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Exploring the Auditory Aspects of Aptitude
for Intensive Modern Foreign Language Learning

By

Antoine Rashid Al-Haik

A.B. (University of California) 1950
M.Ed. (University of California, Los Angeles) 1957

DISSERTATION

Submitted in partial satisfaction of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

Education

in the

GRADUATE DIVISION

of the

UNIVERSITY OF CALIFORNIA, BERKELEY

Approved:

Harold D. Carter
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Committee in Charge

March, 1972

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To my wife Gladys
and my daughters
Cynthia
Sylvia
Jasmine, and
Dianne

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ACKNOWLEDGMENTS

I am indebted to many individuals who have contributed to making this research work possible. Many thanks are extended to Dr. Harold D. Carter, the chairman of my dissertation committee for his continual encouragement and guidance in this endeavor. I am also indebted to Dr. Jesse O. Sawyer and Dr. Nadine M. Lambert for their insights and ideas in refining the design of this research work.

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expectancy tables, and to Mr. Faye Long for processing the item analysis and correlation matrix data.

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Finally, my two teenage daughters Jasmine and Dianne deserve special credit for their understanding and tolerance in not spending as much time with them as I would have liked during this exercise.

A. R. A.

University of California
Berkeley

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FOREWORD

This study was done in the setting of the Defense Language Institute, West Coast Branch, Presidio of Monterey, California (DLIWC). This Branch, together with its sister branches and Systems Development Agency, comprise the Defense Language Institute (DLI), the largest foreign language training establishment in the Western world, with headquarters in Washington, D. C.

About 4,000 students, mostly young military personnel, are trained and graduated from DLIWC annually in some twenty-four languages. Members of the faculty are highly trained native or semi-native speakers of the language.

Although the courses are specifically designed to give prominence to the listening and speaking skills, reading and writing are also taught as secondary objectives. The method of instruction used may be described as intensive, audiolingual, direct, and inductive-deductive.

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CHAPTER I

HISTORICAL BACKGROUND

Background

Prior to World War II there was little justification for investigating foreign language aptitude in terms of its underlying auditory factors. Studying a foreign language in high school or in college was considered to involve basically a form of mental activity not very different from that required for the study of any other school subject. Thus, prediction of success in this area of learning was largely accomplished by the use of IQ tests and past academic performance. Nevertheless, voices of caution against the use of intelligence tests as predictors of foreign language performance began to be heard. In his study of the subject, Henmon (1929a, p. 12) states that although the predictive validities of intelligence tests lie somewhere between .20 and .60 these tests cannot be used alone to any reasonable degree of satisfaction. A search for specific abilities seemed to provide a better answer for subsequent investigators. Richardson (1933, p. 169) concludes in one of his studies that

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"success in a modern foreign language seems to be the result, to a considerable degree at least, of special abilities or aptitudes not measured by a general mental test." This conclusion was reaffirmed much later by Carroll (1962a, p. 89) when he hypothesized that "facility in learning to speak and understand a foreign language is a fairly specialized talent (or group of talents), . . . relatively independent of those traits ordinarily included under 'intelligence' . . . ." Early efforts were indeed made to improve prediction in this area by devising more refined instruments specifically geared to measure aptitude for foreign language learning. Two examples of such instruments are Henmon's Prognosis Tests in the Modern Foreign Languages (1929b) and Symonds' Foreign Language Prognosis Test (1929). These and other early tests generally consist of (1) tests of ability and achievement in English language vocabulary, grammar, spelling, etc., and (2) work-sample tests involving short lessons in the language to be studied or in an artificial language. The main feature of these tests is that they are of the paper-and-pencil type emphasizing ability to deal with the intellectual problem-solving aspects of learning the written form of a foreign language. This emphasis is in line with the objectives of reading and

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translation, which were prevalent in the learning of foreign languages in the United States before the advent of World War II. During and after this war, new criteria of performance were sought to meet new requirements. The United States armed services recognized the need for intensive foreign language training of a considerable number of recruits in a relatively short period of time, giving top priority to the skills involved in speaking the colloquial form of the language. Since this type of foreign language skills was not exactly taught in high schools and colleges at that time, the Army developed its own method of foreign language instruction to meet this objective. Carroll (1963, pp. 1062-64) describes the characteristics of what came to be known as the "Army Method," as follows:

1. The spoken form is presented and learned before the written form.

2. The method makes use of the results of contrastive analysis between the learner's native language and the foreign language.

3. Overlearning through "pattern practice" is stressed.

4. The desirability of simulating "real-life" communication situations is well recognized.

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A fifth point should be added to the above list. The method also required that instruction be conducted by a native speaker (or a non-native with almost native proficiency) of the target language.

This change in objectives was naturally accompanied by a change in methodology. According to Brooks (1960, p. 123), approximately 80 percent of the beginning modern foreign language student's time should be allocated to listening and speaking activities and only 20 percent to reading and writing. The National Education Association (NEA; 1960, p. 9) advises that "the student should understand the foreign language as it is spoken by native speakers. He should speak the foreign language in everyday situations with reasonable fluency and correctness, and with pronunciation acceptable to the native speakers of the language. He should read the foreign language easily and without conscious translation. He should be able to communicate in writing anything he can say."

The new trend in thinking and methodology recognizes the diversity and specificity of talents involved in modern foreign language learning, as is clearly demonstrated by many investigators in the field. In his advice to the foreign language learner, Walsh (1965) explains that: (1) there are approximately

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3,500 languages spoken in the world today, 140 of them with one million or more speakers; (2) when learning their own language, children practice by listening and talking. By constant trial and error they assemble in their minds a simple model of the language--each individual has his own grammar of the language; (3) languages are different. The new language is not expected to be like English. The new sounds and new meanings are fitted into non-English patterns; (4) in all languages, writing has followed speech by many thousands of years. Most of the languages have not yet been put into written form by their speakers. The Roman alphabet used in learning the different languages of Western Europe may cause interference on account of dissimilar pronunciation of identical letters in these languages; (5) learning a foreign language is mainly a physical activity, not just memorizing rules. The interference of native language habits with one's new language habits may be a cause for many learning problems. Emphasis should therefore be placed on learning by imitation and by analogy rather than on rule memorization. Intensive practice is essential; (6) reading and writing become easier after learning how to speak the language. A reader is apt to use some form of pronunciation even if he has to invent one. Therefore, it is advisable to

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start out by learning the correct pronunciation; (7) speech and writing, though related, are different systems. For example, the phoneme /i/ can be written in different ways as in see, key, she, receive, believe, tea, and the grapheme <ea> can be pronounced in many different ways as in meat, create, great, heart, and Seattle.

Pimsleur et al. (1966, p. 17) contend that common experience indicates that there may be a special ability or talent for foreign language study, since people of equal intelligence and diligence often progress at different rates in learning a foreign language. Of particular interest in this connection is a study conducted by the U.S. Army Leadership Human Research Unit (1963, p. 7) at the Presidio of Monterey, California, which examined the validities of the Defense Language Aptitude Test (DLAT)* --a paper-and-pencil test--for predicting differential success in a number of languages taught under the audio-lingually oriented "Army" method to fairly comparable samples of Defense Language Institute servicemen. The obtained validity coefficients (Pearson's Product-Moment) for predicting final grades are listed in Table 1 below.

---

*DLAT was previously called ALAT--Army Language Aptitude Test. For a more detailed description of this test, see Appendix A-1.

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TABLE 1

DLAT VALIDITIES, DLIWC, 1963

Language	*N*	*r*	
Arabic	166	.47	
Chinese-Mandarin	301	.34	
Czech	131	.37	
French	239	.57	
German	526	.50	
Hungarian	73	.43	
Italian	98	.48	
Korean	239	.10	INSIG.
Polish	119	.40	
Russian	328	.25	
Spanish	467	.48	
Turkish	70	.63	
Vietnamese	83	.10	INSIG.

The above data clearly indicate that the validities are not only widely different for different languages but are also generally higher for European languages with Roman writing systems than for non-European languages with non-Roman writing systems. The lowest validity of .10, which is not significantly different from zero, is for Korean and Vietnamese. The highest validity of .63 is for Turkish, which happens to be an agglutinative language similar in structure to the artificial language tasks presented in DLAT. The writer of this paper (1968a, 1968b), being in charge of the Tests and Measurement Branch at the Defense Language Institute, West Coast (DLIWC) for several years, has had

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the opportunity to examine the predictive validities of DLAT. Time and time again data from various DLIWC studies have indicated that: (1) DLAT, being a non-auditory test, offers little improvement over tests of general intelligence in predicting foreign language performance in an intensive, audiolingually oriented course of instruction, and (2) the predictive power of DLAT varies significantly from language to language, giving support to the hypothesis of differential prediction in foreign language learning.

It follows from the preceding discussion that the new shift in emphasis, in terms of objectives, methodology, and conceptualization of foreign language learning, suggests a new approach to foreign language aptitude testing. In order to optimize prediction of success in foreign language learning, therefore, it seems feasible to explore the hypothesis that the predictive power of an aptitude test may be significantly increased if it has an auditory component which is specifically geared to capitalize on errors made by students in a specific course of instruction, such as the audiolingually oriented intensive course offered at the Defense Language Institute.

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Auditory Approach to Modern Foreign Language Aptitude Testing

Until recently, efforts to explore the auditory factor in foreign language learning were restricted mainly to studies concerning the relationship between scores on the Seashore Pitch Discrimination Test and student performance. However, rather inconsistent results were reported by such early studies. Dexter (1934, pp. 717-20), for example, found some relationship between accent ratings and pitch discrimination ability, whereas Dorcus et al. (1952) found no significant relationship between student proficiency scores and pitch discrimination ability. Carroll (1958) tried another approach. In a rather extensive factor analytic study, he used an auditory work-sample test as one of the predictors. In this test the examinee is not only required to learn an artificial number system but is also asked to respond to a rather complex auditory signal. This "number learning" test proved to be significantly related to student performance in an intensive, audiolingually oriented course (r = .53 [Carroll, 1962b, pp. 97-99]). As a result of Carroll and Sapon's joint research efforts over a period of approximately five years, a new test to measure the audio components, as well as the paper-and-pencil verbal components of

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foreign language aptitude, came into being in 1959. This is the Modern Language Aptitude Test (MLAT; Carroll and Sapon, 1959a). The first part of this test consists of the "Number Learning" test referred to above. The second part of MLAT is called "Phonetic Script." This part also consists of auditory item leads. It requires the examinee to learn, retain, and recognize the correct association of a set of spoken English-like nonsense words, each consisting of three phonemes, with their phonemically printed equivalents. Both of these parts require the use of a tape recorder in their administration. The remaining three parts make up "The Short Form" of MLAT. They are paper-and-pencil type and can be administered without the use of a tape recorder in substitution for the whole test.* In evaluating the relative importance of the predictive validities of the auditory and nonauditory parts of MLAT, in the context of an intensive audiolingually oriented type of courses, data in the test manual tend to support the conclusion that the auditory components of the test add very little to the variance which can be explained by scores on The Short Form alone. The average difference between the validity coefficients of the total test and those of

---

*For a more detailed description of MLAT, see Appendix A-2.

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The Short Form is .029 (Carroll, 1959b, p. 14). Two conclusions may be drawn from a review of the research concerning MLAT: (1) Although MLAT appears to have substantial validity (with *r* varying from .27 to .73 [ibid.]) and reliability (with split-half *r* ranging from .90 to .94 [ibid., p. 17]) as a general predictor of success in foreign language learning, there is no consistent evidence to indicate its suitability for making differential predictions, no matter how similar (or dissimilar) the foreign language is to English in terms of phonology, syntax, or vocabulary; and (2) the auditory parts of the test do not seem to make a significant contribution in comparison to the other, more cognitive, nonauditory parts making up The Short Form.

The importance of the auditory component in predicting foreign language performance was also recognized by Pimsleur (1966a). On the basis of extensive research studies made during the period 1958-1966, he concluded that four factors proved to be significantly correlated with foreign language performance: grade-point average (in four major subjects--English, Social Studies, Mathematics, and Science), motivation (interest in studying a modern foreign language indicated on a five-point, self-rating scale), verbal ability (knowledge of English vocabulary and linguistic analysis), and auditory ability

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(sound discrimination and sound-symbol association). These efforts culminated in publishing of the Pimsleur Language Aptitude Battery (PLAB; 1966b). Although the predictive validity and reliability of this battery in terms of an intensive, audiolingually oriented course of instruction are yet to be determined, one of its two auditory parts appears to be rather interesting. Unlike the auditory sections of MLAT (which utilize only English phonemic sounds), the sound discrimination part of PLAB requires the examinee to differentiate between pitch, orality, and nasality in spoken words of a low-density West African language.* The tasks presented to the examinee in this part appear to be more criterion-oriented than their MLAT counterparts.

Conclusion

From the preceding discussion, it appears reasonable to make the following statements:

Research in foreign language aptitude testing does not appear to have received the attention it so rightly deserves. In a fast shrinking world, the need to communicate orally in a foreign language appears to be rapidly increasing. The skills involved in speaking

*For a more detailed description of PLAB, see Appendix A-3.

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a foreign language are quite different from those required for learning reading and writing. In order to save the prospective foreign language learner unnecessary waste of time and effort, to avoid frustration, and to make optimal use of his capabilities, he needs to have a reasonably accurate profile of his abilities in this area before actually embarking on learning a foreign language. The present study is one step in an attempt to accomplish this goal.

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CHAPTER II

PROBLEM AND HYPOTHESES

Introduction

This research study was initially inspired by certain experiences the writer had acquired during his appointment as an instructor of Arabic at the Defense Language Institute, West Coast Branch (DLIWC), Presidio of Monterey, California, in the late 1950's and early 1960's.* During that time it was consistently observed that, despite acquiring high scores on the Defense Language Aptitude Test (DLAT),† a substantial number of students could not keep up with the fast pace of intensive instruction at DLIWC and were subsequently relieved for lack of linguistic aptitude. Additionally, some students who had studied more than one language in DLIWC

---

*Although this writer is deeply indebted to the U.S. Department of Defense for providing the opportunity to conduct this research, and particularly to Colonel Horne, present Commandant of DLIWC, without whose genuine assistance and persistent encouragement this study would probably not have been made, none of the ideas or conclusions offered in this paper should in any way be construed as reflecting the official position or viewpoint of the Defense Language Institute.

†Almost every student at DLIWC has on his records a DLAT score before beginning his foreign language training at the school.

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at different times often observed that while they had experienced unusual difficulty in learning one language, which may or may not have been structurally similar to English, they had little or no difficulty in learning a second foreign language or, conversely, having had no difficulty in learning a foreign language, they were experiencing difficulty with a second. Clearly there was a need for conducting a systematic investigation to explore the possibility of improving prediction of success under the intensive method of audiolingual instruction. This need was later confirmed as a result of minor studies conducted by this writer in evaluating the predictive validities of DLAT. In one such study, the writer (1969, pp. 17-24) found a substantial amount of overlap between the DLAT scores of graduates and those of lack-of-aptitude reliefs. Out of a sample of 234 studied, one student thus relieved had an aptitude score of 59 (the maximum possible on DLAT!), and out of a sample of 2,360 graduates 121 scored below 18. Reproduced as Figure 1 below for visual comparison are two superimposed hystograms based on the percentage distribution of frequencies for graduates and reliefs covered by this study.

As was mentioned earlier, the "Army Method" was perhaps one of the major developments in teaching

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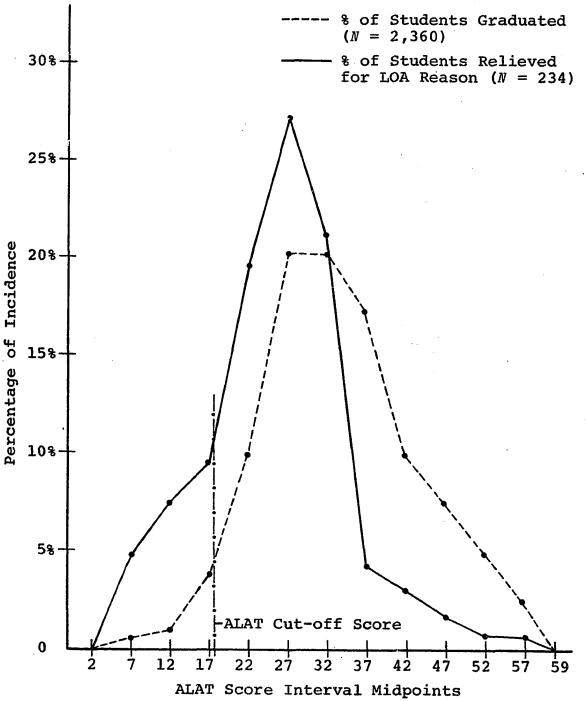

Fig. 1.--DLAT Scores of LOA Reliefs and Graduates, Defense Language Institute, West Coast, FY-69

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foreign languages after World War II. Although this method is essentially intensive-audiolingual, the United States Department of Defense uses a linguistically oriented but nonauditory type of foreign language aptitude test (the DLAT) for selecting trainees for its foreign language training program. There is evidence to suggest that the predictive validity of this test has deteriorated over the years. While in 1959 its validity for predicting final grades was shown to be .68 by Berkhouse et al. (1959), a previously cited study by this writer (1968a) indicates a validity coefficient of .07, which is not significantly different from zero. Although it would be rather speculative to try to explain the reasons for this significant change in the predictive power of DLAT, it is not unreasonable to hypothesize that it was partly due to change in emphasis in the methods of instruction at DLIWC. A gradual shift toward the audiolingual, contrastively-based method of instruction did occur at the school during this period of time. The apparent inadequacy of DLAT in predicting success in foreign language learning under conditions dictated by the intensive, audiolingual, contrastively-based method may further be strengthened by another study made by this writer (1970, p. 15) concerning student relief at DLIWC during fiscal year 1970. In this study, the rate

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of relief for academic reasons, based on a total input of 2,414 students, was 11.8 percent. This attrition rate is considered to be rather high in light of the fact that these reliefs scored 18* or better (and some attained maximum or near maximum scores) on DLAT.

Taking all the above into consideration, it can be surmised that:

1. There is a definite need, which is especially evident in the case of the United States armed forces, for a new study concerning factors relevant to prediction of success in foreign language learning under conditions dictated by the intensive audiolingual format.

2. There is a marked discrepancy between the nature of items making up aptitude tests in current use and criterion performance anticipated under new methods of teaching foreign languages, where listening and spoken skills are emphasized. In one case (DLAT), the test has no listening parts. In others, such as MLAT and PLAB, it is doubtful whether the items comprising their auditory components are of sufficient difficulty, coverage, and complexity to yield significant prediction for all languages.

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*A score of 18 on DLAT is the cut-off score for admitting most students to the DLI foreign language training program.

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3. Starting out with the premise that success in foreign language is to a large extent a function of the learning of linguistic differences between the native language of the student and the target language, it may therefore be hypothesized that, concerning native speakers of English, foreign language aptitude can best be measured by a test which bears specific reference to the unique differential relationship existing between the foreign language and English. The tests examined above attempt to measure the ability to overcome general differences among all languages on the one hand and English on the other. As a result, their predictive validities have probably been vitiated to a point far below maximum efficiency. Ideally, therefore, it may be necessary to develop an aptitude test for every single language. This solution, although appearing to be theoretically sound, may prove to be too difficult to implement in actual practice on account of the vast number of languages taught throughout the United States. It seems more feasible, however, that a well-planned research program resulting in a small number of aptitude batteries, each designed to measure aptitude for learning a group of structurally related languages, may provide an adequate answer to this question.

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Problem

Recognizing the need for a new language aptitude test to replace DLAT, DLIWC, in collaboration with San Jose State College, initiated in March 1969 a comprehensive "Aptitude Assessment Project,"* the purpose of which can be summarized as follows:

1. To explore various factors which are likely to be relevant to foreign language learning, such as general intelligence, foreign language aptitude, motivation, personality characteristics, age, and previous education.

2. To construct and validate four linguistically-based experimental tests and questionnaires, which were later identified as follows: Al-Haik Foreign Language Auditory Aptitude Test (AFLAAT), Horne's Assessment of Basic Linguistic Abilities (HABLA), Foreign Language

---

*This project was conceived, designed, and launched jointly by the following individuals:
Colonel Kibbey Horne, Commandant, DLIWC.
Dr. James Asher, Professor of Psychology, San Jose State College.
Dr. Bela Banathy, then Director of East-Europe Middle East Division, DLIWC, and now Assistant Director, Communication Program, Far West Laboratory for Educational Research and Development.
Mr. Shigeya Kihara, Director of Research and Development Division, DLIWC.
Mr. Alex Szaszy, Language Evaluation Specialist, DLI Systems Development Agency.
Mr. Antoine Al-Haik, Chief, Tests and Measurement Branch, DLI Systems Development Agency.

