THE USE OT SEMPCDED APTITUDE REST SCORES FOR PREDICPITG ACHIEVETBER IN MODERN FOREDGN LANGUAGTS AT TORTF TEXAS SMATE UIIVERSITY

## OLSSERTATION

Presented to the Graduate Council of the North Pexas State University in Partial Pulfilment of the Requirements

For the Degree of

DOCMOR OF EHELOSOPHY

By

Dolores C. Akins, B.A., M.A. Denton, Texas

August, 1971

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The problem of this study was to determine the value of certain selected aptitude test scores for predicting student achievement in Spanish, French, and German at North Texas State Univorsity. Particular enphasis was placed on freshmen enrolled in beginning courses.

Sources of data were scores from the Scholastic Apiitude Test, including both the verbal and mathematical measures of ability; auditory and interest scores on the "Soud Hiscrimination," "Scund-Symol Assooiation," and "Interest" parts of the Pinsleur Jencuage Aptitude Battery; soores from the Mu - Cooperative Foreign Ienguase Tests, Torm JA; and teacher-assigned semester narks.

Date were complete for 105 firgt-semester freshmen in Spenish, 80 first-semester freshmen in Prench, and 24 Eirst-senester freshmen in Geman. Separate data for each language were treated statistically to derive the following:

1. Productmoment coefficients of correlation between the selected measures of eptitude and the measure of learning achjevement.
2. Coefficients of multiple correlation between the measure of learming achievement and combinations of the selected measures of aptitude.
3. The proportion of veriance of a measure of learing achievement attributable to the joint action of the selected measures of aptitude, including the proportion of variance explained by each.
4. Partial coefficients of correlation used in the construction of regression equations for the prediction of scores on 2 measure of leaming achievement.
5. Product-monent coefficients of correlation between teacker-assigned semester marks and the measure of learning achievement.
6. Product-moment coefficients of correlation between teacher-assigned semester marks and the selected measures of aptitude.
7. Coefficients of multiple correlatjon between teacher-assigned semester marks and combinations of selected measures of aptitude.
8. The proportion of varience of teacher-assigned semester merks attributable to the joint action of
selected measures of eptitude, including the proportion of varience explained by each.
9. Partial correlation coefficients used in the construction of regression equations for the prediction of teacher-assigned semester merks.

The study contains five chapters and an appendix. Chapter I includes an introduction and the statement of the problem. Chapter II contains a review of the related literature. Chapter III describes the population and instruments used and outlines the procedures for the collection and analysis of the data. Chapter IV presents the treatment of the data and the findings of the study in relationship to the hypotheses formalated. Correlations between the MLA - Coogerative Poreign Language Tests, Form LA, and teacher-assigned seriester merks in Spanish, French, and German were .706 , .800, and .336 respectively. Chapter $V$ summarizes the investigation and includes the following conclusions:

1. The best predictors of Spanish achievement scores were verbal and interest scores.
2. The best predictors of French achievement scores were mathematical and interest scores.
3. It was clear that no predictions of German achievement scores would be possible on the basis of the study.
4. The mathematjeal and auditoxy scores were the best predictors of teecher-assigned semester marks in Spanish. Consideration of the interest scores as another predictor seemed to be advantageous as well.
5. The auditory and interest scores were the best predictors of teacher-assigned semester marks in French. Consideration of the mathematical scores as another predictor scemed to be edvantageous as well.
6. The mathematical and auditory scores were the best predictors of teacher-assigned semester grades in German.
7. Additional pertinent information available should also be considered in attempts to predict modern foreign language learning achievement.

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## PREFACE

Por permission to collect the data for this study, special acknowlodgment is given to the Chaimman and the Executive Comittee of the Foreign Language Department at North Texas State University. Appreciation is also extended to all of those in the Department whose cooperation made possible the execution of the study.

A very special expression of sincere gratitude is also offered to The Delta Kappa Ganma Society Intemational for its assistance in making this research possible.

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## CHAPTER I

## INTROUUCMION

With regard to many questions remaining to be answered through research in the area of foreign language teaching, John B. Carroll states:

Information is desired on which to base decisions concerning who should be taught foreign langueges, at what ages instruction should be started and how long it should be contimued, what languages shoujd be taught, what skills should be emphasized, and whet kind of outlays of staff, space, and equipment are required to support the resulting instructional program (2, 1, 1094).

There have Iong been differences of opinion about who should be taught forejgn languages; traditions and observations, rather than scientific evidence, have largely been used to support these different opinions (4, p. 3).

Further, Turner has suggested that in spite of a renewal of interest in the teaching of foreign languages the weakest link in the chain of foreign language instruction that extends from the elementary school through the postdoctoral level is the college and university undergraduate program (5, p. 358).

The undergraduate student population has potentially variable needs which ougit to be taken into account in progrem development. Jakobovits has stated that the student should be given more holp in his choice of a foreign language (3, p. 449). This help is needed so that students may be more adequately assured of success and so that an institution may be more effectively assured of the full utilization of its resources. In order to provide this type of counseling, educators need scientific ways of identifying students with aptitudes for learning foreign lenguages (4, pp. 3-4). This kind of infometion can be very useful in the selection and placement of students for university foreign language instruction.

## Statement of the Problem

The problem of this study was to detemane the value of the use of selected aptitude test scores for predicting student achievement in modern foreign languages at North Texas State Univergity. Particular emphasis was placed on freshmen enrolled in beginning courses.

Purposes of the study
The purposes of this study were (l) to investigate and ascertain the value of Scholastic Aptitude Test
scores for predicting a student's echievement in modern foreign langrage study at North Texas State University, both when the scores are used exclusively and when they are used in combination with scores on certain foreign language aptitude tests selected from the Pinsleur Ianguage Aptitude Battery, and (2) to analyze, compare, ond report the findings for educators who are interested in predicting a stadent's achievement in modern foreign languages.

## Hypotheses

The following hypotheses were formulated:

1. There will be a significant positive relationship between learning achievement in selected moderm foreign languages, as measured by the MLA Cooperative Foreign Language Tests, Form IA, and the following measures:
a. Verbal ability as determined by the Scholastic Aptitude Test.
b. Mathematical ability as determined by the Scholastic Aptitude Test.
c. Auditory ability as determined by the "Sound Discrimination" and the "Sound-Symbol Association" parts of the Pimsleur Ianguage Aptitude Battery.
d. Student interest as cetermined by the "Interest" part of the Pjosleur Language Aptitude Battery.
2. There will be a significant positive relationship between Jearning achievenent in selected modem foreign languages, as measured by the MLA - Cooperative Foreign Language restg, Forn IA, and the following combinations of measures:
a. Verbal and mathenatical abilities as detemined by the Scholastic Aptitude Test.
b. Verbal ability as determined by the Scholastic Aptitude Test and anditory ability as deternined by the "Sound Discrimination" and the "Sound-Symbol Association" parts of the Pimsleur Language Aptitude Battery.
c. Verbal ability as determined by the Scholastic Aptitude Test and student interest as determined by the "Interest" part of the Pimsleur Language Aptitude Battery.
d. Nethematical ability as determined by the Scholasgic Aptitude Test and auditory ability as detemined by the "Sound Discrimination" and the "Sound-Symbol Association" parts of the Pinsleur Language Aptitude Battery.
e. Mathenatical ability as determined by the Scholastic Aptitude Tost and strdent interest as determined by the "Interest" part of the Pimsleur Languge Aotitude Battery.
f. Auditory ability, as determined by the "Sound Discrimination" and the "Sound--Symbol Association" perts of the Pimsteur Lenguage Aptitude Bettery, and student interest, as determined by the "Interest" part of the Pimsleur Ianguare Aptitude Battery.
g. Verbal and mathematical abilities as determined by the Scholastic Aptitude Test and auditory ability as determined by the "Sound Discrimination" and the "Sound-Symbol Association" parts of the Pinsteur Lenguage Aptitude Battery.
h. Verbal and mathematical abilities as determined by the Scholastic Aptitude Test, auditory ability and stucent interest as determined by the "Sound Discrimination," the "Sound-Symbol Association," and the "Interest" parts of the Pinsleur Langrage Aptitude Battery.
3. There will be a signifjcant positive relationship betwcen teachor-assigned semester marks in selected modem foreign languages and the following measures:
a. Leaming achievernent in the respective languages, as deterained by the MLA - Cooperative Foreign Lencuase Tosts, Form IA.
b. Verbal ability as determined by the Scholastic Aptitude Test.
c. Mathematical ability as detemined by the Scholastic Aptitude Test.
d. Auditory ability as detemined by the "Sound Discrimination" and the "Sound-Symbol Association" parts of the Pimsleur Language Aptitude Battery.
e. Sthatent interest as noteminer by the
"Interest" part of the Pimgleur Languare Apitude Battery.
4. There will be a significant positive relationship between teacher-wssigned semester marks in each modern foreign language and a combination of the two best predictors of such evaluations of learning achievement in the lansuage as revealed by first-order coefficients of correlation.

Background and Signjificance of the Stuay There is a recognition of the desirability of having foreign language instruction which is geared to individual needs and which is offered in full cognizance and acceptance of the variation that exists in foreign
languace aptitude. Becnard points out the importance of this kind of instruetion throughout the school situation:

Good teeching, which recognizes differences, illustrates acceptance, and challenges potontials, thus providing every pupil a chance to achieve success in effective leaming, is a nost positive approach to mental health. Hore teachers should realize that when they are teaching well, they are practicing mental hysiene (1, p. 423).

- An awareness of the desirability of providing for a wide range of individual differences should lead foreign language educators to establish bases for counseling each stadent in the choice of a lenguage appropriate to his own particular neods, aptitude, and interest. Such colinselints will venerit the jnstibution by helping to insure that students will experience success and by making possible a more effective utilization of resources.

Because each entering freshman at Forth Texas State University is required to submit Scholastic Aptitude Test scores, already available to the student as well as to his courselor or adviser, counseling can be made more effective in accomplishing advantaceous placement of students for foresgr language strady. Use of statistical anelyses of the test data is a potential source of help to the counselor or adviser in providing guidance for the student.

Although foreign language aptitude tests are not being used at North Texas State University, one. significant aspect of this study was an attempt to determine whether an advantageous use of such tests might be considered for the future.

Definition of Terms
For the purposes of this study the principal terms were defined as follows:

1. Achievenent was defined in terms or student performance in beginning Spanish, French, and German at North Texas State University, as measured by the LLA - Cooperative Foreign Language Tostis, Form IA, and as indicated by teacher-assigned semester marks.
2. Auditory was interpreted as the sum of the measures of sound discrimination and sound-symbol association, as determined by the "Sound Discrimination" and the "Sound-Symbol Association" parts of the Pimsteur Language Aptitude Battery.
3. Interest was interpreted as the neasure of the student's desire to study a foreign language, as determined by the "Interest" part of the Fiwsleur Language Aptitude Battery.
4. Mathenatical was interpreted as the sub-test measure of matheratical ability as determined by the Scholastic Aptitude Test.
5. Verbal was intompeted as the sub-test measure of verbal ability as detemined by the Scholastic Aptitude Test.

## Jimitations

This study was limited to first-semestex freshmen Who were enrolled in Spanish 101, French 101, and Gexman lol at North Iexas State University during the fall semester of the 1970-1971 academic year. The time length of language instruction was limited to this one-semester period.

The setting, the instructional staff, and the nature of the population sestrict interpretation beyond the population used in the study.

Basic Assumptions
It was assumed that the subjects responded honestly to the instruments being used in measurement. It was further assumed that the instruction in all of the language sections was comparable, and that the use of a11 Spanish 101, Prench 201, and Geman 101 classes and of subjects who had many teachers would negate the effect of any one teacher upon achievenent.

There was no reason to suppose that freshman students selected in like manner at other institutions with foreign Ianguege requirements or that similarly chosen future

North Texes State University freshan stucents wonld. differ in significent ways from those included in this study.

Sunimaxy
There appear to be unused sources for help in guiding a student in his election and/or selection of a modern foreign Janguage for study. This research evolved as a plan to provide evidence for the potential improvement of the usefulness of such souxces. The problem veas to detemine the value of the use of selected aptitude test scores for predicting learning achievenent in Spanish, Prench, and German at North Texas State University.

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## CHAPIER II

## RELATED LITFRATUTE

The purpose of this chapter is to present a brief review of the Jiterature which relates to the prognostic value of measures of aptitude and interest for determining student achievement in the leaming of modem foreign languages.

The literature is quite extensive in regerd to a number of factors believed to be important in foreign langage learming achievenont. A more comprenensive review of the historical development and recent status of prediction in regard to foreign language learning may be found in the 1968 study by Kannwischer, "Prediction of Tonejon Language Iearming: Development and Present Status" (12).

Aptitude and Learning Achievement
In an attempt to identify ebinities related to or involved in language aptitude, investigators have considered such Eactors as intelligence, verbal and mathematical abilities, grades in other subjects, and auditory ability. Summaries of a ropresertative sannle
of the investigations are being presented chronologically, in order to furnish an overview of the developmental trend in the thinking of interested investigators.

Glover (10), in 1917, using English composition as a criterion of future success in elementary foreign language study, reported a positive correlation of .632 . He also found correlations of .513 between records of performance in arithmetic and subsequent foreign language achievement, and .355 between performance in history and later achievement in elementary foreign language study.

In 1223 Neunfers (13) roportod the resulte of his study of the mean grade-point averages of sone one thousand pupils with varying degrees of jntelligence, as measured by the Terman Croup Test of Mental Ability, Forms A and B. His data showed, with a few extrene exceptions, a strongly consistent rise in nean Spanish language achievement for every sienificant increase in intelligence. Anong his conclusions were that intelnigence significantly influences pupil achievement in Spenjsh, as measured by teacher-assigned grades, and that pupils in the lower levels of mental abilaty ordinarily need superior application habits in order to succeed.

Writing about the foreign larguace prognosis test which he designed, Symonds (33) described a correlation
study undertaken in the fall of 1928 and concluded in May, 1929. The correlation between Form A and achievement, as determined by an achievement test, was . 60 (average of 10 schools), while the corresponding correlation coefficient for Form $B$ was 61 (average of 6 schools). The correlation coefficient between both forms combined and final achievenent was .71 (average of 4 schools).

In 1931 Parker (22) sumarized the ewidence up to that time, concluding that specjal tosts were more effective prognostic instruments than were general intelligence tests. Such special promoses, together with objective measurcments in a trial period, were recomended as the best bases of prediction and classification.

The types of memory in langrage study received the attention of Hagboldt (11), who in 1932 asserted that all phases of memory--auditory, visual, and motor--are implied in language learning, and that lasting success can only be achieved through habitual, effective use of all kinds of images.

In 1.933, after a study using the Symonds Toreign Language Prognogis Test, Torm B, Richardson (27) reported a correlation coefficient of .64 betwoen the prognostic test scores and first-semester gredes, stating that the
placement ranks on the prognons test wece of greater predictive significance than were either nental test score placement ranks or intelligence quotient placenent ranks from the Texien Group test of Mentel Ability.

Dexter and Omwake (6), in their college study of the relation between pitch discrimination and accent, obtained a correlation coefficient of .485 between intelligence and accent retings in French. Among the general conclusions they reported in 1934 were that those with a high ability rating in pitch discrimination may be rated either high or low in French accent and may take much or little college French, but that those with a low ability rating in pitoh discrimination are not rated high in accent, nor do they take more than two years of French in college. Dexter (5) reported a similer study on the hich school. level a few rionths later, citing a coefficient of correlation of .592 between intelligence and accent rating and another of . 639 between pitch discrimination and accent rating. She concluded that the ability to discriminate pitch contributed as much as much as intelligence to the atteinment of a good French accent; and thet comparatively low intellectual ability accompanied by good pitch discrimination seemed to result in roasonable success jin high school French, while Iow intelligence along with low pitch discrimination ebility led to feilure in Trenoh.

After experimentition, Eetom (8) concluded in 1934 that a general Jeaguage coume plus sone consid. eration of an artificial language could be of value in the prediction of lenguage aptitude.

In 1936 Sister Virgil (30) descrived an earlier study of the prosnosis of success in Geman. The prognostic battery at the University of Finmesota consisted of an especjally constructed Gexman prognosis test and the Iowa Foreign Language Aptitude Test. In addition, data were avejlable from the Sinnesota College Aptitude Test and College Ability Ratings. The best single predictor was the Iowa Foreign Language Aptitude Test, with a corcelation coefficient of 491 with firstquarter marks. The coefficients or multiple correlation were also reported, with an $R$ of .497 between firstquarter marks and the ITHAT plus the Gemen prognosis test, and an $R$ of .505 between the same marks and the IPLAT plus the College Ability Rating. The College Ability Rating was defined as the average of a pupil's rank in his high school and his percentile rank on the College Aotitude Iest.

Patheus (20), writing in 1937 after a study of 103 West Virginia state College freshmen who were modern langrage students, sumarized the correlation coefficients obtained as follows: . 4.14 between the George

Washington University Series Language Aptitude Test and scmester grades; 417 between the Psychological Examination for High School Graduates and College Froshmen and semester grades; and . 664 between the psychological test scores and the aptitude test scores.

In 1938 Tallent (34) reported three coefficients of correlation obtained with a random sample of 184 cases in French, German, and Spanish: . 211 between modern forejgn language grades and intelligence quotients, as determined by the Terman Group Test of Mental Ability; .487 between the foreign language grades and scores on an English placenent test devised by the University of Temessee; and .558 between English grades and the noderm language grades.

Seagoe (29), also reporting in 1938, described a study of 120 students whose records were being followed during the Carnegie Guidance Experiment in Fasadena, California. Among the conclusions reached was that the Terman, the Kun7mann-Anderson, and the otis intelligence tests, the New Stanford Reading Tect, the New Stanford Arithmetic Test, and the Luriaworleans Modern Languages profnosis Test all accurately differeatiate degree of success in beginning foreign language study. The noteworthy coefficients of correlation secured were . 63 between reading achievement and language prognosis, . 73
between the Luria-Orleans and the Terman tests, . 71 between the Iuria-Orleens and the Otis Internediate Examination, and .68 between the Iuria-Orleans and the Kuhlmann-Anderson tests. It was pointed out that the total test picture, along with subjective judgments in regard to personal factors, would give a better estimate of probable future success than would any single test. The incependence of the Stenquist Mechanical Aptjude Test was clearly demonstrated. Reading achieverent, though reported as a reliable index of probable language grades, was show to have less validity than either general intelligence or the language prognosins test used. It was regarded as questionable whether the prognosis test had proved to be superior to a general intelligence test in predictive value.

Spoerl (31) reported in 1939 the results of investigations of the possible factors involved in foreign language learming. The Henmon-Nel son Test of Mental Ability, Form A, was used to measure intelligence: The data showed a clear and definitely marked correlation of language grades with intelligence for the wonen, but not for the men. The coefficients of correlation obtained for the freshman men and wonen in the larger of Spoerl's studies were .385 and .611 respectively. The investigator concluded that intelligence seered to be a significant
factor in the case of the fenales but not in the case of the males.

Maronpot (28) pointed out in 1939 that the discovery of pupils with "Iow-linguistic aptitude" was possible through a study of their intelligence quotients, their general scholastic averages, and their scores on a reliable progmostic test. He administered the Symonds Foreign Langare Prognosis Test, Form A, to 170 pupils who were taking a foreign language for the first time, obtaining the following coefficients of correlation: .273 between intelligence quotient and final yearly grades; .512 between general scholastic average end final yearly grades; and .704 between the prognosis test scores and final yearly grades. Significantly, he reported that the prognostic instruments having the hichest predictive value were those that measured the ability to translate.

Stubbins (32) reported in 1940 on the prognostic values of one secondary school entrance examination. The best of the predictors was found to be the Fnglish part of the entrance examination, with correlations of . 3J. 3 with German and . 365 with Wrench for Group A, and of .314 with German and. 342 with French for Group B. Coefficients of multiple correlation were also obtained, with axithmetic, English, head masters' estimates, and an intelligence test weighted. For Group A the coefficients
of multiple correlation were . 36 and .38 for German and French, respectively; for Group $B$ they were . 34 and .37 for the sane two lenguages.

In 1944 Wittenborn and Larsen (36) reported on an earlier factorial study (14) of achievement in college Geman. They used a number of tests, securing complete data on 79 students who had finished one semester of college German. Arong their findings were the following coefficients of correlation: .55 between total scores on the English Training Test of the Iowa Placement Examination and the total scores for the Cooperative German Test, Elementary Form 0 ; also .55 between the Tnglish Training Test and first-senester grades in German; and .37 between the totel scores of the Foreign Language Aotitude Test, Iowa Placenent Exanination, and first-semester German grades. The investigators asserted the value of the English Training Test in predicting Germen achievement, tentatively identifying as a language factor that which the German achievenent and English tesis cefined. Interestingly, they concluded that an auditory factor would be unlikely to occur in a poprlation of normal young adulte, provided that all of the stimuli were kept well above the threshold.

In view of the absence in 1945 of conclusive tests for measuring aural and oral aptitude, Bottke and

Milligan (2) suggester way in wioh this measurenent might be accomplished. The procedures they were using experimentally were designed to check such abilities as these: inference wnderstanding, sound differentiation, assimilation and understanding of vocabulary in sentences, vowel timbre, word fluency, general hearing (audjometer test), ability to mimic, and transfer of rules of pronunciation to unknow material.

Bovee and Froehlich (3), havins compared the Stanford-Binet intelligence quotients of 451 French students with the students' achieverient in French as indicated by the Cooperetive French Test, roported their findings in 1946. There were 279 Eirst-year pupils, for whom the coefficients of correlation were . 46 for the entire group, . 18 for the 32 "strongest" pupils, and . 65 for the 31 "weakest" pupils. The. correlation coefficients for the 172 second-year pupils were .45 for the entire group, 59 for the 31 "strongest" pupils, and . 57 for the 31 "weakest" pupils.

Willians and Leevitt (35) worked with prediction of success in learning Japenese and, after having used various tests, in 1947 concluded that the most discrininating tests were the Army Langare Aptitude Test and the American Council on Education Psyciological Examination for College Treshren, 1943 edition. These
tests they found to be intercorcelated with a coefficient of .63 .

In summarizing the data that hea been collected up to 1948, Dunke] (7) regaxdod intollicence as an important fector in leaming a second lengrage but denied that it is the majox one. He stated that the many stuaies had always shown a positive correlation between intelligence and foreign language achievement, with coefficients ranging from .20 to .60 .

After an earlier three-semester investigation involving prognosis in German, Haclieughton and Altenhein (17) reported their findings in 1950. Among the instruments they had used vere a prognosis test constructed by a comittee at Ifonter College and, in adaition, the Artificial. Lenguage Test of the American Council on Educetion Psycholonical Examination for College Freshmen, 1935 and 1936 editions. The investigation begen with the 432 students who vere entering the first semester of German, but the number of students dininished as the study proceeded. Coeftiocients of correlation were reported es follows: . 21 between proçosis and fixst srade in German; . 33 between prognosis and an index of the three grodes in German; .29 botween the Artificial Iancuase test and the ifrotsornester grede in German; and 20 between the same test and the three semester graces in Goman. The
highest coefficient of correlation obtained was . 58 between prognosis test and grades for a group of students of Gexran background.

Peters (23) published in 1953 the results of his prediction study involving college freshnen enrolled in elementery courses in French, Spanish, and German, with 47 students, 189 students, and 207 students enrolled in the respective beginning language courses. The object was to determine the predictive efficiency of the vocabulary and paragraph reading parts of the Pernsylvania State College Academic Aptitude Examination. Peters concluded that it was possible to predict success and failure, with teachers' grades as the criterion, and that the tests he had used could effectively make such a prediction.

In 1954 Salomon (28) published a review of prognosis testing, supplying a sumary of much of the work done in prognosis between 1917 and 1950 .

Giving his attention to the preception involved in foreign lngzage learning, Mueliler (21) reported in 1958 that approxinately halis of a fourth-semester French class was not able to hear the signals of the tenses or gender. There were 42 per cent who failed to hear the past tenses, 46 per cent who failed to hear the future tenses, and 60 per cent who fajled to hear and
differentiate words indicating gender. In a beginning course, in which gender and plurel were taught and drilled, there were 45 per cent who failed to recognize the oral signals of the feminine and 54 per cent who missed the plural.

More reviews of the reseerch literature appeared in 1962. Pimsleur, Mosberg, and Morrison concluded that the factor they called verbal intelligence (consisting of intelligence and verbal ability) appears to correlate about . 45 with foreign language achievement; however, they pointed out thet this factor accounts for only about 20 per cent of the variance in achicuenent (24, p. 169). Uarroll, after reviewing his own and other investigations, emphasized that facility in foreign languace learming is relatively independent of the traits ordinarily referred to as intelljgence. He also asserted that the verbal factor (vocabulary knowledge) is of little importance in predicting success in elementery audio-lingual language study. Four abilities were identified as corponent parts of language aptitude as measured by tests: auditory phonetic coding ability, grammatical sensitivity, rote memorization ability, and inductive language leaming ability ( 4, , 2. 2088) . Carcoll also called attention to the evidence that the dodern

Ianguage Aptitude Test her proved superion to intelhigence tests in predictive power (4, p. 1089).

