provide important perspectives on the biological aspects of second language acquisition. In addition, brain research can offer additional insight into the different learning styles and how they are applied to learning a foreign language. As the end of the chapter approaches, the subject narrows even further and the topic of foreign language aptitude will be considered. This section will include information about the military's contribution to the field of foreign language aptitude testing. In addition, the notion of *foreign language aptitude* and what it entails will be presented and discussed.

All of the previously stated sections will include various studies that can provide a complete picture of the research leading up to the current question. Finally, the chapter will close with the detailed description of an experiment that is closely related to the present study. The study will be described in terms of the method, findings, strengths, and weaknesses. Furthermore, those factors will be considered and compared to those utilized in the current study.

General Learning Strategies

When considering the extensive area of second language acquisition research, it is important and entirely necessary to examine the bigger picture. The acquisition of a second language is a learning process. It is essential here to distinguish between the child learner and the adult learner. The two have very different capacities and abilities for learning foreign languages. A good deal of research has been done to determine which

characteristics lead to successful acquisition of a second language. Some of the factors that have been investigated include language anxiety, language aptitude, learning and motivation, field independence/dependence, and learning strategies.

When an individual is presented with new information or material, they must utilize some kind of strategy or technique that will facilitate learning. Language learning strategies are those methods that help a person to learn second language material and also enhance their proficiency. Different researchers have proposed various factors that are related to language learning styles. In 1987 Oxford, Nyikos, and Crookall came up with five areas revealed by the Oxford's Strategy Inventory for Language Learning. Those included, general study habits, functional practice, speaking and communicating meaning, studying/practicing independently and mnemonic devices (Gardner, Tremblay, Masgoret 1997). The extent to which an individual can and does make use of these kinds of strategies is associated with achievement in second language classes.

There are also those who take into consideration the role of universal grammar in second language acquisition. Felix (1985) makes a very interesting observation related to cognitive development and language learning. He explains the possibility of two separate cognitive modules being involved in language acquisition. One module is specific to language learning and handles only input that is connected to language acquisition, whether first or second. There is also another module, which is an all-purpose problem-solving module (Felix, 1985). It is believed that these two modules function more effectively at different stages in development. The idea of a critical age for language acquisition is not anything new. It has been found that children at a young age have

much less difficulty in learning a foreign language, as compared to adults. According to Felix and Bley-Vroman (1989), the language specific module is operating during the time before puberty. After, adults use the general problem-solving module because it is activated after puberty. Evidence of this switch between functions can also be seen in Piaget's theory. He claims that the time around puberty is when a child can begin to think abstractly and employ formal operations. Therefore, if a second language is not presented before puberty, there may be an entirely different process that influences acquisition.

Yet other researchers refer to different theories of learning that involved declarative and procedural systems. Rumelhart and Norman (1981) define a declarative system as one that centers around specific data/information and involves general processes; whereas procedural systems focus on specific knowledge that is required to understand a defined situation. In learning a foreign language, it is not sufficient to just know the vocabulary and verbs. It is equally important to understand how the different parts of the language function and interact.

A thought-provoking article by Wakefield (2000) addresses the topic of second language in relation to mathematics. One definition refers to language as "A system of signs, symbols, gestures, or rules used in communicating" (Dictionary.com). This description of language can be applied to both mathematics and foreign languages such as Spanish and French. A few of the features that are shared by both "languages" are: abstractions are used to communicate, symbols and rules are consistent, understanding

increases with practice, translations are required for novice learners, meaning is influenced and can change according to symbol order, and the possibilities for expression are infinite (Wakefield 2000). The similarities here could have major implications in the areas of learning strategies and instruction.

Cognition and Second Language Acquisition

When examining any type of learning process it is necessary to first consider the type of learner that is involved. It is important to recognize the differences between adult learners and child learners. This is especially important for the process of language learning. As a child learns their first language, the information is just added to their entire repertoire of cognition. For a child learning a second language, the same holds true. The child is taking in the two separate codes and is able to manipulate them with little effort. However, for an adult learner of a foreign language, it is a much more deliberate process. An adult already has in place a well-established code for their native language. Then the adult is presented with a new code, the foreign language, and they must now figure out a way to organize and apply meaning to this new code. With adult learners, the trouble starts when their native language code interferes with processing of the foreign language code (Thatcher 2000). The differences in these cognitive processes often make it easier or harder to become proficient in a second language depending on the learner's cognitive development.

The relationship between general cognitive development and proficiency in foreign language has been examined on several different levels. In a study done by

Jacobus (1989), the relationship between cognitive development and achievement in French was examined. Using Perry's Scheme of Cognitive development and the ACTFL oral proficiency scale, Jacobus found that the two are positively correlated. He concluded that the proficiency of the language learner depended on the extent to which the learning contexts correspond to the cognitive structures in place. The implications of which can be seen in a classroom where the learners are at different cognitive stages. There may be students in a class that just are ready to handle certain kinds of information.