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Interest Inventory (FLII), and the Q by Q Interview (Q x Q).*

3. To contrast the validities of the new instruments with those of established measures, such as the MLAT, DLAT, PLAB, Otis-Lennon Mental Ability Test-Advanced Level Form J (Otis), Taylor Manifest Anxiety Scale (TMAS [Taylor, 1953]), and Need for Social Acceptance (NSA [Crowne and Marlowe, 1964, pp. 23-24]).*

4. To revise and refine the experimental tests based on two types of item analysis data: internal consistency validation, using the total items on each test as the criterion measure, and external validation with student achievement measures serving as criteria.

5. To conduct factor analytic and regression analytic studies on all predictor measures using six-week, twelve-week, and final grades as criterion measures. These studies will be based on data from both individual language samples and the combined total sample.

6. The final product is anticipated to be in the form of a foreign language aptitude battery which will provide a specific as well as general aptitude profile for each prospective student. This profile will assist the student in making a decision as to which language or

---

*For more detailed descriptions of these instruments, see Appendix A.

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group of languages he is best fitted to study.

7. Data for this research project will be collected from the following nine representative languages: Arabic, French, German, Korean, Mandarin Chinese, Russian, Spanish, Turkish, and Vietnamese. The total sample size is expected to be about 1,000 for pretesting and validation and another 1,000 for cross validation. The first data collection was initiated in September 1969 and the final product is expected to be completed by the end of 1973.

The present dissertation study covers only one aspect of the comprehensive project described above. Although various factors will be touched upon, the major problem selected for this study will be to explore the auditory aspects of aptitude for modern foreign language learning. It is to be understood that this learning must be viewed within the framework of the instructional methodology adopted by the Defense Language Institute.

Hypotheses

The hypotheses to be tested in this study can be classified in two groups, as follows:

A. Gross prediction

H_1: The auditory factor, measured by a linguistically-based auditory test of sufficient

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complexity, difficulty, and coverage, is as effective in predicting foreign language performance as nonauditory measures of the more intellectual paper-and-pencil type. It is hoped that confirmation of this hypothesis will strengthen the justification for using an auditory component (which is now missing in DLAT) in a future aptitude test battery to be utilized for screening prospective DLI students.

H_2: Using single- and double-entry expectancy tables, the most effective prediction of foreign language performance will be accomplished by the use of a combination of measures: auditory and nonauditory.

B. Differential prediction

H_3: An auditory foreign language aptitude test specifically designed to measure aptitude for one language on the basis of frequent errors made by students learning that language is a better predictor of foreign language performance in the language for which it was designed than for any other language or languages combined.

H_4: An auditory foreign language aptitude test designed in accordance with the specifications stated under H_3 above is a better predictor of foreign language performance in the language for which it was designed than any other purely auditory test used in this study

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(MLAT-Part 1, PLAB-Part 5, and HABLA-Part 1).

H_5: A sound-symbol association type of foreign language aptitude test specifically designed to measure aptitude for learning the written form of the language for which it was designed is a better predictor of success in acquiring that written form than any other sound-symbol association test used in this study (MLAT-Part 2, PLAB-Part 6, HABLA-Part 3).

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CHAPTER III

PROCEDURE, RESULTS, AND ANALYSIS

Introduction

The research design adopted for testing the hypotheses stated in Chapter II may be briefly outlined as follows:

1. A new auditory foreign language aptitude test--the AFLAAT*--was developed, item analyzed, and cross-validated by this writer.

2. AFLAAT and other predictors were administered to DLIWC samples of students before beginning their foreign language instruction.

3. Various student criterion performance data, external and internal, were gathered.

4. Intercorrelation matrices were set up between predictor and criterion measures, using language samples individually and combined.

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*Al-Haik Foreign Language Auditory Aptitude Test. Although the rationale and description of this test, which represents the principal measuring instrument used in this research, are treated mainly in this chapter, the AFLAAT test booklet, scenario, and tapes, together with a short description of the test are found in Appendix A-4a, b, c, and d.

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5. Validity coefficients of the various predictors were evaluated, compared, and analyzed.

6. Simple and double-entry expectancy tables were set up to compare the practical validities of some tests.

7. The validities of predictor measures were also compared using student attrition data as the criterion measure.

In this chapter, a detailed description of the procedure used and the results obtained will be given, together with an analysis of the salient findings.

Construction of the AFLAAT

A special aptitude test called "Al-Haik Foreign Language Auditory Aptitude Test" was constructed. As the title implies, this test is almost exclusively a measure of the auditory component of foreign language aptitude. AFLAAT was designed on the basis of conducting contrastive and error analyses between Arabic and American English on the phonological and syntactic structural levels. The rationale for the selection of test item problems is predicated on the experience of the test writer as a DLIWC Instructor and Class Supervisor in Arabic from 1957 to 1965. The importance of auditory factors in foreign language learning has been previously recognized by Dexter (1934), Carroll (1955,

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1958), Pimsleur (1961, 1968) and Pimsleur et al. (1962). It seems doubtful, however, that the auditory components of tests used by these investigators are of sufficient difficulty, coverage, and complexity to yield significant prediction. The auditory components of MLAT, for instance, can hardly be claimed to add any unique contribution to the explained variance which has already been accounted for by The Short Form (paper-and-pencil parts of MLAT) alone (Carroll, 1959b, p. 14). In developing the various parts of the AFLAAT, utmost care was exercised not only to make the items sufficiently difficult and complex but also to make them reflect, as much as possible, actual problems faced by the foreign language student in acquiring the phonological, morphological, and syntactical structures of the new language taught under the intensive audiolingually oriented method. In Item 9, for example, which is typical of Part I, Foreign Language Sounds, the student is presented with a spoken lead utterance consisting of six Arabic phonemes: /ẟarabtunnahunna/. He is then asked to identify the option (c) which is identical to the lead among the four spoken utterances:

a. /ḏarabtunnahunna/; b. /ẟarrabtunnahunna/;

c. /ẟarabtunnahunna/; d. /ẟarabtuunahunna/.

The seemingly slight differences tested by this item are

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highly significant in terms of frequency of errors made by an American student learning the Arabic phonemic system. As a result of item analysis* conducted on the AFLAAT, this item turned out to have biserial coefficients of correlation (Guilford, 1965, pp. 317-21) of .35 with the total score and .41 with Part I score. In Item 77, Part II, Foreign Language Writing, the student listens to the lead utterance: /takallafinii/ and then selects, according to a specified set of rules,† the correct option (b) among four printed in the test booklet:

a. nflkt; b. nfllkt; c. nlfkt; d. nnfllkt.

The biserials for this item are .38 with the total score and .42 with Part II score. As a last example, to illustrate the elaborate procedure used in the development of the AFLAAT, consider Item 152, Part III, Foreign Language Grammar. The student is presented here with the following lead printed in his test booklet: "The President presents a present." He is then asked to select the correct option (a) among four spoken on tape, in accordance with a set of new morphemic and syntactic rules.§

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*See Item Analysis Data Sheet, Appendix B-1.

†See AFLAAT Test Booklet, Appendix A-4b, p. 4.

§See AFLAAT Test Booklet, Appendix A-4b, p. 10.

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a. /praazident prazinta yaprizent/

b. /prezidenta praazint yaprizent/

c. /yaprazident praazint prazinta/

d. /prezint yaprizent prezidaant/

The biserials for this item are .66 with the total score and also .66 with Part III score.

As was stated earlier, the main purpose of the AFLAAT was to predict success in learning one specific language: Arabic. However, being so elaborately designed to cover a wide variety of foreign language sounds used in conjunction with many types of new morphological and syntactical formations, and since these linguistic features are shared to some extent by any system of speech communication, AFLAAT proved to be not only a good predictor of Arabic language performance but of other languages as well, as will be substantiated by data to be presented later in this chapter. The initial experimental form of the test consisted of a total of 172 multiple-choice items (four options to each, with only one correct option per item), including seven nonscorable practice items. The items, which are all of the auditory type, are distributed as follows:

Part I--Foreign Language Sounds (60 items). This part consists of three sections:

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Section 1: Utterance Identification (20 items). The examinee hears a lead utterance followed by four alternative utterances, only one of which (which the examinee is required to identify) is identical to the lead. The purpose of these items is to test the ability of the student to distinguish Arabic phonemic differences (vowels and consonants) which may sound either new to him or allophonic as far as American English is concerned. The number of syllables for each option within an item is the same. The number of syllables in each utterance tested in this section ranges from two to six.

Section 2: Recognition of Vowel Patterns (20 items). The examinee hears four utterances which are different in consonantal structure but identical in vowel pattern, except for one option. The examinee is required to identify the utterance with the different vowel pattern. The purpose of these items is to test sensitivity in distinguishing vowel patterns imbedded in varied consonantal structures. The number of syllables in each utterance tested in this section ranges from two to nine.

Section 3: Recognition of Stress Patterns (20 items). The examinee hears four utterances which have the same number of syllables but are different in terms of segmental phonemic structure. Furthermore, the main

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stress of three of these utterances is placed on syllables occupying the same position and only in one utterance is the stress shifted to a different position within the utterance. The examinee is required to identify the utterance with the different stress pattern. The purpose of this section is to test sensitivity to shifts in stress pattern (suprasegmental phonemes) in environments with different segmental phonemic structures. The number of syllables in each utterance tested in this section ranges from three to seven.

Part II--Foreign Language Writing or Sound-Symbol Association (25 items). The examinee hears an utterance. He then reads four options printed in his test booklet using Roman alphabet. His task is to identify the option which correctly symbolizes the lead on the basis of the following set of rules:

1. Vowels are omitted.
2. Consonants are printed and read backward, from right to left.
3. When emphasized in pronunciation, consonants are doubled in writing.

The purpose of this part of the test is to measure the student's ability to associate sounds with symbols and also his ability to overcome proactive inhibition in the learning of a new system of writing

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utilizing a familiar orthography. The number of syllables in each utterance tested in this part ranges from two to seven. As in all previous parts of the test, the utterances used in this section, though Arabic sounding, are all artificially coined. The only exceptions to this are the six English utterances (tested in this part) which appear in the following table, together with their biserials:

TABLE 2

BISERIAL VALIDITIES OF SIX ENGLISH WORDS USED IN PART II OF AFLAAT

Item #	English Utterance	r with Total Score	r with Part II Score
69	unknowable	.09	.23
73	rough him up	.31	.29
78	give me hot tea	.32	.45
79	exquisiteness	.31	.37
81	psychologically	-.04	.17
89	irreversible	-.07	.12

The above data suggest that in a sound-symbol association type of foreign language aptitude test the use of English utterances whose spoken slang forms differ significantly from their written forms appears to be justified.

Part III--Foreign Language Grammar (80 items). In this part of the test, the examinee reads a phrase or a

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sentence printed in the test booklet in English. He then hears four alternative translations using the same English words with slight modification in pronunciation and word order to accommodate a new grammatical set of rules. His task is to identify the alternative which correctly conveys the meaning of the printed utterance according to the new rules. This procedure of utilizing utterances with English semantic content is considered to have the following advantages:

1. It motivates the examinee to do his best on the test by making the items more meaningful and therefore more interesting (McDonald, 1965, p. 231; Ruch, 1963, pp. 108-10).

2. By injecting semantic content into the testing situation, the experience becomes more criterion-oriented.

3. The factor of memorizing brand new vocabulary items by rote is eliminated and thus testing time is utilized only for measuring ability to learn, retain, and identify new structure.

4. The procedure makes possible the measurement of the examinee's readiness to overcome proactive inhibition caused by his native language (American English) in learning the grammatical system of a second language.

Part III of the test consists of the following four sections:

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Section 1: Noun-Adjective Agreement (20 items). The purpose of this section is to measure the examinee's ability to memorize and retain new grammatical rules* and to apply them auditorily in the solving of translation problems.

Section 2: The Possessive Form (20 items). The purpose of this section is to measure the examinee's ability to memorize and retain new grammatical rules† and to apply them auditorily in solving translation problems.

Section 3: Sentence Structure (20 items). The purpose of this section is to measure the examinee's ability to memorize and retain new grammatical rules§ (subject-verb-object order changed; use of prefixes, infixes, and suffixes) and to apply them auditorily in the solving of translation problems.

Section 4: Previous Rules Combined (20 items). This section includes the application of rules contained in the previous three sections. Its purpose is to measure the examinee's ability to retain a complex set of rules over a period of time and to apply them auditorily in the solving of translation problems.

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*See AFLAAT Test Booklet, Appendix A-4b, p. 7.

†See AFLAAT Test Booklet, Appendix A-4b, p. 9.

§See AFLAAT Test Booklet, Appendix A-4b, p. 10.

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Test Materials for the AFLAAT

Instructions to students are both tape recorded by a native American English speaker and printed in the test booklet. All foreign language stimuli are also tape recorded by a native speaker of Arabic--the author. Thus, timing of all parts is automatically controlled and the whole test can be easily administered by a non-expert individual who can operate an ordinary tape player. The testing materials consist of the following items:*

1. Two 7-inch tapes (three sides at 7.5 i.p.s., with a total time of ninety minutes).

2. A reusable test booklet.

3. Any standard answer sheet (or IBM cards) consisting of 172 four-choice items.

4. A pencil.

5. An ordinary tape player.

6. A stencil key to score answer sheets by counting the number of correct responses for each of Parts I, II, and III, and the total.

---

*One copy of the Test Booklet and tapes is found in Appendix A-4b and c.

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Item Analysis of the AFLAAT

In September and October, 1969, the experimental form of the AFLAAT was administered to the following DLIWC student inputs, just before starting their courses, for the purpose of item analysis:

TABLE 3

AFLAAT ITEM ANALYSIS SAMPLES

Language	*N*
Arabic	26
Chinese-Mandarin	27
French	34
Hungarian	7
Japanese	10
Korean	24
Persian	7
Russian	74
Serbo-Croatian	8
Turkish	9
Total	226

The above samples consisted of young military personnel who are comparable in age and education to the general student population at DLIWC, as the following table indicates:

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TABLE 4

COMPARISON OF AFLAAT ITEM ANALYSIS SAMPLES WITH DLIWC FY-1970 STUDENT POPULATION

		Age		Education	
	N	Mean	Standard Deviation	Mean*	Standard Deviation
Item Analysis Samples	226	22.7	4.472	2.6	2.098
FY-70 Student Population	2,868	22.5	4.692	2.3	2.301

*Number of years in college.

The test was administered at the DLIWC Russian language laboratory where the students sat in accoustically semi-insulated booths, used headphones, and marked their responses on IBM cards. The cards were then processed at the Computer Facility (IBM Computer 360-67) of the U.S. Naval Post Graduate School in Monterey, California, under the supervision of Mr. Faye Long, Chief, Automatic Data Processing Branch, DLIWC. The output data sheets for this item analysis are included in Appendix B-1. The results of this first experimental administration produced eleven negatively discriminating items (with negative biserial *r*'s). Since these eleven items were measuring in a direction opposite to that of the total test, they were therefore eliminated from

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scoring when the test was administered again to a new cross-validation sample* in January 1970. This sample also consisted of typical DLIWC students (N = 196), who took the test just before starting their courses in the following languages:

TABLE 5

AFLAAT CROSS-VALIDATION SAMPLES

Language	N
Arabic	34
Russian	78
German	31
Spanish	53
Total	196

As before, the students were tested in the Russian language laboratory at DLIWC. Their responses were recorded on IBM cards and item analysis data were prepared at the U.S. Naval Post Graduate School. For comparison, the results of the first and second test administrations are summarized in Table 6. Table 6 indicates that with a reliability coefficient of .92 (Kuder-Richardson, formula no. 20), AFLAAT items are relatively homogeneous. This reliability figure is

*Data obtained from this sample were also used in testing the research hypotheses for this study.

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TABLE 6

AFLAAT ITEM ANALYSIS AND CROSS-VALIDATION DATA: DLIWC SAMPLES

TEST STATISTIC	PART I Foreign Language Sounds		PART II Sound-Symbol Association		PART III Foreign Language Grammar		TOTAL TEST	
	Oct.'69 Ad[a]	Jan.'70 Ad[b]	Oct.'69 Ad[a]	Jan.'70 Ad[b]	Oct.'69 Ad[a]	Jan.'70 Ad[b]	Oct.'69 Ad[a]	Jan.'70 Ad[b]
Size of Sample *N*	226	196	226	196	226	196	226	196
Mean	35.96	34.82	12.05	10.46	53.13	54.47	101.14	99.74
Standard Deviation	6.25	6.39	3.01	2.97	11.28	12.53	17.10	19.05
Standard Error of Measurement	3.26	3.17	2.37	2.13	3.83	3.71	5.53	5.27
Range	14-52	16-49	4-21	2-18	23-75	17-75	48-137	42-141
Number of Scorable Items	60	56	25	20	80	78	165[c]	154
Reliability Coefficient *r* (KR20)	.73	.75	.38	.48	.88	.91	.90	.92
Number of Items with Negative *r* (biserial) vs. Total Score	4	0	5	0	2	0	11	0
Mean Item Difficulty Level[d]	59.93	62.12	48.20	52.25	66.45	69.83	61.31	64.74

Ad = Administration

[a]Before conducting item analysis.

[b]After conducting item analysis and discarding eleven negatively discriminating items.

[c]The total number of AFLAAT items is 172, of which seven are nonscorable practice items.

[d]Item difficulty level is defined as the percentage of examinees passing the item.

considered to be fairly high in view of the fact that AFLAAT is essentially a power test (Thorndike, 1951, p. 589), as reflected by the very small number of items omitted by the examinees. Judging by standards set by Ebel (1969, p. 566), the AFLAAT mean and standard deviation also appear to be adequate. Thus, the obtained AFLAAT mean score value of 100 is approximately midway between the maximum possible score of 154 and the expected chance score of 39 (midway score: 97) and the obtained AFLAAT standard deviation of 19.05 is very close to one-sixth of the difference between the maximum possible score and the expected chance score (19.17). The shape of the distribution of AFLAAT cross-validation scores can be ascertained from data in Figure 2. These data indicate the distribution approximates normality with slight negative skewness.

Taking all the above item analysis data into consideration, AFLAAT appears to be a good objective test from the psychometric point of view. As far as test validity is concerned, AFLAAT should have content validity not only because of the intricate procedure used in constructing its items but also because of its high observed reliability. AFLAAT also proved to have empirical validities for predicting success in learning various foreign languages, as will be seen later in this chapter.

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Class Interval	*f*
140-149	1
130-139	7
120-129	20
110-119	38
100-109	44
90-99	32
80-89	24
70-79	14
60-69	10
50-59	5
40-49	1
	196

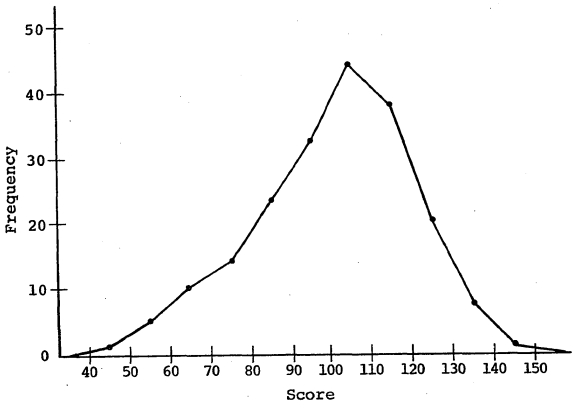

Fig. 2.--Frequency Distribution and Polygon: AFLAAT Cross-validation Scores

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Predictor Measures Used for This Study

In addition to AFLAAT, a number of other predictor measures were applied to the DLIWC January 1970 samples. Except for DLAT, all predictor tests were administered at the DLIWC Russian language laboratory during the two-day period immediately preceding the start of instruction of classes on January 9, 1970. Sufficient rest periods were given to students to minimize the effect of fatigue. They were told that the testing was for research purposes only and that although the scores would in no way affect their performance records in the school they should do their very best in answering all questions.* The tests and other predictor measures† used for this study are listed, as follows:

Experimental Measures. Al-Haik Foreign Language Auditory Aptitude Test (AFLAAT): Parts I and III are strictly auditory, while Part II is partly so (Al-Haik, 1970).

Horne's Assessment of Basic Linguistic Aptitudes (HABLA): Part I is strictly auditory, Part II is paper-

*For a full text of a written memorandum distributed to students before testing, see Appendix B-2.

†A more detailed description of these tests and other predictor measures is found in Appendix A.

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and-pencil, and Part III is televised (visual-sound-symbol association [Horne, 1970]).

Foreign Language Interest Inventory (FLII): Paper-and-pencil (Szaszy, 1970).

Established Measures. Modern Language Aptitude Test (MLAT): Parts I and II are auditory and Parts III, IV, and V are paper-and pencil (Carroll, 1959a).

Pimsleur Language Aptitude Battery (PLAB): Parts I and II are biographical (previous school grades and interest), Parts III and IV are paper-and-pencil, and Parts V and VI are auditory (Pimsleur, 1966).

Otis-Lennon Mental Ability Test-Advanced Level (Otis): Paper-and-pencil (Otis and Lennon, 1967).

Defense Language Aptitude Test (DLAT): Paper-and-pencil (Department of the Army, 1969a).

Taylor Manifest Anxiety Scale (TMAS): Paper-and-pencil (Taylor, 1953).

