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Prediction of academic achievement of foreign students at Iowa State University 1969-1970

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PREDICTION OF ACADEMIC ACHIEVEMENT OF FOREIGN STUDENTS AT IOWA STATE UNIVERSITY 1969-1970

by

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INTRODUCTION

According to the 1968 report on international student exchange made by the Institute of International Education (16), there were 110,315 foreign students reported at United States institutions of higher learning in 1967-68.

These students came from 172 countries and territories. By far the largest proportion of students, 34 percent, came from the Far East. The second largest proportion, 20 percent, came from Latin America. European students made up 14 percent of the total; students from the Near and Middle East, 12 percent; North America (primarily Canada), 11 percent; Africa, 6 percent; and Oceania, 2 percent. As was emphasized by the American Association of Collegiate Registrars and Admission officers (1), the problems of proper placement of students who come to educational institutions in the United States from these foreign countries have long concerned admissions officers in American colleges and universities at both the undergraduate and graduate levels.

After investigating publications relating to foreign student academic achievement in 1967, Spencer and Awe (33) noticed several characteristics in the research on foreign students such as the application of inappropriate statistical models, the smallness of the research samples, and the lack of experimentation on the native language variable. They also emphasized the fact that foreign student programs were developed, organized, and administered without systematic research and that selection and instructional programs were based largely on unvalidated intuition and hunch.

Several studies have been made concerning foreign students in the United States, but the contradiction between the findings of these studies, as will be revealed later in the review of the literature, as well as the relatively small number of these studies, indicate the need for more research and studies to investigate the underlying dynamics of the foreign students' academic success in institutions of higher learning in the United States.

A study was conducted by the author (8) in 1968 of the relationship of certain characteristics of foreign students to academic achievement. This study had certain defects that the present study was designed to avoid. The smallness of the sample size in the previous study was one of the points of weakness which limited the analysis of some of the relationships. For example, it was not possible in the 1968 study to test the interaction between marital status and native language variables because, within the limited number of subjects, no students of a certain marital status category were found under some native language categories. This limitation imposed some restrictions and limited the possibility of testing the effect of many meaningful interactions between several combinations of significant variables. Taking a larger sample in the present study enabled the author to test the effect of eleven interactions whose selection was based on their meaningfulness according to the results of analysis of variance - single classification, rather than imposed by the nature of the small sample as was the case in the previous study. In the first study, the author was able to investigate only two possible interactions. Another defect in the first study was that the purpose was limited to the investigation of the nature of the relationship between the independent and the

dependent variables through employing only one statistical technique (analysis of variance). No attempt was made to explore the possibility of setting up a prediction equation for the academic achievement of the foreign student. One of the purposes of the present study was to develop a regression equation analysis after employing the analysis of variance technique. These factors, including the relatively more extensive review of recent literature, are the chief justifications for conducting the present study.

Seven factors were investigated to determine their relationship to the academic achievement of foreign students. As will be revealed in the chapter on review of literature, these were the factors which were frequently studied in relation to the academic achievement of foreign students: sex, chronological age, native language, field of study, marital status, year of study, and source of support. There were three purposes of this study which can be represented as answers for the following questions:

1. What are the relationships between the previous seven variables and the academic achievement of the foreign student?
2. Which one (or ones) of the seven variables should be eliminated and which one (or ones) should be considered in the prediction of the foreign students' academic achievement?
3. What are the characteristics of the regression equation to predict academic achievement of foreign students?
4. What are the counseling and administrative implications of the findings of this study, and how can they be utilized for advising prospective foreign students?

Although it was realized that the use of a measure of ability would be advantageous, none were used because none were available, and also the differences in the foreign students' background, training, and English language effectiveness would make it difficult to administer a common instrument to measure the academic or mental ability of the subjects under investigation. Lack of time and financial resources presented another limitation for what could be done concerning the measurement and control of the ability variable.

REVIEW OF LITERATURE

After reviewing the literature, it was found that relatively few studies have been conducted on foreign students in the area of academic achievement. Other studies were made on the attitudes and adjustment problems of the foreign students in the United States.

In his doctoral dissertation, Myers (20) investigated the area of the non-return of foreign students after studying in the United States. The data were collected from the Institute of International Education Foreign Student Census 1964-65. Answers of 88,556 foreign students to the question about intention to remain in the United States were coded and cross-tabulated with several individual characteristics and conditions of study. The main variables of investigation were: age, sex, field of study, length of stay in the United States, native country, sponsorship, type of visa, socio-economic status, and academic status. It was found in this study that conditions of study and individual characteristics were more important than characteristics of native country in determining who would remain and who would return home. The countries with the highest rates of non-return were those within the European Communist bloc of nations. Generally, it was found that Latin American countries were higher than Asian or African countries in the rate of non-return. In terms of the conditions of study and the individual characteristics, it was found that non-return was associated primarily with undergraduates, with self-sponsored students, with immigrant visa holders, with students under twenty or over forty years of age, with students of higher socio-economic status, and with students who have been studying in the United States for more than two years. The high-

est non-return percentages were found for students majoring in medicine, engineering, and the humanities. It was also found that the non-return rate for males was 15 percent while the non-return rate for females was 19 percent, but since males had a higher percentage of no answers on intent (33 percent) than females (28 percent), it was suggested that the non-return rate for males was underestimated by more than was that for females. In the same study (20) and for the same purpose, Myers (20) conducted a case study of Peruvian students in the United States concerning the problem of non-return. The same variables were investigated except that the study was restricted to the 476 male Peruvian students in the United States because the total number of females was not great enough to allow separate analysis. The data were collected through the use of two questionnaires and an interview schedule. The first questionnaire was designed to gather data for relating individual characteristics, conditions of study, and vocational expectations to reasons for study abroad and to the decision to migrate permanently or return to Peru. The content of the second questionnaire was similar to the content of the interview where the primary purpose was to collect data concerning occupational and income expectations of male Peruvian students studying in the United States. The first questionnaire was sent to all the 476 students, and interviews were conducted with a randomly selected group of 208 students while the second questionnaire was mailed to those individuals who were not interviewed. Seventy-eight percent of the subjects responded to the questionnaires. Using the same method of cross-tabulating, the data with the categories of non-return showed that non-return was associated with graduates, with self-sponsored students, with students under twenty-five years of age, and with students

of higher socio-economic status. It was also found that the number of non-returnees increased as the number of years since study began increased. The number of non-returnees among J-visa (exchange student) holders was found to be smaller than the number of F-visa (student visa) holders, but the surprising finding here was the high percentage of immigrant visa holders indicating the probably return to Peru. The most frequently cited reasons for studying in the United States by Peruvian students were: to increase job opportunity (57 percent) and to obtain training that is superior to that offered in Peru (48 percent) or that was unavailable in Peru (38 percent).