There have also been a number of studies involving students learning English as a second language. In a study performed by Bean (1990), field independence/ dependence was one of the major factors used to assess language learning in Korean and Japanese adults. Field independence is related to cognitive development in that people vary in their degree of field independence/dependence. Bean found that those who were more field independent learners were more proficient in their second language. This relates back to the issue of breaking the code of a new language. Those that are more efficient at analyzing and organizing new information will be more successful at learning a second language in adulthood.

Brain Research

The debate over left hemisphere – right hemisphere involvement in language acquisition has been a hot topic for years. It has been established that the left hemisphere is indeed responsible for most of the language learning process. However some have found evidence suggesting greater participation of the right hemisphere for

certain components of first and second language acquisition (Hernandez, Martinez, Kohnert 2000). Most studies have found greater left hemisphere activation when a second language is learned early in life and greater right hemisphere activation when learned later in life (Anderson 1985). This is consistent with the idea that the right hemisphere of the brain dominates the first stages of learning any new skill. This would then lead to the question of how proficiency in the second language effects differential involvement of the brain. Again, such studies claim that the right hemisphere is most active in the early stages of language acquisition and as the individual gains mastery of the language, right hemisphere participation weakens significantly (Karapetsas 2000).

In the area of split-brain research, these patients have provided valuable information about the functions of the brain. Through these types of experiments, some have been able to actually examine the abilities of the two hemispheres. Sperry and Gazzaniga found that all verbal and written abilities were found on the left side of the brain and the right side responded to most nonverbal tasks (1968). In a related study by Smith (1966), a patient had undergone brain surgery and the left side of his brain was removed. This man was evaluated five months after the operation and discovered that he had a Weschler performance IQ of 110, which placed him in the 25th percentile. At the same time, the man had a verbal IQ of zero!

In relation to the learners in the classroom, brain research can provide educators with valuable information about how different learning styles affect achievement. Those learners that make better use of the left-brain capabilities, such as logical/sequential processing and analyzing information, will be more successful in a classroom that

emphasizes putting the "parts" of a language together to make the whole. On the other hand, a right-brain learner who thinks more intuitively and prefers to start with the whole and break it down to the parts, will be more successful in a classroom that focuses on communicative activities rather than specific grammar points (Funderstanding.com).

Foreign Language Aptitude

Much of the early research on foreign language aptitude testing was conducted by the military and other government agencies such as the Central Intelligence Agency (CIA) and the Federal Bureau of Investigation (FBI). Many groups are interested in assessing the ability to learn foreign language, however for different reasons. The Department of Defense has several of its own aptitude tests that are used to select individuals specifically for language training (Stansfield 1989). It is quite understandable for these types of agencies to develop a measurement tool for foreign language learning ability. It is safe to assume that they would want their most qualified people to be sent for this sort of specialized training.

In 1988 the Department of Defense and the CIA conducted a joint study investigating the strengths and weaknesses of the VORD artificial language test and the Modern Language Aptitude Test (MLAT) (Carroll 1962). They were also interested in the predictive abilities of these tests. The results showed that overall the MLAT *composite scores* were the best predictors of proficiency in foreign language reading and speaking. The VORD however was found to be a good predictor of specific language skills such as analysis of grammar structures (Parry and Child 1988). These results would

18

suggest that there are several factors that contribute to foreign language aptitude.

In a related study, the FBI examined the connection between language aptitude and speaking proficiency using the Defense Language Aptitude Battery (DLAB) and the Oral Proficiency Interview. They too were interested in finding an appropriate predictor of success in foreign language. However, their results were rather inconsistent. There were actually people who scored very high on the aptitude test while scoring low on oral proficiency and vice versa (Walker and Marjike 1988). Again, these irregularities suggest that the ability to learn a foreign language encompasses many concepts.

This leads into the question of where language aptitude comes from and how does it relate to other cognitive abilities. Carroll (1965) established four aspects of foreign language aptitude: Inductive Language Learning Ability, Grammatical Sensitivity, Phonemic Coding Ability, and Rote Learning Ability for foreign language ability. In 1986 Skehan attempted to show a relationship between foreign language aptitude and achievement. The study also considered the role of first language acquisition to second language learning. Overall, the results show that aptitude tests are indeed a successful predictor of foreign language achievement, however the author offers possible alternate explanations.