In 1963 Bilickenstaff (1) indioated that the talent to discriminate pitch, es measured by one of the Seashore Measures of Musical Tajents, oppears to be of positive benefit to a bigh school or college student who is learning a foreign language, particularly if he is attempting to acquire audio-1ingual skills. Subsequent stuaies by others $(15,16)$ involved the other musical elements in the Searhore Measures of Marical Talents.

In a study concluded in 1965 at the University of Missouri, Martin (19) collected data for 158 Spanish studerts, 222 German students, and 198 French students, 211 of whom were first-semester freshmen enrolled jn Deginning courses. Sources of predictive data were scores from the Verbal, Quantitative, and Iotal subtests of the Cooporative School and College Ability Pests, Porm 1A, and the Univergity of Missouri English Placement Tost. The MHA - Cooperetive Forejgh Language Pests, Porm IA, were the primary criteria for the measurement of achievenent and were administered at the end of one semester of study. The highest coefficients of correlation reported for single predictors were . 449 between the English sub-best and achievement
in Spanish, 557 between the English sub-test and achievenent in French, and . 250 between the motal test score and achievement in German. Among the coefficients of multiple correlation reported were those involving the two best predictors for each language. These were . 524 for Spanish achievement as predicted by the Verbal sub-test and the University of Missouri English Placement Test, . 604 for Prench achicvement as predicted by the Total test score and the University of Missouri English Placement Test, and . 272 Ior German achievement as predicted by the Total test score and the University of Missouri Enolish Placement test. One of the conclusions was that the four predictor variables provided only slightly higher predictive evidence then was provided by the two best predictors for each language.

After an investigation involving 96 high school students, Gardner and Lambert published in 1.965 the results of the study, concluaing that:

> independent of both language aptitude and secondlanguage achievenent, end moreover, that different second-langrage skilis are related to different abilities $(9, p .191)$.

Interests and Language Achievenent
Various investigations have also dealt with the predictive potential of the attitudes, interests, and
motivation of forejgn Ianguage students. In addition, some research reportis heve included speculation with regard to sucin factors.

Kaulfers (13), in 1929, pointed out that the boys in his study generally required an intelligence quotient approximately ten points higher than that needed by the girls to achieve the same Spanish grade everage. His explanation was that there was either a lack of interest or application among the rale students.

Questioning 455 beginning and second--year French and Spanish students, Politzer (26) sought information regarding their motivation and interests. According to his report in the 1953-1954 volume of Languege Learring, he found a far more pronounced lack of notivation among the weak students. In a later study (25), ho discovered more indications of a direct relation between motivation and performance, concluding that the evidence pointed to aptitude plus a normal amount of assiduity as the best combination for success. Hiss data showed that assiduity in Iaboratory attendance could evidently offset the aptitude factors for the student, but that assiduity in the doing of homework apparently would not have any such effect.

According to Carroll (4, p. 1089), rotivation will relate to achievenent only when it affects students' perseverance in efforts directed toward active learning.

In their 1962 report, Pinsleur, Mosberg, and Morrison (24) indicatea that interest correlates positively with achievenent and that the relationship between notivation and foreign language achievement may be as high as .40. There is evidence (14, 24, 25, 26) to support, with leasonable assurence, such a conclusion.

## Summary

The literature reviewed in this chapter concerns studies that have dealt with the prognostic value of measures of aptitude and interest. The review has revealed that, in attempts to predict language achievenent:

1. Investigators have considered a number of factors, including intelligence, verbal and mathematical abilities, grades in other subjects, auditory ability, rote menorization abjlity, interests, and motivation.
2. There has clearly been a developmental trend in the factors considered important for investigation. Intelligence and verbal abjlity are the areas which have been nost thoroughly investigated. More recently, auditory ability has been looked upon as one of the most promising factors for prosnosis of success in secondlanguage learning.
3. There is evidence that better predictions can be made through the consideration of the joint action of two or more predictors than can be made through the consideration of a sjngle predictor.
4. It is clear that much of the variance in foreign language achievenent remains to be investigeted.
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## CHAPTER III

## ORGANIZATION AND DESIGN OP THE STUDY

Selection of Subjects
The problem of this study was to detemine the value of the use of selected aptitude test scores for predicting student achievenent in moderm foreign Ianguages at North Texes State University. Particular emphasis was placed on freshmen enrolled in begraning courses.
 possible to include all firstwsenester freshmen enrolled in the beginning (101) Spanish, Fronch, and Gemen classes. Such a procedure seened to be preferable to the drawing of small randon samples of the population. Furthemore, the inclusion of all subjects for whon data were available and complete would make possible the adninistration of the measuring instruments during the regular class periods and the regular leboratory periods. Description of Instruments

The Scholantic Aptitude Pest or the College Entrance Franjnetion Board wes utilized ess a measure tor each
jndividual: This test yields two scores: verbal and mathematical. According to Dean K. Whitla, Director, Office of Tests, Hervard Universi.ty, and one of the College Entrance Examination Boara Committee of Examiners in Aptitude resting for 1968-1969, the Scholastic Aptitude Test:
. . . is designed to ineasure "the genewal ability to use language and mathematical concepts in the solution of the kinds of intellectual problems the candidate would encounter in college." From its inception, it has been an evolving test with provisions for maintaining stability of scores (1, p. 990).

Furthermore, he points out:
Whe fact that three hours of paper and pencil optituac tosting produces as pownen a prodictor of college achievenent as does the high school record testifies to the validity of the Scholastic Aptitude Test (1, p. 993).

The MLA - Cooperative Roreign Language Tests, Form
IA (7), were used to yield measures of leaming achievement in listening compreheasion, reading, and writing of the selected modern forejign languages. Normed and stendardized, these tests were prepared through the cooperation of the United Stetcs Office of Education, the Modern Language Association of America, and the Educational Testing Service, and therefore seened appropriate as a means of gathering data for this study. There was also the consideration of the possibility for the comparison of the results of this study with those of a study of the predictive value of the University of

Missouri freshman placoment tests, including the Cooperative School and Collese Ability mests, form 1A. The ILA - Cooperative Foreign Janguage Tests, Form LA, were used as the oriterion measure, or criterion variable, in the completed study to which reference is made (4). Three selected tests of the Pimsleur Language Aptitude Battery were used to yield measures of student interest end of auditory ability. Paul Pinsleur, Ohio State University, and Joham F. Stanath, Haxcourt, Brace and World, Incorporated, describe the battery as follows:

The Pimsleur Language Aptitude Battery predicts, within certain limits, a student's potential for foreign language leaming. It is made up of six parets:
3. Grade-point average--the averase of the major subjects.
2. Interest--the student's desire to study a Foreign language.
3. Vocabulary--the student's mowledge of English words.
4. Language analysig--the students ability to manipulate gramar analytically.
5. Sound discrimination-the stadent's ability to tell lorejgn sotnds apart.
6. Sound-symbol association-the student's ablu io corccte amsociate sounds with their written form ( $5, \mathrm{p} .85$ ).

Jakobovits testifies to the predictive value of the Pimsleur Language Aptitude Battory end states that an examination of the tests of the battery "may give an indication of what constitutes a 'talent for $\mathbb{F L} \mathrm{s}^{\prime \prime \prime}$ (3, p. 442). However, he goes on to point out that not all the tests are equally related to foreign longuage
eptitude, $3 n d i c a t i n g$ that when "'underachievers" were compared to "'normal" students in a matched-group experiment, there was no difference between the groups on the tests for vocabulary and language analysis. On the tests for interest, auditory discxmination, and sound association, however, he reports that the underachievers scored siEnificantly lower (3, p. 442). Pimsleur's conclusion in regard to this experiment is as follovs:

According to this investigetion, there does exist a "talent" for learning foreign languagesthat is, a special factor beyond intelligence and industriousness which accounts for how well an individual succeeds in a language course. Our evidence indicates this special factor is auditory hhility, wich may de dofined as We ubility bo receive and process information through the ear (6, p. 135).

Jakobovits also states that Carroll reached a similar conclusion after his extensive work on the Modern Ianguage Aptitude rest, which mas carried out independentiy of and prior to the Pimsleur investigetion (3, p. 442).

Decause of this evidence, the "Sound Disorinination," the "Sound--Symbol Association," ard the "Interest" perts of the Pinsleur Languase Aptitude Battery seemed to be the nost appropriate and up-to-date devices for gathering data for this study. The "Vocabulary" and "Lenguage Analysis" parts were onitted on the basis of the existing evidence previously descrioed, and the Scholestic Aotitude Test scores were used in lieu or the "Gradempoint Average" part of the Pingleur Jangusge Aptitude Battery.

Procedunes Ior Collecting Data
All entering frewhen are required to submit scores on the Scholastic Aptituce Test before they may enroll at North Texas State University. The Registrar's Office supplied a copy of the completed list of these scores.

The Department of Foreign Languages supplied class enrollment lists for all sections of beginning classes in modern foreign languages. These lists bore the nane; the social security number; and, as a check for the completeness of the list of Scholastic Aptitude Test scores, the classification of each student. Because any modern foreign language failing to have a total enrollment of at least 40 first-semester freshmen was dropped from consideration in this study, Russian 101 was not included.

From the list of Scholastic Aptitude Test scores, the verbal and mathenatical scores for all first-semester freshmen who were enrolled in Spanish 101, French 101, and German 101 were recorded on the class enrollment lists.

To all of the students in the solected elementary (101) courses were given the "Interest," the "Sound Discrimination," and the "Sound--Symbol Association" parts of the Pirsieur Languase Aptitude Battery. The scores were needed for first-semestex froshmen only, but the tests were adninistered to all students who were enrolled in each beginning (101) section of Spanish, Prench, and

Gernan. These tests were adninistered during the first part of the fall semester, at regulerily scheduled laboratory periods.

Near tine end of the semester marking the students' completion of the elementary 101 courses, the MIS Cooperative Foreign Language Tests, Form IA, were administered to all students in each section of elementaxy 101 Spanish, French, and Geman. The tests were given during regularly scheduled cless periods and laboratory sessions. For this reason, the tests were administered to all students enrolled in each section, although for the purposes of this study scores were neeced for firstsemester freshuen only. The achievement test scores as well as the teacher-assigned semester marks were recorded on the class enrollment lists.

Procedures for Analysis of Data
All data were coded and punched into cards for automatic data processing, and the North Texas State Thniversity Computer Center's formulae were used for all computations.

The means and standard deviations of the measures of student achicvement in each of the languages and of the following aptitude meanures were computed:
$X_{1}--V e r b a l$ scores; separate data for each language
$X_{2}$.--Mathernatical scoxes; separate data for each language

$$
\begin{aligned}
& X_{3} \quad \text {--Auditory soones; separate data for each } \\
& \text { Ianguage } \\
& X_{4} \quad \text {--Interest scores; separate data for each } \\
& \text { Ianguage }
\end{aligned}
$$

Pearson product-moment coefficients of correlation were computed between the measures of learning achievement in each of the modern foreign languages, as indicated by the MLA - Cooperative Foreign Languege Tests, Form LA, and the verbal, the mathematical, the auditory, and the interest measures of aptitude. The accuracy with which the Jearning achievenent scores can be predicted from each of the four measures of aptitude as single predictors was revealed through the coraputation of the standard errors of estimate. The combined action of these aptitude tests in predicting learning achievenent in the appropriate language was determined by computing various coefficients of multipje comrelation (R) in terms of beta coefficients ( $R^{2}$ ). These coefficients of nultiple correlation were deternined for cach of the combinations of independent variables outlined in Hypothesis 2, with separate data for each language. For the regression equations qormulated, use wes made of the process of $^{\text {m }}$ maximizing the predictive power of the indopendent variables by assigning optinum weights to them.

The standara error of estimete was computed for each combination of varsaties considered. The standard ercor of estimate reveals that the chances are approximately 68 in 100 , or 68.26 per cent, that the prediction of the achievement score will be accurate within plus or minus the value of one standard error of estimate.

Also computed were coefficients of correlation between teacher-assigned semester marks and measures of leaming achievement in the subjects. In addition, coefficients of correlation between measures of aptitude and teacher-assigned marks were computed. The measures of aptitude yieloing the highest correlations with
 in multiple comelation formulae.

Each of the hypotheses was tosted in the null form. The significance of each obteaned $x$ was tested against the hypothesis that the population correlation coefficient is zero. A two-tailed test was used, with Table 25 in Garrett's Statistics in Psychology and Education serving as the appropriate guide for the critical values of the Pearson correlation coefficients (2, p. 201). Calculation of an $\mathrm{F}-\mathrm{ratio}$ served to deterine in each instance the significance of the coefficient of multiple correlation. F-ratios were also used to compare the effectiveness of pairs of prediction equations. fibe
decision as to the level of simificance below which a hypothesis would be rejected was arbitrarily set at the .05 level. Significance at the .01 level has also been reported.

## Sumnaxy

This chapter is a description of the procedures used in studying the relationships of selected measures of aptitude as a means of determining the predictive value of these measures for estimating a student's potential for learning achievement in Spanish 101 , French 101, and German 101 at North Texas State University.

Treatment of the data resulting from the tests was conditioned by the specific hypotheses which hed been formulated. Coefficients of correlation were obtained between measures of learning achievernent in the modern foreign languages and selected neasures of aptitude. The combined action of these aptitude tests in predicting learning achievement in Spanish 101, French IO1, and German 101 at North Texas State University was determined by computing the coefficients of multiple correlation, partial regression equations, and standard errors of estimate for the combinations consiciered. Also computed were coefficients of correlation between teacher-assigned semester marks and
the measures of aptitude. The measures of aptitude yielaing the highest correlations with semester marks in each of the tiree languages were utilized in multiple correlation formulac.

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CHAPIER IV

## ANALYSIS OF TEST DATA

## Purpose

The purpose of this chapter is to report and analyze the data which were obtained. Consideration is given to the following questions, all of which evolved from the hypotheses listed in Chapter I:

1. What is the degree of relationship, if any, between learining echievenent in Spanish, Prench, and Geman, cis mudsured wy ble ma - Covediabive Puzuig Janguage Tests, Form IA, and the following measures:
a. Verbal ability as detemined by the Scholestic Aptitude Test?
b. Nathematical ability as determined by the Scholestic Aotitude Test?
c. Auditory ability as determined by the "Sound Djscrimination" and the "Sound-Symbol Association" parts of the Pinsheur Language Aptitude Battery?
d. Student interest as detemined by the "Interest" part of the Pinsleur Languaçe Aptitude Battery?
2. What is the docree of relaticaship, if any, between learaing achievement in Spanish, French, and German, as neasured by the WLA -- Cooperative Foreign Language fests, Foxm LA, and the following combirations of reasures:
a. Verbal and mathematical abilities as determined by the Scholastic Aptitude Test?
b. Veribal ability as determined by the Scholastic Aptitude Test and auditory ability as determined by the "Sound Discriminetion" and the "Sound-Syiabol Association" perts of the Pinsleur Lancuage Aptitude Battery?
c. Verbal ability as determined by the Scholastic Aptitude Test and student interest as determinea by the "Interest" part of the Pimsleun Ienguage Aotitude Battery?
d. Nathematical ability as determined by the Scholestic Aptituce Test and euditory ability as deterained by the "Sound Discrimination" and the "Sound--Symbol Association" parts of the Pansleur Ianguage Aptitude Battery?
e. Nathematical ability as determined by the Scholastic Aptitude Tlest and student interest as determined by the "Interest" part of the pinsleur Lenguage Aptitude Brbtery?
f. Auảitory abizity and student interest, as determined by the "Sound Discrimination," the "SoundSymbol Association," and the "Interest" parts of the Pirsleur Language Eptituce Battery?
g. Verbal and mathematical abilities as determined by the Scholastic Aptitude Test and auditory ability as determined by the "Sound Discrimination" and the "Sovnd-Symbol Association" parts of the Pimsleur Language Aptitude Battery?
h. Verbal and mathematical abilities as determined by the Scholastic Aptitude sest, auditory ability and student interest as determined oy the "Sound Discrimination," the "Sound-Symbol Association," and the "Interest" parts of the Pimsleux Langugge Aptitude Battery?
3. What is the degree of relationship, if any, between teachermassigned semester marks in Spanish, Fronch, end German and the following ineasures: •
a. Leerning achicvement in the respective langrages, as determined by the MTA - Cooperative Foreign Language Testg, Form IA?
b. Verbal ability as determined by the Scholastic Aptitude Test?
c. Nathemetical ability as detexmined by the Scholestic Aptituae Sest?
d. Auditory abjility as determined by the "Sound Discrimination" and the "Sound--Symbol Association" parits of the Pimsleur Language Aptitude Battery?
e. Student interest as determined by the "Interest" part of the Pinsleur Langage Aptitude Battery?

- 4. What is the degree of reletionship, if any, between teacher-assigned semester marks in each modem foreign language and a combination of the two best predictors of such evaluations of learning achievement in the language as revealed by first-order coefficients of correlation?

Relationships between a Measure of Learning Achievenent
in Spanish and Selectied Measures of Aptitude

Table I shows product-moment coefficients of correlation between a measure of learning achievement in Spanish as indicated by the MIA - Cooperative Toreign Lanpuare Tests, Torm IA, and measures of aptitude as indicatod by the Scholastic Aptitude Test as well as by the auditory and interest parts of the Pirasleur Language Aptitude Battery. Means and standard deviations for these measures are preseated in hppendix $A$.

The xange of coefficients of correlation between a measure of learning achievemert in Spenish and the
selected measures of attiture :anc 172 to .373. The lowest coefficient of correlation with the measure of learning achievenent (y) in Spanjsh involved the measure of mathematical ability, while the highest involved the measure of interest. The coefficients of correlation between the measure of Ieaming achievement ( $Y$ ) in Spanish and verbal abjility, and between the noasure of learning achievement (Y) jn Spanish and auditoxy ability, were . 280 and .230 respectjvely.

## TABLE I

COEFTICIENTS OF CORRELATTON BETHEEN A MEASURE OF LEARINING ACHIEVERENT IN SPAMSH AND SBimCTED mEASURES OF


PRRORS OF ESTTMATE

$$
(\mathbb{N}=105)
$$

| Tests | r | SE (est. Y) |
| :---: | :---: | :---: |
| Varjables |  |  |
| Verbel ( $\mathrm{X}_{1}$ ) | .280\%* | $\pm 31.576$ |
| Mathematical ( $\mathrm{X}_{2}$ ) | . 1772 | $\pm 32.401$ |
| Auditory ( $\mathrm{X}_{3}$ ) | . $230^{*}$ | $\pm 32.011$ |
| Interest ( $\mathrm{X}_{4}$ ) | . 373 ** | $\pm 30.514$ |
| Nignificant at the . 05 level. <br> **Significant at the . OI level. |  |  |

An analysis of the statistical significance of the product-moment cocffictients of correlation (1, p. 201) indicated the levels of sicnificance shown in table I. In addition, an examination of Garrett's descriptive labels for interpreting coefficients of correlation indicated that a "low" correlation appeared to exist between the scores on the criterion of leaming achievement in Spanish and three of the variables: verbal, auditory, and interest. The relationship between the criterion measure of leaming achievenent in Spanish and mathematical ability was rated as "indifferent or negligible" (1, p. 176).

The accuracy with which leaming achjevenent scores in Spanish can be predjeted from the selected measures of aptitude is indicated by the standard errors of estimate. The standerd error of estimate reveals that the chances are about 68 in 100 , or 68.26 per cent, that the prediction of the Spanish learning achieverent score will not miss the actual score of Spanish learning achicvement by more then plus or ainus the value of one standard error of estimate.

Relationships between a Heasure of Ieaming Achievement in French and Selected Measures or Aptitude

Product-monent coefficients of correlation between a measure of learring achievenent in French as indicated
by the NAA-Cooperative Toreign Languge Tests, Form TA, and measures of aptitude as indicated by the Scholastic Aptitude Test as well as by the auditory and interest parts of the Pimsleur Language Aptitode Eattery, are presented in Table II. Means and standard deviations for these measures are presented in Appendix A.

The range of coefficients of correlation between a measure of learming achievement in French and the selected measures of aptitude was . 207 to .322. The

## TABLE II

COEFFICIEMPS OE CORPBLATION BETVEEN A MEASURE OF LEARITIG Achievenint in french and sedected heasumes of APTITUDE ROCDITER WHM STATDAD Errors or estmate (iv $=80$ )

| lests | r | SE (est. Y) |
| :---: | :---: | :---: |
| Variables |  |  |
| Verbel ( $\mathrm{X}_{1}$ ) | .207 | $\pm 37.836$ |
| Watheraticel ( $\mathrm{X}_{2}$ ) | . $299 \%$ | $\pm 36.898$ |
| Auditosy $\left(\mathrm{X}_{3}\right)$ | . $322 \times *$ | $\pm 36.612$ |
| Interest ( $\mathrm{X}_{4}$ ) | . $269 \%$ | $\pm 37.248$ |

*Significant at the . 05 level.
\% Significant at the . OI level.
levels of significance (l, p. 201) are appropriately indicated in Table II.

According to Garrett (1, p. 176), a "Iow" relationship appeared to exist between the criterion measure of learning achisvement in French and each of the measures of aptitude.

The accuracy with which French learning achievoment scores can be predicted from the selected measures of aptitude is indicated by the standard errors of estimate. The standard error of estimate reveals that the chances are about 68 in 100 , or 68.26 per cent, that the prediction of the French learning achievement score will not miss the actual scome of French loarning achievement by more than plus or minus the value of one standard error of estimate.

Relationships between a heasure of Leaming Achievement in German and Selected Meesures of Aptitude

Table III is a presentetion of the product-moment coefficients of correfation between a measure of Jcaming echievenent in German as indicated by the MLA Cooperative Foreign Iancuace Tests, Form IA, and measures of aptitude as indicated by the Scholestic Aptitude Iest and by the cuditory and interest parts of the Pirnsleur Language Aptitude Bettery. Means and stendard deviations for these reasmres are presented in Appendix A.

TABLE III
COEPFICIENTS OF CORRELATION BESYEEN A MEASURE OF LEARIING Achievement in german and selectad leasures of APTIUUDE TOGETHER WITH STATDARD

ERRORS OF ESTImate
$(N=24)$

| Tests | $r$ | SE <br> (est. Y) |
| :---: | :---: | :---: |
| Veriables |  |  |
| Verbal $\left(X_{1}\right)$ | .179 | $\pm 21.073$ |
| Mathematical ( $\left.X_{2}\right)$ | -.224 | $\pm 20.876$ |
| Auditory $\left(X_{3}\right)$ | .157 | $\pm 21.156$ |
| Tnterest $\left(X_{4}\right)$ | -.038 | $\pm 21.404$ |

There were two negative coefficients of correlation between the measure of learning achievement in Cerman and the reasures of aptituce; these were -. 038 for interest and Gerran achieverent, and -.224 for mathematical ability and German achievement. The positive coefficients of correlation with Gernen achievernent for auditory and verbal abilities were . 157 and . 179 respectively.

The negative correlation of mathenatical ability with German achievenent is described by Garrett as "low," and the other coefficients of correlation between German achievernent and the selected measures of aptitude are
described as denoting a "negingible" relationship (a, p. 176). None was significent at the . 05 level (I, p. 201).

The accuracy with which German leaming echievenent scores can be predicted from each of the variables presented in Table III is indicated by standard errors of estimate. The standard error of estimate reveals that the chances are about 68 in 100 , or 68.26 per cent, that the prediction of the Germen learning achievement score will not miss the actual score of German learning achievenent by more than plus or minus the value of one standard error of estimate.

## Single Fredictors Yielding Highest Correlation Coefficients

Of the four independent variables utilized in this study, the measure of interest was the best predictor of the measure of learning achievenent ( $Y$ ) in Spanish, with a product-moment coefficient of correlation of .373. The best predictor of leaming achievenent ( $Y$ ) in Prench was the measure of auditory ability, with a productmoment coefficient of .322. For learning achievement (Y) in Geman the best predictor was the negatively correlated mathenatical ability meesure, with a coefficient of. correlation of -.224 .

Coefficients of Multiple Correlation

The extent to which learning achievenent in Spanish, French, and German was determined by the combined action of the predictor varjables was obtained through the use of the statistical procedure which provides coefficients of multiple correlation ( $R$ ). This procedure, described by Walker and Lev (2, p. 326), involves the following basic formula:

$$
\begin{gathered}
R_{y .1234}^{2}=r_{y 1} b^{*} y 1.234^{+r} y 2^{b *} y 2.234^{+x} y 3^{b^{*}} y 3.124^{+r} y 4^{b^{*}} y 4.123 \\
\text { where }
\end{gathered}
$$

| $x_{y I}$ | $=$ coefficient of correlation between the firet indopendent rarieble and the criterion vexiable. |
| :---: | :---: |
| $\mathrm{b}^{*} \mathrm{y} 1.234$ | = relative weight which the first independent variable contributes to the criterion variable. |
| $r_{y 2}$ | $=$ coefficient of correlation between the second findepondent variable and the criterion variable. |
| $\mathrm{b}^{*} \mathrm{y} 2.134$ | $=$ relative weight which the second independent variable contributes to the criterion variable. |
| $\mathrm{r}_{\mathrm{y} 3}$ | $=$ coefficient of corre? atrion between the third independent variable and the criterion variable. |
| $b^{*}{ }_{y 3} .124$ | $=$ relative weight which the third independent variable contributes to the criterion variable. |
| $r_{y 4}$ | = coefficient of correlation between the fourth findependent variable and the criterion wariahle. |

$$
\begin{aligned}
\text { W* y4.123: } & \text { reletive weignt which the fourth } \\
& \text { independent variable contributes } \\
& \text { to the criterion variable. }
\end{aligned}
$$

Coefficients of multiple correlation were determined for each of the combinations discussed in the subsequent sections of this chapter. Deteiled data relative to the variableg may be found in Appendix B. Relationships between a Measure of Leaming Achievement in Spanish and Combined Measures of Aptitude
Various coefficients of multiple correlation were computed to show the joint action of the measures of aptitude combined with the criterion measure of learning achievement in Spanish. Ta0le IV sumarizes the productmonent coefficients of comelation used in the computation of these coefficients of hultiple correlation. reans and standard deviations for the variables are presented in Appendix $A$.