Peyser (25) conducted a research in 1968 to explore the possibility of using direct translations of a reading test for college-level students in different countries. The instruments which were used in this study were two parallel forms of a reading comprehension test appropriate for high school graduates and college entrants in the United States, their versions translated into Turkish, and their versions retranslated back into English. Each test consisted of thirty five-choice items based on five expository reading passages. The tests were administered to the following five groups of high school and college students in the United States and Turkey:

1. Seven hundred fourteen seniors from the Turkish secondary school.
2. Ninety-six first year Turkish students at the Middle East Technical University.
3. A total of five hundred eighty-seven American high school seniors.
4. Eight hundred sixteen American students from four colleges.

5. Eighty-six Turkish secondary school graduates and graduate students receiving special instruction in English in preparation for study in American universities.

The two forms of the tests in English and Turkish were kept at the same level of difficulty for American and Turkish subjects in the same grade. Using item analysis and rank order, correlation showed that translations of reading tests were relatively culture-fair measures if total test scores, relative difficulty of reading passages, and indices of item difficulty were considered as criteria for test fairness. The similarity of the total scores of American and Turkish students at similar educational levels was obvious when they took the tests in their own native language.

In order to measure the compatibility of a foreign student's English with that of his peers who were native speakers of English, Darnell (6) developed a test combining Cloze procedure and an entropy analysis (Clozentropy). The test of English as a foreign language (TOEFL) and a Clozentropy test were administered to a sample of 48 University of Colorado foreign students. The Clozentropy test was also administered to 200 native English students at the same university. Comparable reliability coefficients of .86 were obtained for the total scores on the two tests. Correlation analysis of the two tests indicated that the total score on the two batteries were correlated .833. Neither test was found to have any significant correlation with grade-point average for the 48 foreign students who took the test. Analysis of variance was employed on the data of the 200 native students in which the findings showed significant differences between graduate and undergraduate students, as well as between engineers and non-engineers. The graduate students and the engineers scored higher than the

undergraduates and the non-engineers respectively. In contrast with the native student analysis, there was no significant difference between graduates and undergraduates or between engineers and non-engineers among the foreign students. A questionnaire was sent in 1967 by the National Association for Foreign Student Affairs (21) to 850 junior colleges on topics pertinent to foreign students. The results of the 410 usable replies showed that 677 junior colleges had foreign students enrolled. Two hundred forty-seven of the junior colleges required a separate admission procedure for foreign students. Eleven percent of these junior colleges had English as a second language program, 41 percent stated that foreign students studied English at some other institution before enrolling, 12 percent indicated special courses in English were provided for foreign students, and 27 percent felt there was a need for special English courses. Almost one-half of all respondents stated that foreign students were participating in student and community activities in order to provide additional opportunity to practice English.

Plaister (26) gave a description of the English Language Institute reading courses for the non-native English applying to the University of Hawaii. All the non-native English were given the Form IC, Cooperative English Tests, Reading Comprehension. The test yielded four scores: vocabulary, comprehension, speed, and a total reading score which is a derived score from vocabulary plus speed scores. Raw scores were then converted to stanines and on the basis of these scores, students were classified as: 1. Exempt (from Stanine 7 to 9), 2. Those who were recommended to Course #72 (from Stanine 4 to 6), 3. Students who had to take Course #71 (from Stanine 2 to 3), and 4. The not admissible students (Stanine 1).

Exempt students were those who read well enough and could compete on fairly even terms with the native students. Course #71 was the basic reading course while Course #72 was a more advanced course. Both courses stressed elimination of poor reading habits, training in reading by structure, time reading exercises, practice in reading different kinds of material in class, lectures on important cultural concepts, practice in taking tests under timed conditions, and systematic attack on vocabulary growth by means of programmed tests. Plaister (26) stated that most of the foreign students were word-by-word readers and, as a consequence, read at very slow rates - 125 to 150 words per minute. To give practice in reading by structures, students were given instructions to read the structures with one fixation of the eyes, and, to do this against time, the metronome was used. Each student was given a 3 x 5 index card, and each time the student heard the metronome tick, he moved the card down. By gradually increasing the metronome speed, the student was able to increase his reading speed from 125 to 400 words per minute.

In 1963, a study was made by the United States Department of State (31) about the effectiveness of the educational and cultural exchange program. The results of the study were presented as a report to congress by the Advisory Commission on International Educational and Cultural Affairs. The inquiry was conducted both overseas and in the United States. The research associates of New York City used either personal or mailed interviews to contact 2,696 former grantees with inquiries about their experience as grantees both in the United States and upon their return home. Questions were asked concerning the academic and social problems of foreign students. Included in the inquiry, in addition to foreign students, were

university presidents; academic leaders; chief officials of private exchange agencies, foundations, and community organizations; the key members of the National Association of Foreign Student Advisors; the principle officers concerned with the educational and cultural affairs program in the Department of State; the United States Advisory Commission members; and the United States embassies where 131 officers responded from 26 embassies: Belgium, Sweden, Germany, Britain, Poland, Yugoslavia, Turkey, Iran, India, Greece, the Philippines, Viet Nam, Japan, Korea, Malaya, New Zealand, Colombia, Chile, Mexico, Guatemala, Uruguay, Brazil, Kenya, Ghana, South Africa, and Sudan. In addition to the previous sources, the research on the operation and effectiveness of the exchange program was reviewed, and the following conclusions were made:

1. There were some cases of poor selection, programing, and placement out of 53,000 foreign grantees brought to the United States since 1949. In spite of that and although there were few grantees who left with negative or hostile attitudes, the program as a whole was considered to be effective.
2. Although the reactions of former grantees varied with the country from which they came, the European grantees were most critical and the Latin Americans the most laudatory. It was found that the program resulted in increased understanding of America and the Americans and a better understanding between America and the other nations.
3. Broader perspectives, a wider international outlook, and an increase in professional knowledge were results frequently cited by both grantees and program personnel abroad and in the United States.

Cormack (5) summarized the methodologies normally used in educational research concerning foreign students in six categories: 1. Census or population count, 2. Opinion poll, 3. Sociological cross-section inquiry using questionnaire and/or interview techniques, 4. Anthropological longitudinal method, 5. Psychological or psychoanalytic method using biological and biographic data and/or projective techniques, and 6. The comparison method as in comparing different foreign cultures in one institution or comparing members of one culture at different institutions. She considered the lack of rigor in the definition of conduct of the research, the problem of selecting and measuring the variables under investigation, and the personal effects together with the different national policies as the major difficulties and problems encountered by the research workers in the field of educational exchange and in the evaluation of that kind of research.