Horwitz (1983) also makes a distinction between different types of language aptitude. There may be a linguistic competence and a communicative competence. The first refers to the ability to analyze and apply the grammatical structures of a language. The second concept refers to social and psychological abilities such as interpersonal maturity. In the study, Horwitz found a high correlation between linguistic competence

19

and communicative competence.

The majority of the research on foreign language aptitude was conducted over 10 years ago and times are changing. The amount of information available now on learning styles, teaching styles, brain research, and testing provides new challenges to second language acquisition and language aptitude testing.

Closely Related Research

A study done by Mary Hart (1993), *Predicting Achievement in Foreign Language*, examined the relationship between general intelligence and foreign language achievement. The author used the scores from a standardized high school entrance exam that was given to all incoming freshman as a measure of intelligence. And then collected data on final exam grades as well as marking period grades from all four quarters in the foreign language class. The STS High School Placement Test includes subtests for Math, Reading, Language and a Cognitive Skills Quotient. The most significant correlation to foreign language achievement was found to be Math and Language. The Cognitive Skills Quotient and foreign language achievement had the least significant connection (Hart 1993). This is also consistent with other research that claims language aptitude is not necessarily a function of IQ and that there may be other domain-specific abilities contributing to success in foreign language learning.

This relates to the current study in which the ability to learn foreign language, as measured by an artificial language test, is going to be correlated with scores on a the nationally standardized *Terra Nova* test.

20

Summary

After reviewing much of the literature related to foreign language learning and second language acquisition, there are still many questions that need to be addressed. It is difficult to make broad statements about foreign language ability because of the great amount of research related to this field. Researchers have been forced to examine much smaller issues such as learning strategies, cognition, brain-based learning, and second language acquisition processes. Then, along with other related studies, the researcher can make assumptions and connect their findings to a wide-range of questions.

In relation to general learning strategies, certain researchers have focused on the kinds of strategies that are available for language-learners and the extent to which they are being used successfully. Essentially, those who have good general study habits, those who practice independently, and those who use mnemonic devices are more successful in the foreign language classroom.

It is difficult to discuss second language acquisition without considering the role of cognitive structures and processes. Researchers have had to make a clear distinction between adult learners of a foreign language and child learners. As the saying goes, "there's a time and place for everything." This statement is true when discussing any kind of development, especially cognitive development. There are specific times in development when certain information is easier to process. In foreign language learning, earlier is much better. Adult learners already have a well-established native language code that often interferes with learning the second language.

Brain research has added a new element to the study of second language learning.

It is now possible to see what areas of the brain are most active when learning a foreign language. In general, the left hemisphere takes on most of the responsibility of language learning. Once again, timing is everything. When second languages are learned early in life, the left hemisphere is more active. However, an adult learner attempting to master a foreign language later in life, is likely to use more of the right hemisphere. A similar pattern can be found in the acquisition of any new skill, not just language learning.

Foreign language aptitude, or the ability to learn a foreign language, has also been a topic of research in second language acquisition. There are those who believe that some people are just better at learning languages, just as there are those more gifted in math, music, and the arts. The attempt to find an appropriate predictor of foreign language aptitude and success has yielded mixed results. In general, studies suggest that scores on aptitude test can predict achievement in the foreign language classroom. However, some inconsistencies in results would indicate that the ability to learn a second language includes many cognitive structures and related abilities. Further research on teaching/learning styles, brain functioning, and language acquisition will help to better understand such a complex process.

CHAPTER 3
DESIGN

Sample

The participants in this study include 134 10th graders ranging in age from 15 years to 17 years. There are 57 male participants and 77 female participants. These students attend a 9th-12th grade high school in a suburban community in southern New Jersey. The sample includes students from a variety of ethnic backgrounds. The majority, 78% are Caucasian, 11% are African-American, 5% are of Asian decent, 3.8% are Hispanic, 1.5% are Native-American, and .05% checked *other*. Because this particular study deals with issue in language acquisition, it is important to include information about the participants' experiences with other languages. In regards to the study of a second language, 12% had never studied a foreign language in school, 12% were in their first year of foreign language education, 32 % were in their second year of study, 11% reported 3 years of foreign language experience, 29% were in their fourth year of study, 2% had studied a foreign language for more than 5 years, and 2% reported being native speakers of a language other than English. Out of the 134 participants, only 18 reported being exposed to languages other than English at home. In the current study, only native speakers of English were included in the survey results.

The participants were recruited through their English classes. All sophomore English teachers were contacted and asked to allow their students to take part in the

study. The students were participating on a volunteer basis and were not required by their teacher to take part. The teachers assured the students that their participation in, or refusal to participate in the current study would in no way affect their grades.