Need for Social Approval (NSA): Paper-and-pencil (Crowne and Marlowe, 1964).

Biographical Measures. Age; Education.

Criterion Measures Used for This Study

All students at DLIWC, including the samples used for this study (see Table 8, p. 52), are subjected to the

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same grading system throughout the course. The students are evaluated by their instructors on a daily basis (subjective ratings) and given weekly quizzes (semi-objective) and comprehensive examinations at the end of each six-week period of the course. Each comprehensive examination consists of two main parts: oral and written. The oral part consists of Listening Comprehension (objective, multiple-choice) and Speaking (subjective). The written part consists of Reading Comprehension (objective, multiple-choice) and Writing (semi-objective). The final examination is identical in format to the six-week comprehensive examination, except that it is not restricted in content to the last six-week period of the course but covers all other periods as well. In assigning a subjective or semi-subjective grade to a student, the following adjectival rating scale is used:

% Grade	Adjectival Rating	% Grade	Adjectival Rating
94-100	Excellent	76-81	Fair
88-93	Very Good	70-75	Borderline
82-87	Good	0-69	Failing

If two or more instructors are involved either in rating independently the same student within the same six-week period (which happens quite often because instructors are usually rotated among classes and sections) or in

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administering an oral examination at the end of the six-week period, these independent ratings are pooled by the Class Supervisor, who is also responsible for transforming all raw scores into percentage grades and recording them on special data sheets. These sheets are forwarded to the School Registrar where they are filed in secured cabinets for later administrative use.

It must be made clear at this point that although this writer was at one time (1957-1965) an Instructor and Class Supervisor at the Arabic Language Department, DLIWC, and is currently Chief, Tests and Measurement Branch, in no way was he involved in writing the tests or in computing the grades used in this study.

In addition to the above tests, which are all internally developed, administered, and evaluated, all students take what is called "The Defense Language Proficiency Test" (DLPT [Department of the Army, 1969b]) at the end of the course. This test which was externally developed for each language by an Army-civilian team of writers in 1955 consists of two objectively scored parts: Listening and Reading. In the listening part, which consists of sixty multiple-choice items, the student listens to a tape recorded lead (a sentence or a short paragraph in the foreign language) and then marks one of the four written English alternatives (a word, a sentence, or a short paragraph) which best fits

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the lead. In the reading part, which also consists of 60 multiple-choice items, the student reads a lead (a sentence or short paragraph) printed in the foreign language and then marks one of the four written English alternatives (word, sentence, or short paragraph) which best fits the lead.

Although the reliability and validity of all the criterion measures discussed so far have not, as far as this writer knows, been formally established, due to their long-time use by experienced foreign language instructors who are usually involved in the evaluation of a small number of students at a time* and because the system has generally been satisfactory to all concerned, it may therefore be assumed that these evaluative instruments yield grades that are fairly valid and reliable. Nevertheless, in order to satisfy his curiosity, this writer conducted a scorer reliability study for oral and written tests administered to the Russian sample participating in this research project. The ratings selected for comparison were assigned by four different instructors to the same group of students taking the Speaking and Writing tests at the end of the first and second six-week periods of instruction. The results are presented in Table 7. The data in Table 7 provide evidence in support of the assumption that subjective ratings assigned to students at DLIWC are quite reliable.

*Class sections at DLIWC normally consist of seven to ten students each.

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TABLE 7

SCORER RELIABILITY DATA: DLIWC RUSSIAN CLASS, JANUARY 1970 INPUT

Item	TEST			
	6-week Speaking	6-week Writing	12-week Speaking	12-week Writing
Number of Students Rated	8	8	8	6
Number of Scorers	4	4	4	4
Average r Between Scorers	.93	.95	.84	.89
Mean Rating	84.8	85.8	89.5	87.2
Mean S.D. of Ratings	7.127	5.296	4.564	4.663

All the criterion measures discussed up to this point apply to all foreign language samples included in this study. In addition to these, it was decided to use commercially available foreign language achievement tests as external criterion measures to furnish additional support for the study. The tests selected for this purpose were The Modern Language Association's Cooperative Foreign Language Tests, Form MA (1963a, 1963b). These tests were administered during the last quarter of the course to the German and Russian samples only. Since the Spanish students participating in this

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study graduated and left the school before the tests were received, and since there are no MLA tests available for Arabic, these samples did not take these measures. The German and Russian Speaking and Writing tests were scored by outsiders* and the Listening and Reading parts were scored by the Digitek scanner at DLIWC. The four parts of the MLA Cooperative Tests are briefly described, as follows:

The listening part of this test consists of forty multiple-choice items. The student listens to a tape recorded sentence, question, or paragraph in Russian. He then decides which of the four printed Russian sentences best fits the lead.

The reading part of this test consists of fifty multiple-choice items. The student reads an incomplete sentence, a written dialogue, or a selection in Russian. He then decides which word or sentence, among the four options printed in Russian, best fits the lead (or fits questions based on the lead).

The speaking part of this test consists of fifteen mimicry items (scored either right or wrong), oral reading of a selection (scored by rating ten critical

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*The names of Chief Scorers in German and Russian were submitted by Educational Testing Service, as per their letter dated June 30, 1970, a copy of which is found in Appendix B-9.

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language features on a right or wrong basis), answering four questions based on four pictures (scored by using a four-point rating scale), describing a single picture (scored by rating each of four language skills--vocabulary, pronunciation, structure, and fluency--on a six-point scale), and telling a story based on a sequence of four pictures (scored by rating each of four key features--vocabulary, pronunciation, structure, and fluency--by using a six-point scale). The maximum raw score for the speaking test is 82.

The writing part of this test consists of thirty fill-in items (scored right or wrong), fifteen sentence-rewrite items (scored by rating specific elements in each sentence on a four-point scale), and writing one paragraph about a specific but familiar subject (scored by rating each of five key features pertaining to paragraph quality, using a four-point scale). The maximum raw score for the writing test is 100.

Although published data provide evidence of high reliabilities for the MLA Tests (average r of .88 for German and average r of .90 for Russian [Modern Language Association, 1965b]), no validity data are available to confirm the adequacy of using these tests in the DLIWC situation. A cursory review of the tests by this writer revealed that their content is not directed

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toward an all-male population, as is the DLI course content, nor does it reflect the military terminology and situations found in the DLI courses.

To recapitulate, the criterion measures used in the intercorrelation matrices for this study (see Appendix B-3, 4, 5, 6, 7) may be summarized as follows:

For All Samples (Arabic, German, Russian, and Spanish): Fifteen criterion measures are used, as follows:

First 6-week Grades:

Oral Comprehensive Examination (O)
Written Comprehensive Examination (W)
Weighted Average of "O" and "W" (AVG)
Overall 6-week-period Grade (OVERALL)*

Second 6-week Grades:

Oral Comprehensive Examination (O)
Written Comprehensive Examination (W)
Weighted Average of "O" and "W" (AVG)
Overall 6-week-period Grade (OVERALL)*

Final Course Grades:

Oral Comprehensive Examination (O)
Written Comprehensive Examination (W)
Weighted Average of "O" and "W" (AVG)
Overall Course Grade (OVERALL)*

Defense Language Proficiency Test Scores:

Listening Comprehension (L)
Reading Comprehension (R)
Total of "L" and "R" Scores (TOT)

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*The "OVERALL" grade is a composite percentage grade consisting of the Comprehensive Examination grade, daily performance ratings, and scores from weekly quizzes.

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For the German and Russian Samples Only: Seven additional measures are used, as follows:

MLA Cooperative Foreign Language Tests:

Listening Comprehension (L)
Reading Comprehension (R)
Speaking (S)
Writing (W)
L + S
R + W
L + R + S + W (TOT)

Samples Used in the Correlational Study

As was mentioned earlier, a variety of predictor measures were administered to the January 1970 student input at DLIWC, consisting of Arabic (N = 34), Russian (N = 78), German (N = 31), and Spanish (N = 53) samples, shortly before beginning instruction in the foreign language. As these students went through their regularly scheduled courses and graduated, criterion measure data were collected and tabulated. Because of administrative, medical, and academic reasons, some of these students were unable to complete the course and were consequently dropped from class (or, to use the military term, "relieved"). Table 8 depicts data describing samples which completed their courses. The correlational study of this dissertation covers these samples only. Later in this chapter another study will be presented concerning student relief.

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TABLE 8

SAMPLES USED IN THE CORRELATIONAL STUDY

Sample	No. of Grades	Age		Education	
		Mean	S.D.	Mean	S.D.
Arabic	29	21.3	1.606	3.3	1.925
German	26	23.3	3.986	3.5	2.249
Russian	62	22.1	2.501	2.9	2.118
Spanish	48	23.6	5.851	2.7	2.157
Total	165	22.6	3.976	3.1	2.120

Compared with the previously tabulated DLIWC data (Table 4, supra, p. 37), the total for these samples seems to have the same average age but is slightly higher on the educational scale (3.1 vs. 2.3). The above samples may therefore be considered fairly representative of the DLIWC student population.

The Correlational Study

The purpose of this study is to test the hypotheses formulated in Chapter II. In order to furnish the required data, the various predictors and criterion measures discussed above were intercorrelated* for each

*The correlation coefficient used is Pearson's Product-Moment Coefficient. The correlation matrices were run at the U.S. Naval Post Graduate School (IBM Computer 360-67) under the supervision of Mr. Faye Long, Chief, Automatic Data Processing Branch, DLIWC.

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individual language separately and for the combined sample. The number and type of variables contained in the resulting five matrices (see Appendix B-3, 4, 5, 6, 7) are listed in Table 9. In addition, each matrix has variable means and standard deviations.

TABLE 9

NUMBER AND TYPE OF VARIABLES USED IN THE CORRELATIONAL STUDY

Sample	Predictor Measures	Criterion Measures	Total
Arabic	24	15	39
German	24	22	46
Russian	24	22	46
Spanish	24	15	39

Gross Prediction

In order to test H_1, which states "The auditory factor, measured by a linguistically-based auditory test of sufficient complexity, difficulty, and coverage, is as effective in predicting foreign language performance as nonauditory measures of the more intellectual paper-and-pencil type," one should consider the test validity data for the total sample shown in Table 10.

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TABLE 10*

VALIDITY COEFFICIENTS OF PREDICTIVE MEASURES FOR TOTAL SAMPLE (N = 165) EXTRACTED FROM CORRELATION MATRIX IN APPENDIX B-3

Measure-Part	No. of Items in Test	1st 6-wk Overall Grade	2nd 6-wk Overall Grade	Final Overall Grade	DLPT Score (Total)
Auditory					
AFLAAT-3	78	.36	.55	.56	.37
MLAT-1, 2	73	.24	.40	.37	.24
PLAB-5, 6	54	.25	.34	.35	.34
HABLA-1	25	.12	.21	.19	.15
Verbal-Paper-and-Pencil					
MLAT-3, 4, 5	119	.31	.53	.57	.42
DLAT	59	.25	.44	.48	.31
PLAB-3, 4	39	.31	.52	.53	.40
OTIS	80	.11	.31	.35	.27
Motivational					
PLAB-2	-	.23	.24	.30	.21
FLII	47	.25	.20	.22	.17
Biographical					
AGE	-	-.01	-.12	-.12	-.12
EDUCATION	-	.28	.37	.36	.20
Previous Grades (PLAB-1)	-	.13	.27	.28	.12

* Since the criterion measures within each of the three grading periods turned out to be rather highly intercorrelated (Average r's: .74, .88, .88), it was decided to use only the most representative grade (the overall grade for the period) of each. Furthermore, since the DLPT is a completely objective test which measures the overall proficiency of students at the end of each language course, it was decided to include this test in addition to the other three criterion measures.

Before beginning to analyze the above data, a word seems to be in order concerning the feasibility of

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using the Spearman-Brown Prophecy formula to correct for test length in this study. This formula, which was originally presented by Spearman in 1910 for estimating the reliability of a test from the score on a smaller segment of it (Thorndike, 1951, pp. 580-83), was derived on the basis of assumptions related to the variabilities within parts of the test itself (Guilford, 1965, pp. 466-67) and was not intended to correct for length in estimating its predictive validity when correlated with an independent external measure. Moreover, there seems to be no logical way in which to correct for length when age or education is used as a predictor. Although it is generally true that the longer a test is the more reliable and the more valid it tends to be, this writer is not aware of any studies which recommend the use of the Spearman-Brown Prophecy formula to correct for length in measuring test validity. Furthermore, it should be pointed out that most of the major tests dealt with in this study have a fairly comparable number of items, which would tend to make the value of any correction rather small even if the Spearman-Brown formula was justifiably used. For example, to correct the validity of MLAT-1, 2 for predicting DLPT total scores in comparison to that of AFLAAT-3, its validity will be raised from .24 to .25. This correction can hardly be

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considered significant in relation to AFLAAT's validity of .37.

It appears from the preceding discussion that the use of the Spearman-Brown Prophecy formula for the purpose of comparing test validities in this study will not be warranted.

Looking at the data presented in Table 10, it can be readily seen that among the auditory measures the test with the highest predictive power is the AFLAAT-3 and among the verbal (paper-and-pencil) the MLAT-3, 4, 5 and the PLAB-3, 4. Although the validities of some of the motivational and biographical predictors are significant at the .05 level*, their predictive power is generally far below that of the other two types of predictors. Since the differences between corresponding pairs of r's (within each criterion measure) for AFLAAT-3 on one hand and MLAT-3, 4, 5 and PLAB-3, 4 on the other were tested for significance† and were all found to be

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*The minimum value of r which is significant at the .05 level is .15 (Guilford, 1965, pp. 580-81).

†Using Hotelling's t test which takes into account the correlation between two predictors when testing the difference between their two predictive validities (Guilford, 1965, pp. 190-91):

$$t_{d_r} = r_{12} - r_{13}\sqrt{\frac{(N-3)(1+r_{23})}{2(1-r_{23}^2-r_{12}^2-r_{13}^2+2r_{23}r_{12}r_{13})}}, \text{ with } df = N-3.$$

The testing of one sample difference between two r's is demonstrated at Appendix B-8.

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insignificant at the .05 level, as appears from the data presented in Table 11, a decision was made not to reject the null hypothesis, namely that the auditory factor as measured by a rather sophisticated instrument such as the AFLAAT-3 is as important as the nonauditory type of factors in predicting foreign language performance. Thus, the obtained evidence is in support of H_1.

TABLE 11

TESTING DIFFERENCES BETWEEN VALIDITIES OF AFLAAT-3 AND VERBAL NONAUDITORY TYPE TESTS (SHOWN IN LEFT COLUMN) FOR THE TOTAL SAMPLE (N = 165)*

Aptitude Test Contrasted with AFLAAT-3	d_r 1st 6-wk Overall Grade	t_{d_r}	d_r 2nd 6-wk Overall Grade	t_{d_r}	d_r Final Overall Grade	t_{d_r}	d_r DLPT Score (Total)	t_{d_r}
MLAT-3, 4, 5	.05	.8089	.02	.3739	-.01	-.1920	-.05	-.8353
PLAB-3, 4	.05	.7190	.03	.5026	.03	.5084	-.03	-.4433

*t_{d_r} significant at .05 level $\geq$ 1.960.

Differential Prediction

In order to test H_3* which states "An auditory foreign language aptitude test specifically designed to

*Testing of H_2 will be dealt with under another heading "Evidence from Expectancy Tables" later in this chapter.

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measure aptitude for one language on the basis of frequent errors made by students studying that language is a better predictor of foreign language performance in the language for which it was designed than for any other language or languages combined," one should consider the test validity data for AFLAAT-1, AFLAAT-3, and AFLAAT-1, 3 in Table 12.

The data in Table 12 represent only a sample of all validity coefficients computed for the three AFLAAT predictors indicated. It seems evident from these data that the two purely auditory parts of the AFLAAT, taken singly or combined, provide the highest prediction of performance for Arabic students as compared to those studying Russian, Spanish, German, or for the total sample combined. Nevertheless, in order to conduct more rigorous comparisons, all validity r's for AFLAAT-1, AFLAAT-3, and AFLAAT-1, 3 were extracted from the correlation matrices in Appendix B-3 through 7, and averaged for each of these three measures using Fisher's z transformation method (Guilford, 1965, p. 589). The results are presented in Table 13. Using a method recommended by Hays* (1963, p. 532) for testing the

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*The test statistic used is $z = \dfrac{Z_1^* - Z_2^*}{\sqrt{\dfrac{1}{N_1 - 3} + \dfrac{1}{N_2 - 3}}}$, with Z^* being Fisher's z.

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TABLE 12

VALIDITY COEFFICIENTS* OF AFLAAT PARTS FOR PREDICTING PERFORMANCE IN VARIOUS LANGUAGES AND IN THE COMBINED SAMPLE (DATA EXTRACTED FROM APPENDIX B-3 through 7)

		AFLAAT-1				AFLAAT-3				AFLAAT-1, 3			
Sample	N	1st 6-wk Exam. AVG	2nd 6-wk Exam. AVG	Final Exam. AVG	DLPT Score (Total)	1st 6-wk Exam. AVG	2nd 6-wk Exam. AVG	Final Exam. AVG	DLPT Score (Total)	1st 6-wk Exam. AVG	2nd 6-wk Exam. AVG	Final Exam. AVG	DLPT Score (Total)
Arabic	29	.71	.60	.67	.49	.70	.84	.69	.43	.75	.80	.72	.48
Russian	62	.41	.40	.27	.36	.54	.54	.41	.48	.54	.53	.37	.48
Spanish	48	.35	.43	.42	.44	.47	.54	.55	.49	.48	.55	.56	.53
German	26	.00	.10	.12	.31	.31	.49	.45	.47	.20	.37	.35	.44
Total "S"	165	.33	.38	.33	.29	.48	.59	.51	.37	.46	.56	.48	.37

*Significance at the .05 level is reached by the following values of r: Arabic, .37; Russian, .25; Spanish, .29; German, .39; Total "S," .15.

TABLE 13

AVERAGE OF FIFTEEN VALIDITY COEFFICIENTS FOR EACH OF AFLAAT-1, AFLAAT-3, AND AFLAAT-1, 3 FOR PREDICTING PERFORMANCE IN VARIOUS LANGUAGES

Sample	*N*	AFLAAT-1	AFLAAT-3	AFLAAT-1, 3
Arabic	29	.59	.65	.67
Russian	62	.35	.47	.46
Spanish	48	.41	.51	.52
German	26	.05	.42	.31
Total "S"	165	.33	.48	.46

difference between two correlation coefficients based on independent samples and assuming bivariate normal distribution* all differences between AFLAAT validity coefficients for predicting Arabic language performance and performance in each of the other languages, as shown in Table 13, were tested for significance and the results are presented in Table 14.

Data in Table 13 show that without exception the validity of AFLAAT--in its purely auditory form (Parts 1 and 3)--for predicting language performance in Arabic is superior to its other validities for predicting success in other languages. However, when differences

*These two assumptions seem to be tenable in the case of data used in this study. The samples in the various languages do not involve the same or matched subjects and Figure 2 (supra, p. 41) shows the distribution of AFLAAT scores to be very close to normal.

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TABLE 14

DIFFERENCES BETWEEN THE VALIDITY COEFFICIENTS OF AFLAAT IN PREDICTING ARABIC AND OTHER LANGUAGE PERFORMANCE

Sample Difference	df (N - 6)	$d_{r_1 - r_2}$	z	Significance at .05 Level
AFLAAT-1				
Arabic-Russian	85	.24	1.3169	NS
Arabic-Spanish	71	.18	.9743	NS
Arabic-German	49	.54	2.2009	S
AFLAAT-3				
Arabic-Russian	85	.18	1.1470	NS
Arabic-Spanish	71	.14	.8931	NS
Arabic-German	49	.23	1.1528	NS
AFLAAT-1, 3				
Arabic-Russian	85	.21	1.3170	NS
Arabic-Spanish	71	.15	.9337	NS
Arabic-German	49	.36	1.7118	NS

between these validities are tested for significance at the .05 level (Table 14), it is found that, although there seems to be a consistent pattern favoring the use of AFLAAT in predicting Arabic performance, only in one case (AFLAAT-1: Arabic-German) did the difference prove to be significant. The apparent lack of statistical significance in the case of other languages may be attributed to two factors. One of the main findings of this study is that AFLAAT is not only a good predictor of Arabic performance but is also a fairly good predictor of performance in other languages. Thus, differences

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between its validities for Arabic and other languages would tend to be reduced in size. Additionally, because of the relatively small samples used in this study, significance of small differences in validities, if any, would tend to escape detection. It was for this last reason that this writer's strategy was primarily directed toward discovering patterns of prediction, using a multi-faceted approach, rather than relying only on statistical tests of significance. The patterns of prediction discovered so far definitely confirm the hypothesis of differential prediction in foreign language learning which is the hypothesis under investigation in this discussion.

In order to test H_4, which states "An auditory foreign language aptitude test designed in accordance with the specifications stated under H_3 is a better predictor of foreign language performance in the language for which it was designed than any other purely auditory test used in this study (MLAT-1, PLAB-5, and HABLA-1)," one should consider the test validity data shown in Table 15.