The correlations between a measure of learning achieverent in Spanish and the selected measures of aptitude ranged from . .772 to .373 . The intercorrelations among the four predictor variables ranged from .003 to .550. The descriptive labels given by Garrett indicate that coefficients of correlation ranging from .00 to $\pm .20$ denote "indifferent or negligible" relationships, from 士. 20 to $\pm .40$ "Iow" relationships, and from $\pm .40$ to $\pm .70$ "substantial or marked" re?ationships (1, p. 276).

The coefficients of multiple correlation and their levels of significance are presented in Table $V$.

## TABLE IV

Infmrcorrelations betwen a weasure or learnang ACIIEVEREN IN SPANISH AND SELECTED HEASURES OF AFTITUDE ( $\mathrm{N}=105$ )

| Tests | Coefficients of Comrelation |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{X}_{\text {I }}$ | $\mathrm{x}_{2}$ | $\mathrm{X}_{3}$ | $\mathrm{X}_{4}$ | Y |
| Verbal ( $\mathrm{X}_{1}$ ) | $\cdots$ | . $550 \%$ | . $349 \%$ | . 063 | .280** |
| Hathematical ( $\mathrm{X}_{2}$ ) |  |  | . $383 \%$ * | . 003 | . 172 |
| Auḋumy $\left(\mathrm{X}_{3}\right)$ |  |  |  | . 176 | . $230 \%$ |
| Interest ( $\mathrm{X}_{4}$ ) |  |  |  |  | . 37.3 ** |
| Spanish (Y) |  |  |  |  | $\cdots$ |

**Significant at the . OI level.

Combination of Variables One, Two, and Y
The ocefficient of multiple correlation between the soores made on the criterion vexieble, Spanjsh achjevoment $(Y)$, and the combined action of the indopendent variables, verbal ( $X_{1}$ ) and mathematical ( $X_{2}$ ), was .281. The proportion of the variance of the criterion measure attri-. buted to the joint action of the two indepondent variables wes 7.88 per oent. Of this amount, 7.83 per cent of the
total veriance in Spenish learning achievement was the fincependent contribution ot the first variable (verbal), and .05 per cent wes the independent contribution of the second variable (mathenatical). The remaining 92.12 per cent of the variance was attributed to other factors not neasured by these two tests.

- Combination of Variables One, Three, and Y

The coefficient of multiple correlation between the scores made on the criterion variable of Spanish achicvement ( $Y$ ) and the combined action of the independent variables, verbal ( $\mathrm{X}_{1}$ ) and auditory ( $\mathrm{X}_{3}$ ), was .313. The propurion of the variance of the criterion variable attributed to the joint action of the two independent variables was 9.8 per cent. Of this arnount, 7.8 per cent of the total variance in Spenish leaming achievenent was the independent contribution of the first variable (verbal), and 2.0 per cent was the independent contribution of the third variable (auditory). The remaining 90.2 per cont was attributable to other factors not measured by these two tests.

Combination of Varjablos One, Four, and Y The coefficient of multiple correlation between the scores made on the criterion variable of Spanish achiovement ( $Y$ ) and the cornbined action of the independent
variabies, verbal $\left(X_{1}\right)$ and inteaest $\left(X_{4}\right)$, was .453. The proportion of the variance of the criterion abtrioutable to the joint action of the two independent variables was 20.5 per cent. Of this anount, 6.6 per cont of the total variance in Spanish leaming achicvement was the independent contribution of the first variable (verbal), and 13.9 per cent was the independent contribution of the fourth variable (interest). Whe remaining 79.5 per cent must be attributed to other factors not measured by these two tests.

Combination of Variables Two, Three, and $Y$ The coefficient of mitiple correlation betreen the scores made on the criterion variable of spanish achievement (Y) and the combined action of the independent variables, mathenatical $\left(X_{2}\right)$ and auditory ( $X_{3}$ ), was .247. The proportion of the varjance of the criterion variable attributed to the joint action of the two independent variables was 6.1 per cent. of this amount, 0.8 per cent of the total variance in Spanish Iearning achievenent was the contribution of the second variable (mathematical), while 5.3 per cent was the independent contribution of the thixd verjable (awditory). The romaining 93.9 per cent was attributed to other factors not measured by these two tests.

Corabination of Variavtes Two, Foux, and Y The coefficient of multiple correlation between the scores made on the criterion variable of Spanish achievement ( $Y$ ) and the combined action of the independent variables, mathematical ( $X_{2}$ ) and interest ( $X_{4}$ ), was . 410 . The proportion of the variance of the criterion variable attributed to the joint action of the two indepencent variables was 16.8 per cent. Of this arount, 2.9 per cent of the total variance in Spanish learning achievement was the independent contribution of the second variable (mathematical), and 23.9 per cent was the independent contribution of the fourtin variable (interest). the romaining 83.2 per cent was attributed to other factors not measured by these two tests.

Corbination of Variables Three, pour, and $Y$ The coefficient of multiple correlation between the scores made on the criterion variable of Spanish achievenent ( $Y$ ) and the combined action of the independent variables, auditory $\left(X_{3}\right)$ and interest $\left(X_{4}\right)$, was .409. The proportion of the variance of the criterion variable attributed to the joint action of the two independent variables was 16.7 per cent. Of this amount, 2.8 per cent of the total vexiance in Spanish learning achievement mas the independent
contribution of the third variable (auditory), and 13.9 per cent was the indeperdent contribution of the fourth variable (interest). The remaining 83.3 per cent was attributed to othor factons not measured by these two tests.

Combination of Variebles One, Two, Three, and Y The coefficient of multiple correlation between the scores made on the criterion variable of Spanish achicvement ( $Y$ ) and the combined action of the inde. pendent variables, verbal $\left(X_{1}\right)$, mathenatical $\left(X_{2}\right)$, and anditory $\left(X_{3}\right)$, was .314 . The proportion of the variance atoributod to the joint eotion of tho theo indoponcont variebles was 9.84 per cent. Of this amount, 7.83 per cent of the total variance in Spanish leaming achievement was the independent contribution of the first variable (verbal), while 0.02 per cent was the independent contribution of the second variable (methematical), and 2.99 per cent of the total variance wes the incependent contribution of the third variable (auditory). The remaining 90.16 per cent of the variance was attributed to other factors not moasured by these tests.

Combination of Variables one, Two, Three, Tour, and $Y$ The coefficient of multiple correlation between the scores made on the criterion veriable of Spanish
achievement ( $Y$ ) and the combined action of the independent variables, verbal $\left(X_{1}\right)$, nethematical $\left(X_{2}\right)$, anditory $\left(X_{3}\right)$, and interest ( $\mathrm{K}_{4}$ ), was .461. The proportion of the variance attributable to the four independent variables was 21.24 per cent. Of this amount, 6.59 per cent of the total variance in Spanish learning achievement was the independent contribution of the first variable (verbal). The independent contribution of the second variable (mathemeticel) was . 02 per cent, while that of the third variable (auditory) was .70 per cent. The fourth variable (interest) accounted for 23.93 per cent of the total variance. The remaining 78.76 per cent was attributed to other factors not measured by these tests.

## Combinations Yjelding Highest Hultiple

 Correlation CoefticientsAs indicated in Table $V$, the combination of the variables, verbal ( $X_{1}$ ) and interest ( $X_{4}$ ), correlated higher with the neasure of learning achievenent ( $Y$ ) in Spanish then did any of the other combinations with two predictor variables. The coerficient of multiple correlation for this combination was .453. The combinatjon yielding the highest correlation included all of the four predictor veriables, with a coefficient of .461 .

## TABIE V

COETFLCLENTS OF HULITPLE CORPELATION BELWEEM A MEASURE
 OF SEIECMED NEASURES OT APTIMUDE

$$
(N=105)
$$

| Maltiple R Factors | R | $\mathrm{R}^{2}$ |
| :---: | :---: | :---: |
| $\mathrm{R}_{\mathrm{y} .12}$ | . $281{ }^{*} *$ | . 079 |
| R y .33 | . $313 \%$ | . 098 |
| R y .14 | . 453 ** | . 205 |
| $\mathrm{R}_{\mathrm{y}} .2 .3$ | $.247^{*}$ | . 061 |
| ${ }^{R} \mathrm{y} .24$ | . $410^{* * *}$ | . 1.168 |
| $\mathrm{R}_{\mathrm{y}} .34$ | . $409 \%$ ** | .167 |
| $\mathrm{R}_{\mathrm{y} . \mathrm{J}} 23$ | . $314^{* *}$ | . 098 |
| $\mathrm{R}_{\mathrm{y} .1234 * * *}$ | . $461 \%$ * | . 212 |
| *Significant at the .05 Level. |  |  |
| \%significent at the . Ol level. |  |  |
| \%\%Variables: |  |  |
| 1. Verbal |  |  |
| 2. Mathematical |  |  |
| 3. Avaitory |  |  |
| 4. Interest |  |  |

Relationships between a lleasure of Jearning Achiovement in French and Combined Measures of Aptitude

Various coefficients of multiple correlation were computed to show the joint action of the measures of aptitude combined with the criterion measure of learning achievement in French. Table VI summarizes the productmoment coefficients of comrelation used in the computation of these coefficients of mitiple correlation. Means and stendard deviatjons for the veriables are presented in Appendix A.

## TPABLE VI


nchieverent In frencif and selected IEASURES OT ALPITUDE
( $\mathrm{N}=80$ )

| Tests | Coefficientis of correlation |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{X}_{1}$ | $\mathrm{X}_{2}$ | $\mathrm{X}_{3}$ | $\mathrm{X}_{4}$ | Y |
| Verbal ( $\mathrm{X}_{1}$ ) | $\cdots$ | . $517 \%$ |  | . 054 |  |
| Mathematical ( $\mathrm{X}_{2}$ ) |  |  | . $360 \%$ | -. 038 | .239** |
| Auditory ( $\mathrm{X}_{3}$ ) |  |  |  | . 101 | . $322 * *$ |
| Interest ( $\mathrm{X}_{4}$ ) |  |  |  |  | .269* |
| Prench (Y) |  |  |  |  | $\cdots$ |

The correlations between a measure of learning achievenent in Prench and the selected measures of aptitude ranged fror . 207 to .322. The intercomelations anong the combinations of the four predictor variebles ransed from -.038 to .517. Garrett's descriptive labels indicate that correlations ranging from .00 to $\pm .20$ denote "indifferent or negligible" relationships, from $\pm .20$ to 士. 40 "Iow" relationships, and from $\pm .40$ to $\pm .70$ "substantial or maxked" relationships (1, p. 176).

The coefficients of multiple correlation and thejr levels of significance are presented in Table VII.

## 

The coefficient of multiple correlation between the scores made on the criterion variable of Erench achievement $(Y)$ and the combjned action of the independent variables, verbal ( $X_{1}$ ) and mathematical ( $X_{2}$ ), was . 305 . The proportion of the variance of the oriterion variable attributed to the joint action of the two independent variables was 9.32 per cent. Of this amount, 0.37 per cent of the total variance in French learning achievement was the independent contribution of the first variable (verbal), and 8.95 per cent was attributed to the independent contribution of the second variable (nathomatical). The remaining 90.68 per cent was attributable to other factors not measured by these two tests.

Combination of Variables One, Maree, and Y
The coefficient of multiple correlation between the scores made on the criterion variable of French achievement ( $Y$ ) and the combined action of the independent variables, verbal $\left(X_{1}\right)$ and auditoxy $\left(X_{3}\right)$, was .339. The proportion of the variance of the criterion variable attributed to the joint action of the two independent variables was 11.47 per cent. Of this amount, 1.11 per cent of the totel veriance in rrench learning achievement was the independent contribution of the first variable (verbal), and 10.36 per cent was attributed to the independent contribution of the third variable (aiditory). The remaining 88.53 per cent was attuibuted to other factors not measured by theso two tests.

Conbination of Variebles One, Eour, and $Y$
Whe coefficient of multiple correlation between the scores made on the criterion vaxiable of French achievenent ( $Y$ ) and the combined action of the independent variables, verbal $\left(X_{1}\right)$ and interest $\left(X_{4}\right)$, was . 331 . The proportion of the variance of the criterion variable attributed to the joint action of the two independent variables was 10.9 per cent. Of this amount, 3.7 per cent of the total veriance in French learning achievonent was the independent contribution of the first variable (verbal), and 7.2 per comt was atbributed to the
independent contribution of the fourth variable (interest). The remoining 89.I per cent was attributed to other factors not measured by these two tests.

Combination of Variables wo, Three, and Y The coefficient of multiple correlation between the scores made on the criterion variable of French achievement (Y) and the cormbined action of the independent variables, mathematical ( $\mathrm{X}_{2}$ ) and anditory ( $\mathrm{X}_{3}$ ), was -377. The proportion of the variance of the criterion variable attributed to the joint action of the two independent variables was 14.2 per cent. Of this amount, 3.86 per cent of the total variance in irench learning achievement was the independent contribution of the second varieble (mathenatical), and 10.36 per cent was attributed to the indepondent contribution of the third variable (auditory). The remaining 85.8 per cent was attributed to other factors not measured by these two tests.

Combination of Variables Two, Four, and Y
The coefficient of multiple correlation between the scores made on the oriterion varjable of Trench achievement ( $Y$ ) and the combined action of the independent vaciables, mathematical ( $X_{2}$ ) and interest ( $X_{4}$ ), was .4.t. The proportion of the variance of the criterion variable astributed to the joint action of
the two incependent veriables was 16.8 per cent. Of this amount, 8.95 per cent of the total variance in Prench Iearning achievenont was the independent contribution of the second variaile (mathematical), and 7.85 per ont was the independent contribution of the fourth veriable (interest). The remaining 83.2 per çent was attributed to other factors not measured by these two tests.

Combination of Veriebles Three, Four, and $Y$
The coefficient of mitiple correlation between the scores made on tho eriterion veriable of prench echicvoment ( $Y$ ) and the combined action of the incepencent variebles, auditory $\left(X_{3}\right)$ and interest $\left(X_{4}\right)$, wes . 400 . The proporticn of the vaniance of the oriterion variable attributed to the joint action of the two independent veriables was 16 per cent. Of this amount, 10.4 per cent of the total variance in Trench leaming achievement was the independent contribution of the third variable (auditory), and 5.6 por cent was the fradepondent contribution of the fourth variable (interest). The remaining 84 per cent was attributed to other iactons not measured by these two tests.

Combination of Vericblos Dat, Two, Three, and Y The coefficient of multiple correlation between the scores made on the criterion variable oi French achievenent ( $Y$ ) and the combined action of the inden pendent variables, verbel $\left(X_{1}\right)$, mathomatical ( $X_{2}$ ), and auditory $\left(X_{3}\right)$, was $\cdot 378$. The proportion of the variance attributed to the joint action of the three independent veriables was 14.26 per cent. Of this amount, 0.03 per cent of the total variance in French Iearnjng achievement was the independent contribution of the first variable (verbal), while 3.86 per cent was the independent contri-i bution of the second varjable (mathemetioni), and 10.36 per cent of the total variance was the independent contribution of the third variable (auditory). The remaining 85.74 per cent of the variance was attributed to other factors not mensured by these tests.

Combination of Varjebles One, Two, Three, Four, and Y The coefficient of multiple corrclation between the scores rade on the criterion variable of Prench achievenent ( $Y$ ) and the combined action of the independent variables, verbal ( $X_{1}$ ), mathematical ( $X_{2}$ ), nuditory ( $X_{3}$ ), and interest $\left(X_{4}\right)$, was . 455. The proportion of the variance attributable to the four jindependent variables vias 20.67 per cent. Of this amount, 4.67 per cent of
the total variance in Irench learning achievement was the independent contribubjon of the second varieble (mathemabican). The independent contribution of the third veriable (auditory) was 10.36 per cent, while that of the fourth variable (interest) was 5.63 per cent. The first variable (verbal) accounted for none of the total variance. There renained 79.33 per cent to be attributed to other factors not measured by the selected aptitude tests.

Combinations Yielding Highest Multiple Correlation Coevricients

As indicated in Table VII, the conbination of the variables, mathematicel ( $X_{2}$ ) and interest ( $X_{4}$ ), correlated higher with the measure of leaming achievenent $(Y)$ in French than did any of the other combinations with two predictor variables. The coefficient of multiple correlation for this combination was .410. The combination yielding the highest correlation inclucied all of the four predictor variables, with a coefficient of .455 , although it shovid be noted that in this combination only three of the variables actually contributed to the total variance in French leaming achievenent. The first variable (verbal) accounted for none of the total varience.

## TABLE VII

COERTICIERTS OF MULTLELE COREWLATION BETVEEN A REASURE OF LEARHJNG ACHIEVERINT IN PRENCH AND CONBINATIONS OF SELECIED IIEASURES OP APTITUDE

$$
(\mathbb{N}=80)
$$

| Multiple R Factors | R | $\mathrm{R}^{2}$ |
| :---: | :---: | :---: |
| $\mathrm{R}_{\mathrm{y}} .12$ | . 305* | . 093 |
| $\mathrm{R}_{\mathrm{y}} .13$ | . $339 \% *$ | . 115 |
| Ry. 14 | . $331 * *$ | . 109 |
| $\mathrm{R}_{\mathrm{y} .23}$ | . $377 \%$ | . 242 |
| R y. 24 | . $41.10 \%$ | . 168 |
| $\mathrm{R}_{\mathrm{y}} .34$ | . $4000^{* *}$ | . 260 |
| $\mathrm{R}_{\mathrm{y} .123}$ | . $378^{* *}$ | . 143 |
| $\mathrm{R} y .1234 * \% *$ | . $455 \%$ | . 207 |
| *gignificant at the .05 level. |  |  |
| **Significant at the . 01 level. |  |  |
| \%\%\% Variables: |  |  |
| 1. Verbal |  |  |
| 2. Pathematical |  |  |
| 3. Auditory |  |  |
| 4. Intercest |  |  |

Relationships between a Teasure of Leaming Achievement in German and Combined Meamures of Aptitude

Various coefficients of malitiple correlation were conputed to show the joint action of the measures of aptitude combined with the criterion measure of leaming achievement in German. Table VIIT summarizes the productmoment coefficients of correlation used in the computation of these coefficienta of muitiple correlation. Means and standard deviations for the variables are presented in Appendix A.

The correlations between a measure of learining achievenent in German and the selected measures of aptituce ranged from -.038 to -.224 . The intercorrelations ariong the combinations of the four predictor varigbles ranged from -.024 to .440. According to Gerrett's descriptive Iakels, correlations ranging from .00 to $\pm .20$ denote "indifferent or negligible" relationships; those ranging from $\pm .20$ to $\pm .40$ denote "low" relationships; and those that fall within the $\pm .40$ to $\pm .70$ renge are indicetive of "substantial or merted" relationships (l, p. 176).

The coefficients of multiple correlation are presentcd in Table IX. There were none found to be significant at the .05 level.

PABLE VIII

## INTERCORREIATIONS BETWEEN A DEASURE OR LEARTING ACHIEVETENT IN GERYAV AND SELCCRED MEASURES OF APTITUDE <br> ( $N=24$ )

| Tests | Coefficients of Correlation |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{X}_{1}$ | $\mathrm{X}_{2}$ | $\mathrm{X}_{3}$ | $\mathrm{X}_{4}$ | Y |
| Verbal ( $\mathrm{X}_{1}$ ) | - | . 335 | . $440 \%$ | . 096 | . 179 |
| Mathenatical ( $\mathrm{X}_{2}$ ) |  |  | . 135 | -. 198 | -. 224 |
| Auditory ( $\mathrm{X}_{3}$ ) |  |  |  | -. 024 | . 157 |
| Interest ( $\mathrm{X}_{4}$ ) |  |  |  |  | -. 038 |
| German (Y) |  |  |  |  | -•• |

*Significent at the . 05 level.

Combination of Veriables One, Iwo, and $Y$
The coefficient of multiple correlation between the scores made on the criterion variable of Gemnan achievement ( $Y$ ) and the combined action of the independent variables, verbal $\left(X_{1}\right)$ and mathenaticel $\left(X_{2}\right)$, was .350 . The proportion of the variance of the criterion variable attributed to the joint action of the two independent Variables was 12.3 per cent. Of this amount, 7.3 per cent of the total variance in Geman leaming achievement was the independent contribution of the first veriable (verbal), and 5.0 per cent was attributed to the
independent contribution of the second variable (nathenatical). The remaining 87.7 per cont was attributable to other factors not measured by these two tests.

Combination of Variables One, Three, and Y
The coefficient of multiple correlation between the scores made on the criterion variable of German achievement ( $I$ ) and the combined action of the independent variables, verbal ( $\mathrm{X}_{1}$ ) and auditory ( $\mathrm{X}_{3}$ ), was . 199 . The proportion of the variance of the criterion variable attributed to the joint action of the two independent variankes was 3.96 per cent. Oe this mount, 3.27 per cent of the total variance in German learning achievenent was the irdependent contwibution of the first variable (verbal), and 0.75 per cent was attributed to the inciependent contribution of the third variable (suditory). The remaining 96.04 per cont was attributed to other factors not measured by these two tests.

Combination of Variables one, Four, and Y The coofficient of multiple correlation between the scores made on the criterion vaxiable of German achievenent ( $Y$ ) and the combined action of the indopendent variables, verbal ( $X_{1}$ ) and interest $\left(X_{4}\right)$, was .188. The
proportion of the variance of the criterion variable attributed to the joint ection of the two independent variables was 3.5 per cent. Of this amount, 3.2 per cent of the total variance in German leaming achievenent was the independent contribution of the first varjable (verbai.), and 0.3 per cent was attributed to the independent contribution of the fourth veriable (interest). The remaining 96.5 per cent was attributed to other factors not measured by these two tests.

Combination of Veriebles Two, Three, end Y
The coefficient of multiple correlation between the scores made on the oriterion variable of Germen achievereat ( $Y$ ) and the combined action of the independent variables, mathematical ( $X_{2}$ ) and audijtory ( $X_{3}$ ), was .293. The proportion of the variance of the criterion varieble attributed to the joint action of the two independent variables was 8.6 per cent. Of this amount, 5.0 per cent of the total variance in Geman learning achievement was the independent contribution of the second variable (nathematical), and 3.6 per cont was attributed to the independent contribution of the third variable (auditory). The remeining 91.4 per cent was attributed to other factors not meesured by these two tests.

Combination of Verjables Two, Four, and Y The coefficient of multiple correlation between the scores made on the criterion variable of German achievenent ( $X$ ) and the combined action of the independent variables, methematical ( $X_{2}$ ) and interest $\left(X_{4}\right)$, wes . 239. the proportion of the variance of the critericn variable attriputed to the joint action of the two independent variables was 5.7 per cent. Of this amount, 5.0 per cent of the total variance in German learning achievement was the independent contribution of the second variable (ilathematical), and 0.7 per cent wes the findepencent contribution of the fourth varisble (interest). The remaining 94.3 per cent was attributed to other factors not measured by these two tests.

Combination of Variables Three, Four, and Y The coefficient of multiple correlation between the scores made on the criterion variable of German achicvenent ( $Y$ ) and the combined action of the independent variables, auditory $\left(X_{3}\right)$ and interest ( $X_{4}$ ), was .160. The proportion of the variance of the criterion variable attributed to the joint action of the two indopendent variables was 2.6 per cent. Of this amount, 2.5 per cent of the totel variance in Germen leaming achieveront was the independent
contribution of the thicd verichte (matory), and 0.1 per cent was the indopendent contrinution of the fourth variable (interest). The remaining 97.4 per cent was attributed to other factors not neasured by these two tests.

Combinetion of Variables one, Iwo, Three, and $Y$ The coefficient of multiple correlation between the scores made on the criterion variable of German achievement ( $Y$ ) and the corbined action of the independent variables, verval ( $X_{1}$ ), mathematical ( $X_{2}$ ), and auditory $\left(X_{3}\right)$, was .360. The proportion of the variance attributed to the joint action of the three independent variebles was 1.2 .96 per cont. Of tris emount, 7.27 per cent of the total variance in German leamine achievenent was the independent contribution of the first variable (verbal), while 5.01 per cent was the independent contribution of the second variable (matheratical), and 0.68 per cent of the total variance was the independent contribution of the third variable (auditory). The renaining 87.04 per cent of the variance was attributed to other factors not ncasured by these tests.