Measures

There are two primary instruments being used in this study. The first is an artificial language test. This is a test used to measure a student's ability to learn foreign languages. The artificial languages used on these tests are developed based on the fundamental principles of language construction. The ability to learn a foreign language involves the capacity to understand the implicit rules of a language and be able to manipulate the different parts accordingly. Artificial language tests measure the skills involved in the formation of words from roots, inflection of verbs for tense, agreement of nouns and adjectives, and inflection for number and case. The participants will be asked to study a list of vocabulary words translated from the artificial language to English and a list of rules for forming different parts of speech. Then the participant will use those tools to complete several translations and fill-in-the-blank questions. There are a total of 12 translations and fill-in-the-blank questions. The test will be scored by adding the total number correct out of 12.

The second measure to be used in this study is the *Terra Nova* test. This is a nationally standardized test given to all 9th graders at the high school. The *Terra Nova* is broken down into 5 major subject areas. Those areas include Reading, Language Arts, Science, Social Studies, and Mathematics. In addition, each of the 5 major content areas

is then divided into sub-categories based on more specific skills. Since all of the participants in this study are 10th graders, they will have already taken the *Terra Nova* test in their freshman year. The test includes both multiple choice items and open-ended questions that require the students to explain their answers in detail. The scores are reported separately for each content area and will be compared to each student's score on the artificial language test.

Hypothesis

Null Hypothesis: There will be no relationship between scores on the Artificial Language Test and scores on each sub-section of the *Terra Nova* Test.

Alternate Hypothesis: There will be a relationship between scores on the Artificial Language Test and scores on each sub-section of the *Terra Nova* Test.

In addition to the hypotheses stated above, there are several other topics that will be explored. For example, the relationship between gender and ability in foreign language, or the relationship between exposure to multiple languages and ability to learn foreign language. These are just some of the smaller issues to be examined.

Design

In order to gather the necessary data and information, the following procedure will be carried out. Those students that choose to participate will be required to read and

sign a consent form, along with their parents. The sample population of 10th grade

English students will be asked to complete the Artificial Language test during one 40-

minute class period. Each participant that completes the test will then fill out an

information sheet, which includes demographic information such as age, sex, ethnicity,

etc. There will also be several questions about native and second languages, experience

with and exposure to other languages, and their parents' native/second languages. This

will provide valuable information to include in the overall analysis of foreign language

ability.

The next step is to review the *Terra Nova* test scores and record each of the

participants' scores on each of the 5 sub-sections. This standardized test also has a

reported *scale score*, which is a total score of Language Arts, Math, and Reading. This

particular score will provide valuable data on the relationship between foreign language

ability and general intelligence. When all of the data has been collected and recorded, the

information will be processed and analyzed using the *Pearson Product-Moment*

Correlation Coefficient. This is one of the most common correlation coefficients and it

considers each participant's place within the group, as well as their deviation from the

mean (Anastasi and Urbina 88). The results that are generated from this type of statistical

analysis will show if there is any relationship between performance on the Artificial

Language Test and performance on the *Terra Nova* Test.

In summary, the process of gathering and evaluating the data is fairly simple and

straightforward. The only task the participants will be asked to do is complete a rather

short Artificial Language test. Then scores on the *Terra Nova* test will be taken from

26

each participant's academic record. Finally, the scores on the Artificial Language test

will be correlated with each of the sub-sections of the *Terra Nova*. From that analysis

one will be able to look at which academic subjects were more highly correlated with the

ability to learn foreign languages.

CHAPTER 4
ANALYSIS OF RESULTS

Introduction

The data and analysis of the results yielded some interesting findings. The Pearson product-moment correlation coefficient was used to explore the relationship between scores on an artificial language test and sub-sections of a nationally standardized high school exam. The goal was to find out if any of the sub-sections of the *Terra Nova* test were significantly correlated with the Artificial Language test scores. From these results we can then make general statements about the ability to learn a foreign language and how it relates to other school subject areas.

Results

The minimun scores, maximum scores, means and standard deviations for the Artificial Language test and all sub-sections of the *Terra Nova* test can be found in Table 4.1. For reasons unknow, not all participants completed the science and social studies sections. The Artificial Language test scores are the total number correct out of 12. The sub-sections of the *Terra Nova* are represented by the percentage of questions answered correctly. The mean score for the Artificial Language test was 6.5, with the minimun being 2 and the maximun being 11. There was not one participant that answered all 12 questions correclty. The mean scores for Language Arts, Science, and Social Studies were all 76 percent. The mean score for the Math section was 62 percent. Also note that

TABLE 4.1

Mean scores (and Standard Deviations) for the Artificial Language Test and the sub-sections of the *TerraNova* test

	N	Minimum	Maximum	Mean	Standard Deviation
AL Test Score (# correct out of 12)	134	2	11	6.5	2.08
TerraNova Test (% out of 100)					
Language Arts	134	23	98	76	14
Math	133	7	99	62	21
Science	116	40	100	76	14
Social Studies	116	38	100	76	14
Scale Score (math, reading, LA)	119	657	822	722	32

the minimun score for math was 7 percent and the maximun score was 99 percent.