After reviewing the literature about the foreign student academic achievement, Spencer and Awe (33) noticed several points of weaknesses in research conducted on foreign students:

1. They found that the type of data collected about foreign students varied from one research to another but with some emphasis on a few markedly common variables such as age, sex, and previous education.
2. They found a lack of application of appropriate statistical models and of selection of adequate population samples which were at variance with accepted research techniques and sophistication.
3. They found a lack of application of the research findings in developing, organizing, and administering foreign student programs

as well as the lack of checking these findings by cross-validation studies.

4. They also found that there was a strong emphasis existing through much of the literature on the study of the relationship between the English language proficiency and the foreign student's academic achievement but with concurrent lack of experimentation on native language proficiency.

In 1963, Deutsch (7) conducted a community study of the foreign students and the international aspects of five colleges and universities in the Cleveland area. The objective of his study was to present a research panorama of the various participants in the international aspects of higher education and exchange. The data were collected about foreign students, American students, American professors and administrators, members of the community involved with foreign visitors, and on the visiting foreign faculty members. Survey methods were employed including historical analysis, informant techniques, personal interviews, and observation. The sample totaled 1,018 (286 foreign students, 143 host families, 376 American students, and 213 American faculty members). This study revealed that most of the foreign students were male, graduate students from the less-developed nations. Two-fifths of these students were self-supporting, one-fifth of them was majoring in the natural and physical sciences, and the same proportion was found in engineering. The majority of the one-third who lived with Americans reported satisfaction with their social interaction with Americans. The foreign students were found to be generally satisfied with their educational experiences. However, one out of eleven students felt that many courses did not apply to his future work. The study indicated

there were no major problems of language or of an academic nature and that the personal problems consisted of homesickness and discrimination. One out of five students was never homesick, including the Canadians who had similar culture. Discrimination on the basis of either race or culture was experienced by 25 percent of these foreign students. The survey (7) found that although the majority of the American students were not involved in the International Student Group and Center, they were interested in international education and foreign languages were being studied by most of them. It was also found that most American professors who had foreign students in their classes indicated that the foreign students were more motivated and interested than American students although sometimes less accomplished due to inadequate backgrounds and language difficulties. The lack of coordination of the various aspects of international education as well as the lack of an articulated policy were the main concerns of the college and university administrators as was reported in the survey (7). Finally, it was found as a result of this study that hosts to foreign students in the Cleveland area colleges had some specific characteristics. They were found to be active, well educated, organizationally involved, internationally traveled, familiar with foreign languages, well above the average in income and occupational prestige, satisfied with their experiences with foreign students, and convinced of the worth of the foreign student programs.

In an attempt to discover the personal and environmental factors involved in cross-cultural friendships, Shaffer (28) investigated the socio-cultural interactions and relationships among foreign students and American students on the Indiana University campus to ascertain their impact on the native group and to determine the distinguishing characteris-

tics of friendship patterns. The sample of this study consisted of 550 American students named by the foreign students as close friends to them and 330 American students not named by foreign students as close friends. Both groups had associated with foreign students for a minimum period of one semester. The procedure included 13 items of personal data (about sex, age, marital status, campus housing unit, class standing, field of study, home state, size of hometowns, participation in activities, military service experience, and birthplaces as well as educational levels and occupations of parents). Two personality inventories were also administered to the subjects: the Edwards Personal Preference Schedule and the Allport-Vernon-Lindzey Study of Values, in addition to personal interviews. Analysis of variance and chi-square techniques were employed in the statistical treatment of the data, and the following conclusions were drawn:

1. No significant differences were found between the students in the named group and the students in the not named group in terms of the following factors: age of students, number of males and females, the size of the hometowns of students, the national birthplace, the educational and the occupational level of the students' parents, participation in high school and college activities, military service experience, previous knowledge of foreign people before, the number of new interests developed as a result of knowing foreign students, the number of attitudes modified as a result of knowing foreign students, change in future plans as a result of knowing foreign students, how they think other Americans view friendships with foreign students, their thinking about the overall arrangements for foreign students at Indiana University, and the

kind of difficulties they think foreign students have or in how these difficulties can be alleviated.

2. Significant differences were found in terms of the marital status, the field of study, and the language factors. It was found that there were significantly more married students in the named group and that American student friends of foreign students tended to major more often in languages and literature and history while American students in the not named group tended to major in biological and physical science or in education. In terms of language, it was found that significantly more students in the named group had conversed with foreign students in other languages and had a wider range of foreign student friends than students in the not named group.
3. It was found also in this study that friendship between foreign and American students was based upon similarities in interests and environmental proximity rather than upon national differences or the personal and background characteristics of the American students. American student friends of foreign students were socially active and well integrated in campus life activities. They viewed foreign students as being more interested in culture and more mature than American students.
4. Friendship with foreign students was found in this study to encourage American students to reevaluate their attitudes toward national and domestic policies of the United States.

Mcleod and First (18) conducted a classroom experiment to study the use of typewriting instruction as an aid to the learning of English as a

foreign language. The experiment was conducted with the students of the American Language Institute at San Francisco State College where a program was provided for foreign students who needed remedial work in English. Thirty students were enrolled in the institute in the spring semester of 1964. The data were obtained about the subjects through the use of a questionnaire, direct questioning, and the students' record folder in addition to the scores on the English language precourse tests which were administered to all the subjects involved in the experiment. The students were ranked on the basis of the mean scores on the precourse language tests, and the subjects were assigned to experimental and control groups of 15 students each. The assignment of individual students to the different groups was done after using the data provided by the questionnaire, the direct questioning, and the students' record folder to take into consideration the native language of the student, the expected exposure to English language usage outside the classroom, and the undergraduate or graduate scholastic standing of the students. Both the experimental and the control groups completed the regular 12-week program of the American Language Institute with the exception that special typewriting instruction was given only to the experimental group for three periods a week and a specially prepared textbook was used by this group. The control group had an equivalent three periods a week of English pattern practice but without typewriting. At the end of the 12-week program, the postcourse English language tests were administered to the two groups. After employing analysis of covariance to adjust the postscore averages for precourse levels in evaluating the increased facility in English attained as expressed by final test scores, the experimental group showed a consistent pattern of superior scores.

In order to determine the seriousness of the language barrier and the comparative English language proficiency of Chinese or Indian students with other foreign students from other countries, Chi and Shivananda (3) made a study of the foreign students at the University of Kansas in 1966. They tested five groups of 303 foreign students: Chinese, Indian, Arabian, African, and Latin American. They found that the language problem was serious for the Chinese students in comparison to other foreign students. Only students from European countries were found to be superior to the Indian students in English language proficiency.

Also in the guidelines set up by the National Association for Foreign Student Affairs (22) in 1966, English language deficiency was considered as the first difficulty that seriously interferes with academic success of foreign students. Other difficulties which were considered by the association (22) to affect the foreign student academic achievement included inadequate study methods and preparation for certain courses; lack, confusion, and conflict of goals especially in cases of sponsored foreign students; and health and living arrangements. Reduction of academic load, addition of language training, extra time on examinations, and substitution of essay for an objective examination were the National Association's (22) major recommendations for assisting the foreign student to compensate for his handicaps, especially in English language.