Corabination of Variables one, Two, Three, Four, and $Y$ The coefficient of multiple correlation between the scoros made on the criterion variable of German achiovoment ( X ) and the conbined action of the independent
variables, verbal $\left(X_{1}\right)$, rathematical $\left(X_{2}\right)$, auditory $\left(X_{3}\right)$, and interest $\left(X_{4}\right)$, was . 382 . The proportion of the variance attributable to the four independent variables was 14.58 per cent. Of this axhount, 7.27 per cent of the total variance in German leaming achievenent was the independent contribution of the first variable (verbal). The independent contribution of the second varicble (mathematical) was 5.01 per cent, while that of the third variable (anaitory) was .52 per cent. The fourth varisble (interest) accounted for 1.78 per cent of the total variaace. The remaining 85.42 per cent was attributed to other factors not measured by the selected aptitude tasts.

## Combinations Yielding Highest Multiple

correlation Coefricients
As indicated in liable IX, the combination of the variables, verbal ( $X_{1}$ ) and mathenatical $\left(X_{2}\right)$, curcelated higher with the measure of leerning achievement ( $Y$ ) in Geman than did eny of the other conbinations with two predictor varicbles. The coefficient of multiple correlation for this combination was .350 . The combination yielding the highest correletion included all of the four predictor variables, with a coefficient of . 382.

## UDEE IX


 OF SELECTED MBASURES OH APCTEUDE

$$
(N=24)
$$

| Eultiple R Factors | R | $R^{2}$ |
| :---: | :---: | :---: |
| $\mathrm{R}_{\mathrm{y} .12}$ | . 350 | . 123 |
| $\mathrm{R}_{\mathrm{y} .13}$ | . 199 | . 040 |
| R y .14 | . 188 | . 035 |
| $\mathrm{R}_{\mathrm{y}} .23$ | . 293 | .085 |
| R y .24 | . 239 | . 057 |
| $\mathrm{R}_{\mathrm{y} .34}$ | . 1.60 | . 026 |
| $\mathrm{R}_{\mathrm{y} .123}$ | . 360 | . 130 |
| Ry.1234* | . 382 | . 146 |

(All coefijecients monsignificent.)
*Variebles:

1. Vexbal
2. Hetnematicel
3. Aucitory
4. Jaterest
X. German

Prediction by Multiple Regression
For the computation of the multiple coefficients of correlation, use was made of the process of maxi-mining the predictive power of the independent variables by assigning optima weights to them. This procedure (2, p. 324) involved the following basic formula:

$$
\begin{gathered}
\hat{\mathrm{X}}_{1234}=\mathrm{A}_{\mathrm{y} .1234}+\mathrm{b}_{\mathrm{y} \mathrm{l} .234^{X_{1}}+b_{y 2.134^{X_{2}}}+b_{y 3.124} \mathrm{X}_{3}} \\
+\mathrm{b}_{\mathrm{y} 4.1233_{4}}^{X_{4}} \\
\text { Where }
\end{gathered}
$$

$\hat{X}_{1234}=$ predicted score on the criterion measure.
y. $1.234=$ a constant.
$b_{y 1,234}=$ partial recession coefficient giving the weight of the score attached to the first jncepencent variable with the second, third, and fourth independent variables held constant.
$X_{1}=$ score on the first independent variable.
$b_{y 2.134}=$ partial regression coefficient giving the weight of the score attached to the second independent variable with the first, third, and fourth independent variables held constant.
$X_{2} \quad$ score on the second independent vexieble.
$b_{y 3.124}=$ partial regression coefficient giving third independent variable with the first, second, and fourth independent variables held constant.
$X_{3}=$ score on the third independent variabze.
$b_{y 4.123}=$ partial regression coefficient giving the wejght of the score attached to the rourth independent variable with the first, socond, and third independent veriables held constont.
$X_{4} \quad=$ score on the fourth independent veriable.
All of the equations which follow ere the result of the application of this basic formula. Detailed data relative to the variables nay be fowd in Appendix $B$.

Prediction of Learning Achievenent in Spanish
The following is the equation involving the use of the verbal $\left(X_{1}\right)$ and nathenation $\left(x_{2}\right)$ score weishts to predjot Spanish achievoment:

$$
\hat{Y}=51.89+.09 x_{1}+.01 X_{2}
$$

The woighta of .09 and . Ol incicate the amovnts by which the scores on variebles $X_{1}$ and $X_{2}$ must be multiplied in order to give the prediction of $Y$. thus a prodiction of a Spanish achievenent score nay be mede by substituting in the regression equation the mown values of $X_{1}$ and $X_{2}$. The stendas emror of estinate of any Spanish achievenent score predicted from the above fomule is $\pm 31.72$ as show in Table $X$. This means that the chances are about two in three that the forecast of the Spanich achievenent score will not miss the acturl scoxe or Spenish achievenent on the criterion measure by rore than $\pm 31.72$ points.

The following is the equetion involving the use of the verbal ( $X_{3}$ ) and anditory $\left(X_{3}\right)$ seore webehts to predict Spanigh achievonent:

$$
\hat{Y}=25.48+.00 X_{2}+.84 X_{3}
$$

Whe weights of .00 end .84 indicate the anounts by which the scores on veriables $X_{1}$ and $X_{3}$ must be multiplied in order to give the prodiction of $Y$. fhus a prediction of a spanish achievencet score may be mede by substituting in the recression equation the know values of $X_{1}$ and $X_{3}$. The standard error of estimate of any Spentish achsevement scone predicted from the above fomma is $\pm 31.39$ as shown in Teble $X$. This means that the chences are about two in three that the forecast of the Gpanish achievernent sore will not miss the anturi score of Sponish achievenent on the criterion measure by more than $\pm 31.39$ points.

The following is the cquation involving the use of the verbel $\left(X_{y}\right)$ and interest $\left(X_{4}\right)$ scone wejghts to prediot Spanish achisvemont:

$$
\hat{I}=30.78+.09 X_{I}+5.16 X_{4}
$$

The weigits of .Og and 5.16 indicate the anounts by which the scores on variables $X_{1}$ and $X_{4}$ must be multiplied in order to give the prediction of $Y$. Thus a predjetion of a Spenish achievencnts seoxe neay be made by subustituting in the regression equation the knom values of $X_{1}$ and $X_{4}$. The stendere exror of estinate ot any gnansh achicvenent scone predioted fron the anovo formon is t29.46 as shom
in Teble $X$. This reens thet the chances are about two in three that the forecant of the Spanish achievernent score will not miss the ectuel scone of spanish achievenent on the criterion measure by more then $\pm 29.46$ points.

The following is the equation jnvolving the use of the mathematical $\left(X_{2}\right)$ and auditory $\left(X_{3}\right)$ score weights to predict Spanish achievenent:

$$
\hat{Y}=34.80+.04 \mathrm{X}_{2}+1.07 \mathrm{X}_{3}
$$

The weights of .04 and 1.07 inaicate the anounts by which the scores on variables $x_{2}$ and $X_{3}$ must be multiplied in order to give the prediction of $Y$. Thus a prediction of a Spanish achieveront scone may be nade by suastituting
 The standard exror of estinate of any Spanish echievenent scone predicted from the above Romme is $\pm .32 .03$ as shom in Table $X$. This means thet the chances are about two in thace thet the Ponecast of the spenish achievement score will not miss the actual score of Spanisin achjevenent on the criterion measuie by more than $\pm 32.03$ points.

The following is the equation involving the use of the mathematical $\left(X_{2}\right)$ and interest $\left(X_{4}\right)$ score weights to preaict Spenish achievement:

$$
\hat{Y}=41.84+.06 \mathrm{~K}_{2}+5.39 \mathrm{~K}_{4}
$$

The wejghte of .06 and 5.39 indicate the amounts oy which the scones on vajiables $X_{2}$ and $X_{4}$ must be moltiplied
in order to give the peediction of $\gamma$. Mnis a prediction of a Spanish achievenent score mag be made by substituting in the regression equation the knom valuos of $X_{2}$ and $X_{4}$. The stendard error of estinate of any Spanish achievenent score preaicted from the above fomula is $\pm 30.14$ es shown in Table $X$. This means that the chences are about two in three that the forecast of the Spanish achievenent score will not miss the actual score of Spenish achievenent on the criterion measure by more than $\pm 30.14$ points.

The following is the equation involving the use of the auditory $\left(X_{3}\right)$ and interest ( $X_{4}$ ) scone wejeghts to preaict spenish aciziovenent:

$$
\hat{Y}=30.98+.95 X_{3} \div 4.96 \mathrm{X}_{4}
$$

The weights of .95 and 4.96 indicate the anounts by which the scores on variebles $x_{3}$ and $X_{4}$ must be multiplied in order to sive the prediction of $Y$. Thns a prediction of a Spanish achicvenent scone nay be made by substituting in the recression equation the known values of $X_{3}$ and $X_{4}$. The standerd crror of estinete of any Spanish achieverent scose predicted from the above formula is $\pm 30.16$ as shown in Table $X$. This meens thet the chances are about two in throe that the forecast of the Spenish achievenent score wijl not mias the actual score of spanish achievement on the criterion neasure by more then $\pm 30.3 .6$ points.

The iollowing is the equabion involving the usc of the verbal $\left(X_{1}\right)$, mathenatical $\left(\pi_{2}\right)$, and andjtory ( $X_{3}$ ) score veignts to prediot Spanigh achievenent:

$$
\hat{Y}=26.10+.08 X_{1}-.01 X_{2}+.86 X_{3}
$$

The weights of $.08,-.01$, and .86 indicate the mounts by which the scores on variables $X_{1}, X_{2}$, and $X_{3}$ must be multipljed in oxer to give the prediction of Y. Thus a preaiction of a Spenish achievenont score may be made by substituting in the megnession equation the known values of $X_{2}, X_{2}$, and $X_{3}$, The standerd error of estimate of any Spaisish achievenent soore predicted from the above fommla is $\pm 3 \mathrm{l} .54$ as shown in Teble $X$.
 theit the forecost of the Spanish achiovement score will not miss the acturl score of Spenish achievemont on the criterion macure by mone then $\pm 31.54$ points. The following is the equation involving the use of the verbal $\left(X_{1}\right)$, wathemetical $\left(X_{2}\right)$, auditory $\left(X_{3}\right)$, and interest $\left(X_{4}\right)$ scone weights to predict Spenish achievenent:

$$
\hat{Y}=13.88+.07 X_{2}+.03 X_{2}+.48 X_{3}+4.97 X_{4}
$$

The weights of . $07, .01, .48$ and 4.97 indicate the amounts by which the scomes on veriables $X_{1}, X_{2}, X_{3}$, and $X_{4}$ must be multiplied in order to give the prediotion of $Y$. minus a prediction of a Spanish achicvenont score ney be made by substituting in the cegression equation the known

## TABL' X

STANDARD TRRRORS OF ESTTHARE FOR SPAIISH ACTIEVEMERI SCORES PREDICTED TROM COMBINATIONS OF SELECTED WEASURES OF APTITUDE

$$
(N=105)
$$

| Combinetions of Variables* | SE (est. Y) |
| :---: | :---: |
| Vexbal $\left(X_{1}\right)$ and Mathenatical ( $X_{2}$ ) | $\pm 31.72$ |
| Verber ( $X_{1}$ ) and Auaitory ${ }^{-}\left(X_{3}\right)$ | $\pm 31.39$ |
| Verbal ( $X_{1}$ ) and Interest ${ }^{-1}\left(X_{4}\right)$ | $\pm 29.46$ |
| Mathematical $\left(X_{2}\right)$ and Auditory $\left(X_{3}\right)$ | $\pm 32.03$ |
| Mathenctical $\left(X_{2}\right)$ and Interest ( $\mathrm{X}_{4}$ ) | $\pm 30.74$ |
| Auditory $\left(\begin{array}{l}\left.X_{3}\right) \\ \text { Interest } \\ X_{4}\end{array}\right)$ and | $\pm 30.36$ |
| Verbal $\left(X_{p}\right)$ <br> Matheratidai $\left(X_{2}\right)$, and Avaitory $\left(X_{3}\right)$ | $\pm 31.54$ |
| Verbel $\left(X_{7}\right)$, Nathemeticel $\left(X_{2}\right)$, Auditory $\left(X_{3}\right)$, and Intorest $\left(X_{4}^{3}\right)$ | $\pm 29.62$ |

velues of $X_{1}, X_{2}, X_{3}$, and $X_{4}$. The standara error of estimate of any Spanish achievonent score predicted from the above fomma is $\pm 29.62$ as incicated in Table $X$. This meens that the chances are about two in three that the forecast of the Spenish achiovement soore will not miss the actual score of spenish achiovement on the oriterion measure by more than $\pm 29.62$ points.

Frediction of Learrin Achievenent In Prench
The following is the equation involving the use of the verbel $\left(X_{1}\right)$ and mathemetical ( $X_{2}$ ) score weights to predict French achievenent:

$$
\hat{I}=20.62 \div .032, .10 \% 2
$$

Who weights of .03 and .10 indicate the anounts by which the scones on variables $X_{1}$ and $X_{2}$ must be multiplied in order to give the prediction of $X$. Thes a prediction of a french achievement score inay be mede by substituting in the regression equation the known values of $X_{1}$ and $X_{2}$. The standard error of estimate of any Trench achievement score predictod from the above fomala is $\pm 37.06$ as shown in Table XI. This means that the chances are about two in three that the forecast of the Prench achievenent score will not miss the actual score of Trench achiovenent on the critorion measure by more then $\pm 37.06$ points.

The following is the equetion involving the use of the verbal ( $X_{1}$ ) and anditory ( $X_{3}$ ) score weights to predict Irench achievoment:

$$
\hat{Y}=-7.70+.05 x_{1}+3.79 z_{3}
$$

The weights of .05 and 1.79 indicete the onownts by which the scores on varianles $X_{1}$ and $X_{3}$ must be multiplied in order to give the prediction of $Y$. Thus a prediction of a Trench achievenent score may be nade by substituting in the recression equation the knom valiaes of $X_{1}$ and $X_{3}$. The standard exror of estimate of any Trench achievenent score predicted from the above formula is $\pm 36.62$ as show in Table XI. This moans that the chances are about two in three that the forecast of the Pronch achievenent soore will not miss the actual score of Prench achievement on the ariterion neasure by nore then $\pm 36.62$ points.

The following is the equation involving the use of the verbal ( $X_{1}$ ) and interest ( $X_{4}$ ) score weights to preaict french achievenent:

$$
\hat{Y}=32.54+.08 X_{1}+4.34 X_{4}
$$

The wejeghs of 08 and 4.34 indicete the amounts by wich the scores on variables $X_{1}$ and $X_{4}$ must be multiplied in orece to give the prediction of Y. Thus a prediction of a french achievenent score may be mede by substitating in tine regression equebion the bnown velues of $X_{1}$ and $X_{4}$.

Whe standard exror or esthate of any Prenon achievement score predicted from the ebove fompla is $\pm 36.73$ as shown in Cable XI. This means that the chances are about two in three that the forecast of the french achievement score will not miss the actual score of Prench achievenent on the criterion measure by more than $\pm 36.73$ points.

The following is the equation involving the use of the mathematical ( $X_{2}$ ) and auditory ( $X_{3}$ ) score veights to predict French achievenent:

$$
\hat{Y}=-14.55+.08 x_{2}+1.55 x_{3}
$$

The weights of .03 and 1.55 indicate the amounts by which the scores on variables $X_{2}$ and $X_{3}$ must be multiplied in order to give the prediction of $Y$. Thus a prediction of a French achievenent score nay be nede by sulostituting in the regression equation the hown values of $X_{2}$ and $X_{3}$. The standard exrox of estimate of any. Fronch achievement score predicted from the ebove fommla is $\pm 36.05$ as showm in Table XI. This means that the chances are about two in three that the forecast of the French achievement score will not miss the actual score of Prench achievenent on the criterion monsure by nore than $\pm 36.05$ points.

The following is the equation jinvolving the use of the mathenaticel $\left(X_{2}\right)$ and interost $\left(X_{4}\right)$ score weichts to predict Prench achjeverent:

$$
\hat{y}=10.48+.12 x_{2}+4.71 x_{4}
$$

The weights of .12 and 4.71 indicate the amounts by which the scores on variables $X_{2}$ and $X_{4}$ nust be mantiplied in order to give the prediction of $Y$. Thus a prediction of a Prench achievencnt score nay be made by subatituting in the rogressjon equation the knom values of $X_{2}$ and $X_{4}$. Whe stoncard exror of estinete of any French achievement score prodicted frcim the above fomula is ${ }^{\dagger} 35.50$ es ahom in Table XI. This means thet the chences are about two in three thet the forecast of the French achieverient score will not gias the actual score of trench achaevenent on the critorion rneesure by more than $\pm 35.50$ points.
the followins is the equation involving the use of the anationy $\left(X_{3}\right)$ and intorest $\left(X_{4}\right)$ score weights to prediot French achievenont:

$$
\mathrm{A}=-10.34+1.87 \mathrm{X}_{3}+4.01 \mathrm{X}_{4}
$$

The weights of I. 87 and 4.01 indicate the amounts by which the scores an varionjes $X_{3}$ and $X_{4}$ must be matiplied in order to give the prediction of $Y$. Thus a prediction of a Frouch achievenont score ney be made by substituting in the regression equation the known values of $X_{3}$ and $X_{4}$. Whe gianderd error of estinate of any Prench achievement woore prodicted from the above fomula is 155.67 as shown in Table XI. Fins meons that the chances are about two in thee that the forecast of the Prench achovement score will not miss the actual score of Erench achievenent on the oritorion mocsure by moce then $\pm 35.67$ points.

The folloming is the equetion involviag the use of the verbal $\left(X_{1}\right)$, mathenatical $\left(X_{2}\right)$, and auditory $\left(X_{3}\right)$ score weights to precict French achievement:

$$
\hat{Y}=-15.95+.01 X_{1}+.08 X_{2}+2.52 X_{3}
$$

The veights of $.01, .08$, and 1.52 indicate the exnounts by which the scores on variebles $X_{1}, X_{2}$, and $X_{3}$ must be multiplied in order to give the prediction of Y. Thus a prediction of a French achieveraent score nay be made by substituting in the regression equation the fnow values of $X_{1}, X_{2}$, and $X_{3}$. The standard error of estinete of any Trench achievenent score predicted from the above formula is $\pm 36.28$ as show in Trable XI. This means that the chonces are about two in three that the forecast of the French achjevenent score will not miss the actual score of Prench achievernent on the criterion measure by move than $\pm 36.23$ points.

The following is the equation involving the use of the veroal $\left(X_{1}\right)$, mathenatical $\left(X_{2}\right)$, anditory $\left(X_{3}\right)$, and interest ( $\mathrm{K}_{4}$ ) score weights to predict French achievement:

$$
\hat{Y}=-31.71+.00 X_{1}+.09 X_{2}+1.33 X_{3}+4.30 X_{4}
$$

The weights of $.00, .09,1.33$ and 4.30 indicate the amounts by which the scores on variebles $X_{1}, X_{2}, X_{3}$, and $X_{4}$ must be maltipijed in oxder to give the prediction of Y. Thus a prodiction of a French achievement scone may be made by arbstituting tin the recression ecuation the

PABLE XI
STANDARD ERRORS OF ESWITATE POR FRENCH ACHTEVETENT SCORES PREDICTED EROM CORBINATIONS OF SELECTED MEASURES OF APTITUDE

$$
(\mathbb{N}=80)
$$

| Combinations of VariabJes* | SE (ost. Y) |
| :---: | :---: |
| Verbal ( $\mathrm{X}_{\mathrm{I}}$ ) and Mathematical ( $\mathrm{X}_{2}$ ) | $\pm 37.06$ |
| $\begin{aligned} & \text { Verbal }\left(X_{n}\right) \text { and } \\ & \text { Auditory }\left(X_{3}\right) \end{aligned}$ | $\pm 36.62$ |
| Verbal $\left(X_{1}\right)$ and Interest ${ }^{-1}\left(X_{4}\right)$ | $\pm 36.73$ |
| Mathematical $\left(X_{2}\right)$ and Auditory $\left(X_{3}\right)$ | $\pm 36.05$ |
| Mathenatical $\left(X_{2}\right)$ and Interest ( $\mathrm{X}_{4}$ ) | $\pm 35.50$ |
| Anditory $\left(X_{3}\right)$ and | $\pm 35.67$ |
| Verbal ( $X_{7}$ ), <br> Mathematical $\left(X_{2}\right)$, and Auditory $\left(\mathrm{X}_{3}\right)$ | $\pm 36.28$ |
| Verbal ( $X_{7}$ ), <br> Mathematical $\left(X_{2}\right)$, <br> Auditory ( $\mathrm{X}_{3}$ ), and Interest $\left(X_{4}^{3}\right)$ | $\pm 35.12$ |

hown values of $X_{1}, X_{2}, X_{3}$, and $X_{4}$. It should be noted that in this conbination only three of the variables actually contribute to the prediction of Trench learning achievonent; the first variable (verbal) was discounted in the construction of the regression equetion. The standard error of estimate of any Irench achjevenent score predicted from the above formula is $\pm 35.12$ as indicated in Peble XI. Mis means that the chances are about two in three that the forecast of the French achievement score will not niss the actual soore of French achievement on the criterion meazure by moce than $\ddagger 35.12$ points.

Prediction of Leerning Honevement in Cecmen
The following is the equation involving the use of the verbel $\left(X_{1}\right)$ and mathemetioel ( $X_{2}$ ) soore weights to predict Gexman achievement:

$$
\hat{Y}=98.34+.06 X_{工}-.07 X_{2}
$$

The weights of .06 and -.07 indicate the amounts by which the scores on variebles $X_{1}$ and $X_{2}$ must be multiplied in oxder to give the prediction of $Y$. Thus a. prediction of a German achievoment scone may be nade by substituting in the regression equation the known values of $x_{2}$ and $X_{2}$. The standard exror of ostinate of any Geman achievenent soore prodicted from the above formula is $\pm 20.53$ es shom in Toble XrI. Ghis mean that
the chances are about two in three that the forecast of the German achsoment acore will not miss the actual score of Geman achevenent on the criterion measure by more then +20.53 points.

The following is the equation involving the use of the verbal $\left(X_{1}\right)$ and auditory $\left(X_{3}\right)$ score weights to predict German achievenent:

$$
\hat{Y}=60.23+.03 x_{1}+.38 x_{3}
$$

The weights of .03 and .38 indicate the amownts by which the scores on variebles $X_{1}$ and $X_{3}$ must be multiplied in order to give the prediction of Y. Thus a prediction of a Gemmen achievemont scose may be made by sunstituting in the resression equation the hrom values of $X_{1}$ and $X_{3}$. The stenderd error of estimate of any Gomen achievement score preaicted foin the above formala is $\pm 21.49$ as shown in Table XII. This neens that the chences are about two in three that the forecast of the Geman achievenent score will not miss the actual scone of Geman achievenent on the criterion meesure by more than $\pm 21.49$ points.

The following is the equabion involving the use of the verbal ( $X_{1}$ ) and interest ( $X_{4}$ ) score wejgens to predict Gernen achievement:

$$
\hat{Y}=75.37+.04 X_{1}-.49 X_{4}
$$

The veights of .04 and -. 49 incioste the amounts by which the scores on veciembes $X_{I}$ and $X_{4}$ manti be wultiplied
in order to give the prediction of $Y$. Thus a prediction of a Germen ackievenent score may be made by substituting in the regression equetion the knom values of $X_{1}$ and $X_{4}$. The standard error of estinate of any German achievenent score predicted from the above formula is $\pm 21.54$ as shown in Table XII. This means that the chences are about two in three that the forecast of the German achieveneat score will not miss the actual score of Geman achiovenent on the criterjon measure by more than $\pm 21.54$ points. The following is the equation involving the use of the inathenctical $\left(X_{2}\right)$ and auditory $\left(X_{3}\right)$ soore woights to preaict Geman achievement:

$$
\hat{Y}=88.39-.05 x_{2}+.75 x_{3}
$$

The weights of -.05 and .75 indicate the amounts by which the scores on veriables $X_{2}$ and $X_{3}$ must be multiplied in order to give the prediction of $Y$. Thas a prediction of a German achievement score may be made by substituting jn the resression equation the knom values oi $X_{2}$ and $X_{3}$. The staudard error of eatimate of any Geman achievenent scone predicted from the above fomma is $\pm 20.96$ as show in table XII. This neans that the chances axe about two in three thet the forecast of the Geman achievenent score will not miss the actual score of Geman achievenent on the cxiterion measure by more then 120.06 points.

The following is the equation involving the use of the mathenatical $\left(X_{2}\right)$ and intorest $\left(X_{4}\right)$ score weights to prodict Geman achievement:

$$
\hat{\mathrm{Y}}=126.05-.05 x_{2}-.75 x_{4}
$$

The weights oi -. 05 and -.75 indicate the anounts by which the scores on variables $X_{2}$ and $X_{4}$ wust be multiplied in order to give the prediction of $Y$. Thus a prediction of a Germen achievement score may be made by substituting in the regression equation the known velues of $X_{2}$ and $X_{4}$. The standard exror of estirate of any German achieverient score predicted from the above forfiula is $\pm 21.29$ as show in Table XII. This reans that the chancos are ebout two in three thet the forecast of tho Geman achicvement score will not miss the actual score of Gexnen achievenent on the criterion neesure by nore than $\pm 21.29$ points.