The Pearson product-moment correlation coefficient was calculated for the each of the sub-sections of the *Terra Nova* test and the Articial Language test. As stated in Chapter 1, the purpose of this study is to examine the relationship of foreign language ability and abilities in other school subject areas. The null hypothesis is that there will be no relationship between scores on the Artificial Language test and the sub-sections of the *Terra Nova* test. Conversely, the alternate hypothesis is that there will indeed be a relationship between foreign language ability and abilities in other school subject areas.

More specifically, the scores on the Artificial Language test will be more highly

correlated with the math / science sub-sections, rather than the language arts / social

studies sections. As shown in Table 4.2, all correlations that were calculated were in fact

significant at the 0.01 level (2-tailed).

TABLE 4.2

**Correlations of Artificial Language Test scores and Sub-sections of the *TerraNova*
test**

	Language Arts	Math	Social Studies	Science	Scale Score
AL Test Score					
Pearson Correlation	.458	.584	.470	.448	.509

* All correlations are significant at the 0.01 level (2-tailed)

The correlation between the Artificial Language test and the math section of the

Terra Nova test ended up to be the highest correlation ($r = .584$) Although not the

lowest, the correlation between the Artificial Language test and the language arts section

yielded a correlation that was lower than the math section ($r = .458$). The scale score,

which is a combination of reading, math, and language arts, was the second highest

correlation ($r = .509$). Of the five sub-scores, the scale score is considered most closely

related to an overall general intelligence score, because it combines three different

subjects.

Along with correlations between the two sets of test scores, there were several

other factors that were considered in this study. The participants were asked to report

information such as sex, ethnic background, years of foreign language education, and

exposure to second languages spoken in the home environment. The goal was to

examine how these factors effect foreign language ability.

After compiling all of the data, there were some interesting results that emerged

from the calculations. There was one question found to be positively correlated with the

scores on the Artificial Language test. With a Pearson product-moment correlation

coefficient of $r = .473$, the number of years in a foreign language classroom was

signficantly correlated with the Artificial Language test score. As illustrated in Figure

4.1 the mean test scores for the Artificial Language test progressively get higher as the

number of years of foreign language instruction in the classroom increases.

Figure 4.1
Comparison of Mean Artificial Language Test Scores
and Years of Foreign Language Study

Years of Foreign Language Study
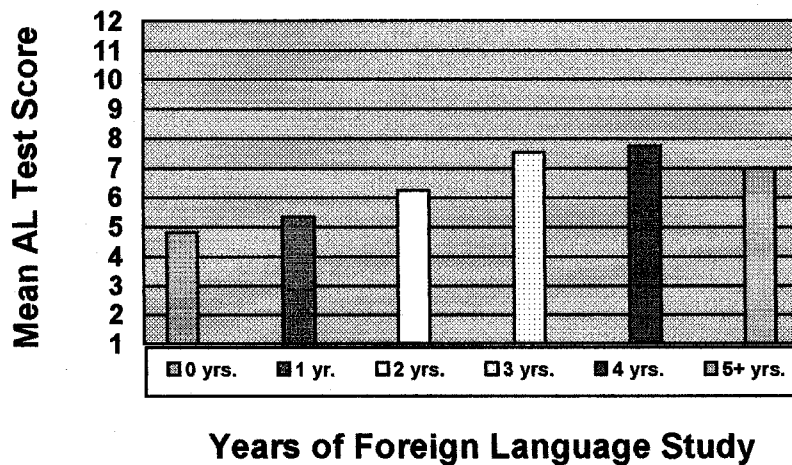
The mean test score for those participants that reported having no formal classroom instruction in a foreign language was 4.82. The mean test score for those in their first year of foreign language class was 5.52. After the second year, the mean increases to 6.25 and after the third year it increases again to 7.53. Those participants that reported being in their fourth year of a foreign language had the highest average test scores (M = 7.7). Although there were only 3 out of the total 134 participants that had more than five years of foreign language education, the average of their test scores was also high (M = 7.00).

Some of the other characteristics yielded interesting but insignificant results. In relation to gender, the mean for females (M = 6.63) was slightly higher than the mean for males (M = 6.47). Although their was an overall difference in average scores, the correlation (r = .039) was not significant.