In a study of the relative culture-fairness of reading tests, Kumbaraci (15) studied the comparability of an English college-level reading comprehension test to its Turkish translation administered in Turkey and to its English retranslation administered in the United States. Eight hundred ten Turkish high school seniors and college students were tested

with the Turkish versions; 1,135 American high school seniors and college students were tested with the original English versions; 189 American high school seniors and college students were tested with retranslated English versions; 86 Turkish students studying English were tested with both a reading test in Turkish and a similar test in English. The study used different versions of two parallel forms of the International Reading Test and a practice test for Turkish students in addition to a vocabulary test for Turkish students studying English.

A questionnaire concerning previous study of English, field of specialization, and the college or university in which the student was planning to enroll was completed for Turkish students who were studying English. Three test scores were used in order to determine the validity of the International Reading Test, the Scholastic Aptitude Test verbal scores, the Otis Intelligence Test scores, and the University of Ankara Entrance Examination scores. For the one college and six of the nine high schools tested in Turkey, the average of literature grades for the previous academic year were also collected as well as their first semester grades in an American university. Subsample analysis, reliability determination, correlational, variance, and item-analysis procedures were employed in the analysis of the data, and the following findings were reported:

1. Average total scores for Turkish and American students were quite similar for samples in the same grade.
2. Retranslation of the English test did not alter its characteristics for American students in terms of total score.

3. The equivalence of the two parallel forms remained stable with translation and administration in the Turkish culture and with retranslation into English.
4. A correlation of .70 was obtained in the relative difficulty of single items in Turkish and in English, and a correlation of .85 was obtained between the original and retranslated English versions, indicating that both translation and cultural differences influenced indices of item difficulty.
5. Correlating discrimination indices for single items between the English and Turkish versions showed a correlation of .15 between the sharpness of discrimination of a specific item in the two cultures, but discrimination indices were stable for students when compared by country.
6. Due to the greater homogeneity in the Turkish group, an appreciable drop was found in the internal consistency reliability of the Turkish test and in the sharpness of discrimination of single items.
7. Items which seemed relatively easier for students of either country also had better discrimination power in the particular country. Item difficulty and discrimination correlated negligibly within the United States but significantly in Turkey.
8. Responses to the wrong options of each multiple choice item were stable within each country but correlated only .40 across cultures. On the basis of the similarity of the correlations between the original and retranslated English versions which was .72, it was

concluded that translations did not have much effect in changing responses to wrong options.

9. Rank correlation of the difficulty of reading passages in the United States and Turkey was .92.

10. Finally, for Turkish students studying English, reading ability in the two languages correlated .54, implying the existence of common reading factors.

A description of the special procedures taken for the education of foreign children in the Detroit public schools was given by Hayden (12) in 1965. Special foreign classes were established for children who had recently arrived in the United States and whose language difficulties prevented regular grade placement. The enrollment was limited to children between the ages of eight and twenty. Intensified language work was given by specially prepared teachers in order to enable the children to speak, read, and write English. Younger foreign children were generally enrolled in the kindergarten or first grade of their neighborhood schools where they remained for a year in the special foreign classes after which the school principal, in consultation with the special foreign class teacher, reassigned the children when they had learned enough English to adjust to the regular classes. Achievement tests were given as a basis for grade-level placement at the end of the first school year in the special foreign classes.

In 1966, the National Association for Foreign Student Affairs (23) developed some guidelines for the selection and admission of foreign students. According to those guidelines, the factors to be considered in the evaluation process of the applicant's background were:

1. The country's educational system and standard, as well as the particular preparatory or secondary school, college, or university which the applicant has attended.
2. The meaning of the applicant's record, marks, certificates, or degrees in his own country, as well as his academic potential as judged by his achievement in his country's educational system.

The following points were considered important by the association (23) in the development of evaluation criteria for a successful American education experience:

1. The suitability of the institution's program to the applicant's educational objective. Applicant's possession of the necessary qualifications for his desired field of study.
2. The maturational and motivational level essential for the applicant's success in an unfamiliar environment.
3. Adequate financial resources. English language efficiency necessary to pursue academic objectives in competition with American students.

A study made by Putnam (27) included a sample consisting of 546 foreign graduate students who were enrolled between September, 1945, and June, 1950, at Columbia University. The purpose of this study was to investigate:

1. The academic performance of graduate students enrolled in Columbia University from selected foreign countries.
2. The relationship between total grade-point average at Columbia University and such factors as sex, national origin and undergraduate academic standing, English language background, admission status, major, scholarship awards, and age.

The results showed that the grade-point average for the total sample was 7.9, just under 8 with averages between 7.6 and 8.3 for eleven of the national groups totaling 498 cases. Undergraduate academic standing converted to grade-point averages showed a correlation with the criterion of only 0.23. Several factors gave strong indication that language facility was an important factor in the academic success of foreign students at Columbia University. He found that first-term grade-point average correlated highly with both overall grade-point average and remainder grade-point average. It would have been a satisfactory predictor for total grade-point average in 94.2 percent of individual cases. In addition, he found that age, admission status, scholarship awards, and national origin had no appreciable relationship with academic achievement.

Intensive case studies of 76 graduate students attending the University of Minnesota (19) during the 1951-1952 academic year showed that of the many factors affecting academic achievement, motivation was one of the most important and must be understood if academic achievement is to be realistically assessed. The case studies gave evidence that among the causes of poor achievement of foreign students were the factors of English deficiency, lack of motivation, delayed or improper vocational choice, and "cultural imbalance". In the section of the study dealing with the achievement of 516 foreign students as measured by honor-point ratio (HPR), a number of statistical tests were used.

The comparisons involving the mean achievement of foreign students offered the best measure of the outcome of the study when the three variables of country of origin, field of study, and degree were held constant. A sufficient number of students from China and India with HPR distributions

homogeneous in variance were available for inter-country comparisons, and it was shown that achievement of students from China and India earning a master's degree with designation in the field of civil engineering differed significantly at the one percent level in favor of the Chinese students. Students from these same countries earning the doctorate in the field of agronomy-plant genetics did not achieve significantly different HPR levels. The Chinese students in entomology earning the Ph.D. achieved at a significantly higher level of HPR than did the Chinese students in agronomy-plant genetics but showed no significant difference in achievement when compared to Indian students earning the doctorate in plant pathology. Chinese students earning the master's degree with designation in aeronautical engineering achieved at a significantly higher HPR level than did the Chinese students in chemical engineering. The comparisons of achievement of American and foreign graduate students gave no clear instances of statistically significant difference. Chinese students in aeronautical, civil, and electrical engineering averaged HPR above those of American students but fell below the American students' achievement in agronomy-plant genetics, entomology, chemical engineering, agricultural economics, and economics. The American students ranked consistently above the Indian and the Norwegian students in the comparison made.