The followinf is the equation finvolving the use of the auditory $\left(X_{3}\right)$ and interest $\left(X_{4}\right)$ score woights to predict German achieverent:

$$
\hat{y}=67.08+.62 x_{3}-.30 x_{4}
$$

the weichts 0 i . 62 and --. 30 incicate the anounts by which the scores on variables $X_{3}$ and $X_{4}$ must be multiplied in ortier to give the prediction of $Y$. Mhus a prediction or a Gemen achievement seore may be mede by substituting in the regression cquation the known values of $X_{3}$ and $X_{4}$. The standard exror of estinate of any Gemm achioveneat

STANDARD ERRORS OF ESTTHATE FOR GPRAAN ACHIEVENENT SCORES PREDICAED FROR COHBINARIONS OF SELECTED WEASIRES OF APMITUDE

$$
(N=24)
$$

| Combinations of Variables* | $\operatorname{SE} \text { (est. Y) }$ |
| :---: | :---: |
| Verbal ( $X_{7}$ ) and Nathematical ( $\mathrm{X}_{2}$ ) | $\pm 20.53$ |
| Verbal ( $X_{7}$ ) and Auditory $-\left(X_{3}\right)$ | $\pm 21.49$ |
| $\begin{aligned} & \text { Verbal }\left(x_{1}\right) \text { and } \\ & \text { Interest }\left(X_{4}\right) \end{aligned}$ | $\pm 21.54$ |
| Rathenatical $\left(X_{2}\right)$ and Auditory ( $\mathrm{X}_{3}$ ) | $\pm 20.96$ |
| Hathematical $\left(X_{2}\right)$ and Interest $\left(X_{4}\right)$ | $\pm 21.29$ |
| Auditory ( $\mathrm{X}_{3}$ ) and Interest $\left(X_{4}^{3}\right)$ | $\pm 21.64$ |
| Terbal ( $\mathrm{X}_{\mathrm{f}}$ ), <br> Matheinatidel $\left(X_{2}\right)$, and <br> Auditory ( $X_{3}$ ) | $\pm 20.96$ |
| Verbal ( $X_{1}$ ), <br> Mathematical $\left(\mathrm{X}_{2}\right)$, <br> Avditory $\left(X_{3}\right)$, and Interest $\left(X_{4}^{3}\right)$ | $\pm 27.30$ |

score predicted from the above fomma is t2l.64 as shown in Table XII. This means that the chances axe sbout two in three that the forecast of the Geman achievencent score will not miss the actual score of Germon achievement on the criterion meagure by wore then ton. 64 points.

The followins is the equation iavolving the use of the verbal $\left(X_{1}\right)$, mathomaticel $\left(X_{2}\right)$, and auditory $\left(X_{3}\right)$ score weights to prouict Geman achievoment:

$$
\hat{y}=86.06+.05 x_{1}-.07 x_{2}+.36 x_{3}
$$

The veights of $.05,-.07$, and .36 indicate the anounts by which the scores on veribloges $X_{1}, X_{2}$, and $X_{3}$ must be multiplied in order to give the prediction or y. Thus a prediction of a Coman ahievenont scone may be made by substituting in the rogreasion oquation the known values of $X_{2}, X_{2}$, and $X_{3}$. the standerd error of estinate of any Germen achicvenent score predicted from the above formula is $\pm 20.96$ as mhom in liable XII. This means thet the chences are about two in three that the forecast of the Gemman achievenert scone will not miss the actual score of Coman achievenent on the criterion measure by more then $\mathbf{t} 20.56$ points.

The following is the equation involving the use of the verbal $\left(X_{1}\right)$, nathematieal ( $X_{2}$ ), auditory $\left(X_{3}\right)$, and interest $\left(X_{4}\right)$ score woights to prodiot Germen achievonent:

$$
\hat{Y}=95.87+.06 x_{1}-.07 X_{2}+.32 X_{3}-1.16 X_{4}
$$

The weights of $.06,-.07, .32$ and -1. 16 inäicate the enounts by which the scores on vaniables $X_{1}, x_{2}, X_{3}$, and $X_{4}$ must be multiplied in order to give the prediction of $Y$. Thus a prediction of a German achievement score may be made by substituting in the regression equation the known values of $X_{1}, X_{2}, X_{3}$, and $X_{4}$. The standard error of estimate of eny Gemman achievencent score predicted from the above fommula is $\ddagger 21.30$ as indicated in Table XII. This neans that the chances are about two in three that the forecast of the Geman achievoment score will not iniss the actual score of Cerman achicvenent on the criterion measure by nore then $\pm 21.30$ points.

Comparisons of Predjction Rquations
For each languege, Fwratios nere calculated to compare the effectiveness of pairs of regression equations in predicting achievenent as neasured by the LiLA … Cooperative Forejgh Lenguese Rests, Foma LA.

## Spenish

1. Threeveredictor gquation. .-.the three-rpedictor equation, including the verbal $\left(X_{1}\right)$, mothenatical $\left(X_{2}\right)$, and auditory $\left(X_{3}\right)$ variables, wes shown to be:
a. Significantly better, at the . 05 level, than the two-predictor equetion whioh included the nathenatical ( $\mathrm{X}_{2}$ ) and anditory $\left(\mathrm{X}_{3}\right)$ varibules only.
b. Not signisicently better then the two.. predictor equation which included the verpal ( $X_{1}$ ) and nathenatical $\left(X_{2}\right)$ veriables.
c. Not significently bettex then the twopredictor equation which included the verbel ( $X_{1}$ ) and avditory ( $X_{3}$ ) variables.
2. Four-predictor equation. - The four-predictor equation, including all of the independent variables, was showm to be:
a. Significantly betber, at tho . Ol level, than the two-predietor equations which involved the pollowing combinations: verbal $\left(x_{7}\right)$ and mathomatical $\left(X_{2}\right)$; verbal $\left(x_{1}\right)$ and euditomy $\left(x_{3}\right)$; mathemetical $\left(X_{2}\right)$ and auditory $\left(X_{3}\right)$.
b. Significently better, at the . Ol level, then the threemprediotor equation which included the verbal $\left(X_{1}\right)$, methemetical $\left(X_{2}\right)$, and auditory $\left(X_{3}\right)$ variables.
c. Not significantly better than any of the twompedictor equations wich included the interest $\left(X_{4}\right)$ verieble as one of the two predictors.

## French

1. Three-predjetpregution.--rhe three-predictor equation, including the verbal $\left(X_{1}\right)$, mathenatical ( $X_{2}$ ), and auditory $\left(X_{3}\right)$ variables, was shom to be:
combineticma: wothenabicel $\left(X_{2}\right)$ and intereat $\left(X_{4}\right)$; auditory $\left(X_{3}\right)$ and intorest $\left(X_{4}\right)$.

## Germen

2. Three-prentotor equation. --rhe three-predictor equation, including the verbal ( $\mathrm{X}_{1}$ ), mathematical ( $\mathrm{K}_{2}$ ), and auritory $\left(\mathrm{X}_{3}\right)$ variables, was shown to be not significantiy better than any of the two-predictor equations involving combinations of these same three independent veriables.
3. Tour-wrodictor equation.-.-The four-predictor equation, including all of the independent variables,
 threc-predictor equation described above and not significantly better than any of the two-predictor equations.

Relationohips between neacher-Assigned Senester Rarks and the Selocted Hearsures of Aptitude and of Leaminis Achievenent

The teechermassigned semester marks vere converted to their mathematical equivelents, as follows:

$$
\begin{aligned}
& A=4 \text { points } \\
& B=3 \text { points } \\
& C=2 \text { points } \\
& D=1 \text { point } \\
& F=0 \text { points }
\end{aligned}
$$

Pearson product-noment coefticients of correlation were computed betrieen the point equivalents of the tercher-assigned semester rarks and the selected measures
combinations: wabenaticel $\left(X_{2}\right)$ and interest $\left(X_{4}\right)$; auditony $\left(X_{3}\right)$ and interest $\left(X_{4}\right)$.

## Geman

1. Three-predjotor equation. --rthe three-rredictor equation, including the verbal ( $X_{1}$ ), nathemetical ( $X_{2}$ ), and auditory $\left(Z_{3}\right)$ veriables, was show to be not significantly better than any of the two-predictor equations lavolving combinations of these same three independent variables.
2. Eour-predictor equation.--The four-predictor equation, including all of the independent variables, was whom to be not sicutiticntry botton then the threc-predictor equation descrjbed abovo and not sigmificantly betber than eny of the two-predictor equations.

Relationunps between Teacher-Assigned Semester fiaxks end the Selected Roasuros of Aptitude and of Leaming Achievenent

Phe teachermassigned semestor marks were converted to theim mathematicel equivelents, an follows:

$$
\begin{aligned}
& A=4 \text { points } \\
& B=3 \text { points } \\
& C=2 \text { points } \\
& D=1 \text { point } \\
& B=0 \text { points }
\end{aligned}
$$

Pearson productmonent coefficients or comelation were computed between the point equivelents of the tecoher-assigned senester monks onc the selected measures
of aptjtude, as well as between the point equivalonts of the teachermassigned somester marls and the meesures of leaming achievenent in Gponish, Prench, and Geman.

Table KTJI shows the relationships foxad between teacher-assigned senesten maris end leaming achievenent in Spenish, French, and Geman, as neasured by the MITA Copenetive Poreju Inguege Testis, Iorm IA; the respective coefficients of correlation were $.706, .300$, and .336 . Two of the comelations, those for Spanish and French, were found to be significent at better than the . Ol level. This level ncans that in only one case out of one hundred would the comelation be expected to be due to chence ox to sompling fluotuations. The une of Garatt's teminology as a criterion would indicate that the compelations for Spanish and for Fxench denoto a "bigh to very high" degree of reletionship botweon teacher-assigned seneater marks and scores on the measures of leaming achicvernent in Spanish and Prench. The coofficjent of correlation for Geman, however, was described by Gamett as a "low corcelation; present but slight" (I, p, 1.76). It wes not found to be significant et the .05 level, posoibly due in paxt to the suallec size of the populetion of Gexmen students.

Also junicated in peble XIIT are the relationships found between teachermassigned semester marks and the
selected measures of antitude. The corxelations canced fron . 209 to .304 for Spanish from .219 to .363 for French, and from .082 to .484 for German. Gerrett's descriptive labels classify as "low" (1, p. 176) all of the neletionships involving either Spanish or French grades correlated with scores on each of the four aptitude measures. However, for both Spanish and Irench, the conrelations between marks and the mathematical $\left(X_{2}\right)$ variable, as mell as between marks and the auditory $\left(X_{3}\right)$ variable, are significant at the . OL level. For the sane two lenguges the correlations between manks and the verbal ( $X_{1}$ ) varieble, es mall as between marks end the interest $\left(X_{4}\right)$ varable, are significant at the .05 level.

According to Garrett's classitications, there were "substential on manled" (I, p. 176) reletionships involving Coman Exades correlated with the verbal ( $x_{1}$ ) and the auditory $\left(X_{3}\right)$ variables. Accordjngly, the coriesponding coerijeients of correletion were tound to be gighificant ot the .05 level. On the other hand, there wes a "Low" comelation between rades in Gemon and the mathemetical $\left(X_{2}\right)$ varieble; and the correlation between Geman grades and the interost $\left(X_{4}\right)$ variable fell in the category descrived as denoting an "indifferent or negligible relationship" (1, 9.276 ). Neitrer wes found to be sigrificant at the . or level.

## TABEE XISE

REIAMIONSEIPS BETWEEN TEACHER-ASSIGNED SEUTSSTER MARKS AND THE SELECTED ITEASURES OT APTTMUDE AND OF TMARNEMG ACHTEVERENT

| Variables | Coefticionts of Correlation |  |  |
| :---: | :---: | :---: | :---: |
|  | $\begin{gathered} \text { Wi.th Grades } \\ \text { in } \\ \text { Spanish } \\ (N=.205) \end{gathered}$ | $\begin{gathered} \text { With Grades } \\ \text { in } \\ \text { Trench } \\ (\tilde{T}=30) \end{gathered}$ | $\begin{gathered} \text { With Grades } \\ \text { in } \\ \text { German } \\ (N=24) \end{gathered}$ |
| Y | . $706 \%$ | . $300 \%$ | . 336 |
| $\mathrm{X}_{1}$ | . 24.1 * | .219* | . $438^{*}$ |
| $X_{2}$ | . 2918 | . $325 \%$ | . 382 |
| $\mathrm{X}_{3}$ | $.304^{* *}$ | $.363^{* *}$ | . $484 \%$ |
| $\mathrm{X}_{4}$ | .209* | . $274 *$ | . 082 |

stonificent at tho . 05 level.
*Significont at the , Ol level.
Variables:
Y - Leaming arisevenent test
$X_{2}$ - Verbel neasure
$x_{2}-$ Nothenationl meamure
$X_{3}$ - Auditoxy measure
${ }_{4}^{X_{4}}$ - Interest nearure

Relationships betwoen Reccher-Assigned semester maxks
in Spenish and Combinations of lieasures of Aptibude

A coefficient of mutiple conrelation was computed utiliming the two veriables which yielded the highest product-monent coefticionts of comeletion with grades in Spanish. Pertial correletion coefficionts confimed the choice of these two variables as the best. The calculation of an Tarato indicated a .05 level of signtificance por the inclusion of a thind variable. Therefore, another coefficient of multiple correlation was computed to include the two ompinally selected variables as well as 3 third one. Another P-retio indicated that the inclusion of all four variables would not produce a significantly higher coefxiciont of mutiple correlation than was moduced by the combination of three selected varinules. Jhe intercomejetions used in the computatjon of the coefticients of multiple cocrelation are prowented in Table XIV.

Combination of Veriables Two and Three
The coefricient of multiple correlation between teacher-assigned sencster narks in Spanish and a combination of the mathenaticel ( $\mathrm{X}_{2}$ ) and aucitory ( $\mathrm{X}_{3}$ ) variables was .358 . The proportion of vaxiance of teacher-assigned semestex merls in Spanish attributed to the joint action of the to jadepondent variables
was 12.81 per cent. of this amount, 3.55 per cent of the total variance in teachermassigned semester maxks in Spanish was the independent contribution of the second variable (nathenaticel), and 9.26 per cert was the independent contribution of the third variable (auditory). The remaining 87.19 per cent of the variance was attributed to other factors not measured by these two tests. The coefficient of multiple comrelation vas significant at the . Ol level.

## TABTE XIV

ITTERCORTPTATYOTS BETWEEN TEACHTR-ASSIGNTD SEMUSTER MATE TN SPATTSE VTM STRGMO RTASTRTS OF APRTEUDE

$$
(\pi=105)
$$

| Vaciables | Coefficients of Correlation |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{X}_{2}$ | $\mathrm{X}_{3}$ | $\mathrm{X}_{4}$ | Y |
| Wathomaticel ( $\mathrm{X}_{2}$ ) | -• | . $383 \% \%$ | . 003 | . $291 \%$ |
| Auctitory $\left(x_{3}\right)$ |  |  | . 176 | . 30483 |
| Interest ( $\mathrm{X}_{4}$ ) |  |  |  | . 209* |
| Spanish grades (Y) |  |  |  |  |
| *Significant at the . 05 Ievel. |  |  |  |  |

Combination of Varicion ymo. Three, gan Tour The selection of the interest $\left(X_{4}\right)$ varieble as the one to be included along with the methematical ( $X_{2}$ ) and auditory $\left(X_{3}\right)$ veriables was cetemined by partial correlation coefficients. Althong the first variable (verbal) had a higher Pearson product-moment coefficient of correlation with atarks in Spanish, the fourth variable (interest) was found to contribute more sjegnificently to a multiple correlation involvins a combination of three variables. The reason is that there was considerably less overlap involved in the contribution of the interest neasure than was involved in the contribution of the verbal neasure.

The coefficient of multiple correlation between teacher-assigned semester manks in Spanish end a combination of the mathematical $\left(X_{2}\right)$, auditory $\left(X_{3}\right)$, and interest $\left(X_{4}\right)$ variables was $\cdot 397$. The proportion of variance of teacher-essigned seneater menks in Spanish attributcd to the joint action of the theree jndependent variables was 25.76 per cent. Of this amount, 3.55 per cent of the fotal varience in teacherassigned semester memos in Spanish was the jndependent contribution of the second varjeble (mathematical), and 9.26 per cont was the indepentont contribution of the thind variable (auditory). The Rourtin variable (interest) accounted for 2.95 per cent of the totel variance. The
remaining 84.24 per cent of the vaxiance mas attributed to other factors not neasured by these three tests. The coefficient of multiple correlation was significant at the . Ol level.

Relationships between Teacher-Assigned Semester Marks in French and Combinations of Reasures of Aptitude

A coefficient of multiple correlation was couputed utilizing the two variebles which yjelded the highest product-inoment coefficionts of correlation with Erades jn Prench.

Another coefficient of multiple correlation was compten utilizing the tho varimblas whose partial courclation coefinjcients indjeated the posability of a higher coefficient of multiple correlation. The calcuIation of an r-matio then indicated a or level of siguificance for the inclusion of a third variable. Therefore, another coefficient of multiple correlation was computed to incluce three selected variables. Another Pr-matio indicated that the inclugsion of all four variebles would not produce a signilicantly higher coerticient of multiple corpelation then was produced by the combination of three selectod variables.

The intercorrolations used in the computation of the coerticjents of ravinple comelation are presented jin Tadje XV.

Combination of Variedos Two and hree The coefficient of muthple correlation between teacher-assigned semostor hemos th french and a combination of the mathemetion ( $\mathrm{X}_{2}$ ) and auditory ( $\mathrm{X}_{3}$ ) variables was 418 . The proportjon of variance of toacher-assignod sensater norks in French abtributed to the joint ection of the two incependent veriebles was 37.5 per cent. The romaming 82.5 per cent ox the variance was attributed to other factors not neasured by these two tests. The coefficjent of multiple comelation was significent at the . Ol level.

## 

IMTERCORRETABIONS BETWER TEACHER-ABSIGIED SIEESTER hanks in migich ato semmered lmasures Or Arywtude

$$
(i=80)
$$

| Variebjes | Coefricients of Correlation |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{X}_{2}$ | $x_{3}$ | $\mathrm{Z}_{4}$ | Y |
| Lathometical ( $\mathrm{X}_{2}$ ) | $\cdots$ | . 360 ** | -. 038 | .32\% ${ }^{\prime \prime}$ |
| Anditary ( $\mathrm{X}_{3}$ ) |  |  | . 202 | . $363 \cdots$ |
| Intcrest ( $\mathrm{X}_{4}$ ) |  |  |  | .274* |
| Trench eredes ( Y ) |  |  |  |  |

Combination of Variables three and Eour
The coefficient of maltiplo correlation between teacher-assjenod semestec macks in French and a combination of the auditomy $\left(X_{3}\right)$ and interest ( $X_{4}$ ) Tamiables wos .434. The proporifion of variance of tebchermassigned semestex manks in Irenoh attributed to the joint action of the two independent veriebles was 18.8 per cent. Of this anount, 13.1 per cent of the total veriance in teacher-assimed senester mexks in French was the indepencent contribution of the thind variable (auditory), and 5.7 pex cent was the independent contribution of the fourth variable (interest). The Geneming 81.2 pox cont of the vaxionce mas attributed to other factors not measured by these two teats. Ihe coerificient of multiple comelation was significant at the ol Ievel.

Combination of Verjables Two, Three, end Pour The threo variables found to cortribute most sigenfocmtly to a mottiple comeletion were the mathomaticel ( $X_{2}$ ), auditory $\left(X_{3}\right)$, and interest $\left(X_{4}\right)$. veriables. Bach of those three vsriobles hed also produeed a higher pearson product-moment coefficiont of comeletion with markin inench than was produced by the verbal ( $X_{\eta}$ ) measure of aptitude.

The coefficignt of multiple correletion between teachernassigned semester marks on mrench and a combination of the mathenation ( $X_{2}$ ), auditory ( $X_{3}$ ), and intorest $\left(X_{4}\right)$ variables was 490 . The proportion of variance of teacher essigned somester menks in Pronch attributed to the joint action of the three jndependent variables ras 24.0 per cent. Of this anount, 5.2 per cent of the total variance in teacherassigned senester manks in French was the jndependent contribution of the rocond variable (rethomatical), and 23.] pej cent was the indeponcient contribution of the Wird vaidene (Enditory). Whe fourth varieble (intenost) accounted tox 5.7 per cont ot the total variace. The remaning 76.0 per cent of the veriance was attrjbuted to other factors not measured by these three tostis. Tho coefficient of mutiole correletion wos angificent af the ol level.

Relationships between Teacher-Assigned Senester jurks in Geman and Combinabjons of Heasures of Aptitude

A coofficiont of mitiple comrelation was computed ubiliaing the two veriables which yielded tho hignost product-monent coesficients of conredation with grades in Gexman.

Another coefriciont or matiple corcelation was compated ubiliamg bhe two varjomos wobe partaj
correlation coefricients nimicabed the possibility of a higher coefficient of multiple comelation. The calculation of Pratios indicatod that the inclusion of either or both of the renaining variebles would not produce a simificently nigher coefficient of mutiple correlation then was produced by the combination of two selected variables.

The intorcorvelations used in the computation of the coerficients of mitiple correletion are presented Lin Teble XVI.

TABES XVI

 OB Asurue

$$
(17=24)
$$


*Significent at the . 05 Jevel.

Conbination of Veriables one and thuee The coefticient of multhle comelation between teachermassigned somester maxts ju German end $a$ conbination of the verbel. ( $X_{1}$ ) and andjtory $\left(X_{3}\right)$ variables vas .545. The propontion of variance of teachermassigned senester manse in Gemmen atoributod to the joint action of the two independent variables Wes 29.7 per cent. The neneining 70.3 per cent of the verionce was attributed to other factors not neasured by these two testis. The coefficient of multiple comelation was signtionat at the .05 level.
Compatior gevingor my gne mpoo

The coefficient of muttiplo comelation between teachejmassigned semester rablas in German and a combination of the mathematicel $\left(X_{2}\right)$ and anditomy $\left(X_{3}\right)$ veriables was .580 . The proportion of variance of teacher-assigned shester marks jn Geman attributed to the joint action of the two findependent reriebles mos 33.61 per cent. Of this anount, 10.17 per cent oi the total verience in teachemancjgned senester marks in Gemen was the indeperdent contribution of the second variable (nathemationl), endi 23.44 pex cent wes the independent contribution ot the thixd veriable (anditory). The remaning 66.39 pen cent of the variance wes atribubed to owne reubone zot meashred
by these two tests. The coerticient or multiple correlation mas sighinicont at the .05 level.

Frodiotion by ludivipe Regrossion
All of the regression equations which follow are the result of the application of tho besic formula doscribed by Walker and Lev (2, p. 324). This procedure serves to moximize the preajotive power of the indepencoat variables by the assigmont of optisum wotents to them.

Detajled data melative to the vexiebles may be found in Appondix B.
pyediotion of semoston waws in sonish
The mathenation $\left(X_{2}\right)$ and auditory $\left(X_{3}\right)$ veriables appearca to be the sest combination ot two predictors, yiclating a mutiple coreletion coesticient oi . 358 with semester grades in Spenish.

The following is the equation involving the use of the mathematicat $\left(X_{2}\right)$ and auditory $\left(X_{3}\right)$ soore weighta to prodjot semester manks in Spenish:

$$
\hat{Y}=-.18362+.00254 x_{2}+.04341 x_{3}
$$

Rhe wejghts of. 00254 end .0434J indicete the anountis by which the scores on veriables $X_{2}$ and $X_{3}$ must be multipliod in order to give the prediotion of $x$. Prus a prediction of a semestor nemk in Spanish may be nede by
substituting in the regersion equation the krom veluers of $X_{2}$ and $X_{3}$. The standard ermor of estinate of any semoster mark in Spanish preaiotod from the above Commala is ti. 0598 . Mhis means that the chances are about two in three that the norecast of the teachosessigned smester maxi in Spenish will not miss the ectual mank in spanjan by more than $\pm 1.0598$. This stemord error of estinate is the mathemetioal equivalont of plos on minus approxinately one lotter srade.

The nathematical $\left(X_{2}\right)$, audtomy $\left(X_{3}\right)$, and interest $\left(X_{1}\right)$ veriebles appeared to be the best combination of three prodictors, yiolding a mutule correletion coefficient of .397 wh semestor grades in jpanisu. Puxthemore, thore was a .05 level of signifioance foma for the inclusion of the interest ( $x_{4}$ ) veriable.