The decision to use grades on the oral parts of examinations as criterion measures in this table was based on the assumption that purely auditory aptitude tests would correlate more strongly with oral performance

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than with writing. The results, however, were not consistent with this assumption, as can be seen from data in Table 16.

TABLE 15

VALIDITY COEFFICIENTS FOR PREDICTING ARABIC ORAL LANGUAGE PERFORMANCE USING PURELY AUDITORY APTITUDE TESTS (N = 29)

Test	1st 6-wk Oral Exam Grade	2nd 6-wk Oral Exam Grade	Final O. E. Grade	DLPT-Listening Comp. Score
AFLAAT-1, 3	.64	.56	.62	.48
MLAT-1	.37	.35	.31	.19
PLAB-5	.67	.43	.46	.48
HABLA-1	.33	.25	.43	.23

TABLE 16

VALIDITY COEFFICIENTS FOR PREDICTING ARABIC WRITTEN LANGUAGE PERFORMANCE USING PURELY AUDITORY APTITUDE TESTS (N = 29)

Test	1st 6-wk Written Exam Grade	2nd 6-wk Written Exam Grade	Final Written Exam Grade	DLPT-Reading Comp. Grade
AFLAAT-1, 3	.67	.81	.81	.42
MLAT-1	.20	.62	.39	.04
PLAB-5	.38	.40	.51	.45
HABLA-1	.41	.47	.47	-.01

Data in Tables 15 and 16 clearly show that with a few exceptions, and for reasons not clearly known, the

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aptitude tests under discussion predict written performance better than oral performance. It is quite possible that this apparent discrepancy is related to criterion test reliability. The feeling of this writer is that written examinations are generally more reliable than oral examinations because of three main reasons. First, unlike oral examinations (unless taped), the same stimuli are presented to the examinees when taking written examinations. Second, the writing and scoring of written examinations tend to be done more carefully than oral examinations. The oral examination is not only usually shorter in duration but in many cases the instructor assigns a global rating to the student based on his total oral performance rather than on detailed sampling and rating of critical oral language features. Third, unlike oral examinations (again, unless taped), student responses on written examinations are permanently fixed and are readily accessible for thorough analysis and evaluation by the rater.

Returning to the main point under the present discussion, inspection of data in Tables 15 and 16 shows that in twenty-one out of twenty-four comparisons the validities of AFLAAT-1, 3 surpass those of the other auditory tests. Using Hotelling's t test (Guilford, 1965, pp. 190-91), nine of these comparisons proved to

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be significant at the .05 level, as indicated in Table 17 below.

TABLE 17

TESTING DIFFERENCES BETWEEN VALIDITIES OF AFLAAT-1, 3 AND OTHER AUDITORY TESTS (SHOWN IN LEFT COLUMN) FOR THE ARABIC SAMPLE (N = 29)

Item	d_r 1st 6-wk Exam	t_{d_r}	d_r 2nd 6-wk Exam	t_{d_r}	d_r Final Exam	t_{d_r}	d_r DLPT	t_{d_r}
Oral Performance								
MLAT-1	.27	1.7071	.21	1.2333	.31	1.9063	.29	1.5959
PLAB-5	-.03	-.2383	.13	.6781	.16	1.0940	.00	.0000
HABLA-1	.31	2.0996*	.31	1.9506	.19	1.2768	.25	1.4836
Written Performance								
MLAT-1	.47	3.0817*	.19	1.8032	.42	3.4578*	.38	2.0501
PLAB-5	.29	2.0561*	.41	3.6834*	.30	2.7266*	-.03	-.1820
HABLA-1	.26	1.8313	.34	3.0317*	.34	3.0317*	.43	2.5804*

*Significant at the .05 level.

Again, the evidence tends to support the differential prediction hypothesis that at least on the auditory level a language aptitude test which is custom-built for a specific language is a better predictor of success in that language than other language aptitude tests which have a more general purpose.

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In order to test H_5, which states "A sound-symbol association type of foreign language aptitude test specifically designed to measure aptitude for learning the written form of the language for which it was designed is a better predictor of success in acquiring that written form than any other sound-symbol association test used in this study (MLAT-2, PLAB-6, HABLA-3)," consider the test validity data presented in Table 18.

TABLE 18

VALIDITY COEFFICIENTS FOR PREDICTING ARABIC WRITTEN LANGUAGE PERFORMANCE USING SOUND-SYMBOL ASSOCIATION TESTS (N = 29)

Test	1st 6-wk Written Exam Grade	2nd 6-wk Written Exam Grade	Final Written Exam Grade	DLPT-Reading Comp. Grade
AFLAAT-2	.17	.16	.35	.36
MLAT-2	-.04	.30	.31	.47*
PLAB-6	.06	.04	.22	.36
HABLA-3	.26	.17	.03	-.05

*Significant at .01 level.

Examination of the data in Table 18 reveals that only one validity coefficient (MLAT-2 x DLPT-R) is significant at the .01 level and two (AFLAAT-2 x DLPT-R and PLAB-6 x DLPT-R) approach significance at the .05 level ($r_{.05}$ = .37). Correlation of these tests with the end-of-course performance rather than with initial

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performance may reflect the emphasis shift which takes place in an audiolingually oriented course. In such a course, the writing system acquires increasing emphasis as the course progresses. Moreover, compared to other auditory and verbal tests (see Tables 11, 15, and 16), sound-symbol association tests seem to have lower validities. Perhaps in an audiolingually oriented program of instruction, the aptitude factor represented by the sound-symbol association tests is too minor to be amenable to further differentiation into specific language factors. It seems, therefore, reasonable to conclude that the findings do not support H_5, i.e., a custom-built sound-symbol association test does not seem to yield better prediction of written language performance than other sound-symbol association tests of more general nature and purpose.

Before concluding the correlational study, it seems appropriate at this time to present data comparing the overall validities of total scores on the main tests used in this study, both for the total sample (Table 19) and for each individual sample (Tables 20-23). Moreover, in the case of the German and Russian samples, test validities have been included for predicting the external criterion measure used, i.e., the MLA-Cooperative Foreign Language Tests, Form MA. It should be

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noted that since this criterion measure was available only for the German and Russian samples it was not possible to include it in the preceding analyses, which required comparisons between test validities based on criterion measures common to all samples studied.

TABLE 19

VALIDITIES OF MAJOR TESTS (TOTAL SCORES) USED FOR PREDICTING OVERALL GRADES FOR THE TOTAL SAMPLE (N = 165)*

Test	1st 6-wk Grade	2nd 6-wk Grade	Final Grade	DLPT Score (Total)
DLAT	.25	.44	.48	.31
MLAT	.32	.55	.58	.41
PLAB	.38	.57	.60	.47
OTIS	.11	.31	.35	.27
HABLA	.25	.45	.47	.33
AFLAAT	.38	.53	.54	.39

*r significant at .05 level $\geq$ .15.

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TABLE 20

VALIDITIES OF MAJOR TESTS (TOTAL SCORES) USED FOR PREDICTING OVERALL GRADES FOR THE ARABIC SAMPLE (N = 29)*

Test	1st 6-wk Grade	2nd 6-wk Grade	Final Grade	DLPT Score (Total)
DLAT	.37	.35	.59	.62
MLAT	.62	.66	.77	.45
PLAB	.38	.41	.53	.51
OTIS	.31	.43	.52	.37
HABLA	.51	.45	.42	.30
AFLAAT	.64	.60	.78	.52

*r significant at .05 level $\geq$ .37.

TABLE 21

VALIDITIES OF MAJOR TESTS (TOTAL SCORES) USED FOR PREDICTING OVERALL GRADES FOR THE GERMAN SAMPLE (N = 26)*

Test	1st 6-wk Grade	2nd 6-wk Grade	Final Grade	DLPT Score (Total)	MLA-Coop. FL Test Score (Total)
DLAT	.33	.50	.41	.46	.58
MLAT	.35	.45	.43	.46	.55
PLAB	.29	.32	.40	.40	.48
OTIS	.20	.33	.34	.62	.52
HABLA	.27	.41	.38	.48	.44
AFLAAT	.21	.31	.36	.43	.50

*r significant at .05 level $\geq$ .39.

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TABLE 22

VALIDITIES OF MAJOR TESTS (TOTAL SCORES) USED FOR PREDICTING OVERALL GRADES FOR THE RUSSIAN SAMPLE (N = 62)*

Test	1st 6-wk Grade	2nd 6-wk Grade	Final Grade	DLPT Score (Total)	MLA-Coop. FL Test Score (Total)
DLAT	.23	.46	.44	.44	.46
MLAT	.28	.51	.55	.58	.54
PLAB	.31	.57	.57	.61	.56
OTIS	-.03	.11	.21	.22	.24
HABLA	.27	.50	.52	.41	.50
AFLAAT	.42	.56	.49	.50	.46

*r significant at .05 level $\geq$ .25.

TABLE 23

VALIDITIES OF MAJOR TESTS (TOTAL SCORES) USED FOR PREDICTING OVERALL GRADES FOR THE SPANISH SAMPLE (N = 48)*

Test	1st 6-wk Grade	2nd 6-wk Grade	Final Grade	DLPT Score (Total)
DLAT	.44	.44	.46	.43
MLAT	.53	.61	.63	.63
PLAB	.64	.68	.66	.65
OTIS	.29	.38	.34	.38
HABLA	.38	.43	.44	.40
AFLAAT	.53	.55	.59	.56

*r significant at .05 level $\geq$ .29.

It should be pointed out that, in attempting to compare the validities of the above six major tests used in this study, judgments should be tempered by the

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fact that these tests differ both in the number and type of components related to foreign language aptitude. For example, while AFLAAT does not presume to measure other than the purely auditory component (since its sound-symbol association part proved to be virtually insignificant), PLAB on the other hand claims to measure interest in learning a foreign language, previous school grades, as well as auditory and nonauditory verbal factors. AFLAAT was never intended to be a complete and self-contained foreign language aptitude test. Its main purpose was to strengthen the auditory component in a battery which should include other components as well.

A cursory examination of the data in the last five tables will provide further evidence in support of the hypotheses concerning the importance of the auditory factor in predicting success in foreign language learning and the specificity of aptitude in differentially predicting such success in individual languages. These data show that, in general, the validities of the verbal nonauditory tests (DLAT, OTIS) are rather low compared to the other tests which have both auditory and nonauditory components (PLAB, MLAT). Furthermore, AFLAAT appears to predict Arabic language performance better than German, Russian, or Spanish.

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Evidence from Expectancy Tables

In order to test H_2, which states, "Using single- and double-entry expectancy tables the most effective prediction of foreign language performance will be accomplished by the use of a combination of measures: auditory and nonauditory," three expectancy tables were constructed--two single-entry and one double-entry. All three tables were based on a sample of Fiscal Year 1972 DLIWC students consisting of the following languages:

Arabic	N = 148
Chinese-Mandarin	253
French	81
German	106
Korean	87
Russian	258
Spanish	99
Turkish	51
Vietnamese	88
Total	1,171

The method utilized in constructing the tables was similar to that recommended by Wesman (1966). Three variables were used: one criterion measure (the first six-week overall grade) and two predictor measures (AFLAAT-Total Score and DLAT). One should recall at this point that, unlike AFLAAT which is auditory, DLAT is a nonauditory, paper-and-pencil type test. The total sample was divided into three groups, "Low," "Medium," and "High" on each of these three measures

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by setting up frequency distributions and establishing cut-off scores on the basis of 33-1/3 percent divisions. The results are presented in Tables 24-26.*

TABLE 24

RELATIONSHIP BETWEEN DLAT AND FIRST SIX-WEEK OVERALL PERCENTAGE GRADE (N = 1,171)

DLAT	Six-Week Grade L 0-80	M 81-88	H 89-99	%
H 36-58	57 / 15	133 / 34	196 / 51	100
M 28-35	127 / 34	128 / 34	120 / 32	100
L 6-27	214 / 52	134 / 33	62 / 15	100

*For Tables 24-26, the numbers in small boxes denote frequencies and the numbers in large boxes denote percentages.

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TABLE 25

RELATIONSHIP BETWEEN AFLAAT TOTAL SCORE AND FIRST SIX-WEEK OVERALL PERCENTAGE GRADE (N = 1,171)

AFLAAT		Six-Week Grade L 0-80		Six-Week Grade M 81-88		Six-Week Grade H 89-99		%
H	107-141	11	45	31	124	58	228	100
M	92-106	33	128	41	155	26	100	100
L	42-91	57	222	30	117	13	52	100

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TABLE 26

RELATIONSHIP BETWEEN DLAT, AFLAAT TOTAL SCORE, AND FIRST SIX-WEEK OVERALL PERCENTAGE GRADE
(N = 1,171)

AFLAAT	Criterion	DLAT L (6-27)	DLAT M (28-35)	DLAT H (36-58)
H (107-141)	89-99 H	52 / 29	H 46 / 55	H 65 / 144
	81-88 M	30 / 17	M 37 / 45	M 28 / 62
	0-88 L	18 / 10	L 17 / 20	L 7 / 15
M (92-106)	89-99 H	11 / 15	H 32 / 40	H 35 / 44
	81-88 M	39 / 51	M 40 / 50	M 43 / 53
	0-80 L	50 / 66	L 28 / 36	L 22 / 28
L (42-91)	89-99 H	8 / 18	H 19 / 25	H 20 / 8
	81-88 M	30 / 66	M 26 / 33	M 45 / 18
	0-80 L	62 / 138	L 55 / 71	L 35 / 14

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Comparing the data in Tables 24 and 25 by concentrating on the number of cases falling around the diagonal which runs from the lower left end to the upper right end of each table (disregarding the last column), it can be seen that more cases cluster around the diagonal in Table 25 than that in Table 24. If one desires to use either AFLAAT or DLAT for predicting success in foreign language learning, the choice will clearly fall of AFLAAT. This conclusion is further strengthened by the observation that DLAT does not appear to discriminate between students achieving medium grades (Table 24, M-column: 33, 34, 34), while AFLAAT does (Table 25, M-column: 30, 41, 31). A more accurate assessment of these results can be made by computing and comparing the "forecasting efficienty" (percentage of correct prediction [Guilford, 1965, p. 387]) of DLAT and AFLAAT, as appears in Table 27.

TABLE 27

COMPARING THE FORECASTING EFFICIENCY OF DLAT AND AFLAAT, BASED ON DATA FROM TABLES 24 AND 25

Test	# of Students Correctly Predicted	Total # of Students Predicted	Forecasting Efficiency (% of Correct Prediction)
DLAT	538	1,171	46
AFLAAT	605	1,171	52

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Data in Tables 24, 25, and 27 therefore provide further evidence in support of H_1, demonstrating the importance of the auditory component of aptitude (vs. the nonauditory) in predicting success in foreign language learning under the audiolingually oriented method. Since the size of the sample used for this study was quite large (N = 1,171), the weight of evidence thus provided should be considered substantial.

Inspecting the data in the double-entry expectancy table (Table 26) by concentrating on the three large cells extending along the diagonal from the lower left end to the upper right end of the table, it can be observed that the forecasting efficiency will be further improved by the joint use of DLAT and AFLAAT in predicting foreign language performance. The joint forecasting efficiency of DLAT and AFLAAT has been computed in accordance with data presented in Table 28.

TABLE 28

JOINT FORECASTING EFFICIENCY OF DLAT AND AFLAAT, BASED ON DATA FROM TABLE 26

Test	# of Students Correctly Predicted	Total # of Students Predicted	Forecasting Efficiency (% of Correct Prediction)
AFLAAT & DLAT	332	569	58

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Computation of the joint forecasting efficiency has been done on the basis of the three diagonal cells of Table 26. Since in these cells the L, M, and H categories of both DLAT and AFLAAT are matched, the resulting forecasting efficiency value can be compared with those indicated in Table 27. Such comparison further demonstrates that the prediction of student grades attained by using DLAT and AFLAAT in team is superior to that achieved by using either of these two tests alone. The evidence gained from this study therefore clearly supports H_2, i.e., the most effective prediction of gross (across languages) foreign language performance will be accomplished by the use of a combination of measures: auditory and nonauditory.

It should be pointed out as a final note to the expectancy table studies that, had a different criterion measure been used the evidence might have been even more convincing. This statement is based on the fact that both DLAT and AFLAAT correlate least with the first six-week period grades (used in the expectancy table studies) as compared to the second six-week period and final examination grades, as was previously shown in Table 10 (supra, p. 54).

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Evidence from Student Dropout Data

This study is of special importance to the DLI because it touches upon the heart of the problem of reducing failure among students who do not possess sufficient aptitude by improving initial selection within the Defense Language training program. As a corollary to H_1, the following hypothesis (H_{1a}) was formulated: "The auditory component of foreign language aptitude is as important as the nonauditory component and other biographical factors (age, education, and previous school grades) in predicting potential failures in an intensive, audiolingually oriented foreign language training program." In order to test this hypothesis, the performance of students who dropped out of class because of academic reasons was investigated. The sample studied covered all such failures in the September 1969 and January 1970 classes which participated in this study. To achieve comparability of scores among the various predictor measures used, raw score averages of dropouts were transformed into standard scores (z scores) based on the performance of the parent population of each of these measures. Assuming an approximately normal distribution of population scores on each of the measures, the value of the z score can thus serve as an index for predicting student failures during the initial period of

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the course.* The lower the value of z on a certain predictor measure is, the more different is the performance of dropouts on that measure from the parent population, and hence the more efficient is the measure in screening such dropouts. To further enhance the interpretation of z scores, these were transformed into percentile ranks. The data, so compiled and summarized, are presented in Table 29.

Differences between each pair of means presented in Table 29 were statistically tested (using t tests) and in all but one case (age) they were found to be significant beyond the .01 level. This means that four out of five predictors used can significantly differentiate between dropouts and total student inputs. Furthermore, it is significant to note that the sensitivity of predictors in isolating dropouts, as reflected in their average percentile rank (last column of Table 29) varies from AFLAAT as being the most sensitive measure to DLAT, Education, Previous School Grades, and Age as the least sensitive--in that order. Therefore, the evidence furnished by this study confirms the hypothesis under investigation. The auditory factor as measured by AFLAAT is at least as significant as other nonauditory,

*All failures studied dropped out of the course during the first six-week period.

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TABLE 29

COMPARING PERFORMANCE OF ACADEMIC DROPOUTS AND TOTAL SAMPLE ON CERTAIN APTITUDE MEASURES (SEPT. 1969 AND JAN. 1970 DLIWC STUDENT INPUTS)

Aptitude Measure	Size of Group N	Raw Mean Score $\bar{X}$	Standard Deviation S	Standard Mean Score $\bar{z}$	Average %ile Rank
AFLAAT-Total					
Total Sample	413	101.1385	18.2671		
Dropouts	40	81.8750	16.8507	-1.0545	15
DLAT					
Total Sample	413	33.6231	10.9931		
Dropouts	40	23.6000	8.8738	-.9118	18
Age					
Total Sample	413	22.6679	4.3658		
Dropouts	40	23.8250	7.1750	.2650	60
Education[a]					
Total Sample	413	2.7688	2.1281		
Dropouts	40	1.3500	1.9552	-.6667	25
Previous School Grades[b]					
Total Sample	413	11.1975	2.4349		
Dropouts	40	9.9250	2.5357	-.5226	30

[a]Expressed as number of years in college.

[b]Measured by PLAB-1 (see Appendix A-3).

linguistic, and biographical factors in predicting dropouts in an intensive, audiolingually oriented foreign language training program. This conclusion corroborates findings from a similar investigation conducted by

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Pimsleur et al. (1966) on underachievement in foreign language learning. One of their chief findings was:

> Underachievers did not perform less well than average-achievers in tests of verbal intelligence (Vocabulary), verbal reasoning (Linguistic Analysis), or word fluency (Rhymes), but they did so on the two tests of auditory ability. This finding indicates that the so-called "talent for languages" resides principally in the domain of auditory ability, which may be described as the ability to receive and process information through the ear. (Ibid., p. 18)

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CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

Introduction

As was alluded to earlier, the basic question which inspired this research was: "How can prediction of success in modern foreign language learning be improved?" Of course, the present writer was not the only one intrigued by this question. Many investigators in the field such as Henmon (1929), Richardson (1933), Carroll (1958, 1962), Carroll and Sapon (1955), Pimsleur (1962, 1963, 1966), and others have formulated and attempted to answer, the same question; however, what is unique about the present study may be summarized as follows:

1. Four foreign languages taught under the audio-lingually oriented method were treated simultaneously.

2. The instructional format for these languages was highly similar, if not identical. This similarity permeates fundamental features of instruction at the DLI. The objectives of instruction, as clearly stated in the DLI Policy Guidelines (1970), apply to all language instruction within the DLI system and so is the

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methodology implemented to achieve these objectives. The program of instruction for the basic course in the various languages, covering grammar perception drills, dialogue memorization and recitation, pattern drills, application drills, and number of words to be learned, is the same. The textbooks used were developed by DLI personnel in accordance with DLI stated objectives and methodology. The instructors throughout the school are continuously trained to ensure the effective application of approved methods, procedures, and techniques in the classroom to achieve the desired objectives.