Another issue that was taken into consideration was exposure to second languages at home. Of the 134 participants only 18 reported having a non-native English speaker in the household. However, the means for the two groups were slightly different. Those students that reported having languages other than English spoken regulary at home had a mean score of 6.95 and those that did not have this experience had a lower mean score (M= 6.50). Althought the mean for one group was higher, these mean scores are not significantly different.

Summary

After analyzing all of the survey results and data, there are a few important

conclusions. The alternate hypothesis has been accepted. The results show that there is in fact a significant relationship between the Artificial Language test scores and the sub-sections of the nationally standardized *Terra Nova* test. All Pearson product-moment correlation coefficients for the two sets of test scores were significant at the 0.01 level (2-tailed). Furthermore, the highest correlation was found to be between the Artificial Language test and the math section of the *Terra Nova*.

Several other items were included to expand the investigation into foreign language ability. Of the characteristics in question, there was one in particular that yielded significant results. The scores on the Artificial Language test were found to be significantly correlated with the number of years with foreign language instruction. More specifically, those that had studied foreign language for a longer period of time scored higher on the Artificial Language test.

CHAPTER 5
SUMMARY AND CONCLUSIONS

Summary

The purpose of this study is to examine the relationship between the ability to

learn a foreign language and abilities in other school subject areas. The outcomes of this

research will help educators in several ways. First, testing foreign language ability is

useful academically, in predicting success in the foreign language classroom and also in

the placement of students into specific language classes based on level. In addition, these

findings will offer better understanding of how learning styles affect performance in

different subject areas. The information on learning styles may also help educators to

modify their teaching styles so that they might connect with a wider range of students.

There is an enormous amount of research on second language acquisition and how

the brain acquires such skills. The studies range in topic from the way an infant learns to

distinguish between its native language and a foreign language to the affects of brain

injury on language. Because the language process is so complex, adding a second

language compounds the issue.

In this particular study, foreign language ability was measured by an Artificial

Language test. These types of tests are designed to measure a person's ability to

understand and manipulate different parts of a language. This one in particular was made

up of 6 statements to be translated from the artificial language to English and 6 questions

in which they had to choose the artificial language vocabulary word that best completed

the sentence. The results of this test were then compared to scores from the nationally standardized *Terra Nova* test. The *Terra Nova* test is divided into different subject areas, including language arts, math, science, and social studies. The two sets of test scores were compared to uncover any relationships with specific subject areas. Additional information was gathered about the participants including sex, ethnic background, years of foreign language classroom experience, and exposure to non-native speakers of English at home. These factors were analyzed to find any significant differences between the Artificial Language test scores of the different groups.

There are several questions that this research hopes to answer. The principal issue was the relationship between foreign language ability and achievement in other school subject areas. The focus lies in the connection between scores on an Artificial Language test and scores on various sub-sections of a nationally standardized test. There are several factors that might affect a person's ability to learn a second language. First, the learning environment must be considered. A student that is placed in a total immersion situation is going to pick up language very differently than a student that sits in a classroom and does practice activities out of a textbook. It is very important to take into account the brain functions that are at work during the learning process. In the present situation, these students are learning foreign language in a very systematic and analytical way. The Artificial Language test also requires students to manipulate new vocabulary and different parts of speech in a logical manner. One might assume that those students who score high on the Artificial Language test will also show greater proficiency in areas

35

that involve the same kind of processing, such as math and science. A person learning a second language in a natural setting is more likely to employ different parts of the brain, including the holistic capabilities of the right hemisphere.

Conclusions

After all data was collected, scored, and analyzed the following has been concluded regarding various issues related to the ability to learn foreign language:

- There is a positive and significant relationship between the ability to learn a foreign language and achievement in other school subject areas.

- There is a higher correlation between the ability to learn foreign language, as measured by the Artificial Language test, and the math section of the 9th grade *Terra Nova* test.

- There is a lower correlation between foreign language ability and achievement on the language arts section of the *Terra Nova* test.

- The processes that are involved in successfully completing the Artificial Language test are also important for solving mathematical problems. These two areas likely require skills such as analyzing parts of a whole, manipulating fragments, and logically organizing information into meaningful chunks.

- There was a notable difference in Artificial Language test scores between those students that had studied a foreign language in school and those that did not. The participants that had more years of foreign language education scored significantly higher than those with less experience.

• Gender did not have a major impact on the Artificial Language test scores. Although there was a slight difference in mean scores for boys and girls, this difference was not significant.

• Exposure to languages other than English in the home environment did not have a significant influence on foreign language ability. The 18 (from a total of 134) participants that had regular contact with a non-native speaker of English at home did have a higher mean score on the Artificial Language test however, this difference was not significant due to the small group size.