Clark (4) studied the cross-cultural academic experience of Ghanaian students in the United States during the 1959-1960 academic year. She defined academic achievement as the rating of the student on a pass or fail basis by the educational institution attended and academic satisfaction as the satisfaction of the student with the academic standing assigned to him by the institution. Clark, then, sampled two populations, Ghanaian stu-

dents in the United States and the educational institution they were attending. Subsequently, questionnaires were mailed to 190 students and 98 educational institutions. All the institutions returned the questionnaires. The return from the students was 76 percent. Clark investigated factors selected from the educational background of the students in Ghana and the characteristics of the responding students and of the educational institutions. Her findings were reported at the five percent level of significance. She discovered that significantly more students were passing who:

1. Held government grants than those who did not.
2. Attended accredited institutions.
3. Held the equivalent of the advanced level general certificate of education. In addition, the investigation revealed a significant difference in satisfaction between married and unmarried students. Significantly more of the former were satisfied than the latter. Also, students 30 years or older were more satisfied than those under 30.

Elaine Forstat (9) explored specific areas in which international students at Purdue University encountered difficulties. Her mail questionnaire to 201 foreign students in West Lafayette included a checklist of problems. She discovered that academic status and country of origin were factors associated with the total number of adjustment problems of the students in her sample. On the other hand, age, length of stay in the United States, and field of study appeared unrelated to difficulties encountered by foreign students.

In one of his studies, Hountras (13) investigated factors relating to the academic achievement of foreign graduate students enrolled at the Uni-

versity of Michigan in the years 1947 to 1949. He studied and analyzed the records of 587 foreign graduate students, 257 of whom were on academic probation sometime during the period under study.

Hountras concluded that:

1. There was a significant relationship between the geographical origin of the students and their academic achievement. Students from the Far East, Near East, and Latin America were more likely to be on temporary enrollment than those from other parts of the world.
2. There was a significant relationship between academic achievement and field of study. Students in the social and physical sciences were more apt to incur probation than those in the other broad academic areas.
3. There was predictive association between academic achievement and such variables as type of admission, degree held at admission, marital status, and length of residence in graduate school. In connection with the last factor, academic difficulties were almost encountered in the first and second terms of enrollment. There was no significant relationship between academic achievement and variables like sex, age at entrance, employment status, and summer attendance.

In another study, Hountras (14) reviewed Miller's work and a study done with the Miller Analogies Test at the University of Michigan on foreign graduate students. He concluded that the test should be included in the admission requirements of foreign graduate students because it showed great promise as a yardstick for selecting foreign students who have the knowledge, aptitude, ability, and skill to profit from graduate education.

Another study was conducted by Ohuche (24) of the academic achievement of Nigerian students in the United States during the academic year 1966-1967. The population of the Nigerian students in the United States was 1,882. Of this number, 1,426 were undergraduates and the rest were graduate students. A representative sample of the students was selected using proportional sampling method. The total population was separated into two groups, graduate students and undergraduates, including students in professional schools who had not obtained a first degree. The names were arranged alphabetically, and from the sub-population of graduate students, the first of each group of five names was selected, while from the subset of undergraduates, the first of each set of ten names was chosen. Thus, questionnaires were mailed to 143 undergraduates and 92 graduate students. Sixty-five of the latter and 104 of the former returned the questionnaires. Data were collected on the background of the students while in Nigeria, their financial sponsorship and academic performance in the United States. In addition, a shorter questionnaire was mailed to the faculty adviser of each student in the sample. As a result, the validity of the response of the students was checked by carrying out an analysis of variance between the cumulative grade-point averages reported by the students and those reported by the academic advisers. The following conclusions were drawn from the findings of this study:

1. Previous educational experience, as measured by the grade in the school certificate examination of Nigerian undergraduates attending institutions of higher learning in the United States, could not be used to predict satisfactorily the academic achievement of such students as measured by their cumulative grade-point averages.

2. Nigerian undergraduates who completed the equivalent of the higher school certificate examination performed better academically than those who did not.
3. No significant difference was found in academic achievement between those Nigerian undergraduates who held government scholarships and those who did not.
4. It was found that both the first-term grade-point average and the cumulative grade-point average at the end of the first term of the second year in college correlated highly with academic achievement.
5. No significant difference was found in academic achievement between the Nigerian graduate students who obtained bachelor degrees in the United States and those who received initial degrees elsewhere.

An important survey of students from Africa, south of the Sahara, excluding the Union of South Africa, was carried out in 1961. This survey was made by the Institute of International Education through the International Center of the University of Michigan. Writing in the forward to the Survey Report (17), the president of the Institute of International Education defined the purpose of the survey thus:

> "The assignment was to obtain comprehensive, up-to-date statistical information on African students in the United States during 1961, their backgrounds, major problems, educational and social experiences and future plans."

There was a total of 1,600 students who qualified for the population. The investigation team located and sent mail questionnaires to 1,553 of these. Sixty-seven percent of the recipient students returned the questionnaires. Following the returns, a sample of 208 of the students and 112 institutional administrators in 43 of the 366 colleges and universities

were interviewed. The survey (17) found the composite student in the population to be "a 26-year-old single male from either Nigeria or Kenya who was beginning the junior year and was studying social science". Twenty-seven percent of the students were freshmen, 17 percent were sophomores, 16 percent juniors, 10 percent seniors, and 22 percent graduate students. In spite of the fact that about 50 percent of the students were still in their initial adjustment phase, 79 percent reported satisfaction with their academic program. In the words of the report:

> "In contrast to American students who frequently change their major field of study, only a handful of the African students have changed their major since their arrival here. This seems to indicate that they have semi-definite ideas about their academic interests, although they may not have as definite ideas on how they will be able to apply their knowledge upon their return home."

The students reported that their major problems were in communication, discrimination, adjustment to school, academic work, adjustment to the United States, social adjustment, finance, food, and homesickness.

Six percent of the students reported having academic difficulties. The major reasons given by the students for academic problems were language and communication differences and the difficulty of adjusting to the American educational system with its objective tests and fast pace. The overall grade-point average of the sample as reported by the students was a B-, which seems relatively high. However, it should be remembered that 22 percent of the sample was made up of graduate students who were expected to maintain a B average. The only check on the accuracy of the students' responses was provided by opinions voiced by 31 academic advisers. Thirty-six percent of these thought the African students were doing better than American students, 23 percent thought the African students were doing

worse, and 19 percent thought there was no appreciable difference. The academic advisers agreed with the students that there were communication problems and that it was not easy to adjust to objective tests. They added that in some cases preparation was inadequate. Nevertheless, most of the advisers "believed that a majority of the students make satisfactory academic progress after an initial period of adjustment".