Phe following is the cquation involving the use of the athenatical $\left(X_{2}\right)$, andiony $\left(x_{3}\right)$, and interest $\left(X_{4}\right)$ seose weights to predict semestor marks in Spanish:

$$
\begin{aligned}
& \hat{X}=-.40748+.00271 X_{2}+.03655 X_{3}+.08673 X_{4} \\
& \text { The wejents of } .00271, .03655, \text { and } .08673 \text { indicate }
\end{aligned}
$$

the mounts by which the soores on variables $X_{2}, X_{3}$, and $X_{4}$ must be multiplied in order to give the prediction of Y. Thas a prediction of a semestex max in Spanish inay be mare by subsut tuting in the regrossion equation the kown values of $x_{2}, X_{3}$, and $X_{4}$. whe sibnderd erxor of
estimate of any semester mank in Spenish predicted from the above formula is $\pm_{1} .0469$. This neans that the chances arc about two in three that the forecast of the teacherassigned semester rark in sperish will not miss the actual merk in Spanish by more then $\pm 2.0469$. This stondard exror of estimate is the nathematical equivelent of plus or minus approzinately one lettor grede.

## Prediction of Screster Marks in Prench

The two variables which yielded the highest Pearson productmoment coefficients of corvelation with grades in French were the mathematical ( $X_{?}$ ) and avditory $\left(X_{3}\right)$ veri...
 A combination of these two variables yicled a multiple correlation coefficient of 418 with sernester grades in French. Hovever, the auditory $\left(X_{3}\right)$ and interest $\left(X_{4}\right)$ voriables appared to be the beat combination of two predictors, yjelajng a mutiple comelation coefficient of .434 with semester grades in French.

The following is the equation involving the usc of the auditory $\left(x_{3}\right)$ and interest $\left(x_{4}\right)$ score woights to predict semestar mank in Prench:

$$
\hat{Y}=-.-1.08923+.06955 x_{3}+.13133 X_{4}
$$

The weights of .06955 and . 23133 indicate the mounts by which tie scores on variables $X_{3}$ and $x_{4}$ muet be multipliod in order to give the pedietion of $Y$. mhas
a prediction of esonctron mank in Frenoh mey be rede oy mbstituting in the rosessame enntion the known venues of $X_{3}$ and $X_{4}$. The stenderd errox of ostinate of any semester maxk in Fronch prodioted pom the above formua is ty. 4.457 . phas means that bue chenoes are about two in three that the forocest of tho teacherassigned senestor memk in monch vinl not miss the actual maw in mpench by more than t1.1457. Rois standand exor of estimate is the mathenatical equivajent of plus or minus onpoximetely one lotter grede.

The methonticat $\left(X_{2}\right)$, exditoxy $\left(X_{3}\right)$, and interest $\left(X_{4}\right)$ umienles eppeared to be the best combinetion of thee mediotors, yioluing a matiple comelation coefficient of 490 with scmester grades in french. Furthomore, there was a ol lovel of sigoificance found for the inolusion of the mathondical. ( $X_{2}$ ) variable. The following is the equation involving the use of the mathometion $\left(X_{2}\right)$, and tory $\left(X_{3}\right)$, and intemest $\left(X_{4}\right)$ scone weignts to probjot semestea mex in fronch:

$$
\hat{Y}=-1.82788+.00309 x_{2}+.05099 X_{3}+.14141 X_{4}
$$

The meishts of , 00309, .05099, and . 24141. 4 indicate the amounts by which the scores on veriables $X_{2}, X_{3}$, and $x_{4}$ must be multiplied in order to sive the prediotion of V. thus a probiotion of a senoster mank in prenoh mey be made by sidbsththine in the repession equation the
knom values of $X_{2}, X_{3}$, and $x_{4}$ the btondard extor of estimato of ary senestew merk in wench predioted from the above formula is $\pm 1.1155$. Mma mems that the choncoa are about two in three that the gorecast or the toacherassigud gonoster mask in Exomen mill not mjess tho actuat nexk in Exenols by mose than tu, 1195. Ihis standoxd exror of estanato is the moneration equivalont of plus on rimus appoxinately one lottor grode.

## Froniotion of Sonester Gerkg in German

The two vaxiables which yielacd the highest poarson productmonemt coeffocients of comelation with grades in Coman whe the ymber $\left(x_{1}\right)$ and andtory $\left(x_{3}\right)$ watenton, with coerchatents or 438 and 4.34 , werpacively. A ocmbuntion of theso two variebles yielded a matiple comelation coefficionts of . 545 with senester grades in Gorman. However, the mathemajical ( $X_{2}$ ) and avajtory $\left(X_{3}\right)$ watiables eppeared to be the best combination of two predictors, yielding a multupe onmelation coocricient of .580 with somester greders jan ceman.
tho following tis the equation involving the use of the mathenatical $\left(x_{2}\right)$ and anditory $\left(x_{3}\right)$ score weights to predict somoster mexks in Germen:

$$
\hat{Y}=-2.20558+.00295 \mathrm{X}_{2}+.07560 \mathrm{X}_{3}
$$

The weights of . 00205 and .07560 jndicato the

be muldiplied in onder to aive we porisution of $Y$. Thus a predjotjon of a semester mark in Gemman may be mede by substituting in the regreasion equation the known values of $X_{2}$ and $X_{3}$. The standard error of estimate of any memestex mark in Geamen predioted from the above formula is $\pm .7742$. Thia means that the chances are about two in three that the forecast of the teacherassigned semester mark in Gexman will not miss the aotual. maxk in Geyman by more then $\pm .7742$. This standard error of estinate is the mathematical equivalent of plus or minus slighty less than one letter grade.

The calculation or r-intion indicated thet the inclusion of either or both of the Gomeining variobles would not produce a significantly highor coerficient of multiple correlation then was produced by the combination of the nathematical $\left(X_{2}\right)$ and auditory $\left(X_{3}\right)$ variables. Additional Combinetions of iptitude Measures Correlated
with Senester Maras

With regerd to the mantiple prediction of teacherassigned semesten marks, it seemed to be of possible finterest to nake various other computations which were not specifically required to test the hypotheses Comulated for the study. The result was that additional maltiplempredictor combinations were found to be of significance.

1. Spanisa. -- Tn addition to the best conongtion of two variables ( $X_{2}$ and $X_{3}$ ) and the best conbination of three vaxiables $\left(X_{2}, X_{3}\right.$, and $\left.X_{4}\right)$, the following conbinations were found to be significant at the . ol level:
a. Verbal $\left(X_{1}\right)$ and nathenatical $\left(X_{2}\right)$, witr a multiple correletion coefriciont of 307 with senester morks in Spanish.
b. Verbal ( $X_{1}$ ) and auditory ( $X_{3}$ ), with a multiple conrelation coefficient of .337 with senester marks in Spanish.
c. Vorbel ( $X_{1}$ ) and interest $\left(X_{4}\right)$, with a multiple concelution coerficient on .310 with semester marks in Spanish.
d. Matheratical $\left(X_{2}\right)$ and intorest $\left(X_{4}\right)$, with a multiple correlation coefficient of. 357 with semester maxiss in Spanish.
e. Auditory $\left(X_{3}\right)$ and interest $\left(X_{4}\right)$, with a moltiple correlation coefficient of .343 with senester marks in Spanish.
f. Verbal $\left(X_{1}\right)$, mathomatical $\left(X_{2}\right)$, auditory $\left(X_{3}\right)$, and interest $\left(X_{4}\right)$, with a muldiple correlution coefficient of . fol with semoster marks in Sponish.
2. Erench. .-In adation to the best combination of two verimbles $\left(X_{3}\right.$ and $\left.X_{4}\right)$ and the best ooribinetion
of three varianles $\left(X_{2}, X_{3}\right.$, and $\left.X_{4}\right)$, one other combi.. natjon of variebles $\left(X_{2}\right.$ and $X_{3}$ ) hes alrecty beon reported. In addition to these, the following ombinations were found to be significant at the . O1 level:
a. Verban $\left(X_{1}\right)$ and mathenatical $\left(X_{2}\right)$, with a multiple correlation coofeicient of 3.31 with semester marks in Trench.
b. Verbal ( $x_{1}$ ) and auditory $\left(X_{3}\right)$, with a mutiple correlation coefficient of .377 with semester marks in Fronch.
c. Verbal ( $X_{1}$ ) and interost ( $X_{4}$ ), with a multiple correlation coefficient of .342 with semosten mands in mrench.
a. Mathembtat $\left(X_{2}\right)$ and interest $\left(X_{4}\right)$, with a multiole cormelation coefficiont of .433 with semestor merts in Prench.
3. Gemen. -a.In addition to the best combination of two variables $\left(X_{2}\right.$ and $\left.X_{3}\right)$, one other coubination of variebles $\left(X_{1}\right.$ and $X_{3}$ ) has alreedy been zeported. In addition to these, the following combinations were found to be significant at the . OS level:
a. Verioal $\left(X_{1}\right)$ and mathenatical $\left(X_{2}\right)$, with a multiple corcelation coeftioient of . 504 with semeater grades in Geman.
b. Anditory $\left(X_{3}\right)$ and interost $\left(X_{4}\right)$, with a multiple correlation coeftioieat of .493 with semester grades in Coman.
o. Verbal ( $\mathrm{X}_{1}$ ), mathemetionl ( $\mathrm{X}_{2}$ ), and aditory $\left(X_{3}\right)$, with a multiple corelation coefficient of .601 with somestex graden in German.
d. Vorbal $\left(X_{1}\right)$, mathematical $\left(X_{2}\right)$, auditory $\left(X_{3}\right)$, and intorest $\left(X_{4}\right)$, with a matiple correlation coefficient of .615 with semester grades in Geman.

## sumaty

This chavter is swnarized with rofenence to the hyporinoses prosontod in Choptoet.

## Hypothesis One

1. Spanich. -The celationships described below are those which were found between lamaing achievenent in Spenish, as measured by the wh - Cooreretive Foreign Iancuare Test, Form IA, nd each of the denignated measures of aptitude.
a. There was a corcelation of .afo with verbat ability as detemined by tho Scholnstio Aptitude Tegt. As categorized by Garaett, this would indicate a "low" roletionship between the meesures, although the coreclation coefficiont was Iound to be sigater icant at the ol level. Whe standard error of
estimate for any Spanish score predicted from a verbal score was $\pm 31.576$.
b. There was a corretation of .172 with methematical ability as detormined by the Scholastic Aptitude fest. According to Gercett, this would indicate an "inüilferent or negligible" relationship between the messures. The comelation coefficient was not large enough to be of significance at the .05 level. The standard error of estimate for any eny Spanish score predicted from a mathematical score was $\pm 32.401$.
c. There was a comolation of . 230 with auditory ability as detominea by the appropriate perts of the Pimgreur Iengrage Aptitude Batery. According to Garrett, this would indicate a "low" or "slight" relationship between the measures, although the correlation cocfficient was found to be significant at the .05 level. The standard exror or estinate for any Spanish score predicted from an auditory score was $\pm 32.021$.
A. There was a correlation of .373 with interest as deternined by the appropriate part of the Pinsleur Irnguage Aptitnde Battory. As categorized by Gaxcett, this would indicate a "low" relationshjp betwoen tho measures, although the
corcelabion coefficjent was found to be wigntioant at the .01 level. The standard onfor of ostimate Pox any Spanish score predicted from an intorest scone wes $\pm 30.514$.
2. Prench. ....The relabionships descxibed belou are those which were found between leaming achievemont in French, as measured by the Wit - Cooperative Jopeig Sanguase Test, Form IA, and each of the aesignated moasures of aptitude.
a. There was a comrelation of . 207 with verbal ability as detemined by the Scholastic Aptitude Test. As categorized by Garocto this would indicate a "low" nolationship botweon the meesures. The correlation coerticient was not Jame enough to be of significance at the . 05 level. The standard exror of estinate for any Tronch soore predicted from a verben score was $\pm 37.836$.
b. There was a corcelation of .299 with rathematioal ability as detorminod by the Soholastic Aptitude Test. Acoording to Gercett, this would indicate a "low" or "suight" relationship between the measures, whough the correlation coefficiont was found to be sighificant at the ol level. the standard error of estinate for any imench score predioted fron a mathenatical soore was $\pm 35.898$.
c. There was a correlation of .322 with cuditory ability as daternined by the appropriate parts of the Pimgleur Lancuase Aptitude Battery. According to Garrett, this would indicate a "low" relationship botwoen the reasuses, although the correlation coefficiont was found to be of significance at the . Ol level. The standard error of estimate for any Trench score predicted from an auditory score was $\pm 36,612$.
d. There was a correlation of .269 with interest as determined by the appropriate part of the Pimgleur Thmgage Aptitude Bettery. As entegralzed by coxrett, this would incicate a "low" relationship between the measures, although the correlation coefficient was found to be significant at the .05 Ievel. The standard error of estimate for any French sone predicted from an interest coore was 1 27.248.
3. German.-. The relationchips described below are those which were foun between leaming achievement in Geman, as measured by the MA - Cooperative Poreigh Ianduage Test, Boxm LA, and each of the designated noasures of aptitude.
a. There was a correlation of .179 with verbal ability as detomined by the Scholestic Aptitude Test.

As cetegrized by Garett, thas would indicate an "jndifeerent or negligible" reletionskip botwaen the moasures. The coefficient of correlation was not lerge enough to be significant at the .05 level. The standard error of estimate for any Geman score predicted from a verbel scone was $\pm 21.073$.
b. There was a cortelation of.- .224 with mathematical abilitity as determined by the Scholastje Aptitude Test. According to Garrett, this would indicate a "low" relationship between the measures. the coefficient of correlation wes not large enough to be sigutficant at the .05 level. The standard error of estimate for eny Geman score predjeted from a mathomatical score was $\pm 20.876$.
c. There wers a correlation of .157 with auditory abjility as determined by the appropriate parts of the Pinsteur Ienguge Aptituae Bettery. According to Garrett, this would indicate an "indifferent or negligible" rolationship betueen the neesures. Ine cooficient of correlation was not laree enough to be signipicant at the .05 level. Ihe standard ecror of estinate for any Germon score predicted from an anditory score was $\ddagger 2 l .156$.
d. There was a correlation of $\cdots .038$ with interest as aetcmined by the approprjate part of the Pimstour Tangrage Aotitude Eetbery. Ais
cotegorized Dy Gacmet, thin would indicate an "indiffenent on nogligible" relationship between the meesures. The coefficient of correlation was not jarge enough to be gignitionat at the or hevel. The atendard emon of estimete for any Geman score predioted from an interest score was t21.404.

## Hypothesis Two

I. Spanjsh. .- The relationghips described botov are those which wrove found bobveen levrning achievenent in Sponish, as meesumed oy the MTA - Coopenetjve Foreign Languere feat, Form LA, and each of the designated combinetions of aptitude nendmes.
a. The coefticient of multiple correlation with vexual and mathenatical abilities was .281. The proportion of totel variance explained by these two veriables was 7.88 per cent.
b. The coefficient of mutiple correlation with vervel and auditory abilities was .31.3. The proportion of totel variance explained by these two variables was 9.3 per cent.
c. Iline coefficient of multiple comelation with verbol ability and student interest wes . 453. Whe proportion of total verrience explained by these two variables vas 20.5 per cent.
d. The voofficiont of arbente comelation with mothenaticel and auditory abilitios vas $.24 \%$.

The proportion of total variance explained by these two variables was 6.l per cent.
e. The coefficient of maliple corrolation with matheratical ability and sthdent interest was .410. The proportion of totel variance oxplained by these two variables was 16.8 per cent.
I. The coefficjent of wultiple correlation with auditory ability and student interest was 409 . The proportion of totel veriance explained by these two variables was 16.7 per cent.
g. The coefficient of multiple correlation with verbal., mathenatical, and auditory abilities was . 314. The proportion of tolvel variance explained by these three variables was 9.84 per cent.
h. The coefficient of riultiple correlation with the verbal, mathenatical, aucitory, and interest Variables was .AGI. The proportion of total variance explained by these variables was 21.24 per cent.

There wes found to be a . O1 level of significance for all except one of the iaultiple correlation coefficients involving combinations of aptitude measures correlated with Spanish achievement. A . 05 levol of signjficonce was found for the coofficient of .247 involving mathematical and auditory abilities correlated with Spanisin achieverent.
2. Erench. .-. The rolationanips described below axe those which were found botwon lomening ackievenent in Fronch, as moacurod by the MbA ... Cooperative Foreign Lanouare Test, Fomm IA, and each of the designatiod combinations of aptibude measures.
a. The coefficiont of muthole correlation with verbel and mathonetice 1 abilities was .305 . The proportion of total variance explained by these two variables was 9.32 por cent.
b. the coefficient of multiple correlation with verbol and auditory abilities vas. 339 . The peportion of total veriance expleince by these two variandos was 11.47 per cont.
c. The coefficjent of mulitiple correlation with verbal ability and student interest was .331. The proportion of total varience explained by these two variablos was 10.9 per cent.
d. The coefficient of mutiplo correlation With madhemetical and auditory abilities was . 377 . The proportion of totel variance expleinod by these two variables ves 14.2 per cent.
e. The coefficient of multiple correlation with mathematical abinity and student interest was .410. The proportion of total variance explatined by these two varjables was 16.8 per cent.
f. The coefficient of matiple correlation with audjtory abjility and stradent interest was ,400. The proportion of total variance explainea by these two variablea was 16.0 per cont.
g. The coefficient of maliple correlation with verbal, mathematical, and auditory abilities was . 378. The proportion of total variance explained by these three variables was 14.26 per cent.
h. The coefficient of maltiple correlation with the verbal, mathematical, auditory, and jaterest variables wes .455. The proportion of total variance explained by these variables was 20.67 per cent.

There was found to be a . Cl level of significance for all except one of the multiple correlation coetficients involving combinations of aptitude measures corvelated with French achievement. A . 05 level of significance wes found for the coefficient of .305 involving verbal and mathematical abil.ities correlated with French achievement.
3. German.-..The relationstips doncribed below are those which were found between loarring achiovement in German, as measured by the MTA - Cooperative Roreign Languase Test, Porm LA, and each of the designated combinations of aptitudo measures.
a. The coefrioinnt ot matiple corzolation with verbal and rowhomaical abilitjes was $\cdot 350$. The proportion on total vaxiance explained by these two veriablen wes 12.3 per cent.
b. The cooficient of multiple correlation with verbal and auditory abilities wes .199: The proportion of total veriance explained by these two variables was 3.96 per cent.
c. The coofficient of mutiple correlation with vorbal ability and student interest wes .188. The paportion of total variance explained by these two vaxjeoles was 3.5 per cent.
d. Ihe coufficiont or multape comelation with mathenaticel and avaitory abjuties wes .293. The proportion of total variance explained by these two veriables was 8.6 pec cent.
e. the coefficient of multiple coxrelation with mathenationl ability and student intexest was .239. The proportion of totel variance explained by those two variables was 5.7 per cont.
f. The coefficient of multiple correlation with auditory aility and student interest was . 160 . The proportion of total variance explained by these two variables was 2.6 pec cent.

ह. The coofficiont of muthole comrelation with verbol, nathomaticel, and ouditory abilities
vas . 360 . The proportion of totel vaxjance explained by those three varis ab? ves 22.96 par cent.
h. The coefficient of multiple corcelation with the verbal, nethenatioal, anditory, and interest variables was. 302. The propontion of total variance explajned by these variables wes 14.58 per cent.

The findings were nonsignjificent in regard to the combinetions of aptitude measures comelated with German achievement.

## Hyoothosis rimee

1. Spanish. - mhe relaticnghips described belon are thone mich were found botwean teachor-asstigned semostes marks in Spanish and each of the desjoneted meanures of aptitude or achievement.
a. There was a corcelation of .706 between Spanish grades and the measure of Suenish achievoment. According to Garrett, a cocfficient of this size would indicate a "high" relationship between the two variables. The corrolation coefticient was found to be sjegificant at the . OI level.
b. Ihere wes a correlation of . 241 betwoen Spanish gredes and verbal ability. According to Garrett, a coefficient of this aize muld indicate a "Tow" or "shicht" reladionsinin. The comelation
coefficiont was roma to ho aignifiomit at the .05 level, however.
c. There was a correlation of . 291 between Spanish grades and retheratiobl ability. Aocording to Garrett, this mould indionto a "low" relationship, although the coeftioiont of corcelation was found to be significant at the ol level.
d. There was a correlabion of .304 between Spanish grades and andiowy abilituy According to Garrett, this would indioate a "low" relationship. However, the coefficient of correletion was found to be significant et the ol lovel.
e. d'here was ancolation of . 209 between Spenish grades and student interost, Garrett labels a coeficiciont of this sive as an indication of a "low" relationship. However, the correlation coefticient was found to be significant at the .05 level.
2. French....The reletionships described below are those which were found bolwoen teecher-ansigned semester marks in French and oach of the deaignated neamures of aptitude or achievenont.
a. There was a comelation of, 800 between French crades and tie measure of French achievement. According to Gexrett, a coetpicient of this size would indicate a "high" relationship between the two variables the comelation coofficient was
accordingly found to be of signikjence at the . 01 level.
b. There wes a correlation of .219 between Trench grades and verbal abjlity. According to Garrett, a coefficient of this sire would incicate a "low" or "slight" rolationship. The correlation coefficient wes significent at the .05 Ievel.
c. There was a corcelation of .325 between Prench gredes and mathematical ability. According to Gerrett, this would indicate a "low" relationship, although the coefricient or correlation wes found to we sigmiticent at the . Ol lovel.
d. There was a comelation of .363 hetween French grades and auditory ebility. Acoording to Garcott, this mould indicate a "low" relationship. However, the coefficient of corrolation was found to bo ajegnificent at the . Ol level.
e. There was a correlation of .274 between French grades and student intorest. Garrett labels a coefficient of this size as an indiertion of a "Low" relationshi.e. Ifowever, the corrolation was found to be signiricant at the .05 level. 3. Cexmon.-.-The rolationships doscribed below are those which were found betwen teacher-assigned scrnoster
grades in German and each of tho destenated measures of aptitude or achievement.
a. There was a corcelation of .336 between German grades and the measure of Gemen achievement. According to Gerrett, a coefficient of this size would inaicate a "low" relationship between the two variables. The correlation coefficient was found to be nonsignificant at the .05 level.
b. There was a correlation of .438 between German grades and verbel ability. According to Garrett, a coefficient of this size would indicate a "substantial or marked" relationship. The correlation coefficient was found to be significant at the .05 level.
c. There was a correlation of .382 between Geman grades and mathematical ability, According to Garrett, this would indicate a "low" relationship. The correlation coefficient was found to be of no significance at the . 05 Ievel.
d. There wes a correlation of .484 between German grades and auditory ability. According to Gerrett, this would indicate a "substantial or marked" relationship. The correlation coefficient was found to be significant at the .05 level.
e. Thore was a corretation of .082 botweon German grades and stwaent interest. Gerrott labola a coefficient of this size 20 an indication of an "indifferent or neglietible" relationship. The correlation cocfficient was Tound to be nonsigrif.. icant at the .05 level.

## Hypothegis Poux

The relationships described below are those which were found between teacher-assigned senester marks in each modern forejgn language and corbinations of the best predictors of such evaluations of learning aviongmen in tho lonsuate.

1. Spanjig. -According to product-moment as well as partial correlation coefficients, the best predictors of Spanish marks were the mathematical $\left(\mathrm{K}_{2}\right)$ and auditory $\left(\mathrm{X}_{3}\right)$ variables. The coefficient of multiple correlation between Spanish grades and a combination of the independent variables, matheratioal ( $X_{2}$ ) and araditory ( $X_{3}$ ), ves .358. The proportion of total varience explained by these two independent variables was 12.81 per cent. The addition of the interest ( $X_{4}$ ) variable to the combination of predictors resulted in a maltiple correlation coefficient of .397. The proportion of total variance explained by the thrce independent variables, mathematical ( $X_{2}$ ), auditory $\left(X_{3}\right)$, and intorest $\left(X_{4}\right)$, was 15.76 per cent.

Both of the multiple correlation coefficionts were significent at the ol level. In addition, the theepredictor combination was found to be significentiy better, at the .05 level, than the twompredictor combination.
2. French.-Acoordine to product-monent coefficients of correletion, the best predictors of grades in French were the mathematicol $\left(X_{2}\right)$ and auditory $\left(X_{3}\right)$ variables. The coefficient of multiple corretation between French grades and a combination of the independent voriables, matheratical $\left(X_{2}\right)$ and auditory $\left(X_{3}\right)$, ves . 418. the proportion of total verjonce expleined by these two variables was 77.5 per cent. However, the bost predictors as revealed by partial correlation coefficients were the auditory $\left(X_{3}\right)$ and interest $\left(X_{f}\right)$ variables. The coefficient of multiple correjation between French gredes and a combination of the independent varjables, auditory $\left(X_{3}\right)$ and interest $\left(X_{4}\right)$, was . 434. The proportion of total varience explained by these two veriables was 18. 3 per cent. The addibion of the nathematical ( $X_{2}$ ) variable to the latter combinetion of prediotors resulted in a multiple correlation coefficient of .490 . The proportion of total variance expleined by the three independent veriables, matienatical $\left(X_{2}\right)$, auditory $\left(X_{3}\right)$, and interest $\left(X_{4}\right)$, was 24.0 per cent. Alt three of the
multiple correlation cocffcjonts were significant at the . 01 Jevel. In addition, the wree-predictor combination was found to be significanty letter, at the . Ol level, than the two predictor combination of the auditory ( $X_{3}$ ) and interest $\left(X_{4}\right)$ variables.
3. Geman.-..Acconding to productmoment coefficients of correlation, the best prodictors of learning achievenent as revealed by grades were the verbal ( $X_{1}$ ) and auditory $\left(X_{3}\right)$ variables. The coefficient of multiple correlation between German grades and a combination of the independent variables, verbal ( $\mathrm{X}_{\mathrm{l}}$ ) and auditory ( $\mathrm{X}_{3}$ ), was .545 . The propontion or totel varisnce explaind by these two independent variables was 29.7 per cent. According to partial correlation coefficjents, the two best predictors were the mathematical ( $\mathrm{X}_{2}$ ) and auditory $\left(X_{3}\right)$ variables. The coefficiont of multiple comelation between Gexnan grades and a combination of the independent variables, methenatical $\left(X_{2}\right)$ and auditory $\left(X_{3}\right)$, was .580 . The proportion of total variance explained by these two independent veriables wis 33.61 per cent. Both of tike coefficients of multiple correlation were found to be significant at the .05 level.