Discussion

The amount of research in second language acquisition is endless. Many researchers have examined the different brain processes that are involved in learning a foreign language. This valuable information adds to the current knowledge of general learning processes and how the brain functions when dealing with different kinds of information. Generally speaking, the acquisition of a second language is just a specific kind of learning, such as learning to read, learning to do algebra, learning to ride a bike, or learning about the laws of physics through experimentation. All of these processes engaged different parts of the brain and require a different approach to learning.

Previous research has found that language processes are generally located in the left hemisphere of the brain. However, there is strong evidence that both hemispheres are involved and different areas are responsible for different types of learning scenarios. The left side of the brain mostly controls those tasks that require a student to think logically

37

and sequentially. Activities and problems that involved a more holistic approach usually

engage more of the right hemisphere of the brain. This concept becomes very important

in learning a second language because both kinds of processing are necessary in order to

be successful in a foreign language classroom. The left-brain skills, such as analyzing

grammar and categorizing vocabulary, are important parts of acquiring a second

language. Also, once you have the "parts" of a language, it is essential to be able to

assemble them in a manner that will facilitate communication and overall competency in

the language.

The current research generated some interesting and useful results that can be

applied to foreign language learning in the classroom. Generally speaking, the results

show that the ability to learn a foreign language is related to abilities in other subject

areas. With the original hypothesis in mind, it is not all that surprising that the Artificial

Language test was highly correlated with the math section of the *Terra Nova* test. The

Artificial Language test required the students to analyze, manipulate, and logically think

through the rules and vocabulary of a simulated language. These are the same skills that

a person need in order to be successful in a math class. The fact that all of the

correlations were significant would lead to the conclusion that foreign language ability is

not an isolated skill and is connected with general achievement in all areas. Although

those students that excel in math may find it easier to learn a foreign language, this study

shows that students who are strong in other areas can still be successful in the foreign

language classroom.

The information that was collected concerning experience and exposure to foreign

language proved to be very valuable in understanding success on the Artificial Language test. Not surprisingly, the only significant factor was the number of years a student had studied a foreign language. The test scores increased right along with the number of years in a foreign language classroom. As with any skill or subject, the more experience and practice a person has, the better they are likely to perform.

Along with experiences in the classroom, exposure to second languages outside of school would also seem to be an important factor. There was a question that addressed this very issue. Those students that had a family member who spoke a language other than English in the home did score higher on the Artificial Language test however; this result was not significant. The reason for a non-significant correlation was because of the sample size. Of the 134 participants, only 18 had this experience and the number is just too small to be able to say it is a true difference.

The question now becomes how to use the information and results from this study to help all students. The findings here will help students, teachers, and counselors better understand the skills involved in learning a second language in school. Teachers can use this information to vary the teaching techniques to not only reach those students that have the analytical skills, but to also include activities that help the right brain thinkers. Students can become more aware of their strengths and weaknesses when it comes to learning. Then they can modify their own tools and study habits. For academic counselors, this information may be useful when trying to schedule new classes for a student. There is nothing harder than seeing a student struggle in a class that is too difficult, or having a student that is not challenged in a class that is too easy. This

information can help in the placement of students into the appropriate class levels. For example, if there is a student that is an overall average student but happens to excel in math class, it is not unreasonable to think that student might also excel in a higher level foreign language class.

The nature of the two tools used in this study is an important issue that warrants some discussion. Any time a test is involved in measuring some particular behavior, it is vital to assess whether the test actually measures what it is supposed to measure. For instance, does this Artificial Language test really test the ability to learn foreign language, or does it test general problem-solving techniques. Also, is it appropriate to correlate this test with a test like the *Terra Nova*. The Artificial Language test is a short test with a limited variety of questions. While the *Terra Nova* is much longer and includes multiple choice questions, open-ended question, as well as the opportunity to explain your thought process and how you arrived at a particular solution. The Artificial Language test did not include those features.

Implications for future research

The current study provided valuable information into the processes that are involved in the ability to learn foreign languages however; there is still so much to learn. This particular Artificial Language test was very short and very limited in scope. Learning a foreign language involves more than just the analytical left-brain capabilities. It woud be interesting to add a measure that could assess communicative skills. The combination of the two areas would provide a better picture of the ability to learn *and*

speak foreign langauges.

The sample population in this study was made up of only native English speakers. It would be worth comparing these scores with a larger population of bilingual students. This could provide more valuable information about non-native speakers and how their language abilities relate to general intelligence. The similarities and differences might provide insight into the processes and abilities of bilingual students. With this particular population growing in the United States, it is important to obtain as much understanding as possible. Research such as this will also offer awareness and appreciation for both language abilities and learning processes in general.