3. The student population at the DLI is rather unique. In many respects it is extremely homogeneous, consisting of highly motivated young men who have completed about two years of college study, and their percentile rank in general mental ability is approximately 84, as compared to high school graduates.* However, they are highly diversified geographically and socioeconomically. They tend to represent a cross-section of the general United States population in these respects.

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*Their mean of 66.87 on the Otis-Lennon Mental Ability Test is approximately one S.D. above the mean compared to high school graduates (Otis and Lennon, 1967b, p. 22).

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4. The criterion measures used are very comprehensive and highly comparable. They represent all four major skills of listening, speaking, reading, and writing, evaluated by using the same rating scale in the four foreign languages studied, and taken at three crucial points of the course. Additionally, external criterion measures were applied on two out of the four samples used, which were evaluated by recognized experts outside the school.

5. The writer is not aware of any study which has been undertaken in the past where so many experimental and established aptitude measures were applied, evaluated, and compared using the same samples of foreign language students.

In an unpublished speech given at the 1971 Washington Linguistic Club Meeting, Horne* (1971) stated:

> Research into the prediction of language aptitude to date has produced no clear-cut relationships between individual characteristics and success in second language learning. For example: if general mental ability is used as a predictor, the validity coefficient varies from .21 to .65. If one uses as a predictor the individual's mastery of his native language, English, the validity coefficients range from .18 to .53. If, on the other hand, one employs as a predictor

*Commandant, Defense Language Institute, West Coast Branch (Colonel, U.S. Army, and Ph.D., Georgetown University).

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> the student's demonstrated ability to learn a second, usually artificial, language in a micro-situation, the coefficients run from .25 to .78 for high school courses, and from .13 to .69 for college courses.

These seemingly varied results concerning the validity power of measures used in predicting foreign language performance may be attributed, in part, to differences in type of samples used in these individual studies, heterogeneity of instructional objectives and methods employed, and most importantly to inadequate, if not completely lacking, comparability among criterion and predictor measures used by the various investigators. Since the present study sought to minimize these extraneous factors, it is hoped that the findings generated by it will carry slightly more weight in attempting to understand the relationship between aptitude and achievement in modern foreign language learning.

Summary

On the basis of previous research findings relating to the role of aptitude in determining achievement in foreign language learning, several hypotheses were formulated and tested. The main concern of this research was to investigate whether the auditory component of aptitude plays a significant role in

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predicting achievement in languages in general, and if so, whether this component can be profitably utilized in making differential predictions to further increase the efficiency of predictions when the predictor measure used has been tailor-made to fit the phonology and structure of a particular foreign language. A key aptitude test, the AFLAAT, was carefully constructed for this purpose on the basis of phonological and structural errors frequently made by American students learning Arabic under an instructional format prescribed by the audiolingual method as practiced at the DLI. The AFLAAT was administered for item analysis purposes to a large sample of DLIWC students before their enrollment in classes in various languages. The resulting item analysis data indicated a high degree of internal consistency with a semi-normal distribution of scores. Other AFLAAT characteristics such as the mean and standard deviation proved to be near ideal. Along with AFLAAT, other measures such as DLAT, HABLA, MLAT, PLAB, Otis, and various motivational, personality, and biographical measures were administered to a new sample of DLIWC students, again before beginning their instruction in Arabic, German, Russian, and Spanish. The progress of this sample was closely followed and criterion measures of various types, internal and external, were taken

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at three main points of the course until graduation. Predictors and criterion measures were intercorrelated. These intercorrelations provided the basis for making the correlational study of this paper. The findings from this study clearly showed that the auditory component measured by AFLAAT-3 was at least as important in predicting gross (across languages) foreign language performance as the nonauditory verbal factors measured by MLAT-3, 4, 5, PLAB-3, 4, DLAT, or Otis. Furthermore, the validity of AFLAAT-3 appeared to be substantially superior to the motivational, personality, and biographical components.

As far as differential (by language) prediction is concerned, the data definitely demonstrated a consistent pattern of AFLAAT-1, 3 as being the most powerful predictor of Arabic language performance with validity coefficients running as high as .84 in comparison to its prediction of performance in all other languages taken individually or combined. Furthermore, all other auditory tests which were not tailor-made for Arabic proved to be inferior to AFLAAT-1, 3 in predicting Arabic language performance. One interesting finding was that the differences in predictive power were more accentuated in written language performance than in oral performance, perhaps because the written

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tests are more reliable than oral tests. If this is true, then improving the reliability of the criterion measures will probably lead to a further sharpening of the differences discovered in this study.

Although the sound-symbol association part of AFLAAT proved to be of some significance in predicting written Arabic language performance, it did not appear to do a better job than other tests of this kind which were not geared specifically to Arabic. Learning the orthography of a language is perhaps a minor factor which does not lend itself to differential treatment in an intensive, audiolingually oriented course of instruction.

In concluding the summary findings of the correlational study, the validities of total scores on all major tests for predicting success both in the total sample and in the individual samples were compared. This overall comparison provides additional evidence in support of the gross and differential hypotheses concerning the importance of the auditory component in predicting success in modern foreign language learning.

The second approach attempted in investigating the importance of the auditory component of aptitude in predicting success in foreign language learning was

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through setting up single- and double-entry expectancy tables. DLAT and AFLAAT were administered to a large representative sample (N = 1,171) of DLIWC students prior to their enrollment in nine different language courses. The third variable used was the first six-week overall grade. Again, the results corroborate earlier findings from the correlational study, i.e., the gross forecasting efficiency of AFLAAT, an auditory test, is at least as significant as that of DLAT, a nonauditory verbal test. Furthermore, the joint use of both AFLAAT and DLAT was found to yield a still higher level of prediction than either test when used alone. Since the choice of first six-week grades did not turn out to be the best choice of predictor measure that could have been made (because this criterion measure was found to be least correlated with all predictors in comparison to the second six-week and final grades) it seems reasonable to suggest that the results would have been even more definitive had either of the two other measures been used instead.

The third study made concerned a comparison between the performance of dropouts and the average performance of another sample (N = 413) consisting of DLIWC students in ten different languages. Again, the superiority of AFLAAT over DLAT and other measures in

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sorting out potential dropouts was clearly demonstrated.

Conclusions

The evidence provided in the preceding studies suggests that (1) inclusion of a relevant auditory component in a foreign language aptitude battery will significantly enhance gross prediction of success in learning a second language, and (2) given an auditory aptitude test of sufficient complexity and difficulty levels with content focusing on problems encountered by learners of a particular second language, optimum efficiency can be attained in predicting success in that language. In both cases, the learner population is assumed to consist of young adults following a formal course of instruction which may be described as intensive and audiolingually oriented.

In earlier discussions it was shown that as a result of rigorous design, item construction, and validation, AFLAAT has met to a large extent the preset levels of complexity, difficulty, and linguistic specificity. Furthermore, the rationale of AFLAAT was based on the assumption that the auditory factor resides in a specific aptitude domain and cannot be efficiently measured by a general mental ability test. However, this

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specific aptitude for modern language learning appears to be highly related to the learner's ability "to receive and process information through the ear" (Pimsleur et al., 1966, p. 18). The ability to receive and process information through the ear was exactly what AFLAAT was designed to measure. This ability was differentiated into various linguistically-related components: phonological (segmental and suprasegmental), morphological, and syntactical. In all these, the tasks formulated presented significant problems to an American learning Arabic. Thus, on both theoretical and empirical grounds, AFLAAT is considered to have proven its relevance.

It was stated earlier that one of the main conditions on which this research was based is that the method of instruction should be audiolingual. The question might be raised as to what evidence warrants applying this label to the method of instruction at the DLIWC from which the samples for this study were drawn. Generally speaking, language courses, as they are actually taught, tend to differ from each other not by being either purely audiolingual or purely of the grammar-translation type, but by having both of these methods represented in varying degrees and combinations. This is certainly true of the method of instruction applied at the DLIWC. The next question then to ask is

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"How audiolingual is the DLIWC method compared to high school and college foreign language courses offered in the United States?" The question cannot be answered by direct comparison, but substantial clues exist in comparing terminal performance of the two groups. The performance of the German and Russian samples used in this study on the MLA-Cooperative Foreign Language Tests was compared to that of available high school and college norms (Modern Language Association, 1965a) and the results are presented in Table 30.

TABLE 30

PERCENTILE RANKS OF DLIWC GERMAN (N = 26) AND RUSSIAN (N = 62) SAMPLES ON THE FOUR SKILLS OF THE MLA-COOPERATIVE FOREIGN LANGUAGE TESTS (FORM MA) AS COMPARED TO U.S. HIGH SCHOOL AND COLLEGE NORMS

Language Skill	2nd Year College	3rd Year High School	4th Year High School
GERMAN			
Listening	96	92	73
Reading	89	92	73
Speaking	99.9+	95	-*
Writing	95	96	91
RUSSIAN			
Listening	93	88	-*
Reading	92	88	-*
Speaking	97	98	-*
Writing	94	98	-*

*Norms not available.

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Two main observations may be made on the basis of data in the above table:

1. The performance of DLIWC students highly exceeds that of high school and college students, and

2. Compared to second-year college norms, the performance of DLIWC students is slightly superior in the listening and speaking skills than in the reading and writing skills.

Thus, the second observation stated above tends to support the statement that the DLIWC method of instruction is slightly more audiolingual than that utilized in second-year college foreign language courses. Further evidence in support of this statement was furnished by Szaszy (1970). In comparing the performance of a DLIWC French sample (N = 33) on the MLA-Cooperative Foreign Language Tests with high school and college norms, he found even more pronounced differences in percentile rank between listening and speaking on one hand, and reading and writing on the other, than was discovered in the present study.

In making comparisons between the performance of DLIWC students and that of high school and college students, it is necessary to consider the length of the period of instruction for each course. The total number of weeks and hours of instruction covered by the DLIWC

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courses studied in this research together with their equivalent number of college semesters are listed in Table 31.

TABLE 31

TOTAL NUMBER OF WEEKS AND HOURS OF INSTRUCTION FOR THE DLIWC LANGUAGE SAMPLES STUDIED, WITH EQUIVALENT NUMBER OF COLLEGE SEMESTERS

Language Course	Number of Weeks at DLIWC	Number of Contact Hours at DLIWC	Equivalent Number of College Semesters*
Arabic	47	1,389	18.5
German	32	939	12.5
Russian	47	1,389	18.5
Spanish	24	699	9.3

*Each semester consisting of 75 contact hours.

It can be seen from the above table that compared to college courses the duration of DLIWC courses is much longer. These data explain in great part the superiority in performance of DLIWC students over college students.

The differences in length of the DLIWC courses are based on the tenable assumption, which has been supported by long-term experience, that from the point of view of an American native speaker, foreign languages vary in difficulty. The various course durations indicated in Table 31 have therefore been more or less arbitrarily established so that approximately the same

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levels of learning objectives are attained by all DLIWC students.

Another basic condition on which this research was based is that the method of instruction should be "intensive." An explanation of what this term means within the framework of the DLIWC courses seems to be in order at this point. At the DLIWC, the student is exposed daily to six contact hours (50 minutes each) of instruction by foreign language native or semi-native instructors for five days of each week throughout the course. A typical daily lesson consists of introducing a dialogue to be memorized by the student using tape recorded materials as part of his homework assignment. Other parts of the daily lesson consist of practicing the use of newly acquired vocabulary items (usually around thirty) and grammatical features through the utilization of various types of pattern and application drills. Utilization of pictorial visual aids instead of orthography is emphasized to facilitate student learning, especially during the first six-week, crucial period of the course. This initial period is "crucial" in the sense that if the student happens to lag sufficiently behind in performance he becomes subject to dismissal from the school for "lack-of-aptitude" reasons. Under these rigorous conditions of learning, many

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students often feel and report a substantial pressure while struggling through this initial period (and sometimes later periods) of the course. This type of instruction may therefore justifiably be called intensive as compared to other types of instruction where the pace and volume of learning tasks are not so demanding.

Before concluding this topic, a question might be asked whether or not two full days of aptitude testing prior to the inception of foreign language instruction have made any significant contribution toward the improvement of performance of the four samples studied in this research. In order to answer this question, the terminal performance of these samples was compared with that of Fiscal Year 1969 and 1970 DLIWC graduates who did not participate in this study and the results are presented in Table 32.

A cursory examination of the data in Table 32 will reveal that with regard to the criterion of final overall grade, the differences between the two groups are inconsistent. However, in the case of the DLPT, which is a completely objective test, with the exception of Russian all participant groups showed a slight edge in performance over nonparticipant groups. Although it is a matter of conjecture to relate the differences observed

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in this study to the effect of two days of aptitude testing, the differences are too small to warrant any serious analysis.

TABLE 32

COMPARISON OF TERMINAL PERFORMANCE OF SAMPLES OF THIS STUDY WHO PARTICIPATED IN TWO DAYS (12 HOURS) OF APTITUDE TESTING (PARTICIPANTS) AND FY 69 AND 70 DLIWC GRADUATES WHO DID NOT PARTICIPATE IN THE PROJECT (NONPARTICIPANTS)

Sample	Number of Graduates	Average Final Overall Grade	DLPT-L Score	DLPT-R Score
ARABIC				
Nonparticipants	41	86.8	40.1	32.1
Participants	29	89.1	40.4	33.5
GERMAN				
Nonparticipants	55	89.4	44.0	46.8
Participants	26	88.3	45.5	47.7
RUSSIAN				
Nonparticipants	161	86.8	52.9	48.8
Participants	62	86.8	52.4	47.4
SPANISH				
Nonparticipants	130	87.1	42.6	41.0
Participants	48	84.0	44.5	43.1
TOTAL				
Nonparticipants	387	87.3	46.8	44.1
Nonparticipants*	165	87.3	46.3	43.3
Participants	165	86.6	46.9	43.7

*Corrected for frequency.

To summarize what has been said in this section, it can therefore be stated that the various studies

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presented throughout this paper furnish evidence to warrant the following main conclusions:

1. AFLAAT (Parts I and III) seems to be an adequate instrument for measuring the auditory component of aptitude for learning a modern foreign language under conditions prescribed by the intensive, audiolingual method. Its predictive power is further increased when the language under consideration is Arabic.

2. Sound-symbol association aptitude tests do not seem to play a significant role in predicting foreign language performance.

3. AFLAAT seems to be a more powerful gross predictor of general foreign language performance than DLAT.

4. AFLAAT seems to be more sensitive than DLAT in screening potential dropouts in an intensive, audiolingually oriented course of foreign language instruction.

5. Using a powerful auditory test (such as AFLAAT-3) and a nonauditory measure (such as DLAT, HABLA-2, or MLAT-3, 4, 5) in team will yield better perdiction than either instrument used alone.

6. The DLIWC method of instruction may be described as intensive and audiolingual to meet the restraints imposed in this study.

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7. Administering twelve hours of a variety of aptitude tests to students prior to enrollment in an intensive, audiolingually oriented foreign language course does not seem to significantly affect their terminal performance.

Recommendations for Future Research

This research has raised a greater number of, and perhaps more profound, questions than it attempted to answer. For example, one may consider the intercorrelations between AFLAAT-3 (a purely auditory test) and the nonauditory type of tests used in this study, both for the total sample and for the individual language samples, as shown in Table 33.

TABLE 33

INTERCORRELATIONS BETWEEN AFLAAT-3 AND NONAUDITORY APTITUDE TESTS

Test	*N*	DLAT	MLAT-3, 4, 5	PLAB-3, 4	Otis
AFLAAT-3					
Arabic	29	.51**	.74**	.58**	.69**
German	26	.55**	.71**	.39*	.51**
Russian	62	.56**	.52**	.49**	.24
Spanish	48	.59**	.57**	.51**	.51**
Total	165	.62**	.64**	.54**	.49**

*Significant at the .05 level.
**Significant at the .01 level.

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Do the above data mean that the auditory and nonauditory aptitude factors have a substantial amount of common variance? If so, what is the nature of the elements common between them? Are these common elements purely linguistic, or are they of the general mental ability, problem-solving type, or any other type? If the common elements are structured in a specific way, what is the magnitude of each component?

Why in the Russian sample is the correlation between AFLAAT-3 and the Otis much lower than that in the Arabic sample? Is the organization of the common elements of aptitude differently structured for different languages? How is this structuring related to "native" aptitude for the language being learned vs. idiosyncrasies of methodology in teaching that language?

It was shown earlier (Tables 12-14, 17, 20-23) that the predictive power of a particular test varies from language to language. Does this mean that aptitude for learning a foreign language is in part so specific that, in order to achieve optimum prediction, individual test batteries should be constructed and validated for each language? In the case of Arabic this seems to be true, but how about other languages, which may or may not be structurally similar to Arabic? Which will be more feasible: to construct a small number of aptitude

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batteries, each geared toward predicting success in a group of structurally similar languages, or to develop only one battery with different scoring keys for separate languages?

Suppose that some aptitude elements, or clusters of elements (such as the auditory component) have been fairly well iden ed, can pretraining be used, and if so, what type an at extent, to facilitate later learning?

Definitive ans most of these questions and others are obviously dependent upon the construction of more valid and reliable tests (both predictors and criterion measures), conducting rigorous factor analytic studies, and most of all upon establishing operational definitions for the variables of foreign language aptitude and achievement. These activities should by no means be implemented as though they were separate and independent entities. Only by allowing constant and dynamic interaction between them, leading to repeated revision of both the definitions and the measuring instruments, can insight be gained into the nature of these variables (Ghiselli, 1964, pp. 15-19).

With regard to the DLI's present student screening efforts, an immediate need exists to reduce the approximately 10 percent dropout rate caused by the

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inadequate validity of DLAT--the only linguistic aptitude measure used--at the lower end of the ability scale. The savings in terms of money and human resources can be great when it is realized that tens of thousands of military personnel are trained on an annual basis in some fifty or sixty languages under the Defense Language Program. The need for improving the screening of potential failures will soon become more urgent as the new "Volunteer Army" concept is put into operation, resulting in substantial reduction of available manpower resources. As was mentioned earlier, a research project titled "Aptitude Assessment Project"--of which this paper is a part--was specifically launched to achieve this purpose. What can be done at this juncture of the project is to find a solution whereby an immediate improvement can be achieved in forecasting potential dropouts over the present procedure. This solution may come about by forming an aptitude battery consisting of the following components:

1. An auditory aptitude measure, such as AFLAAT-3.
2. A nonauditory aptitude measure, such as HABLA-2.
3. A short motivational measure, such as the ten most valid items of the FLII.
4. A nine-point educational level scale (the one used in the present study).

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5. A sixteen-point scale for measuring previous high school or college grades in certain subjects (similar to the one used in this study).

After administering the above battery to large samples of students, separate item analyses (by language) will be made using two validation criteria: dropouts vs. graduates and final overall course grade. On the basis of these item analyses, separate scoring keys will be developed, based on differential weighting of items, for each language. Thus, a prospective student at the DLI will be provided with a profile of his linguistic capabilities depicting his chances of success in a number of languages or groups of languages. These individual profiles will serve as the basis for channeling students into the language programs for which they are best suited.

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APPENDICES

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APPENDIX A

DESCRIPTION OF PREDICTORS

1. Defense Language Aptitude Test (DLAT)

This test consists of fifty-nine nonauditory, paper-and-pencil type, multiple-choice items. The examinee is given written instructions on the vocabulary and structure of an artificial language. The structure used is of the agglutinative type with Roman-based orthography. The examinee is then tested by solving translation problems, from English into the artificial language and vice versa. Scoring of the test is based on the use of a formula to correct for giving wrong answers with a minimum possible score of zero. This test has been in use by the various U.S. armed services since 1955. It used to be called the Army Language Aptitude Test (ALAT) before the military foreign language training program came into being under the direct supervision of the Defense Department in 1963. The test takes one hour to administer.

2. The Modern Language Aptitude Test--Form A (MLAT)

The test has five parts, as follows:

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Part I--Number Learning. This part requires the examinee to learn, retain, and recognize auditorily an artificial number system based on the digits 1, 2, 3, and 4. It is supposed to measure memory for sounds and auditory alertness. This part of the test consists of forty-three multiple-choice items.

Part II--Phonetic Script. This part requires the student to learn, retain, and recognize the correct association of a set of English-sounding, monosyllabic, nonsense words of three phonemes with their phonemically printed equivalents. In addition to measuring ability to learn sound-symbol association, it may also test memory for speech sounds and ability to recognize these sounds. It has thirty multiple-choice items.

Parts I and II make up the auditory component of MLAT.

Part III--Spelling Clues. This part consists of fifty paper-and-pencil, multiple-choice, single vocabulary items. Each lead consists of a semi-phonemically spelled English word. The examinee's task is to identify the meaning of this "disguised" word by marking one of the five alternative words which is most similar in meaning to the lead. Example: Lead: luv; Options: A. carry; B. exist; C. affection; D. wash; E. spy.