The author (8) recently completed a study of the relationships between academic achievement of foreign students at Iowa State University in 1967-1968 and the variables of sex, age, native language, source of support, curriculum, marital status, and year of study. A sample of 120 foreign students was randomly selected, 50 undergraduates and 70 graduates who were enrolled in the spring quarter, 1968. The data about the subjects were collected through the use of the students' academic records and the Foreign Students' Adviser's records in addition to personal interviews. The cumulative grade-point average obtained by the student at Iowa State University was used as the measure of academic achievement, and the analysis of variance was employed to test the null hypothesis of no difference between the various categories on the basis of the grade-point averages.

This study revealed that there was no significant difference in the academic achievement of undergraduate students on the basis of their ages, while at the graduate level, it was found that the older students (25 years old or over) had a significantly higher mean grade-point average than those who were under 25 years of age. The author concluded that this difference might be due to the interaction between age and some other variables since testing the main effect of the age factor showed no significant difference at both the graduate and undergraduate levels. For the sex variable, while

no significant difference was found in the academic achievement of graduate students, it was found that undergraduate females were achieving significantly better than undergraduate males. On the other hand, no significant difference was found at the graduate level when the students were categorized on the basis of the course of support, while at the undergraduate level it was found that the self-supported students had a significantly higher mean grade-point average than the government supported students. Concerning marital status, it was found that although there was no significant difference at the undergraduate level, testing the main effect of that variable showed that the married students were achieving significantly better than the single students. Marital status resulted in no significant difference in the academic achievement of graduate students. At the same time, there was insufficient evidence to reject the null hypotheses of no difference in the academic achievement of foreign students when they were categorized on the basis of kind of curriculum, year of study, native language, or in terms of the interaction between the age, sex, and marital status variables at both graduate and undergraduate levels.

The Literature and the Variables of Investigation

As revealed by the review of literature, the seven variables of interest in this study were frequently considered through much of the literature on foreign students.

The sex variable was among the main variables in Myers' study (20) and was also included in the studies conducted by Deutsch (7), Shaffer (28), Putnam (27), and Hountras (13) who investigated the relationship between the sex variable of the foreign graduate student and his academic achieve-

ment. The relationship between the foreign student's age and his academic performance was explored in Putnam's study (27) and was also one of the main variables in the studies made by Shaffer (28), Myers (20), Clark (4), Forstat (9), and Hountras (13) who investigated the relationship between the age and sex of foreign student and his academic achievement.

Concerning the language factor, the review of literature about foreign students' academic achievement which was done by Spencer and Awe (33) revealed that although the sex, age, and previous education were the common variables through the literature on foreign students, there was an evident emphasis on the English language proficiency but with concurrent lack of exploring the native language factor. In his evaluation of the Student Exchange Program, Friedrichs (11) found that the language problem was the most frequently encountered difficulty by the foreign student. Besides, one of the basic recommendations given by the Advisory Commission (31) after the study conducted by the United States Department of State (31) was that the foreign student be given intensive language training prior to his taking up studies in the United States. The same variable was also considered in the studies made by Peyser (25), Darnell (6), Plaister (26), Deutsch (7), Shaffer (28), Mcleod and First (18), Kumbaraci (15), Hayden (12), Putnam (27), Moore (19), Chi and Shivananda (3), the Institute of International Education (17), the National Association for Foreign Student Affairs (21), and Hountras (13) who studied the relationship between academic achievement and the geographical origin of the foreign student, a factor which is closely related to the native language variable.

The marital status of foreign students was studied by Hountras (14) to investigate the predictive association between that variable and the

academic achievement. The same variable was also considered in the works of Clark (4) and Shaffer (28).

The year of study was another variable in Hountras' study (13) of the relationship between the length of stay in the United States and the foreign student's academic achievement. The same factor was studied by Forstat (9) and by Myers (20) who included "time" among his main variables.

Concerning the field of study variable, it was recommended by the Advisory Commission of the United States Department of State (31) that to assure better quality of foreign students for exchange programs, "field selection centers" should be set up on a regional basis overseas. Also, the review of the literature showed that the field of study was included in the works of Deutsch (7), Shaffer (28), Kumbaraci (15), Myers (20), Putnam (27), Moore (19), Forstat (9), Hountras (13), the National Association for Foreign Student Affairs (23), and in the Institute of International Education Survey (17).

Finally, the source of support factor which was studied by Clark (4) in terms of its relationship to the foreign student academic achievement was also studied by Deutsch (7), the National Association for Foreign Student Affairs (21), and Myers (20) who selected it among the main variables in his study conducted on foreign students in general and on Peruvian students in particular. Also, according to the United States Department of Health and Welfare Office of Education Report (23) on International Education and the Junior Colleges, the financial problem of foreign students was reported as one of the main difficulties encountered by the students, the majority of whom (85 percent) financed their studies by funds from home or

from employment in the United States while only 15 percent were financed by government scholarships.

DESCRIPTION OF THE SAMPLE OF INVESTIGATION

A definition of foreign student was given by the National Association for Foreign Student Affairs (21) as "any student who is foreign born and not a United States citizen or naturalized United States citizen". This would include nonimmigrant aliens, immigrant aliens, and refugees. The same description applies to the subjects under investigation in this study who should be considered as a sample of foreign students taken over a time continuum. Although it was realized that this study would have been more effective if the sample was drawn from some other institutions in addition to Iowa State University, time and financial resources available limited what could be done concerning the selection of the subjects. Also, this study was conducted on the foreign students in Iowa State University with the hope that the findings would be checked by some cross-validation studies in other educational institutions enrolling foreign students.

The sample of investigation for this study consisted of 454 foreign students coming from 46 foreign countries with ten different native languages. These students were found at both undergraduate and graduate levels and were distributed in the different fields of study at Iowa State University. The students were predominantly males (only 17.8 percent were females), over 25 years old (less than 28 percent were under 25), and graduates (74 percent). Less than 41 percent were married, and more than 55 percent were self-supporting. The biggest proportion of the subjects were under the native language category which uses the Latin alphabet (28 percent) and in the field of science and humanities (44.9 percent) or in engineering (30.2 percent).

The native languages were distributed as follows: 28 percent originally Latin languages (those were the students whose native language was not English but their language alphabet was in the form of Latin letters. They were the students who came from Italy, Greece, Cyprus, Denmark, Belgium, Spain, Panama, Peru, Venezuela, Mexico, Columbia, Brazil, Uruguay, Guatemala, Argentina, El Salvador, Turkey, Philippines, and Biafra), 18.5 percent Arabic (these were the students of the countries which either used the Arabic language or the Arabic letters such as students from Saudi Arabia, Lebanon, Egypt, Kuawait, Iraq, Syria, Libya, Pakistan, Ethiopia, and Iran), 15.6 percent Chinese (from China and Hong Kong), 15.4 percent English (those were the students from Canada, England, Ireland, New Zealand, Australia, Guyana, Ghana, South Africa, and Haiti), 9.5 percent Hindi (Indian students), 4.2 percent Tsai (from Thailand), 3.5 percent Yoruba (from Nigeria), 2.2 percent Japanese, 2 percent Korean, and 1.1 percent Hebrew (from Israel).