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APPENDIX

INFORMATION SHEET

READ ALL DIRECTIONS FIRST!
Please complete the following questionnaire. The information you are providing is
completely confidential and will not be shared with anyone. The data being gathered is
for the purpose of better understanding foreign language ability. This evaluation will in
NO WAY affect your grade in this class (In fact, your cooperation and effort in this
project just might win you some *bonus points*!).

1. Sex: M _____   F _____

2. Ethnic background:

    _____ African American

    _____ Asian

    _____ Caucasian

    _____ Hispanic

    _____ Native American

        _____ Other   (please indicate) _____

3. Are you a native speaker of English?   _____ Yes   _____No

    If you answered **no**, what is your native language? _____

4. How long have you studied a foreign language in the school setting?

    _____ 0 years   _____ This is my 1st year   _____ 2nd year   _____ 3rd year

    _____ 4th year   _____ I have been studying for more than 5 years.

5. Is there anyone in your house that speaks a language other than English on a regular
basis?
            _____ Yes   _____No

        If you answered **yes**, what language or languages are spoken in your house?
        (other than English)

        _____   _____

        _____   _____

ARTIFICIAL LANGUAGE

Read and study vocabulary and grammar rules then answer the questions below

VOCABULARY – Part I

nim-uk	hunter		*nim-ek*	to hunt (for)
nim-og	the hunted, game		*et-ek*	to be
wod-og	wood, forest		*av-ek*	to have, hold
zek-uk	boy		*vis-ek*	to see
zek-te	girl		*al-ek*	to go
			hs	in, into (w/ the objective)
			zt	not

GRAMMAR RULES

Nouns: The mascline nominative singular ending is *-uk.*
The feminine nominative singular ending is *-te.*
The neuter nominative singular ending is   *-og.*
The objective singular ending of ALL nouns is *-az* added to the stem.
To form the plural of a noun, add   *-yf* to the singular form of the proper case.
- There is no definite or indefinite article.

Verbs: To form the infinitive, add *-ek* to the verb stem.
To form the present tense (singular), add *-ot* to the verb stem.
To form the past tense (singular), add *-er* to the verb stem.
To form the future tense (singular), add   *-ap* to the verb stem.
*To form the plural of ANY tense, add *-ir* to the singular

Directions: **Use vocab list and grammar rules to select the correct translation.**
Please answer all questions to the best of your ability

1. *Zekuk etot nimuk.*
    a. The girl is a hunter.   c. The boy hunts game.
    b. The hunter is a boy.   d. The boy is a hunter.

2. *Wodogyf avotir nimaz.*
    a. The woods have hunters.   c. The forests have game.
    b. The boys see the game.   d. Hunters hunt game.

3. *Zekteyf zt eterir nimukyf.*
    a. The girl is a hunter.   c. The boys do not see the game.
    b. The girls were not hunters.   d. The game is not hunted.

4. *Zekukyf visotir nimaz.*
   a. The boys see the game.
   b. The girls do not se the game
   c. The boy sees the game.
   d. The girls are in the forest.

5. *Nimukyf alapir hs wodaz.*
   a. The hunters will go into the wood.
   b. The hunters will be in the forest.
   c. The girls are in the wood.
   d. Game was in the forest.

6. *Zekteyf zt nimerir nimaz hs wodazyf.*
   a. The game goes into the forest.
   b. The boy will not hunt the game.
   c. Girls see the hunters in the wood.
   d. The girls did not hunt game in the woods.

VOCABULARY II

lek-uk	father		*lub-og*	love
lek-te	mother		*don-ek*	to give
dro-uk	brother		*stor-ek*	to work
dro-te	sister		*lub-ek*	to love, like
zek-og	child		*ga*	and
pec-og	money			

ADDITIONAL GRAMMAR RULES

- To form the dative *(to, for)*, singular, for any noun, add *–ux* to the stem.
- To form the dative plural, add *-yf* to the singular form.

Directions: In each sentence one word has been omitted. Select the word that completes the sentence. *Use both sections of vocabulary and grammar to answer the questions below.*

1. *Lekuk ga _____ lubotir zekaz*
   a. storuk
   b. droog
   c. lekte
   d. nimog

2. *Drouk donap pecaz _____.*
   a. drouk
   b. lubogyf
   c. nimyf
   d. drote

3. *Zekogyf zt lubotir _____.*
   a. lubog
   b. storek
   c. pecuxyf
   d. nimux

4. *Zekuk _____ lekux.*
   a. etekzt
   b. storotir
   c. visog
   d. storap

5. *Nimuk _____ nimaz drouk.*
   a. doner
   b. storot
   c. eter
   d. visotir

6. *Droukyf _____ droteyf hs wodazyf.*
   a. visap
   b. nimapir
   c. lubog
   d. avekir