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Part IV--Words in Sentences. This part covers forty-five paper-and-pencil, multiple-choice items. The object of this part is to test the ability of the examinee to understand the function of English words and phrases without using grammatical terminology. The student, for example, reads a lead, such as: LONDON is the capital of England. Immediately underneath this sentence there is another one:

He liked to go fishing in Maine.
A B C D E

The examinee is then asked which word in the second sentence does the same thing in that sentence as LONDON does in the lead sentence.

Part V--Paired Associates. This part consists of twenty-four paper-and-pencil, multiple-choice items. The examinee is first given time to memorize the meaning of twenty-four vocabulary items in a low density Indo-European language. He is then asked to identify the meaning of each of these words by marking the correct English equivalent which is imbedded within four distractors.

Parts III, IV, and V make up The Short Form of MLAT which can be administered without the use of a tape recorder in substitution for the whole test.

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3. Pimsleur Language Aptitude Battery--Form S (PLAB)

The Battery consists of six parts, as follows:

Part I--Grades in Major Subjects. This part of PLAB covers grades in four major subjects: English, Social Studies, Mathematics, and Science. Each of the four grades is measured by a five-point scale: zero for E/F, 1 for D, 2 for C, 3 for B, and 4 for A, with a maximum possible score (for all four grades) of 16.

Part II--Interest. This part measures interest in learning a foreign language by the use of a five-point self-rating scale: zero for "Rather Uninterested" to 4 for "Strongly Interested." The raw score on this part of the battery is doubled when combined with raw scores on the other subtests, giving a maximum possible score of 8.

Part III--Vocabulary. This is a straight single English vocabulary test (multiple-choice, four options) consisting of twenty-four items.

Part IV--Language Analysis. This is a work-sample test based on the vocabulary and structure of an artificial language. It consists of fifteen items, each containing a lead (a short English sentence) followed by four plausible translations in the artificial language, only one of which is correct.

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Part V--Sound Discrimination. This part of PLAB consists of thirty tape recorded items. The examinee is taught auditorily the meaning of three words in a West African tonal language (the three words are phonemically identical except for tone). For each item, the examinee hears one of the three words. He then identifies its meaning by marking the correct English equivalent.

Part VI--Sound-Symbol Association. This part comprises twenty-four tape recorded items. The examinee listens to an English-sounding nonsense word. He then reads the four options printed in English and selects the one that correctly symbolizes the lead.

4. a. Al-Haik Foreign Language Auditory Aptitude Test (AFLAAT)

Part I--Foreign Language Sounds. This part consists of the following three sections:

(1) Utterance Identification (19 scorable items). The examinee hears a lead utterance followed by four alternatives (similar utterances), only one of which is identical to the lead. He is required to identify the option which is identical to the lead. The purpose of these items is to test the ability to distinguish Arabic phonemic differences (vowels and consonants) which may sound either new to the student or allophonic as far as

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American English is concerned. Example:

Lead utterance: /ritubin/

Options: a. /ra:tibin/ b. /rituba:n/

c. /ritubin/ d. /ritabun/

(2) Recognition of Vowel Patterns (17 scorable items). The examinee hears four utterances, only one of which is different in vowel pattern. He is required to identify the utterance with the different vowel pattern. The purpose of these items is to test sensitivity to distinguish vowel patterns imbedded in varied consonantal structures. Example:

a. /bakrit/ b. /tulfis/ c. /faslib/ d. /kamnif/

(3) Recognition of Stress Patterns (20 scorable items). The examinee hears four utterances which have the same number of syllables. The main stress of three of these utterances is placed on syllables occupying the same position and only in one utterance is the stress shifted to a different position. The examinee is required to identify the utterance with the different stress pattern. The purpose of this section is to test sensitivity to shifts in stress pattern (suprasegmental phonemes) in environments with different segmental phonemes. Example:

a. /baknúdin/ b. /dárjufin/

c. /rádbukim/ d. /sátkubin/

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Although utterances used in Part I of AFLAAT are Arabic-sounding, nearly all of them are artificially coined.

Part II--Foreign Language Writing. Part II of AFLAAT covers twenty scorable items. The examinee hears an utterance. He then reads four options printed (in Roman alphabet) in his test booklet. His task is to identify the option which correctly symbolizes the lead in accordance with a specified set of new rules. The purpose of this part of the test is to measure, among other things, readiness to overcome proactive inhibition in the learning of a new system of writing utilizing a familiar orthography. Example:

Lead utterance: /tadaka/

Options: a. tdk b. kdt c. ddk d. ktt

Part III--Foreign Language Grammar. Part III of AFLAAT comprises seventy-eight scorable items. In this part of the test, the examinee reads a phrase or a sentence printed in the test booklet in English. He then hears four alternative translations using the same English words wtih slight modification in pronunciation and word order to accommodate new grammatical rules. His task is to identify the alternative which correctly conveys the meaning of the printed utterance according to the new rules. The new rules, which are both morphological and syntactical, pause cumulative tasks

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of graded difficulty. Example: Lead sentence (printed): The house is large.

Options (spoken): a. /hawsu larju/ b. /hawsi larju/
c. /larji hawsu/ d. /larju hawsi/

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4. b. AFLAAT Test Booklet*

*This test is the property of the Defense Language Institute and is subject to its test control regulations. Qualified individuals may direct requests to inspect any material connected with this test to Chief, Defense Language Institute, Systems Development Agency, Presidio of Monterey, California, 93940.

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4. c. AFLAAT Test Tapes

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4. d. AFLAAT Scenario

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5. Horne's Assessment of Basic Linguistic Aptitudes (HABLA)

Part I--Phonology. Part I of HABLA consists of twenty-five items recorded on tape. For each item the student hears a group of three words which are not English. At least two of the words are identical and one may be different. Each group of words is heard twice. The student then decides which, if any,of the three words is different from the other two. If the first word is different, he marks A; if the second is different, he marks B; if the third is different, he marks C; and if all the words are identical, he marks D.

Example: /lomp/ /lomp/ /gomp/ C

Part II--Grammar. Part II of HABLA is divided into two sections, as follows:

(1) Grammar: Inductive. This section covers ten pages, each consisting of a group of three items. At the top of the page is a set of four pictures, each captioned with a non-English text. The text identifies what is seen in the picture. Immediately below the four pictures is a set of three additional pictures. Opposite each of the three pictures are four alternative non-English texts. The student's task is to identify the text which correctly conveys what he sees in the picture,

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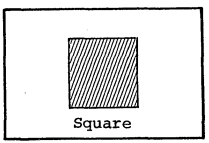
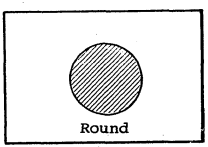
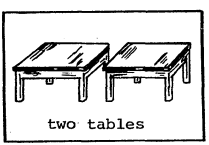
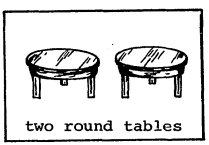
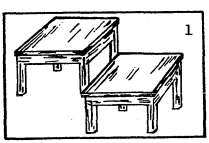
utilizing the information gained from the top section of the page. Each page is self-contained. Example (in English):











1. a. round two tables
   b. two square tables
   c. two tables squares
   d. tables two square

(2) Grammar: Deductive. Section 2 of HABLA contains thirty items, ten on each of three sample languages. The examinee sees on each left-hand page an explanation of grammar and vocabulary. On the right-hand page he sees five pictures showing objects and actions.

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Opposite each picture are four phrases in the language described. The student's task is to select the phrase which is correct for the picture shown.

Part III--Orthography. This part of HABLA comprises fifteen items administered by means of television. These items are divided into three groups (five items each: semitic, logographic, and alphabetic) preceded by short explanations and practice items.

Example: A Chinese-like character is flashed on the television screen, followed by three similar characters. The student is then asked which of the three characters is identical to the lead. A fourth choice, "none of these," is also provided.

6. Foreign Language Interest Inventory (FLII)

This inventory was developed by Mr. Alex Szaszy of DLIWC. It consists of forty-seven scorable items. Each item contains a lead and five choices, comprising a five-point self-rating scale. The items attempt to measure a variety of factors which are considered to be related to motivation to learn a foreign language.

Example: I was assigned to the language course at DLIWC:

a. by my own choice (5 points)
b. by my choice, but not the first choice (4 points)
c. not by my choice, but acceptable (3 points)
d. not by my choice (2 points)
e. I would prefer to do something else than learn languages (1 point)

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7. The Q by Q Interview (Q x Q)

This motivational measure was developed by Asher (1970). This is a highly simplified interview format which has demonstrated extremely high reliability under certain conditions. The interview is approximately ten minutes per student and consists of ten questions.

8. Otis-Lennon Mental Ability Test, Advanced Level, Form J (Otis)

This test consists of eighty omnibus, multiple-choice, paper-and-pencil type items. The items cover a wide variety of subjects, such as knowledge of English vocabulary, verbal analogies, sentence completion, arithmetic reasoning, number series, figure analogies, figure series, etc.

9. Taylor Manifest Anxiety Scale (TMAS)

This scale conissts of fifty "True and False" type items. Each item contains a statement, such as "I do not tire quickly." The student reads the statement and marks it "T" or "F" depending on whether it applies to himself or not. This scale is administered together with the NSA Scale.

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10. Need for Social Approval as Measured by the Marlowe-Crowne Social-Desirability Scale (NSA)

This scale contains thirty-three "True and False" type items. Each item consists of a statement, such as "I never hesitate to go out of my way to help someone in trouble." The student reads the statement and marks it "T" or "F" depending on whether it applies to himself or not. These items are imbedded (at random) within the Taylor Manifest Anxiety Scale, and both of these scales are administered together using a single test booklet.

11. Education

Education was measured by using the following point scale:

Highest Level Attained	Point
Non-High School Graduate	1
High School Graduate	2
1 Year College	3
2 Years College	4
3 Years College	5
4 Years College without Degree	6
B.A. Degree	7
M.A. Degree	8
Doctorate	9

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APPENDIX B

MISCELLANEOUS

1. Item Analysis Data Sheets, AFLAAT, October, 1969*

*See note, p. 125.

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2. Announcement to Students
re January 1970 Input

APTITUDE ASSESSMENT PROJECT

Memorandum to All Students Enrolled
in the Following Classes:

01RU47W0570
01SS24W0570
01GM32W0370
01AB47W0270 } ARABIC
01AI47W0370 }

You have been selected to participate in an experimental project which aims at the improvement of current selection procedures for prospective DoD foreign language trainees. The project, a joint effort between the Defense Language Institute and San Jose State College, will seek to explore the extent to which various types of aptitudes, interests, and past experiences contribute to foreign language learning. You may be interested to know that owing to the experimental nature of the project all data collected will be used strictly for research purposes and, therefore, no scores, data, or information thus obtained will ever become part of your military record.

Test booklets will be distributed for all tests. Do not write on or mark test booklets. Your responses to test items will be made on special IBM cards. Electrographic pencils will be issued to you in the testing room. No other pencils or pens are to be used.

Every set of tests will have its own instructions, and you will be given sufficient rest periods between the tests. Try to do your very best and please answer every question. Your cooperation is highly appreciated.

You are asked to be present at the precise times and place indicated below, bringing your headset with you at all testing sessions:

Time	Activity/Test	Place
7 Jan 70	General Orientation	Bldg No. 35 Labs A & B
0800-1100 hrs	Foreign Language Background Inventory	"
	HABLA	"

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Time	Activity/Test	Place
1300-1600 hrs	Otis-Lennon	Bldg. No. 35 Labs A & B
	FLII	"
8 Jan 70		
0800-1130 hrs	AFLAAT	"
	Pimsleur	"
1300-1630 hrs	MLAT	"
	TMAS	"
	NSA	"

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3. Intercorrelation Matrix,
January 1970 Input,
Total Sample (N = 165)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Age													
2 Education	.23												
3 DLAT	-.17	.29											
4 MLAT-1,2	-.22	.01	.39										
5 MLAT-3,4,5	-.13	.38	.65	.47									
6 MLAT-Total	-.19	.28	.62	.71	.92								
7 PLAB-1	.02	.20	.15	.10	.27	.26							
8 PLAB-2	.21	.16	.19	.08	.21	.18	.13						
9 PLAB-5,6	-.06	.05	.29	.45	.32	.41	.00	.11					
10 PLAB-3,4	-.19	.40	.59	.34	.60	.58	.17	.14	.31				
11 PLAB-Total	-.09	.30	.54	.48	.59	.63	.36	.33	.79	.75			
12 OTIS	-.20	.25	.41	.33	.48	.49	.22	.01	.25	.50	.46		
13 HABLA-1	.07	.10	.17	.22	.22	.28	.08	.14	.23	.15	.26	.18	
14 HABLA-3	-.22	.05	.32	.30	.26	.28	.09	-.05	.23	.32	.31	.45	.16
15 HABLA-2	-.18	.21	.60	.42	.61	.63	.24	.07	.33	.58	.56	.56	.25
16 HABLA-Total	-.17	.21	.60	.45	.60	.64	.23	.06	.35	.58	.57	.59	.43
17 AFLAAT-1	-.04	.14	.41	.51	.53	.60	.12	.10	.55	.33	.55	.31	.37
18 AFLAAT-2	-.07	.05	.36	.46	.47	.52	-.05	.07	.41	.25	.38	.32	.21
19 AFLAAT-3	-.10	.33	.62	.51	.64	.65	.18	.15	.40	.54	.58	.49	.31
20 AFLAAT-1,3	-.08	.30	.60	.55	.66	.70	.18	.15	.49	.52	.63	.48	.35
21 AFLAAT-Total	-.09	.27	.61	.59	.68	.73	.15	.15	.53	.51	.64	.48	.37
22 FLIT	.14	.17	.21	.00	.12	.07	.22	.63	.13	.12	.30	.01	.02
23 NSA	.08	.07	-.01	-.05	-.03	-.04	.24	.13	-.08	-.19	-.06	-.06	.11
24 TMAS	-.05	-.12	-.09	.07	-.07	-.02	-.13	-.08	-.07	-.06	-.12	-.05	-.16
25 1st 6-wk Ex-O	-.11	.25	.46	.38	.49	.51	.15	.34	.33	.50	.54	.26	.15
26 1st 6-wk Ex-W	.01	.37	.31	.18	.37	.37	.27	.24	.23	.35	.42	.16	.20
27 1st 6-wk Ex-AVG	-.04	.36	.41	.28	.47	.47	.24	.34	.31	.46	.53	.22	.20
28 1st 6-wk OVERALL	-.01	.28	.25	.24	.31	.32	.13	.23	.25	.31	.38	.11	.12
29 2nd 6-wk Ex-O	-.24	.29	.58	.43	.58	.59	.19	.18	.34	.60	.58	.39	.13
30 2nd 6-wk Ex-W	-.13	.38	.42	.35	.46	.48	.26	.23	.29	.51	.53	.31	.19
31 2nd 6-wk Ex-AVG	-.17	.36	.52	.42	.57	.59	.27	.23	.33	.59	.60	.38	.20
32 2nd 6-wk OVERALL	-.12	.37	.44	.40	.53	.55	.27	.24	.34	.52	.57	.31	.21
33 Final Ex-O	-.18	.26	.48	.30	.47	.48	.14	.33	.30	.50	.52	.31	.23
34 Final Ex-W	-.09	.40	.40	.31	.54	.54	.29	.26	.27	.54	.55	.31	.21
35 Final Ex-AVG	-.14	.34	.47	.32	.54	.54	.22	.32	.31	.57	.58	.32	.23
36 Final OVERALL	-.12	.36	.48	.37	.57	.58	.28	.30	.35	.53	.60	.35	.19
37 DLPT-L	-.18	.21	.37	.29	.49	.48	.10	.22	.36	.43	.49	.29	.17
38 DLPT-R	-.05	.16	.24	.18	.33	.31	.13	.18	.30	.33	.41	.22	.14
39 DLPT-Total	-.12	.20	.31	.24	.42	.41	.12	.21	.34	.40	.47	.27	.15
Mean	22.58	5.00	35.83	65.61	72.41	138.00	11.53	7.01	45.79	14.22	98.55	66.87	22.06
Standard Deviation	3.976	2.120	11.30	6.912	17.704	21.436	2.360	1.540	5.76	4.25	9.357	10.384	1.91

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11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
.46															
.26	.18														
.31	.45	.16													
.56	.56	.25	.45												
.57	.59	.43	.56	.97											
.55	.31	.37	.21	.43	.46										
.38	.32	.21	.21	.30	.33	.46									
.58	.49	.31	.31	.64	.64	.62	.38								
.63	.48	.35	.30	.63	.64	.81	.45	.95							
.64	.48	.37	.31	.62	.64	.83	.58	.93	.98						
.30	.01	.02	-.08	.02	.00	.04	.02	.09	.08	.08					
-.06	-.06	.11	-.01	-.15	-.11	.06	-.01	-.11	-.05	-.05	.28				
-.12	-.05	-.18	-.05	-.09	-.12	-.15	-.03	-.04	-.09	-.08	-.21	-.46			
.54	.26	.15	.22	.42	.41	.30	.33	.47	.44	.46	.30	.01	.00		
.42	.16	.20	.09	.31	.30	.34	.10	.43	.43	.41	.20	.21	-.20	.58	
.53	.22	.20	.17	.39	.39	.33	.22	.48	.46	.47	.31	.12	-.13	.87	.89
.38	.11	.12	.12	.26	.25	.33	.20	.36	.38	.38	.25	.11	-.09	.67	.69
.58	.39	.13	.28	.48	.47	.35	.29	.54	.52	.53	.14	.05	-.02	.76	.57
.53	.31	.19	.16	.42	.41	.33	.15	.53	.50	.49	.23	.09	-.05	.67	.72
.60	.38	.20	.24	.49	.48	.38	.23	.59	.56	.56	.20	.09	-.07	.76	.71
.57	.31	.21	.23	.45	.45	.37	.23	.55	.53	.53	.20	.06	-.08	.77	.74
.52	.31	.23	.24	.36	.38	.26	.27	.45	.41	.43	.22	.06	-.12	.68	.50
.55	.31	.21	.17	.42	.42	.37	.24	.52	.51	.51	.22	.06	-.12	.68	.69
.58	.32	.23	.21	.42	.42	.33	.27	.51	.48	.49	.24	.04	-.12	.72	.62
.60	.35	.19	.22	.48	.47	.37	.26	.56	.53	.54	.22	.07	-.10	.79	.69
.49	.29	.17	.26	.34	.35	.33	.32	.43	.42	.45	.16	-.05	-.07	.51	.31
.41	.22	.14	.20	.27	.28	.23	.24	.29	.29	.31	.17	-.03	-.16	.45	.36
.47	.27	.15	.24	.31	.33	.29	.30	.37	.37	.39	.17	-.04	-.12	.50	.35
.55	66.87	22.06	13.45	39.06	74.56	35.76	10.67	56.45	92.07	102.88	195.61	17.29	11.35	84.45	86.55
.357	10.384	1.915	1.488	8.328	9.926	5.845	2.895	11.139	15.480	16.940	17.148	5.566	7.603	7.870	10.317

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24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
.00															
-.20	.58														
-.13	.87	.89													
-.09	.67	.69	.76												
-.02	.76	.57	.72	.57											
-.05	.67	.72	.78	.58	.76										
-.07	.76	.71	.81	.62	.93	.92									
-.08	.77	.74	.84	.67	.85	.86	.93								
-.12	.68	.50	.66	.49	.76	.68	.77	.72							
-.12	.68	.69	.76	.60	.70	.74	.78	.78	.76						
-.12	.72	.62	.75	.57	.77	.74	.81	.79	.93	.93					
-.10	.79	.69	.83	.63	.86	.83	.90	.91	.86	.88	.92				
-.07	.51	.31	.46	.31	.53	.44	.53	.56	.58	.55	.60	.62			
-.16	.45	.36	.66	.31	.41	.35	.43	.51	.49	.50	.53	.55	.79		
-.12	.50	.35	.49	.33	.49	.41	.50	.56	.56	.55	.60	.62	.94	.95	
11.35	84.45	86.55	85.55	84.89	84.41	86.07	85.61	86.15	85.53	86.30	86.07	86.64	46.87	43.74	90.55
5 7.603	7.870	10.317	7.876	8.243	8.702	9.484	8.589	7.277	7.740	8.189	7.540	6.535	7.974	9.069	16.03