Table 1. A frequency distribution for the total sample of foreign students by the factors under consideration

Factor	Category	Number	Percentage
Sex	Male	373	82.2
	Female	81	17.8
Age	Under 25	126	27.8
	25 or over	328	72.2
Marital status	Single	270	59.5
	Married	184	40.5
Support	Government	203	44.7
	Self	251	55.3
Field of study	Science and humanities	204	44.9
	Engineering	137	30.2
	Agriculture	81	17.8
	Home economics	20	4.4
	Veterinary medicine	12	2.7
Native language	Original Latin	127	28.0
	Arabic	84	18.5
	Chinese	71	15.6
	English	70	15.4
	Hindi	43	9.5
	Tsai	19	4.2
	Yoruba	16	3.5
	Japanese	10	2.2
	Korean	9	2.0
	Hebrew	5	1.1

METHOD OF PROCEDURE

The basic criterion for measuring the foreign student's academic achievement in this study was his cumulative grade-point average (CGPA). The justification for selecting this criterion as the dependent variable was that the main objective of this study was the prediction of academic achievement of the foreign students at Iowa State University. The GPA is the only acceptable measure of academic achievement. The data were collected for all the foreign students enrolled at Iowa State University in the 1968-1969 school year (454 students). A coding system was developed as shown in the appendix.

Three different sources were exploited for gathering the data about the seven variables of interest:

1. The foreign students' adviser's records where the foreign students were identified and information about their fields of study were obtained.
2. The foreign students' permanent records in the Registrar's Office which provided data about the foreign students' age, sex, and length of stay.
3. The personal interviews with the subjects to provide data about the native language, marital status, and source of support.

Statistical Techniques

The purpose of this study was to investigate the seven variables under consideration in order to see if they could be used for prediction of academic achievement of foreign students.

Three stages of statistical analysis were employed:

1. Performing analysis of variance-single classification in order to identify the significant variables which showed significant difference when the observations were grouped on the basis of a single factor while disregarding all the other variables.
2. Performing selected two-way analysis of variance to test the main effect as well as the interaction effect between the selected variables, hence adjusting for one variable and studying the criteria on the basis of this adjustment.
3. Running multiple regression analysis by:
   a. Utilizing those variables which part 1 and 2 above have revealed to have a significant difference alone or in combination with others.
   b. Testing of the significance of the loss by including in the regression equation all the significant variables and eliminating one of them at a time in order to determine which one (or ones) should be included in the final prediction equation.

First: Analysis of variance-single classification was used to test the null hypotheses of no significant difference between the mean grade-point averages (GPA) when foreign students were categorized:

1. On the basis of sex
2. On the basis of age
3. On the basis of native language
4. On the basis of field of study
5. On the basis of marital status

6. On the basis of the year of study or

7. On the basis of source of support

Also, these hypotheses were tested in terms of their main effect in the two-way classification framework after adjusting for the unequal numbers.

The statistical model for analysis of variance-single classification was as follows:

$$X_{ij} = \mu + A_i + E_{ij}$$

where X_{IJ} = the Jth of observation of the Ith treatment

μ = the overall grand mean

A_i = effect due to the Ith treatment

E_{ij} = random error or deviation corresponding to the jth observation of the Ith treatment

$i = 1, 2 \ldots\ldots\ldots t$

$j = 1, 2 \ldots\ldots\ldots n_I$

Assumption

$$E_{IJ} \sim NID\ (0, \sigma^2)$$

$$\Sigma n_i A_i = 0$$

Second: Analysis of variance-selected two-way classification was used to test the null hypotheses of no significant difference between the mean GPA of foreign students due to:

1. The interaction between the sex and age variables

2. The interaction between the sex and native language variables

3. The interaction between the sex and marital status variables

4. The interaction between the sex and support variables

5. The interaction between the age and native language variables
6. The interaction between the age and marital status variables
7. The interaction between the age and support variables
8. The interaction between the native language and marital status variables
9. The interaction between the native language and support variables

or

10. The interaction between the marital status and support variables

The statistical model for the analysis of variance-multiple classification was as follows:

$$X_{ijk} = \mu + A_i + B_j + (AB)_{ij} + E_{ijk}$$

where μ = the true mean effect

A_i = the main effect of the ith level of factor a (adjusting for the other factors)

B_j = the main effect of the jth level of factor b

$(AB)_{ij}$ = the main effect of the interaction of the ith level of factor a with the jth level of factor b

E_{ijk} = the random error associated with the kth experimental unit subjected to the (ij)th treatment combination

$i = 1 \ldots\ldots\ldots a$

$j = 1 \ldots\ldots\ldots b$

$k = 1 \ldots\ldots\ldots n_{ij}$

Assumption

$$E_{ijk} \sim NID \ (0, \sigma^2)$$

$$\sum_i n_{ij} A_i = 0 \qquad \sum_i n_{ij} (AB)_{ij} = 0$$

$$\sum_j n_{ij} B_j = 0 \qquad \sum_j n_{ij} (AB)_{ij} = 0$$

Third: Multiple regression analysis will be computed, first by including the variables which part 1 and 2 above have revealed to have significant difference alone or in combination with others and then by dropping from the seven independent variable regression equation one variable at a time (sex, age, native language, field of study, year of study, source of support, and finally the marital status). The purpose was to determine which variable (or variables) could be eliminated without causing a significant loss and which one (or ones) should be retained in the prediction equation.

FINDINGS

Analysis of Variance-Single Classification

On the undergraduate level

In the following pages, the results of analysis of variance-single classification for the 117 undergraduate students will be presented in the form of tables and explanation of the tables will follow.

Table 2. Analysis of variance of academic achievement of undergraduates by sex groups

Source	df	Sum of squares	Mean square	F value
Between	1	2.1891	2.1891	5.50*
Within	115	45.7504	0.3978	
Total	116	47.9395		
			Table F value	.05 = 3.93
				.01 = 6.86

*Significant at .05 level.