## Adattional Tinbings

For each language, sevoral adātional multiple correlation coefficients were conputed in order that
a report might be mado of the wolvionving botween toachor-assigned semestor marks and various other possible combinations of the selected eptitude measures. A listing was made of those found to be sigmificant at the . 01 end . 05 levels.

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## CHAPGER V

## SUMPARY, CONCLUSTONS, AND IMPEICATTOMS

In attompts to prodict language achievement, investifators have considered a number of factors, incluang intelligence, verbal and mathematical abilitios, gredes in other subjects, auditory ability, robe nomorization ability, interestr, and motivation. A review of the literature releten to language achievonent grediction revealed that thore his clearly been a
 for investigation. Intelligence and veroal ability are the areas which heve been most thoroughly investigated. Foye rocently, auditory ability has been looked upon as one ol the mont promising factoxs Eon prognosis of success in seocnd-language leaming, espocially in view of the evidence that much of the variance in foreign language achiovoment remuins to be exploined.

This study was an attompt to determine the value of the use of selocted aptitude test scores for prodioting a studont's Learning achievonent in Spanish, French, or Gomen at Nowth Texas Stete University. In order that an investigation might be made of the
 these languages and the selectod measures of aptitude, standardized achievenent tests vere administered to all chasi sections of Sponish 101, French 101, and Gemen 1.01 at North Texas State Univenojty, Although teachexassignod semester monks were used as one way of evaluating achievoment, the primexy criterion measures of learning achievernent in the three longuages were the MLA Cooperative Foreion Innurge gosts, Forn IA. These tosts wore administered in Docember, 1970, after students had received one semester of instruction. These same students had earlier been terted and scoced on the autitory and
 In edution, thore were available the studentis' verbal and mathenatioal scores on the Scholastic Aptitude Test. Data were complete for 105 first-semester freshmen in Spanisf 80 firgt-senester frosbmen in French, and 24 firstsenester freshmen in Ceman.

Soparete data for each larguace were treated stetistically to derive the following:
I. Productimonent coafficients of correlabion between the selected measures of aptitude and the measure of loaming sohievement.
2. Coefficients of mutiple correlation between the measure of leaming achievement and combinations of the selected measures of aptitude.
3. The proportion or marimen of a meesure of Jearning achievenent atmantan to the joint action of the selected measures of aptitnde, including the proportion of variance axplaisw by each.
4. Partial coerticionts of corrolation used in the construction of regession equations for the predictjon of scores min modure of leaming achievenent.
5. Product-moment coofficicrts of correlation between teecher-assignod seaester mams and the measure of learning achievenent.
6. Froductmonent coeficients of correlation between towner-assignod sonestor mants and the selected measures of aptitude.
7. Coefficients of mitiple correlation between teacher-assjegned senestor narks and combinations of selected moasures of aptitude.
8. The proporition of variance of teacherwassigned semester marks attributembe to the joint action of selected measures of aptitude, including the proportion of variance expleinod by each.
9. Partial coetricicats of comelation used in the construction of receession equations for the prediction of toacher-assigned semester marks.

Sumemy of Bigutiocht Findings
The rollowing ere the moth significent findings oit this study:

1. The Pearson productmonent coofeiciont of correlation was .706 betreen teacher-assigned semester marks and learnjig achievement in Sponish, as rossured by tho MIA - Coonerative Foreign Lamere Rest, Porin IA. This comelation coefficient is significant at better then the ol lovel and would indicate a hach relationship betwon tho variables.
2. The Pearson productmonent coefficient of
 wants and leaming achieveront in French, as measured by the MA - Coopergive Toneign Lancuage Rest, Pom LA. phis comrelation coeticient jis significant at botter than tre . Ol level and would indicate a high rolationship bobveen the veriables.
3. The Powston productwnomen coeflicient of compelation between the criterion neasure of leaming achievenont in spansh ond the neasure of verbal abilitty was .280 , and the Fearson procuctmanent coefficient of corrolation was .373 botween the criterion neasure of leaning achievenent in Spanisin and the reasure of studant interest. Both of these correlation coefficicnts wore sigationat at wetter than the ol level.

The productmoment comelation coefficient of .230 between the criterion measure of learning aohievencnt in Spanish and the measure of auditory ability was significent at better than the .05 level.
4. The Pearson prownctmonent coefficient of correlation between the criterion neasure of leaming achicvencat in French and the measure of auditory abili.ty was .322, and the Peerson productmonent coefficient of corcclation was . 299 between the criterion moasure of learning achiovement in lirench and the measure of mathematical abjlity. Both of these corrclation coefficients were sighificont at bettor than the . 0.1 level. whe proubutwonent correlation coefticjent of . 269 between the criterjon measure of leaming achievenent in arench end the neasure of stakent interests was found to be sjegnjetionnt at better than the .05 Ievel.
5. The Pearson product-moment coefficients of correlation betweon feacher-assiged screster marks in Spanish and each of the neesures or mathenatical and auditory apilities were .291 and .304 respectively. Bach was significant at botter then the . Ol level. The product-monent cocflicjeats of correlation between Spaish grades and each of the reasures of verbal ability and student intorest wore .241 and .209 respectively. Bech was significent at bettex than the .05 level.
6. The Pearson woductmonent coefficientis on corcclation botween teacher-assicned semoster narks in Fronoh and each of the measures of methematical and aund.tory abiJitien were .325 and .363 respectively. Tach was sjecrificant at better than the .OI Jevel. The product-moment coefficjents of correlation betveen Fronch graces and each of the neasures of verbal abjility and student interest wexe 2219 and .274 respectively. Both were significant at the .05 level.
7. The Pearson productmomont coefficients of cocrelation between toacher-assigned senester marlss in German and each of the neasures of verbal and auditory abilitios woce 438 and .484 respectively. Dach mas sjignilicant at better than the .05 level.
8. The coefticient of muttiple corcelation was .453 between the cxiterion neasure of leaming achievenent in spanish and the combined measures of verbal ability and student interest. The proportion of the variance of a measure of leaching achjevenent in Spanish attributed to the joint action of the measures of verbal ability and stucuent interest was 20.5 per cent. The coefficient of rultiplo corrolation was . 461 betwoen the criterion measure of leaming achievement in Spaisish and the combinod measures of apl of the tndependent variables: verbal, mathonatical, auditory, and interest. The
proportion of the variance of a measure or learaing achievenent in spanish attributed to the joint action of these four veriables wiss 21.24 por cont. Both of these coefficients of multiple oocrelation were found to be significant at better thea the ol level.
9. The coefficient of aultiple correlation between the criterion measure of leaming achievenent in Prench and the independent variables, mathematical and interest, was .410. The proportion of the variance of the criterion moasure of learning achsevenent in Frcach explained by these two independent veriables was 26.8 por cent. The coefficient of multiplo comelatina was 455 betwen the criberion neasure of learnong achievement in Wrench and the three independent variebles: matheratical, auditory, end interest. phe proportion of the varionce of the exiterion neasure of leaminy echiovement in French attributed to the joint action of these three independent variables was 20.67 per cent. Both of these coefficients oil muttiple correlation were found to be sigailifoont at better then the .03. lovel. The use of all four independont variables yielded the sane coefficient of multiple correlation as was found for the combination of the three variables: mathenatical, auditory, and interest.
10. The coeracient or matizale correlation betweon teacher-assigned semester narks in Spanish and a combination of the mathonetical and auditory measures was .358. Tho proportion of the vartance In Spanish grades explained by these two variables was 12.81 per cent. The addition of the interest veriable to this combination of prodictors resulted in a multiple correlation coceficients of .397 and raised the proportion of total variance eaplained by known factors to 15.76 per cent. Both of these coeflicients of multiple correlation were found to be signjficant at better then the , ol level. Min inctusion of all four incopondent veriebles in the correlation with Spenish grades resulted in a hjegner matiple correlation coofficient of 4.01 , also found to be gicnificont at better than the . OI level, although not signifj.cantily higher then the coefficient of .397 produced by the three--variable combination.
11. The coefficicnt of nut.tiple correlation between teacher-assigned semester marks in Prench and a combination of the acitory and interest measures wes .434. The proportion of the variance in Prench grades explained by tirese two variables was 3.8 .8 per cont. The addition of the mathematical vactable to this conbination of preatotors resulted in a mitinte corrolation
coefficient of, 490 and reised the proportion of total variance explained by knom faotons to 24.0 per cent. Both of these muthale cormelaton coefficienta were found to be sigaificent at better than the . OL level.
12. The coefficiert of multiple corcelation botwon toecher-awsigned semester marks in German and a ombination of the methemetical and auditory neasures was 0580 . The proportion of the varjance jn German grades explained by these two neasuren was 33.67 por cent, and the multiplo correjation coerficient wes found to be significant at bettor then the .05 lovel. Also found to he sisnjeicant at this level woce two higher multiple corrolation coeficients: .601 betweon Gomen grades and a combination of the varbat, mathomatical, and wudjtory variables; and . 615 boween Gemman grades and all four independent varoables. Neither wes sicrificantly higher, however, than the coefficient of .580 produced by the twovaidolo combination of rathenetioel and auditory roasuros conrelated with Geman grades.

Frediction of Achievement as Measured by a Standerdized Test

## Spanish Achievenent Predictions

Of the conbinations with two predictor variables, the combination of the verbal and intenest measures
produced the most accurate predietion of spanish learning achiovenent as measuxed by a standardized test. The rultiple regression equation giving the score weighta to be attached to theso two independent variables, verbal ( $X_{1}$ ) and interest $\left(X_{4}\right)$, was:

$$
\hat{Y}=30.78+.09 X_{1}+5.16 X_{4}
$$

The standard error of estinate was $\pm 29.46$. When the four indopendent variables, verbal ( $X_{1}$ ), nathematjeal. $\left(X_{2}\right)$, anditory $\left(X_{3}\right)$, and interest $\left(X_{4}\right)$, were combined to predict spanish learning achievement as measured by a standaraized test, the suitiple regrossion equation was:

$$
\hat{Y}=23.88+.07 X_{1}+.01 X_{2} \cdot .48 x_{3}+4.97 X_{4}
$$

grae stondard orme of ostimete wa: $\pm 23.62$.

French Achieverent Predictions
OI the conbinations with two predictor variables, the combination of the mathematioal and interest measures produced the most accurate prediction of French Ieaming achievenent as measured by a standardized tost. The multiple regression equation giving the score veights to be atteched to these two independent variablos, wathenatical ( $\mathrm{K}_{2}$ ) and intorest ( $\mathrm{X}_{4}$ ), was:

$$
\hat{y}=10.48+.12 X_{2}+4.71 X_{4}
$$

Ihe standard error of estimate was $\pm 35.50$. When the four independent variables, verbal ( $X_{1}$ ), nathenatical ( $X_{2}$ ), auditowy $\left(X_{3}\right)$, and intorest $\left(X_{4}\right)$, were oonbined to predjet

French learning achievement as measured by a stendardized test, the multiple regression equation was:

$$
\hat{Y}=-31.71+.00 X_{1}+.09 X_{2}+1.33 X_{3}+4.30 X_{4}
$$

The standard error of estimate wes $\ddagger \mathbf{3 5} .12$. It should be noted that in the four-predictor combination only three of the variables actually made a contribution, as the verbal $\left(X_{1}\right)$ measure was discounted in the regression equation.

## German Achievement Predictions

None of the regression equations can be recommended, since a.ll findings were nonsignificant with regard to coofficienta of maliple cofrelation cetwoen aptitudemeasure combinations and German learning achievement as measured by a standardized test.

Prediction of Teacher-Assigned Semester Marks

## Spanish Grades

The mathematical ( $X_{2}$ ) and auditory ( $X_{3}$ ) variables appeared to be the best combination of two predictors. The multiple regression equation giving the score weights to be attached to these two independent variables was:

$$
\hat{Y}=-.18362+.00254 \mathrm{X}_{2}+.04341 \mathrm{X}_{3}
$$

The standard error of estinate was $\pm 1.0598$.

The mathematical $\left(\mathrm{x}_{2}\right)$, euditory $\left(\mathrm{X}_{3}\right)$, and interest $\left(X_{4}\right)$ variables apporred to be the best combination of three predictors. The multiple rogrossion equation giving the score weights to be attached to these three independent variables was:

$$
\hat{y}=-.40748+.00271 X_{2}+.03655 X_{3}+.08673 X_{4}
$$

The stendexd error of estinate was $\pm 1.0469$.

French Grades
The auditory $\left(X_{3}\right)$ and interest $\left(X_{4}\right)$ variabjes appeared to be the best combination of two predictors. The multiple regression equation giving the score widets to be atterched to these two inumendent variables was:

$$
\hat{Y}=-1.08923+.06955 X_{3}+.13133 X_{4}
$$

The standard erron of estimate wes ${ }^{-1.1457 .}$.
The mathenatical ( $X_{2}$ ), auditory ( $X_{3}$ ), and intorest $\left(X_{4}\right)$ variables appeared to be the best combination of three predictors. The multiple rogression equation giving the score woigats to be attached to these three independent variables was:

$$
\hat{Y}=-1.82188+.00309 X_{2}+.05099 X_{3}+.14141 X_{4}
$$

The standerd crror of estimate was $\ddagger 1.1255$.

## Gomen Grgdes

The mathematical $\left(X_{2}\right)$ and auditory $\left(X_{3}\right)$ varibules appeared to be the best combinetion of two predictors.

The multiple regression oquation siving the score Weightss to bo attached to these bwo independent variables was:

$$
\hat{Y}=-2.20553+.00295 x_{2}+.07560 x_{3}
$$

the standend enror of eatimate wan $\pm .7742$.
The verbal $\left(X_{1}\right)$, mathonetical $\left(X_{3}\right)$, and aditory $\left(X_{3}\right)$ variables appeared to be the best combinetion of three predictors. The multiple cegression equation involving these three predictors hes been onitted because it is not wicnifsentry better than the two predictor regression equetion.

## Conolumions

The findings revealed by the statistioel analysis of the data would appear to warrant these conclusions:
I. Tro product-moment correlstion coefficient of sufficient magntude and sjeniricance was found to justify the use of any one measure of aptitude as a single prediotor of nodern foretg lenguage leaming achievement as measured by a stondardized tost or as indicuted by boacher-mssignod semester mams.
2. The verbal part of the Scholastic Aptitude sest and the interest part of the einsleur Iancuege Aptitude Battery appeared to be tre best combination of two preaicuors whon the MA . - Coogetitive poreign Ingruage hert, rosm TA, Spentigh, wo used as a criberion.
3. The mathomatioul part of the Scholastic Aptrode Tost and the interest part of the Pimsleus Language Aptitude Bettory appeared to be the best combination of two predictors when the MrA - Cooperetive Foceign Jenguage Iest, Form IA, Fronch, was used as a criterion.
4. The verbal and mathematical parts of the Scholastic Aptritude Tost appeared to be the best conbination of two predictors when the MTA - Cooperative Forejgu Imavage Iest, Tom IA, German, was used as a criterion. Howover, tho multiple correlation coefficient yielacd by the joint action of these two variablas was nonstgnificont at the .05 level. For this reason, it is clear that no predictions of Geman ack ievement test scores can be made or should be attempted on the bosis of the findings of this study.
5. The nathematicol part of the Scholestic Aptitude Fegt and the anditory part of the Pingleur Tanguage Aptidude Bettery appeared to be the best combination of two predictors when teachermssighed semester marks in Spanish were used as the criteria of achicvenent. Consideration of the interest part of the Pingleur Iancurge Aptituce Battery seemed to be advantageous as well. There would thus be a total of threc predjetors.
6. The audjtory and intorest parts of the Pinslour Jrangace atitude Eottory appered to be the best
combinetion of two prediotoxs when teacher-assigned semester manks of French were used as the criteria of achievenent. Consideration of the Scholsstic Aptitude Iest nathemetical scores seened to be advantageous as well. There would thus be a total of three predictors.
7. The mathematical part of the Scholastic Aptitade Test and the auditory part of the Finsleur Jonauge Aptitude Battery appecred to be the best combination of two predictors when teacher-assigned semester grados in German were used as the criteria of achievenent.
8. It would be expedient in each attempt at actual prediction to use the best conbination of two or three predictors, for there is little edvantage to be gained from the use of all four predjetor varjebles.
9. Any adaitional pertinent information avajlable should be considered in attempts to predict learning achievemont in Spanish, French, or Geman. Due to the percentage of unexplained variance in such achievement, the subjective consideration of various personal, enotional, and social factors cannot be onitted.
10. This btudy has jdentilied the bost combinations of selocted aptitude measures for the prediction of modern forejgh language learning achievenent as measured by standardjed tests end as indicated by teacher-ascigned semester inarks. The infomation provided by the study ney be used to supplonent the consideration of other
pertinent information about individual students. In order to assure the proper weighting of the scores, the process of esteblishing predictive indices of learning achievement as measured by semester marks is presented in Appendix $C$.

Recommendations for leurther Study
Definitive answers to the following questions would possibly provide information relevant to the unexplained variance in the learning of Spanish, French, and Gemmen:

1. What personal, social, and emotional factors are associated with success in modern foreign language study? What personal, social, and emotional factors are assoninted with tailure? Other then interest or the lack of it, what qualities can be identified as cmincial to success or failure in Spanish, French, or Germen? Would quantitative measures of such qualities be possible? If so, would such measurements provide information relevant to the unexplained variance in the learning of modern foreign languages?
2. What would be the quantj.tative effect of absences and withdrawals in reducing the predictive power of . aptitude measures by narrowing the range of variability in aptitude and on the criterion measure? To what degree, if. any, are students' course withdrawals closely associated with or directily related to low scores on one or more of the aptitude.measures? Is there a relationship between
aptitude test scores and the resularity of class attendence?
3. What additional informetion night be supplied by a replidation of this study or by a longibudinal study involving prediction of language leaxning at INorth Texas State University? To whet degree of acoureoy can actual prodictions be based on the findings of this study? What information could teachers and stuaents supply to acoount for any inacouracies?
4. In predicting language achievenent, what would be the quantitative offect of consideration given to students' percentile ranks in their hish sohool gocuating dlasses?
5. If aptitude moesures were used Ror diagnostic purposes, what possibilities would there be fos specific trajaing to improve language aptitude, particularly nuditory ability? What other fectors in lenguage aptitude might be found through exporiences with such attermpts at training?

Educationel Tmplications
The major purbose of this investigetion wes to ascertain the predictivo value of certain seleoted modomes of aptitude in estimating the degree of achiovoment a first-seneston freshman migt be expected to ettain by the and of one somesten of iasurubion in

Bpenish 101, Feach 101, or Gemama 101 at rovet Texes State Univorsity, Therefore, eomain educational implications should be recognizod by foreign language educators and edvisors. Wthen the limits imposed by the setting and the tests uned, the following inplications seen to be pertinent:

1. A relabionship appears to exist between 'stadents' mathenctioal aptitude and the marks they eam in begiming modern foreign language counses. Perinops many toreig lenguage educators are unaware of the plausibility of such a relationship. Arong the abilities comon to both methenatical success and Lamonge aptitude, one might point outs such qualities ess gensitivity to reletionships, inductive learning ability, memorization abjuiby, a kind of coc̆ing ability fow the assimilation and use of information, and instantancous, accurate recall.
2. Predictions of leaming achievenent can be mone aocurately mede thtoush the use of a combinetion of measures of agtitude then through the use of a single eroup measure on aptitude. Various conbinations of measures of interect, auditory ability, verbal abjlity, and mathonatical ability have been used in this study. The auditory scones made a very sigaificant contribution, espocially for the prodiotion of teachor-assigned marks.
3. Frodictions besed on a convinetion of measures of aptitude cen be made only when consideration is also givon to many other Pactors that may operate to very studenis' leaming achievencil. Tor this conon, the importance of cereful counseline camot be overatressed. The ecasures of aptitude used in this stady can be very helpful in such counseling and in the diegnosis of Ianguage learning difficulties but must be supplemented by wise andi carefully consldered attention to possible intervoning personal, social, and emotioncil factors.

## APPEMDIX A

TABLES PRESENTT:NG ADITJHONAI DARA

TABBTE XVIT
IEEANS AND WRANDARD DEVTATTONS HOR GETECDED MTASTRES OF APTITULE AND FOR GPANISE JFARNJNG ACHESUREESE

$$
(1)=105)
$$

| Test | nean. | S. D. |
| :---: | :---: | :---: |
| Verbal ( $\mathrm{X}_{1}$ ) | 4.66 .3 .6 | 96.83 |
| Mathenabical ( $\mathrm{X}_{2}$ ) | 456.55 | 90.09 |
| Maditory ( $\mathrm{X}_{3}$ ) | 43.73 | 5.86 |
| Interest ( $\mathrm{X}_{4}$ ) | 5.18 | 2.27 |
| Spenish achievement best | 98.05 | 32.73 |
| Spenish grades | 2.88 | 1.12 |

Mame XVIT
 OE APSTMUDE AWO TOR FREuCS HEARTING ACHEVDHENI?

$$
(N=80)
$$

| Test | Pean | S. D. |
| :---: | :---: | :---: |
| Vexbal ( $\mathrm{X}_{1}$ ) | 476.55 | 94.11. |
| Mathematical ( $\mathrm{X}_{2}$ ) | 483.51 | 99.85 |
| Auditory ( $\mathrm{X}_{3}$ ) | 4.3 .81 | 6.21 |
| Interest $\left(X_{4}\right)$ | 5.18 | 2.29 |
| Wrench achiorencnt test | 92.49 | 38.42 |
| Pronch grades | 2.64 | 1.26 |

R4B6 XIX
MEANS ATE SMANDARD JEVIATTONS FOR SEIECEED PGEASURES OF APIIPUDE AND FOR GPRUAN TEABNITG ACHTJVERIETVI.

$$
(N=24)
$$

| Test | moan | S. D. |
| :---: | :---: | :---: |
| $\operatorname{Verbal}\left(\mathrm{X}_{1}\right)$ | 562.33 | 101.03 |
| Hatheneiticel ( $\mathrm{X}_{2}$ ) | 558.75 | 99.02 |
| Auditory ( $\mathrm{X}_{3}$ ) | 4.6 .50 | 5.29 |
| Interest ( $\mathrm{X}_{4}$ ) | 6.08 | 2.39 |
| Gemman achievenent test | 93.32 | 20.95 |
| Gernan sredes | 2.96 | 0.91 |

## ADETNDIX B

TABTES PRESENGTG ADBRGGOAL DATA

TABUS YK
SCORES MAOE TE STUDEMS OR SPANESH

| Code | Promostio rest soones* |  |  |  | Critoria $\%$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{X}_{1}$ | $\mathrm{X}_{2}$ | $\mathrm{X}_{3}$ | $\mathrm{X}_{4}$ | rest | marks |
| 1.001 | 593 | 601 | 49 | 2 | 81 | 3 |
| 1.002 | 628 | 567 | 50 | 6 | 104 | 4 |
| 1003 | 745 | 573 | 5.3 | 6 | 163 | 4 |
| 1004 | 567 | 489 | 43 | 2 | 59 | 1 |
| 1.005 | 460 | 432 | 46 | 6 | 60 | 1 |
| 1006 | 403 | 481 | 41 | 6 | 109 | 4 |
| 1007 | 523 | 4.16 | 47 | 8 | 129 | 4 |
| 1008 | 570 | 4.19 | 42 | 6 | 131 | 4 |
| 1009 | 494 | 423 | 39 | 2 | 64 | 2 |
| 2010 | 567 | 517 | 51 | 6 | 65 | 3 |
| 1011 | 346 | 370 | 45 | 8 | 145 | 4 |
| 1012 | 398 | 451 | 43 | 0 | 70 | 2 |
| 1.013 | 455 | 43.3 | 49 | 8 | 102 | 4 |
| 1014 | 557 | 556 | 53 | 6 | 130 | 4 |
| 1015 | 356 | 340 | 37 | 6 | 158 | 3 |
| 1016 | 295 | 4.04 | 43 | 2 | 68 | 3 |
| 1017 | 361 | 389 | 38 | 6 | 75 | 2 |
| 1018 | 569 | 426 | 49 | 6 | 9.2 | 3 |