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4. Intercorrelation Matrix
January 1970 Input,
Arabic Sample (N = 29)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Age													
2 Education	.84												
3 DLAT	.38	.50											
4 MLAT-1,2	.46	.49	.26										
5 MLAT-3,4,5	.50	.62	.48	.55									
6 MLAT-Total	.54	.65	.46	.74	.97								
7 PLAB-1	-.04	.14	.38	.08	.35	.30							
8 PLAB-2	.43	.32	.46	.11	.17	.17	-.01						
9 PLAB-5,6	.51	.47	.45	.41	.47	.50	.03	.16					
10 PLAB-3,4	.39	.41	.48	.43	.39	.44	.22	.34	.34				
11 PLAB-Total	.56	.56	.65	.48	.58	.61	.33	.42	.85	.72			
12 OTIS	.31	.54	.26	.45	.70	.70	.26	-.05	.43	.51	.54		
13 HABLA-1	.32	.43	.25	.22	.46	.44	.01	.40	.14	-.01	.17	.29	
14 HABLA-3	.20	-.02	-.05	.08	.03	.05	-.16	-.06	.40	.01	.26	.06	.14
15 HABLA-2	.40	.39	.40	.21	.56	.51	.10	.21	.33	.58	.50	.60	.33
16 HABLA-Total	.43	.43	.39	.23	.59	.54	.07	.25	.37	.51	.50	.58	.50
17 AFLAAT-1	.42	.55	.62	.39	.74	.71	.11	.30	.53	.25	.54	.51	.55
18 AFLAAT-2	.13	.15	.21	.21	.42	.40	-.02	-.02	.44	-.15	.24	.38	.15
19 AFLAAT-3	.54	.61	.51	.56	.74	.77	.21	.20	.43	.58	.59	.69	.45
20 AFLAAT-1,3	.53	.62	.58	.53	.78	.79	.19	.25	.49	.49	.61	.67	.52
21 AFLAAT-Total	.51	.61	.58	.53	.81	.81	.17	.23	.54	.43	.61	.69	.51
22 FLII	.22	.12	.35	.06	.11	.11	.18	.57	.33	.05	.39	-.22	.01
23 NSA	.14	.21	.06	-.01	.20	.16	.13	-.03	.24	-.24	.10	.06	.15
24 TMAS	-.24	-.30	-.36	.02	-.27	-.21	-.10	-.28	-.26	.07	-.23	.02	-.15
25 1st 6-wk Ex-O	.57	.48	.62	.45	.50	.54	-.18	.31	.63	.43	.61	.31	.33
26 1st 6-wk Ex-W	.36	.32	.38	.15	.47	.43	-.14	.06	.35	.27	.32	.48	.41
27 1st 6-wk Ex-AVG	.53	.47	.58	.36	.56	.56	-.18	.23	.57	.42	.54	.45	.42
28 1st 6-wk OVERALL	.62	.47	.37	.42	.62	.62	-.14	.17	.44	.22	.38	.31	.40
29 2nd 6-wk Ex-O	.54	.53	.50	.40	.48	.51	.05	.05	.42	.38	.45	.45	.25
30 2nd 6-wk Ex-W	.62	.61	.27	.64	.63	.70	.01	.08	.36	.39	.40	.56	.47
31 2nd 6-wk Ex-AVG	.66	.65	.39	.62	.65	.71	.05	.08	.42	.43	.47	.59	.43
32 2nd 6-wk OVERALL	.63	.56	.35	.73	.56	.66	-.11	.22	.42	.29	.41	.43	.47
33 Final Ex-O	.46	.55	.59	.41	.54	.56	.25	.16	.46	.29	.51	.36	.43
34 Final Ex-W	.61	.57	.61	.45	.71	.71	.17	.18	.49	.23	.50	.43	.47
35 Final Ex-AVG	.54	.58	.62	.45	.63	.64	.23	.18	.49	.28	.53	.40	.46
36 Final OVERALL	.57	.61	.59	.61	.73	.77	.11	.14	.51	.35	.53	.52	.43
37 DLPT-L	.30	.38	.61	.33	.49	.49	.12	.01	.52	.37	.52	.38	.16
38 DLPT-R	.11	.18	.55	.22	.38	.37	-.03	-.03	.48	.34	.44	.33	-.01
39 DLPT-Total	.20	.28	.62	.28	.45	.45	.03	-.01	.53	.38	.51	.37	.06
Mean	21.31	5.28	42.62	68.93	78.86	147.79	11.90	7.03	46.24	36.14	101.31	70.52	22.03
Standard Deviation	1.606	1.925	8.104	4.877	13.019	16.207	1.877	1.476	5.533	2.961	8.067	8.318	1.97

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11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
.54																
.17	.29															
.26	.06	.14														
.50	.60	.33	.34													
.50	.58	.50	.45	.97												
.54	.51	.55	-.03	.50	.54											
.24	.38	.15	.06	.05	.08	.40										
.59	.69	.45	.03	.73	.73	.76	.18									
.61	.67	.52	.01	.69	.71	.89	.27	.97								
.61	.59	.51	.02	.65	.67	.91	.44	.94	.98							
.39	-.22	.01	-.11	-.19	-.18	.19	.26	-.05	.04	.08						
.10	.06	.15	.03	-.22	-.16	.16	.39	.01	.07	.14	.43					
-.23	.02	-.15	.03	-.08	-.10	-.43	.20	-.18	-.28	-.30	-.63	-.48				
.61	.31	.33	.25	.46	.50	.63	.34	.59	.64	.66	.22	.04	-.35			
.32	.48	.41	.26	.61	.65	.62	.17	.65	.67	.66	-.22	.01	-.14	.60		
.54	.45	.42	.28	.61	.64	.71	.31	.70	.75	.75	.02	.02	-.27	.92	.87	
.38	.31	.40	.38	.44	.51	.56	.39	.58	.61	.64	.13	.17	-.40	.80	.64	.81
.45	.45	.25	.17	.39	.41	.43	.15	.58	.56	.55	-.06	.01	-.13	.71	.50	.68
.40	.56	.47	.06	.56	.58	.60	.16	.85	.81	.79	-.17	.04	-.11	.54	.59	.64
.47	.59	.43	.11	.55	.58	.60	.18	.84	.80	.78	-.14	.05	-.14	.65	.61	.71
.41	.43	.47	.25	.38	.45	.48	.23	.61	.60	.60	-.05	.00	-.11	.69	.56	.70
.51	.36	.43	-.02	.25	.30	.58	.16	.59	.62	.61	.11	.05	-.24	.58	.35	.52
.50	.43	.47	.03	.42	.46	.75	.35	.78	.81	.82	.13	.23	-.28	.71	.62	.74
.53	.40	.46	-.02	.32	.37	.67	.23	.69	.72	.72	.13	.11	-.27	.66	.47	.64
.53	.52	.43	.00	.38	.42	.69	.35	.74	.76	.78	.01	.04	-.20	.77	.55	.75
.52	.38	.16	.23	.33	.34	.49	.38	.43	.48	.52	-.03	.14	-.09	.66	.34	.58
.44	.33	-.01	-.05	.28	.23	.44	.36	.38	.42	.46	.01	-.05	-.08	.56	.34	.51
.51	.37	.06	.06	.32	.30	.49	.40	.43	.48	.52	-.01	.03	-.09	.64	.36	.58
.31	70.52	22.03	13.76	42.34	17.14	37.55	11.03	60.66	98.21	109.24	195.24	18.34	12.24	86.73	89.73	87.76
1.067	8.318	1.973	1.154	8.436	9.724	5.804	3.111	10.728	15.592	16.707	16.953	5.888	8.708	4.415	7.382	4.80

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	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
3																
4	-.35															
1	-.14	.60														
2	-.27	.92	.87													
7	-.40	.80	.64	.81												
1	-.13	.71	.50	.68	.64											
4	-.11	.54	.59	.64	.60	.60										
5	-.14	.65	.61	.71	.67	.81	.95									
0	-.11	.69	.56	.70	.73	.69	.74	.80								
5	-.24	.58	.35	.52	.50	.65	.52	.63	.50							
3	-.28	.71	.62	.74	.73	.67	.69	.76	.67	.76						
1	-.27	.66	.47	.64	.60	.69	.61	.70	.59	.97	.89					
4	-.20	.77	.55	.75	.74	.78	.71	.81	.79	.85	.88	.91				
4	-.09	.66	.34	.58	.51	.73	.41	.58	.46	.56	.54	.57	.67			
5	-.08	.56	.34	.51	.36	.57	.29	.41	.33	.44	.44	.46	.58	.72		
3	-.09	.64	.36	.58	.45	.68	.36	.51	.41	.52	.51	.54	.66	.89	.96	
1	12.24	86.73	89.73	87.76	87.17	90.73	91.48	91.07	88.10	88.45	86.45	88.45	89.07	40.38	33.45	73.83
38	8.708	4.415	7.382	4.801	5.764	5.750	5.736	5.271	6.587	5.040	4.793	4.579	4.407	5.660	9.136	13.774

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5. Intercorrelation Matrix, January 1970 Input, German Sample ($N = 26$)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Age															
2 Education	-.06														
3 DLRT	-.07	.34													
4 MLAT-1,2	-.14	.05	.28												
5 MLAT-3,4,5	-.25	.33	.67	.51											
6 MLAT-Total	-.24	.27	.61	.77	.94										
7 PLAB-1	.03	.34	.24	-.10	.29	.17									
8 PLAB-2	.16	.55	.00	-.08	-.02	-.05	.15								
9 PLAB-5,6	.06	-.20	-.08	.50	.23	.36	.07	-.19							
10 PLAB-3,4	-.26	.38	.45	.23	.41	.39	.02	.03	.08						
11 PLAB-Total	-.08	.26	.27	.44	.47	.52	.37	.09	.73	.64					
12 OTIS	-.29	.19	.47	.38	.52	.54	.30	.03	.46	.58	.74				
13 HABLA-1	.35	.03	.21	.00	.07	.05	.00	-.07	.10	.24	.20	.25			
14 HABLA-3	-.30	.12	.44	.43	.69	.68	.28	-.21	.28	.39	.46	.71	.13		
15 HABLA-2	-.18	-.08	.35	.52	.53	.59	.15	-.21	.37	.50	.55	.63	.15	.61	
16 HABLA-Total	-.13	-.04	.41	.50	.57	.62	.17	-.23	.37	.53	.58	.70	.36	.70	.97
17 AFLART-1	-.21	.19	.44	.59	.67	.73	.12	-.22	.47	.25	.47	.50	.24	.40	.31
18 AFLART-2	.01	.01	.36	.37	.52	.53	-.05	-.18	.30	.22	.29	.35	.15	.35	.27
19 AFLART-3	-.09	.21	.55	.68	.71	.79	.09	.09	.47	.39	.59	.51	.21	.42	.62
20 AFLART 1,3	-.15	.22	.55	.70	.75	.83	.11	-.03	.51	.37	.59	.55	.24	.45	.54
21 AFLART-Total	-.13	.20	.55	.69	.76	.83	.09	-.06	.51	.36	.58	.55	.24	.46	.53
22 FLIT	.01	.39	.12	-.17	-.18	-.20	.30	.60	-.17	.09	.12	.22	.03	-.20	-.10
23 NSA	.00	.42	.30	-.16	.17	.06	.34	.14	-.38	-.17	-.24	.03	.11	.19	-.01
24 TWAS	-.06	-.25	-.30	.22	-.11	.01	.07	-.17	.05	-.32	-.15	-.29	-.34	-.04	-.32
25 1st 6-wk Ex-O	-.22	.22	.33	.15	.42	.37	.30	.37	-.02	.44	.38	.21	-.07	.20	.27
26 1st 6-wk Ex-W	-.29	.21	.39	.16	.41	.36	.29	.29	-.25	.38	.17	.16	-.07	.20	.21
27 1st 6-wk Ex-AVG	-.25	.22	.36	.15	.41	.37	.30	.36	-.16	.41	.27	.18	-.06	.20	.24
28 1st 6-wk OVERALL	-.25	.15	.33	.11	.41	.35	.30	.34	-.14	.42	.29	.20	-.11	.18	.31
29 2nd 6-wk Ex-O	-.05	.32	.62	.11	.52	.43	.35	.32	-.04	.52	.43	.47	.11	.31	.45
30 2nd 6-wk Ex-W	.09	.28	.47	.23	.27	.29	.43	.40	-.12	.28	.27	.34	.25	.10	.30
31 2nd 6-wk Ex-AVG	.00	.35	.60	.20	.49	.44	.37	.41	-.07	.47	.40	.41	.14	.24	.43
32 2nd 6-wk OVERALL	-.11	.28	.50	.20	.50	.45	.36	.40	-.14	.43	.32	.33	.11	.27	.41
33 Final Ex-O	.05	.35	.35	-.04	.38	.26	.14	.45	-.07	.39	.29	.27	.33	.16	.22
34 Final Ex-W	-.20	.18	.38	.15	.47	.41	.23	.45	.05	.37	.39	.32	.17	.13	.30
35 Final Ex-AVG	-.07	.26	.38	.06	.45	.36	.20	.46	.01	.39	.36	.32	.27	.16	.28
36 Final OVERALL	-.09	.23	.41	.22	.46	.43	.27	.46	.04	.38	.40	.34	.16	.20	.37
37 DLPT-L	-.62	.25	.40	.14	.52	.44	.18	.21	.04	.41	.36	.58	.07	.45	.37
38 DLPT-R	-.59	.19	.50	.19	.50	.45	.15	.12	.03	.58	.42	.61	.04	.50	.56
39 DLPT-Total	-.63	.23	.46	.17	.53	.46	.17	.18	.04	.50	.40	.62	.02	.49	.47
40 MLA-Coop-L	-.46	.23	.48	.22	.46	.43	.25	.12	-.07	.55	.36	.47	.09	.48	.39
41 MLA-Coop-R	-.27	.08	.49	.36	.61	.59	.21	.18	.11	.48	.44	.49	.32	.42	.45
42 MLA-Coop-S	-.47	.26	.48	-.01	.60	.44	.24	.13	-.17	.26	.12	.19	-.14	.24	.03
43 MLA-Coop-W	-.33	.28	.55	.19	.53	.47	.24	.19	.16	.67	.60	.60	.11	.38	.51
44 MLA-Coop-L,S	-.51	.27	.52	.07	.60	.47	.26	.14	-.15	.38	.22	.30	-.07	.34	.16
45 MLA-Coop-S,W	-.33	.22	.56	.27	.60	.54	.24	.20	.15	.64	.57	.59	.20	.42	.52
46 MLA-Coop-Total	-.42	.25	.58	.21	.63	.55	.27	.19	.05	.58	.48	.52	.11	.42	.42
Mean	23.27	5.50	33.40	62.38	67.04	129.42	11.96	7.08	44.08	33.85	96.96	65.92	21.46	13.27	37.00
Standard Deviation	3.986	2.249	10.904	8.367	15.858	21.398	2.271	1.294	5.484	4.549	7.897	9.699	2.249	1.663	8.433

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12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
-.25																		
.71	.13																	
.63	.15	.61																
.70	.36	.70	.97															
.50	.24	.40	.31	.38														
.35	.15	.35	.27	.32	.58													
.51	.21	.42	.62	.63	.69	.47												
.55	.24	.45	.54	.58	.88	.56	.95											
.55	.24	.46	.53	.57	.89	.67	.93	.99										
.22	.03	-.20	-.10	-.11	-.20	-.25	.04	-.06	-.10									
.03	.11	.19	-.01	.05	.01	-.10	-.02	-.01	-.03	.35								
-.29	-.34	-.04	-.32	-.35	.04	-.16	-.17	-.10	-.12	-.24	-.25							
.21	-.07	.20	.27	.24	.01	-.12	.34	.23	.18	.26	-.03	.01						
.16	-.07	.20	.21	.20	.01	-.01	.29	.20	.17	.28	.12	.03	.88					
.18	-.06	.20	.24	.22	.00	-.08	.31	.20	.17	.29	.05	.02	.97	.97				
.20	-.11	.18	.31	.27	-.01	-.07	.38	.25	.21	.30	-.02	.03	.94	.92	.95			
.47	.11	.31	.45	.45	.12	.12	.49	.38	.36	.29	.11	-.37	.76	.73	.75	.77		
.34	.25	.10	.30	.32	.00	-.05	.32	.21	.18	.52	.18	-.14	.65	.69	.69	.66	.74	
.41	.14	.24	.43	.43	.10	.06	.49	.37	.34	.38	.17	-.32	.79	.79	.81	.80	.96	.9
.33	.11	.27	.41	.41	.08	.09	.46	.34	.31	.38	.14	-.17	.86	.86	.88	.89	.89	.8
.27	.33	.16	.22	.28	.05	.18	.37	.27	.27	.16	-.01	-.50	.58	.52	.56	.56	.75	.6
.32	.17	.13	.30	.30	.17	.07	.46	.37	.35	.25	-.08	-.19	.84	.70	.79	.79	.75	.8
.32	.27	.16	.28	.32	.12	.14	.45	.35	.33	.20	-.07	-.36	.74	.63	.70	.71	.79	.8
.34	.16	.20	.37	.38	.11	.13	.49	.37	.36	.26	-.03	-.24	.84	.76	.83	.82	.84	.8
.58	.07	.45	.37	.38	.36	.23	.42	.43	.42	.16	.12	-.30	.56	.59	.59	.54	.63	.5
.61	.04	.50	.56	.56	.22	.20	.50	.42	.41	.20	.02	-.41	.55	.59	.58	.57	.65	.6
.62	.02	.49	.47	.48	.31	.23	.47	.44	.43	.19	.06	-.37	.58	.61	.61	.58	.67	.6
.47	.09	.48	.39	.42	.26	.13	.36	.35	.33	.10	.10	-.15	.72	.75	.75	.69	.69	.6
.49	.32	.42	.45	.52	.37	.33	.53	.51	.51	.02	-.13	-.09	.72	.71	.74	.69	.67	.6
.19	-.14	.24	.03	.03	.30	.22	.30	.32	.33	.04	.12	-.07	.65	.69	.67	.69	.58	.5
.60	.11	.38	.51	.51	.28	.24	.58	.50	.49	.21	-.10	-.35	.71	.65	.69	.70	.86	.7
.30	-.07	.34	.16	.17	.31	.21	.34	.36	.36	.07	.12	-.10	.73	.77	.76	.75	.67	.6
.59	.20	.42	.52	.55	.33	.29	.59	.53	.53	.15	-.12	-.27	.76	.71	.75	.74	.84	.7
.52	.11	.42	.42	.44	.35	.28	.54	.50	.50	.13	-.04	-.23	.80	.78	.80	.79	.83	.7
65.92	21.46	13.27	37.00	71.73	32.38	9.85	53.81	86.12	96.04	199.73	18.92	11.27	87.08	87.46	87.46	86.50	85.27	87.
9.699	2.249	1.663	8.433	10.125	6.027	2.752	9.440	14.280	15.976	14.922	5.067	7.718	5.067	5.148	4.893	4.885	6.181	4.

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8	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
.77																		
.66	.74																	
.80	.96	.87																
.89	.89	.84	.94															
.56	.75	.53	.71	.72														
.79	.75	.67	.78	.84	.77													
.71	.79	.62	.78	.82	.95	.94												
.82	.84	.77	.88	.94	.84	.93	.94											
.54	.63	.33	.57	.60	.52	.63	.60	.62										
.57	.65	.38	.59	.59	.59	.63	.65	.63	.84									
.58	.67	.37	.60	.62	.57	.66	.65	.65	.97	.95								
.69	.69	.51	.68	.77	.52	.64	.61	.71	.80	.73	.80							
.69	.67	.61	.69	.78	.65	.85	.79	.83	.70	.70	.73	.74						
.69	.58	.33	.55	.64	.51	.63	.59	.61	.67	.53	.64	.65	.59					
.70	.86	.54	.78	.75	.70	.75	.77	.79	.79	.83	.84	.74	.76	.62				
.75	.67	.42	.65	.74	.56	.69	.65	.70	.78	.65	.75	.83	.69	.96	.72			
.74	.84	.60	.79	.81	.72	.83	.83	.85	.81	.83	.85	.78	.90	.65	.57	.75		
.79	.83	.57	.79	.83	.71	.83	.81	.85	.84	.82	.87	.85	.88	.80	.93	.89	.97	
6.50	85.27	87.35	86.73	87.15	87.15	86.81	87.23	88.27	45.50	47.65	93.15	32.81	29.08	51.54	69.85	84.35	98.92	133.27
4.885	6.181	4.816	5.220	4.602	5.917	5.622	5.494	4.513	6.665	5.223	11.415	4.454	9.169	9.201	16.019	12.573	23.740	34.20

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6. Intercorrelation Matrix, January 1970 Input, Russian Sample ($N = 62$)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Age																
2 Education	.39															
3 DLAT	.00	.29														
4 DLAT-1,2	-.01	-.15	.27													
5 DLAT-3,4,5	.13	.38	.57	.30												
6 DLAT-Total	.06	.19	.50	.62	.82											
7 FLAG-1	.04	.12	.01	.15	.30	.33										
8 FLAG-2	.11	-.15	.13	.05	.21	.15	.04									
9 FLAG-5,6	.00	.12	.36	.47	.27	.40	-.04	.14								
10 FLAG-3,4	.13	.45	.67	.05	.63	.51	.20	.02	.31							
11 FLAG-Total	.09	.30	.56	.37	.60	.62	.40	.29	.77	.73						
12 OTIS	.07	.09	.21	.08	.30	.25	.10	-.07	.20	.33	.30					
13 HABLA-1	.15	.10	-.03	.19	.01	.18	.26	.03	.30	-.03	.26	-.05				
14 HABLA-3	.09	.07	.23	.11	.13	.05	.09	-.09	.08	.24	.18	.39	.09			
15 HABLA-2	-.01	.33	.56	.25	.56	.56	.32	-.04	.35	.62	.60	.35	.15	.37		
16 HABLA-Total	.04	.32	.52	.28	.52	.54	.33	-.08	.38	.58	.60	.36	.33	.50	.97	
17 APLAAT-1	.04	.22	.28	.36	.31	.41	.16	-.03	.65	.34	.60	.19	.30	.06	.36	
18 APLAAT-2	.11	.06	.29	.48	.35	.45	-.14	.10	.46	.19	.35	.10	.07	.19	.30	
19 APLAAT-3	.23	.44	.56	.23	.52	.42	.11	.02	.33	.49	.48	.24	.15	.24	.42	
20 APLAAT-1,3	.20	.44	.53	.29	.52	.48	.15	.02	.48	.51	.59	.28	.20	.19	.49	
21 APLAAT-Total	.19	.39	.54	.37	.53	.52	.11	.03	.54	.49	.60	.25	.22	.22	.47	
22 FLIT	.08	.02	.26	.01	.18	.09	.12	.51	.18	.14	.31	.00	-.03	-.01	.09	
23 WSA	.07	.03	-.16	.04	-.10	-.07	.22	-.01	-.02	-.29	-.09	-.03	.26	-.10	-.17	-.
24 TWAS	-.12	-.25	-.01	.04	-.12	-.05	-.28	.00	-.09	-.08	-.18	-.09	-.29	-.13	-.11	-.
25 1st 6-wk Ex-O	.03	.13	.46	.40	.48	.52	.09	.17	.40	.41	.50	.10	.15	.17	.46	
26 1st 6-wk Ex-W	.14	.43	.34	.15	.42	.44	.33	.10	.32	.32	.47	.06	.37	.02	.35	
27 1st 6-wk Ex-AVG	.11	.38	.45	.26	.53	.53	.27	.19	.45	.42	.59	.07	.37	.12	.46	
28 1st 6-wk OVERALL	.11	.25	.23	.20	.26	.28	.07	.06	.33	.20	.31	-.03	.22	.07	.24	
29 2nd 6-wk Ex-O	.09	.24	.56	.36	.52	.52	.19	.06	.39	.50	.54	.10	.04	.08	.39	
30 2nd 6-wk Ex-W	.02	.39	.35	.17	.33	.33	.31	.04	.22	.31	.39	.07	.17	.10	.33	
31 2nd 6-wk Ex-AVG	.17	.35	.45	.29	.52	.52	.37	.07	.32	.42	.52	.12	.20	.13	.42	
32 2nd 6-wk OVERALL	.16	.38	.46	.27	.51	.51	.40	.09	.36	.43	.57	.11	.27	.13	.48	
33 Final Ex-O	.19	.19	.41	.18	.35	.36	.10	.30	.25	.34	.40	.19	.18	.31	.27	
34 Final Ex-W	.15	.46	.39	.20	.53	.53	.40	.09	.24	.49	.52	.24	.15	.19	.53	
35 Final Ex-AVG	.18	.35	.44	.21	.51	.51	.26	.22	.28	.51	.53	.23	.16	.24	.46	
36 Final Overall	.12	.38	.44	.26	.54	.55	.35	.16	.36	.44	.57	.21	.19	.20	.52	
37 DLPT-L	.24	.39	.46	.36	.58	.61	.25	.18	.35	.55	.58	.16	.12	.07	.32	
38 DLPT-R	.16	.31	.42	.40	.49	.53	.41	.21	.32	.49	.60	.28	.17	.28	.47	
39 DLPT-Total	.22	.37	.44	.39	.55	.58	.35	.20	.34	.54	.61	.22	.14	.19	.41	
40 MLA-Coop-L	.06	.14	.41	.21	.48	.41	.14	.21	.29	.47	.48	.21	.05	.10	.32	
41 MLA-Coop-R	.10	.26	.46	.33	.59	.57	.32	.14	.21	.51	.50	.20	.02	.25	.49	
42 MLA-Coop-S	.01	.23	.37	.16	.42	.45	.34	.17	.25	.45	.50	.20	.19	.18	.43	
43 MLA-Coop-W	.00	.24	.40	.21	.41	.46	.33	.16	.28	.41	.50	.22	.23	.28	.44	
44 MLA-Coop-L,S	.03	.23	.44	.20	.50	.50	.32	.21	.30	.52	.57	.23	.17	.18	.45	
45 MLA-Coop-R,W	.04	.26	.45	.27	.50	.52	.35	.16	.26	.47	.52	.22	.16	.29	.49	
46 MLA-Coop-Total	.04	.26	.46	.26	.52	.54	.35	.19	.29	.51	.56	.24	.17	.26	.49	
Mean	22.06	4.94	38.71	66.42	77.81	144.18	11.24	7.10	47.35	34.94	100.65	68.58	22.55	13.32	41.52	78
Standard Deviation	2.508	2.118	11.47	6.639	17.785	19.737	2.792	1.606	5.420	4.238	8.876	9.782	1.646	1.181	7.489	8

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13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
.09																		
.15	.37																	
.33	.50	.97																
.30	.06	.36	.38															
.07	.19	.30	.32	.37														
.15	.24	.42	.44	.51	.31													
.20	.19	.49	.50	.74	.40	.93												
.22	.22	.47	.50	.77	.53	.92	.97											
-.03	-.01	.09	.05	-.06	.00	.13	.08	.07										
.26	-.10	-.17	-.11	.02	-.24	-.23	-.17	-.19	.06									
-.29	-.13	-.11	-.16	-.15	.20	-.03	-.10	-.03	-.08	-.55								
.15	.17	.46	.46	.29	.40	.47	.44	.50	.20	-.16	.04							
.37	.02	.35	.38	.43	.05	.48	.50	.49	.13	.27	-.39	.37						
.37	.12	.46	.50	.41	.22	.54	.54	.56	.24	.08	-.25	.74	.86					
.22	.07	.24	.27	.45	.19	.33	.40	.42	.14	.05	-.06	.47	.55	.61				
.04	.08	.39	.37	.36	.15	.50	.48	.50	.11	-.01	-.02	.66	.55	.69	.45			
.17	.10	.33	.35	.29	.00	.43	.41	.39	.17	.07	-.15	.40	.71	.70	.39	.59		
.20	.13	.42	.43	.40	.08	.54	.53	.53	.19	.10	-.18	.57	.78	.82	.51	.86	.81	
.27	.13	.48	.50	.42	.11	.57	.57	.56	.18	.05	-.16	.63	.82	.88	.54	.83	.80	.97
.18	.31	.27	.31	.12	.14	.29	.22	.26	.17	-.05	-.07	.48	.43	.56	.31	.57	.48	.60
.15	.19	.53	.52	.35	.11	.48	.47	.47	.11	-.06	-.17	.43	.65	.65	.40	.55	.55	.66
.16	.24	.46	.47	.27	.17	.41	.37	.40	.18	-.11	-.11	.51	.57	.66	.38	.61	.53	.67
.19	.20	.52	.52	.35	.15	.50	.48	.49	.13	-.01	-.13	.65	.71	.82	.48	.79	.70	.86
.12	.07	.32	.33	.35	.22	.51	.49	.51	.22	-.15	-.02	.63	.49	.66	.40	.73	.58	.74
.17	.28	.47	.48	.36	.17	.43	.45	.46	.26	.03	-.20	.57	.58	.69	.40	.72	.61	.79
.14	.19	.41	.41	.36	.21	.48	.48	.50	.25	-.05	-.12	.62	.56	.71	.41	.76	.63	.80
.05	.10	.32	.31	.19	.13	.40	.36	.36	.19	-.12	-.16	.64	.38	.60	.29	.60	.45	.60
.02	.25	.49	.48	.24	.17	.40	.36	.39	.11	-.06	-.11	.58	.47	.61	.35	.74	.55	.72
.19	.18	.43	.43	.36	.22	.40	.41	.44	.05	-.06	.01	.50	.51	.58	.34	.58	.45	.62
.23	.28	.44	.48	.31	.18	.39	.39	.41	.09	.05	-.17	.53	.64	.71	.43	.66	.65	.74
.17	.18	.45	.45	.35	.22	.46	.45	.48	.11	-.09	-.05	.62	.53	.67	.37	.67	.51	.70
.16	.29	.49	.50	.29	.18	.41	.40	.42	.10	.01	-.16	.58	.61	.71	.42	.73	.65	.77
.17	.26	.49	.50	.33	.21	.45	.43	.46	.11	-.03	-.12	.62	.60	.72	.42	.74	.67	.78
2.55	13.82	41.52	78.00	36.82	11.21	59.40	95.85	107.44	193.53	16.10	12.16	84.23	84.81	84.61	82.79	84.81	85.87	86.03
1.646	1.181	7.489	8.495	5.494	2.904	10.379	14.193	15.315	16.247	5.281	8.207	7.908	12.697	8.257	9.994	6.935	9.094	7.163

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28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46
.45																		
.39	.59																	
.51	.86	.81																
.54	.83	.80	.97															
.31	.57	.48	.60	.60														
.40	.55	.55	.66	.69	.66													
.38	.61	.53	.67	.69	.90	.90												
.48	.79	.70	.86	.89	.78	.85	.88											
.40	.73	.58	.74	.70	.70	.68	.78	.81										
.40	.72	.61	.79	.77	.72	.73	.80	.83	.80									
.41	.76	.63	.80	.78	.76	.75	.83	.86	.93	.96								
.29	.60	.45	.60	.57	.58	.49	.61	.66	.73	.67	.72							
.35	.74	.55	.72	.70	.72	.67	.77	.81	.78	.84	.85	.67						
.34	.58	.45	.62	.64	.55	.60	.62	.71	.60	.66	.66	.46	.66					
.43	.66	.65	.74	.74	.67	.63	.70	.82	.68	.80	.77	.58	.80	.76				
.37	.67	.51	.70	.71	.64	.65	.71	.79	.73	.76	.78	.72	.76	.95	.81			
.42	.73	.65	.77	.76	.72	.68	.77	.86	.75	.85	.84	.65	.92	.76	.97	.83		
.42	.74	.62	.78	.77	.72	.70	.78	.87	.78	.85	.85	.70	.90	.87	.95	.93	.98	
2.79	84.81	85.87	86.03	86.27	86.18	86.13	86.26	86.82	52.35	47.40	99.60	35.02	37.79	51.27	75.08	86.29	112.89	199.
9.994	6.935	9.094	7.163	6.869	7.606	8.330	7.538	6.431	5.735	7.543	12.533	4.051	7.683	8.884	12.714	11.334	19.403	29.

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Intercorrelation Matrix,
January 1970 Input,
Spanish Sample (N = 48)

able	1	2	3	4	5	6	7	8	9	10	11	12	
ge													
ducation	.25												
LAT	-.23	.17											
LAT-1,2	-.39	-.02	.48										
LAT-3,4,5	-.18	.34	.62	.53									
LAT-Total	-.26	.27	.65	.73	.97								
LAB-1	.03	.26	.33	.22	.28	.30							
LAB-2	.33	.30	.25	.21	.30	.30	.33						
LAB-5,6	-.13	-.10	.17	.37	.21	.28	.06	.16					
LAB-3,4	-.26	.35	.45	.58	.59	.65	.22	.21	.32				
LAB-Total	-.15	.21	.43	.59	.52	.60	.40	.42	.79	.77			
TIS	-.28	.30	.50	.44	.46	.50	.37	.07	.05	.51	.37		
ABLA-1	-.04	.01	.21	.35	.28	.33	.00	.22	.16	.23	.25	.24	
ABLA-3	-.29	-.01	.26	.37	.04	.14	.13	.00	.13	.28	.24	.40	
ABLA-2	-.26	.14	.72	.54	.58	.63	.38	.19	.10	.49	.42	.64	
ABLA-Total	-.27	.10	.69	.58	.54	.61	.33	.19	.13	.53	.44	.66	
FLAAT-1	.01	-.17	.38	.58	.57	.63	.17	.31	.44	.33	.51	.19	
FLAAT-2	-.17	.03	.48	.59	.56	.62	.15	.16	.30	.42	.45	.46	
FLAAT-3	-.23	.15	.59	.65	.57	.66	.39	.26	.32	.51	.56	.51	
FLAAT-1,3	-.17	.05	.58	.69	.63	.71	.35	.30	.39	.50	.60	.45	
FLAAT-Total	-.18	.05	.60	.73	.66	.75	.34	.30	.41	.52	.62	.48	
LTI	.18	.23	.32	.16	.28	.28	.34	.83	.18	.20	.41	.09	
SA	.11	-.17	.05	-.08	-.03	-.05	.23	.37	-.11	-.10	-.01	-.17	
MAS	.11	.31	-.26	-.08	-.06	-.07	.03	-.07	-.11	-.13	-.14	-.05	
st 6-wk Ex-O	-.16	.29	.47	.52	.56	.61	.24	.53	.33	.57	.61	.33	
st 6-wk Ex-W	-.04	.35	.34	.25	.41	.40	.25	.55	.29	.47	.54	.22	
st 6-wk Ex-AVG	-.10	.33	.42	.40	.50	.52	.25	.56	.30	.54	.59	.29	
st 6-wk OVERALL	-.12	.30	.44	.44	.49	.53	.23	.54	.37	.57	.64	.29	
nd 6-wk Ex-O	-.37	.22	.48	.59	.61	.67	.19	.29	.38	.66	.64	.43	
nd 6-wk Ex-W	-.20	.34	.40	.50	.55	.59	.22	.43	.43	.66	.70	.37	
nd 6-wk Ex-AVG	-.29	.29	.45	.56	.59	.65	.21	.37	.42	.68	.69	.41	
nd 6-wk OVERALL	-.30	.28	.44	.55	.56	.61	.23	.37	.42	.64	.68	.38	
inal Ex-O	-.40	.16	.44	.55	.53	.59	.16	.39	.40	.63	.64	.29	
inal Ex-W	-.19	.37	.40	.48	.59	.62	.20	.43	.33	.67	.64	.31	
inal Ex-AVG	-.30	.28	.44	.53	.58	.63	.18	.42	.37	.67	.66	.31	
inal OVERALL	-.23	.28	.46	.53	.58	.63	.24	.45	.39	.63	.66	.34	
PT-L	-.33	.19	.44	.57	.55	.61	.18	.40	.39	.60	.63	.38	
PT-R	-.25	.13	.40	.56	.53	.60	.03	.38	.44	.58	.62	.35	
PT-Total	-.31	.16	.43	.59	.56	.63	.11	.41	.43	.61	.65	.38	
	23.65	4.67	29.27	64.29	64.46	128.75	11.44	6.83	44.42	32.33	95.02	62.98	2
lard Deviation	5.851	2.157	9.303	6.277	17.429	21.450	2.041	1.642	6.056	5.240	10.330	11.523	

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10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
.77															
.51	.37														
.23	.25	.24													
.28	.24	.40	.14												
.49	.42	.64	.23	.32											
.53	.44	.66	.45	.48	.94										
.33	.51	.19	.33	.23	.42	.44									
.42	.45	.46	.37	.14	.37	.38	.49								
.51	.56	.51	.33	.27	.67	.64	.59	.44							
.50	.60	.45	.37	.28	.64	.64	.80	.51	.96						
.52	.62	.48	.39	.28	.65	.64	.81	.62	.94	.99					
.20	.41	.09	.14	-.02	.22	.20	.30	.09	.24	.29	.28				
-.10	-.01	-.17	.05	.01	-.12	-.10	.20	.13	-.03	.05	.07	.35			
-.13	-.14	-.05	-.06	-.18	-.19	-.24	-.19	-.32	-.07	-.12	-.16	-.07	-.47		
.57	.61	.33	.22	.22	.46	.45	.42	.45	.48	.51	.53	.45	.11	.00	
.47	.54	.22	.11	.13	.28	.25	.28	.24	.44	.43	.43	.46	.17	.05	.
.54	.59	.29	.17	.18	.39	.37	.35	.35	.47	.48	.49	.46	.15	.02	.
.57	.64	.29	.12	.19	.42	.38	.36	.36	.52	.52	.53	.43	.12	.00	.
.66	.64	.43	.17	.29	.49	.46	.42	.51	.50	.52	.56	.23	.03	-.03	.
.66	.70	.37	.17	.15	.44	.41	.42	.34	.54	.55	.56	.38	.06	-.02	.
.68	.69	.41	.17	.22	.48	.44	.43	.43	.54	.55	.57	.31	.04	-.02	.
.64	.68	.38	.10	.24	.46	.43	.41	.39	.51	.53	.55	.32	.04	-.02	.
.63	.64	.29	.19	.17	.43	.40	.40	.47	.50	.51	.54	.35	.16	-.17	.
.67	.64	.31	.25	.17	.41	.40	.41	.42	.55	.56	.58	.36	.13	-.04	.
.67	.66	.31	.24	.17	.43	.41	.42	.46	.55	.56	.58	.36	.15	-.10	.
.63	.66	.34	.16	.20	.48	.44	.46	.41	.55	.58	.59	.39	.13	-.09	.
.60	.63	.38	.10	.27	.40	.37	.40	.50	.51	.52	.55	.39	.14	-.20	.
.58	.62	.35	.27	.33	.38	.41	.46	.51	.44	.49	.53	.27	.08	-.18	.
.61	.65	.38	.19	.32	.40	.40	.44	.52	.49	.53	.56	.35	.12	-.20	.
32.33	95.02	62.98	21.77	12.90	35.02	69.48	35.13	10.19	51.54	86.67	96.85	196.29	17.31	9.79	81.
5.240	10.330	11.523	1.916	1.753	7.439	9.216	5.518	2.726	11.238	15.176	16.719	19.447	5.791	5.794	9

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24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
.00															
.05	.86														
.02	.96	.97													
.00	.93	.93	.96												
-.03	.86	.71	.81	.83											
-.02	.88	.84	.89	.90	.88										
-.02	.89	.80	.88	.89	.97	.97									
-.02	.88	.77	.85	.87	.95	.96	.98								
-.17	.85	.69	.80	.81	.88	.86	.90	.87							
-.04	.86	.79	.86	.85	.85	.91	.91	.88	.86						
-.10	.89	.77	.86	.86	.90	.92	.93	.90	.96	.97					
-.09	.88	.77	.85	.87	.93	.94	.96	.96	.92	.92	.95				
-.20	.77	.62	.72	.76	.87	.81	.86	.85	.89	.83	.88	.91			
-.18	.74	.63	.71	.73	.84	.76	.83	.81	.78	.78	.80	.84	.85		
-.20	.79	.65	.74	.78	.89	.82	.88	.86	.87	.83	.88	.91	.96	.96	
9.79	81.96	86.40	84.40	85.35	79.60	82.35	81.17	84.27	82.06	84.96	83.75	84.04	44.46	43.10	87.5
5.794	9.811	10.244	9.693	8.017	10.631	11.892	10.969	8.939	8.981	10.419	9.291	7.803	7.989	7.546	14.9

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8. Demonstration of Hotelling's t test

Testing the difference between the predictive validities of two correlated tests: AFLAAT-3 and MLAT-3, 4, 5, using Hotelling's t test (see Table 10, *supra*, p. 54, and Appendix B-3).

r_{12} = correlation between AFLAAT-3 and 1st 6-wk grade = .36

r_{13} = correlation between MLAT-3, 4, 5 and 1st 6-wk grade = .31

r_{23} = correlation between AFLAAT-3 and MLAT-3, 4, 5 = .64

Hotelling's formula:

$$t_{d_r} = (r_{12} - r_{13}) \sqrt{\frac{(N - 3)(1 + r_{23})}{2(1 - r_{23}^2 - r_{12}^2 - r_{13}^2 + 2r_{23}r_{12}r_{13})}},$$

with $df = N - 3$.

Substituting the observed r values:

$$t_{d_r} = (.36 - .31) \sqrt{\frac{162(1 + .64)}{2[1 - .4096 - .1296 - .0961 + 2(.36)(.31)(.64)]}}$$

$$= .05\sqrt{\frac{265.68}{1.0150}} = .05\sqrt{261.7537} = .05(16.1788) = .8089,$$

which is insignificant at the .05 level, using the two-tailed test.

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9. ETS Letter Dated June 30, 1970

EDUCATIONAL TESTING SERVICE PRINCETON, N. J. 08540

Test Development Division

June 30, 1970

Mr. Antoine R. Al-Haik
2020 Lassen Street
Seaside, California

Dear Tony:

I am delighted to hear that you are getting full support for your project and I am sure that Colonel Horne is quite correct in assuming that the project will be of value to the school.

The chief scorer in German is Mrs. Margaret Aschaffenburg, 22 Morgan Place, Princeton, New Jersey 08540. The chief scorer in Russian is Mrs. Natalie Sukacev, Box 154, R.D. 1, Jackson, New Jersey 08527. Should you have any trouble contacting the scorers at these addresses, let me know.

I would very much like to know how your study turns out and if there is any way that I can help out, let me know.

All the very best,

Protase E. Woodford

PEW:np
cc: Mrs. Houis
Mr. Loret
Mr. Solomon

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