TABEAXX Coginmed

| Code | Prognotic Pest Scores: |  |  |  | Ccitexa ${ }^{*}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | ${ }^{X_{1}}$ | $\mathrm{X}_{2}$ | ${ }^{\text {X }}$ | $\mathrm{K}_{4}$ | Test | Marks |
| 101.9 | 453 | 501 | 40 | 2 | 59 | 2 |
| 1020 | 627 | 737 | 52 | 8 | 187 | 2 |
| 1021 | 512 | 51.8 | 49 | 6 | 107 | 4 |
| 1022 | 423 | 419 | 44 | 6 | 118 | 4 |
| 1023 | 384 | 394 | 35 | 8 | 89 | 2 |
| 1024 | 348 | 403 | 4.6 | 8 | 103 | 3 |
| 1025 | 368 | 323 | 43 | 6 | 70 | 3 |
| 1026 | 342 | 358 | 48 | 8 | 125 | 3 |
| 1027 | 460 | 441 | 39 | 0 | 72 | 2 |
| 1023 | 407 | 357 | 23 | 6 | 55 | 1. |
| 1.029 | 552 | 431 | 49 | 6 | 152 | 4 |
| 1030 | 448 | 401 | 42 | 8 | 90 | 3 |
| 1031 | 342 | 353 | 40 | 6 | 89 | 2 |
| 1032 | 446 | 426 | 47 | 4 | 100 | 4 |
| 1033 | 34.8 | 338 | 46 | 6 | 67 | 1 |
| .2034 | 560 | 526 | 54 | 8 | 99 | 4. |
| 1035 | 365 | 419 | 9 | 6 | 40 | 0 |
| 1036 | 576 | 473 | 40 | 0 | 34 | 2 |
| 1037 | 567 | 4.23 | 4.3 | 6 | 156 | 4 |
| 1.038 | 435 | 410 | 37 | 5 | 97 | 2 |
| 1039 | 414 | 407 | 36 | 0 | 64 | 1 |
| 1.040 | 397 | 320 | 35 | 4 | 88 | 3 |
| 1041 | 370 | 309 | 37 | 6 | 132 | 3 |
| 1042 | 321 | 394 | 38 | 6 | 1.3 84 |  |
| 1043 | 534 | 677 | 49 | 6 | 84 1.21 | 3 |
| 1044 | 414 | 436. | 40 | 4 | 121 92 | 3 4 |

TABTE $\operatorname{rax}-\mathrm{Cont} \operatorname{med}$

| Code | Promostice Rent scores\% |  |  |  | Criteria $\%$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{X}_{1}$ | $\mathrm{x}_{2}$ | $\mathrm{K}_{3}$ | $\mathrm{X}_{4}$ | Test | Marks |
| 1045 | 71.2 | 592 | 42 | 6 | 1.48 | 3 |
| 1046 | 461 | 528 | 45 | 2 | 48 | 0 |
| 1.047 | 378 | 464 | 46 | 8 | 72 | 2 |
| 1048 | 481. | 566 | 51 | 0 | 113 | 4 |
| 1049 | 552 | 509 | 42 | 8 | 103 | 3 |
| 1050 | 627 | 394 | 49 | 6 | 69 | 2 |
| 1051 | 639 | 460 | 41 | 8 | 1.53 | 4 |
| 1052 | 585 | 466 | 46 | 8 | 70 | 2 |
| 1.053 | 488 | 502 | 37 | 4 | 65 | 2 |
| 1054 | 479 | 51.8 | 34. | 4 | 95 | 4 |
| 1055 | 355 | 333 | 49 | 2 | 65 | 3 |
| 1.056 | 4.12 | 394 | 49 | 0 | 100 | 3 |
| 1057 | 391 | 4.10 | 40 | 2 | 3.05 | 2 |
| 1058 | 516 | 439 | 52 | 4 | 55 | 0 |
| 1059 | 473 | 380 | 34 | 2 | $\underline{.03}$ | 4 |
| 1060 | 480 | 272 | 37 | 4 | 107 | 1 |
| 1061 | 421 | 4.13 | 34 | 0 | 78 | 3 |
| 1062 | 335 | 412 | 47 | 4 | 112 | 4 |
| 1063 | 472 | 436 | 49 | 8 | 142 | 4 |
| 1064 | 365 | 392 | 39 | 6 | 92 | 3 |
| 3.065 | 401 | fr 41 | 37 | 4 | 93 | 3 |
| 1.066 | 442 | 383 | 45 | 4 | 68 | 3 |
| 1.067 | 519 | 500 | 52 | 4 | 152 | 4 |
| 1068 | 487 | 557 | 41. | 4 | 87 | 3 |
| 1069 | 394 | 285 | 5.2 | 6 | 95 | 4 |
| 1070 | 597 | 507 | 48 | 4 | 60 | 3 |

TABJJ XX - -acortinued

| Code | Prognostie Test Scores* |  |  |  | Oritoria |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{X}_{3}$ | $\mathrm{X}_{2}$ | $\mathrm{X}_{3}$ | $x_{4}$ | Pest | Marks |
| 1.071 | 460 | 421 | 47 | 6 | 125 | 3 |
| 1072 | 374 | 338 | 52 | 6 | 57 | 1 |
| 1073 | 384 | 33.1 | 46 | 6 | 107 | 3 |
| 1074 | 479 | 613 | 41 | 4 | 80 | 3 |
| 1075 | 54.0 | 507 | 53 | 8 | 147 | 4 |
| 1076 | 4.39 | 439 | 39 | 6 | 77 | 3 |
| 1077 | 712 | 473 | 40 | 6 | 99 | 3 |
| 1.078 | 463. | 414 | 50 | 8 | 119 | 4 |
| 1079 | 323 | 379 | 32 | 8 | 47 | 0 |
| 1080 | 625 | 567 | 52 | 8 | 69 | 3 |
| . 2081 | 487 | 442 | 4.1 | 4 | 134 | 4 |
| . 2082 | 447 | 451 | 43 | 4 | 97 | 4 |
| 1083 | 512 | 520 | 46 | 8 | 170 | 4 |
| 1084. | 445 | 490 | 33 | 6 | 95 | 3 |
| 1085 | 348 | 583 | 52 | 6 | 118 | 4 |
| 1086 | 474 | 583 | 48 | 6 | 80 | 4. |
| 1087 | 627 | 4.66 | 48 | 8 | 177 | 4 |
| 1088 | 435 | 491 | 41 | 6 | 107 | 4 |
| 1089 | 478 | 580 | 48 | 6 | 80 | 1 |
| 1090 | 523 | 439 | 51 | 6 | 112 | 3 |
| 2091 | 305 | 385 | 37 | 6 | 89 | 2 |
| 1002 | 262 | 41.3 | 49 | 6 | 89 | 3 |
| 1093 | 460 | 627 | 48 | 6 | 98 | 3 |
| 1094 | 447 | 347 | 44 | 0 | 66 | 2 |
| 2.095 | 543 | 567 | 50 | 4 | 121 | 4 |
| 1096 | 500 | 4.51 | 40 | 6 | 54 | 2 |

TABIE XX ...Contimed

| Code | Prognostic rest scores* |  |  |  | Crituria** |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{X}_{1}$ | $X_{2}$ | $\mathrm{X}_{3}$ | $\mathrm{X}_{4}$ | Jest | Marks |
| 1097 | 547 | 507 | 40 | 4 | 92 | 2 |
| 1.098 | 368 | 347 | 32 | 6 | 151 | 4 |
| 1099 | 461. | 599 | 47 | 6 | 108 | 4 |
| 1.1 .00 | 362 | 436 | 35 | 6 | 65 | 2 |
| 2.101 | 391 | 367 | 38 | 8 | 108 | 3 |
| 11.02 | 54.4 | 4.64 | 45 | 4 | 159 | 4 |
| 1.1 .03 | 509 | 687 | 49 | 4 | 11.2 | 4 |
| 1.104 | 460 | 611 | 40 | 4 | 1.05 | 3 |
| 11.05 | 453 | 520 | 4.6 | 4 | 58 | 3 |

"Vaxiables:
$X_{1}$ - Verbel score on the Scholastic Aptitude Test.
$\mathrm{X}_{2}$ - Irathematical score on the Scholestic Aptitude Test.
$X_{3}-$ Auditory score on tho Pinsleur Language Aptiture Battery.
$\mathrm{X}_{4}$ - Interest score on the Firisleur Lenguage
*Criteria:
Test - MTA - Cooperetive Foxeig Lencuace Test,
Marks- Teacher-essisned semestor grades in Spanish.

$$
\begin{aligned}
& A=4 \\
& B=3 \\
& C=2 \\
& D=1 \\
& B=0
\end{aligned}
$$

TABSE XXI
SCOKRS HADP BY SMUTEMS OF PRENCH

| code | Prognostic Teot Scores* |  |  |  | Criteria** |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{X}_{\text {I }}$ | $\mathrm{X}_{2}$ | $\mathrm{X}_{3}$ | $\mathrm{X}_{4}$ | Test | Marks |
| 21.06 | 370 | 358 | 46 | 6 | 99 | 4 |
| 2107 | 44 | 309 | 40 | 6 | 103 | 3 |
| 2108 | 520 | 630 | 4.3 | 0 | 66 | 3 |
| 2109 | 474 | 626 | 42 | 6 | 81 | 2 |
| 2110 | 480 | 498 | 51 | 6 | 157 | 4. |
| 21.11 | 361 | 347 | 4.5 | 4. | 117 | 2. |
| 2 J .12 | 382 | 457 | 46 | 6 | 96 | 3 |
| 2713 | 696 | 71.9 | 52 | 8 | 184 | 4 |
| 2114 | 703 | 520 | 31 | 6 | 49 | 0 |
| 2115 | 553 | 668 | 47 | 0 | 82 | 3 |
| 21.16 | 647 | 54.8 | 53 | 4 | 52 | 2 |
| 2117 | 4.67 | 617 | 45 | 4 | 146 | 4 |
| 21.18 | 620 | 507 | 51 | 8 | 63 | 2 |
| 21.19 | 381 | 460 | 31 | 6 | 63 | 1 |
| 2120 | 349 | 439 | 40 | 0 | 70 | 2 |
| 2121 | 61.5 | 442 | 34 | 6 | 78 | 3 |
| 2122 | 507 | 639 | 52 | 8 | 73 | 3 |
| 2123 | 372 | 4.82 | 37 | 6 | 75 | 2 |
| 2124 | 584 | 490 | 4. | 4 | 169 | 4 |
| 21.25 | 371 | 366 | 4.4 | 4 | 52 | 1 |
| 21.26 | 453 | 473 | 38 | 4 | 53 | 1 |
| 2127 | 54.4 | 419 | 4.6 | 6 | 312 | 3 |
| 2128 | 374 | 545 | 40 | 6 | 69 | 2 |
| 21.29 | 444 | 375 | 40 | 8 | 85 | 2 |

MABIE XKI -Gontimued

| Code | Prognostic Test scoros* |  |  |  | Criterja* |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{X}_{1}$ | $\mathrm{X}_{2}$ | $\mathrm{X}_{3}$ | ${ }^{8} 4$ | Test | darks |
| 2130 | 4.07 | 445 | 46 | 8 | 116 | 3 |
| 213.1 | 405 | 484 | 27 | 4 | 47 | 1 |
| 21.32 | 498 | 608 | 50 | 6 | 106 | 4 |
| 21.33 | 606 | 529 | 40 | 6 | 111 | 4 |
| 2334 | 401 | 470 | 41 | 6 | 69 | 2 |
| 23.35 | 520 | 272 | 36 | 6 | 38 | 0 |
| 2136 | 549 | 662 | 49 | 6 | 73 | 1 |
| 2137 | 4.79 | 4.45 | 53 | 6 | 14.4 | 4 |
| 2138 | 429 | 389 | 49 | 8 | 124 | 4 |
| 21.39 | 626 | 498 | 37 | 6 | 175 | 4 |
| 2140 | 495 | 394 | 45 | 6 | J. 35 | 4 |
| 21.41 | 34. | 4.12 | 34. | 0 | 51 | 0 |
| 21.42 | 586 | 573 | 51 | 8 | 106 | 3 |
| 21.43 | 467 | 479 | 46 | 0 | 73 | 2 |
| 2.144 | 500 | 469 | 49 | 6 | 159 | 4 |
| 23.45 | 507 | 479 | 40 | 4 | 109 | 4 |
| 2146 | 535 | 471 | 53 | 6 | - 152 | 4 |
| 21.47 | 460 | 573 | 29 | 6 | 143 | 4 |
| 2148 | 394 | 379 | 43 | 0 | 51 | 2 |
| 21.49 | 307. | 375 | 38 | 4 | 105 | 3 |
| 2150 | 394 | 435 | 42 | 4 | 34 | 2 |
| 2151 | 434. | 394 | 4.4 | 8 | 67 | 2 |
| 2152 | 442 | 576 | 42 | 6 | 122 | 3 |
| 2153 | 346 | 338 | 44 | 8 | 110 | 3 |

TABTE XXT - - convinued

| Code | Fromostic Test Sconos* |  |  |  | Criteria** |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{X}_{1}$ | $\mathrm{X}_{2}$ | $\mathrm{X}_{3}$ | $\mathrm{X}_{4}$ | sest | Marks |
| 2154 | 478 | 487 | 45 | 4 | 74 | 3 |
| 2155 | 626 | 696 | 44 | 6 | 111 | 4. |
| 2156 | 499 | 374 | 34 | 6 | 83 | 2 |
| 2157 | 404 | 308 | 4.1. | 4 | 37 | 1 |
| 2158 | 481 | 511 | 4.8 | 6 | 13.5 | 4 |
| 2159 | 365 | 356 | 36 | 6 | 37 | 1 |
| 2160 | 552 | 582 | 43 | 8 | 83 | 4 |
| 21.61 | 439 | 475 | 43 | 2 | 82 | 4 |
| 21.62 | 533 | 394 | 4.1 | 4 | 60 | 1 |
| 2163 | 519 | 356 | 36 | 3 | 43 | $?$ |
| 2164 | 582 | 608 | 39 | 0 | 70 | 0 |
| 21.65 | 481 | 42 | 46 | 6 | 63 | 2 |
| 21.66 | 573 | 564 | 45 | 2 | 75 | 2 |
| 2167 | 527 | 572 | 50 | 4 | 77 | 2 |
| 21.68 | 464 | 479 | 38 | 8 | 162 | 4 |
| 21.69 | 496 | 506 | 37 | 6 | 93 | 3 |
| 21.70 | 410 | 347 | 45 | 4 | 53 | 1 |
| 2171 | 600 | 621 | 52 | 6 | 79 | 3 |
| 2172 | 518 | 492 | 49 | 0 | 50 | 1 |
| 2173 | 3621 | 557 | 47 | 6 | 160 | 4 |
| 2174 | 518 | 492 | 48 | 4 | 84 | 3 |
| 23.75 | 403 | 452 | 44 | 6 | 157 | 4 |
| 2176 | 34.3 | 537 | 44 | 2 | 95 | 2 |
| 2177 | 335 | 385 | 4.1 | 8 | 42 | 0 |

SABEIE KXI --Contjuved

| Code | Drognostio fogt geoges* |  |  |  | Criteria ${ }^{* *}$ |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $\mathrm{x}_{1}$ | $\mathrm{X}_{2}$ | $\mathrm{X}_{3}$ | $\mathrm{K}_{4}$ | Test | Marks |
| 2.778 | 300 | 403 | 34 | 8 | 4.5 | 1 |
| 2179 | 356 | 493 | 54 | 6 | 57 | 3 |
| 21.80 | 454 | 347 | 44 | 4 | 90 | 3 |
| 2181 | 468 | 509 | 54 | 6 | 170 | 4 |
| 21.82 | 633 | 489 | 48 | 4 | 125 | 4 |
| 2183 | 610 | 662 | 52 | 6 | 169 | 4 |
| 21.84 | 4.45 | 604 | 51 | 8 | 103 | 4 |
| 21.85 | 524 | 548 | 49 | 6 | 1.03 | 4 |

"Variables:
$X_{2}-$ Verbal score on the Scholastio Aptitude Tost.
$x_{2}$ - Methematical score on the Schozastic Antitude Test.
$\mathrm{A}_{3}$ - Auditory score on the Pimsleup Lamguage Aptitude Battery.
$X_{4}$ - Thterest socre on the Ping? eur Language

MMriteria:
Iest ... Mha ... Cooporetive Roreig Langege Test, zom It, Erench.

Harks- Teacher-assigned semester grades in Freach.

$$
\begin{aligned}
& A=4 \\
& B=3 \\
& C=2 \\
& D=1 \\
& F=0
\end{aligned}
$$

TABIE XXIT
SCONES MADE BK SHUDEHTS OF GERMAN

| Code | Prognostic fest scores* |  |  |  | Criteria** |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  | $x_{1}$ | $\mathrm{X}_{2}$ | $\mathrm{y}_{3}$ | $\chi_{4}$ | lest | Marks |
| 37.86 | 64.0 | 672 | 51 | 4 | 69 | 2 |
| 31.87 | 500 | 592 | 50 | 8 | 82 | 3 |
| 3188 | 401. | 479 | 37 | 6 | 143 | 3 |
| 3189 | 64.4 | 635 | 52 | 8 | 88 | 4 |
| 31.90 | 493 | 461. | 48 | 8 | 1.04 | 2 |
| 31.91. | 4.67 | 581 | 48 | 8 | 76 | 3 |
| 3192 | 653 | 536 | 46 | 8 | 89 | 4 |
| 31.93 | 653 | 639 | 50 | 6 | 89 | 4 |
| 31.94 | 359 | 563 | 33 | 1 | 56 | 2 |
| 3195 | 564 | 529 | 4.8 | 0 | 1.17 | 3 |
| 3196 | 558 | 695 | 4.7 | 6 | 1.18 | 4 |
| 3.197 | 635 | 369 | 52 | 6 | 90 | 3 |
| 3198 | 622 | 635 | 40 | 6 | 79 | 2 |
| 3199 | 62.6 | 536 | 50 | 4 | 213 | 4 |
| 3200 | 527 | 536 | 31 | 6 | 68 | 2 |
| 3201 | 348 | 413 | 45 | 4 | 80 | 1 |
| 3202 | 567 | 592 | 49 | 8 | 88 | 4 |
| 3203 | 589 | 679 | 44 | 6 | 73. | 2 |
| 3204 | 62.0 | 639 | 50 | 8 | 98 | 4 |
| 3205 | 647 | 510 | 47 | 8 | 94 | 3 |
| 32.06 | 62.0 | 719 | 53 | 0 | 105 | 4 |
| 32.07 | 654. | 389 | 48 | 8 | 128 | 2 |
| 3208 | 418 | 421 | 47 | 8 | 92 | 3 |
| 3209 | 691 | 590 | 45 | 8 | 117 | 3 |

## TABLE XXII ---Contimued

"Vaxiables:
$X_{1}$ - Verbal score on the Scholastio Aptibude Test.
 Test.
$X_{3}$ - Auditory scome on the Pinsleur Lenguage Ariztude Battory.
$X_{4}$ - Interost score on the Pinsleur Lenguage Aptijtude Battery.
\# Criteria:
Test - Ma - Cooperetive Poreign Languare Test, Warks- Seacher-abigned zenester grados in Gornen. $A=4$
$B=3$
$C=2$
$D=3$.
$\mathrm{F}=0$

## APPEIDTX C

## PREDICRIVE INDICES OE SETESTER IMAMS

Por Predicting Somester Grades in Spanish When combining scoces on the Soholastic Aptitude Test and scores on the Pinglens Languase Aptitude jettery into a predictive index of a student's senester mark in Spanish, one of the three procedures given below is recommended. The proceduses are listed in order of preferonce, with the Nest conbination lop prediction efiven first. lif scoros are not available for the student on the approuriatc parta of the Pimsheur Jangase Aptituge Bettery, the third procodure nay be used, since it requires only the Scholestje Aptituce lest scores.

Procedure A. -...Combination of the mathematical score on the Scholastic Aptitude Test, the euditory and interest scores on the Pimsjeur Lencuase Aptitude Battery:
3. Wultipl.y the mathometical score by . 00271 .
2. Multiply the auditory scowe by .03655 .
3. Dultiply the interest score by, 08673 .
4. Add the products of the above oteps.
5. Subtract . 407 f 3 from the total found in slen 4.
6. Allow for an exwor of eatimate to within at least $\pm .0469$. This allowance for exrox is the mathematical equivalent of plus or minus approximately one letter grade, since $A=A ; B=3 ; C=2 ; D=1 ; F=0$.

Procedure B.....Combination of the methematical score on the Soholestide Aptitude Test and the auditory score on the Pingleur Language Aptitude Battery:

1. Pioltiply the mathomatical score by .00254.
2. Fultijply the anditory score by . 0434l.
3. Add the products of the above steps.
4. Subtract. 18362 from the total found in step 3.
5. Allow ron en emor of ostimete to within at least +1.0598 . This andomance for error is the mathematical equivelent of plus or minus appoximately one Letter gracie, since $A=4 ; B=3 ; C=2 ; D=1 ; F=0$.

Procedure C.---Corbination of the verbal and mathematical scores on the Scholastic Aotitude Iest:

1. Iurliply the verbel. score by .00136 .
2. Thutiply the nathonaticul score by . 00282 .
3. Add the products of the above steps.
4. Add .95428 to the botal found in step 3.
5. Allow for an exror of estinate of at loast plus or minus one J.etter grade. 'this is based on the 4.0 systen, with $A=4 ; 33:=3 ; C=2 ; D=1 ; \mathrm{F}=0$.

The tridex provided by oither of the above procodures mey best be usca to supplenent the consideration of other pertinent infomation about individral sudents.

For Predictins Somester Grades in French
When conbining scores on the Scholestio Aptitude Fest and scores on the Pirsieur Ianguare Aptituce Battery into a prodictive index of a student's sencoter mark in Prench, one of the three procedures given bolow is recommended. The procermen ane listed in order of beeference, wh the best combintion for prediction given first. If scores are not available on the
 Battery, the thind procedure may bo used, gince it roquiros only the Scholostie dutitude tost scores.

Erocedure A.--Combination of the matheriaticel score on the senolestio Artitnce Pest, the anditory and interest scores on the Pimpleur Sangace Aptitude Bettery:

1. Minltiply the mathenatical score by .00309 .
2. Tultiply the auditary scoce by .05099 .
3. Nultiply the interest score by .14141.
4. Add the products of the abovo steps.
5. Subtract 1.82188 from the total found in step 4.
6. AzLow for an error or estjmate to within at Iosst tu. 11.55. This allownoe for emor is the
mathematical equivalent of plus on minus apporinately one letter grade, since $A=4: B=3 ; C=2 ; D=1 ; T=0$.

Procedure B.--Mombination of the auditory and interest scores of the Pingleur Janguge Antitude Battery:

1. Fultiply the euditory score by .06955.
2. Fifultiply tine interest score by .13133.
3. Add the products of the above steps.
4. Subtract 1.03923 fron the total found in step 3.
5. Allow for on error of ostinate to within at least $\pm 1.1457$. Whis allowance for arrox is the mathematical equivalent of plus or minus approximately one lettor gede, sinco $A=A ; B=3 ; C=2 ; D=1 ; F=0$.

Procedure C.--Combination of the verbal and mathenatical scores on the Scholestic Aptitude Test:

1. Miultiply the verbel score by . 00093 .
2. Multiply the matheratical score by .00364.
3. Add the products of the above steps.
4. Add. 43532 to the toter found in step 3.
5. Allow for an evror of estrinate of at least plus or mimus one letter grade. This is based on the 4.0 system, with $A=4 ; B=3 ; C=2 ; D=1 ; R=0$.

The index provided by either of the above procedures may best be usod to supplement the consideration of other pextinent informetion avout individual stuaents.

For Fredioting Semestor Griades in Germen
When conbinjng scones on the Scholastio Aptioude Test and scores on the wingleur Lengese Aptitude Detitery jnto a predictive index of a student's semester grade in Geman, one of the two procedures given below is recomended. the better combination for prediction is given first. IIowever, if scores axe not available for the auditory part of the Pimgleur Lenguace Aptjtude Bettery, the second procedure may be used. It requires only the Scholastic Aptitude Tents scores.

Procedure A.--Combinaticn of the mathenatical score on the sodolngice hotibude Thed and the auditory scoro on the Pimslous Lanmare Notjtude Battery:

1. autiply the mathenatiscal scoce by .00295 .
2. Multiply the anditory score by .07560 .
3. Add the products of the above steps.
4. Subtract 2.20553 from the total found in step 3.
5. Allow eor an exror of estinate to within at loast $\pm .7742$. This allowance for crror is the mathematical equivalent of plus or minus slightly less than one Ietter grade, since $A=4: P=3 ; C=2 ; D=I ; F=0$.

Procedure B.-.Combination of the verbal and nathentical sooros on the sotolagtic Aptitude rest:

1. Multiply the veriel acoce by .00314.
2. Mutiply the mathenatic score by . 00243 .
3. Add the products of the above steps.
4. Subtract. 16190 from the total found in step 3 .
5. Allow for an error of essinate of at least plus or minus one Ietter grade. This is based on the 4.0 system, with $A=4 ; B=3 ; C=2 ; D=1 ; \mathrm{F}=0$.

The index provided by either of the above procedures may best be used to sixplement the consideration of other pertinent information about individual students.

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