Table 3. Analysis of variance of academic achievement of undergraduates by age groups

Source	df	Sum of squares	Mean square	F value
Between	1	3.6073	3.6073	9.36**
Within	115	44.3322	0.3855	
Total	116	47.9395		
			Table F value	.05 = 3.93
				.01 = 6.86

**Significant at .01 level.

Table 4. Analysis of variance of academic achievement of undergraduates by native language groups

Source	df	Sum of squares	Mean square	F value
Between	7	6.5469	0.9353	2.46*
Within	109	41.3926	0.3797	
Total	116	47.9395		
			Table F value	.05 = 2.09
				.01 = 2.81

Table 5. Analysis of variance of academic achievement of undergraduates by field of study groups

Source	df	Sum of squares	Mean square	F value
Between	4	1.9946	0.4986	1.22
Within	112	45.9449	0.4102	
Total	116	47.9395		
			Table F value	.05 = 2.45
				.01 = 3.49

Table 6. Analysis of variance of academic achievement of undergraduates by marital status groups

Source	df	Sum of squares	Mean square	F value
Between	1	4.0331	4.0331	10.56**
Within	115	43.9064	0.3818	
Total	116	47.9395		
			Table F value	.05 = 3.93
				.01 = 6.86

Table 7. Analysis of variance of academic achievement of undergraduates by year of study groups

Source	df	Sum of squares	Mean square	F value
Between	3	0.8084	0.2695	0.65
Within	113	47.1311	0.4171	
Total	116	47.9395		
			Table F value	.05 = 2.69
				.01 = 3.96

Table 8. Analysis of variance of academic achievement of undergraduates by support groups

Source	df	Sum of squares	Mean square	F value
Between	1	3.7925	3.7925	9.91**
Within	115	44.1470	0.3836	
Total	116	47.9395		
			Table F value	.05 = 3.93
				.01 = 6.86

As was revealed by the analysis of variance results in Tables 2 through 8, significant differences between the mean GPA were found when the observations were grouped on the basis of any of the sex, age, native language, marital status, or support variables. The categories which were found to have highly significant differences in mean GPA were the female, the older, the married, and the government supported students. For the native language variable, further t tests utilizing the formula:

$$t = \frac{D}{S_{\bar{D}}}$$

where D = the difference between two means and $S_{\bar{D}} = S\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$ showed that the Chinese undergraduates were achieving significantly better than the students under the language categories of Original Latin, Arabic, Yoruba, and Hindi, while there was no significant difference between Chinese and English, Hebrew, or Tsai categories.

Table 9. Tabled values of the undergraduates' language categories

Between	t value
Chinese and Arabic	3.52**
Chinese and Latin	2.64**
Chinese and English	1.88*
Chinese and Yoruba	2.37*
Chinese and Hindi	2.41*
Chinese and Tsai	1.86
Chinese and Hebrew	1.58
Latin and Hebrew	1
Latin and Arabic	1
Latin and Tsai	1
Latin and Hindi	1.56
Latin and Yoruba	1.41
English and Yoruba	.97
English and Hindi	1.60
English and Latin	.26
English and Hebrew	.47
English and Arabic	.96
English and Tsai	.74
The table t value at 109 df	.05 = 1.96
	.01 = 2.62

Therefore, the first, the second, the third, the fifth, and the seventh null hypotheses of no significant difference in the academic achievement of foreign students on the basis of either sex, age, native language, marital status, or support, respectively, were rejected at the undergraduate level.

On the other hand, no significant difference was found when the foreign undergraduate students were categorized on the basis of either the field of study or the year of study, and, accordingly, the conclusion was that there was insufficient evidence to reject either the fourth or the sixth null hypotheses of no difference in the foreign students' academic achievement when the observations were grouped on the basis of either the field or the year of study, respectively, at the undergraduate level.

On the graduate level

Analysis of variance-single classification was also employed for the data collected about the 337 foreign graduate students concerning the same variables, and the following results were found:

Table 10. Analysis of variance of academic achievement of graduates by sex groups

Source	df	Sum of squares	Mean square	F value
Between	1	0.2400	0.2400	1.41
Within	335	56.8401	0.1697	
Total	336	57.0801		
			Table F value	.05 = 3.87
				.01 = 6.73

Table 11. Analysis of variance of academic achievement of graduates by age groups

Source	df	Sum of squares	Mean square	F value
Between	1	0.5840	0.5840	3.46
Within	335	56.4961	0.1686	
Total	336	57.0801		
			Table F value	.05 = 3.87
				.01 = 6.73

Table 12. Analysis of variance of academic achievement of graduates by native language groups

Source	df	Sum of squares	Mean square	F value
Between	9	3.5421	0.3936	2.40*
Within	327	53.5380	0.1637	
Total	336	57.0801		
			Table F value	.05 = 1.91
				.01 = 2.47

Table 13. Analysis of variance of academic achievement of graduates by field of study groups

Source	df	Sum of squares	Mean square	F value
Between	4	0.8848	0.2212	1.31
Within	332	56.1953	0.1693	
Total	336	57.0801		
			Table F value	.05 = 2.40
				.01 = 3.38

Table 14. Analysis of variance of academic achievement of graduates by marital status groups

Source	df	Sum of squares	Mean square	F value
Between	1	1.0458	1.0458	6.72*
Within	335	56.0343	0.1673	
Total	336	57.0801		
			Table F value	.05 = 3.87
				.01 = 6.73

Table 15. Analysis of variance of academic achievement of graduates by year of study groups

Source	df	Sum of squares	Mean square	F value
Between	2	0.6308	0.3154	1.69
Within	334	56.4493	0.1670	
Total	336	57.0801		
				.05 = 3.03
			Table F value	
				.01 = 4.68

Table 16. Analysis of variance of academic achievement of graduates by support groups

Source	df	Sum of squares	Mean square	F value
Between	1	0.0998	0.0998	0.59
Within	335	56.9803	0.1701	
Total	336	57.0801		
				.05 = 3.87
			Table F value	
				.01 = 6.73

The analysis of variance Tables 10 through 16 indicate that when the foreign graduate students were categorized on the basis of any of the sex, age, field of study, year of study, or source of support variables, no significant differences were found in terms of their mean GPA while significant differences were found when the observations were grouped on the basis of either the native language or the marital status variable. Concerning the marital status variable, it was found that the married students were achieving significantly better than the single students. For the native language variable, further t tests based on the formula:

$$t = \frac{D}{S_{\bar{D}}}$$

where D = the difference between two means and $S_{\bar{D}} = S\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$, S^2 = pooled variance showed three types of relations in that variable:

1. The first relation indicated that the foreign graduate students whose native language was English obtained a significantly higher mean GPA than the students whose native language was Arabic, Original Latin, Korean, Tsai, or Japanese.
2. The second relation showed that the foreign graduates whose native language was Hindi or Chinese were achieving significantly better than the foreign graduates whose native language was either Tsai or Japanese.
3. Finally, the third type of relation revealed the fact that the foreign graduates of the Arabic and the Original Latin language categories had a significantly higher mean GPA than the Japanese graduate students.

Table 17. The relationships among graduate students' native languages on the basis of the mean GPA

GPA	3.5023	3.4795	3.3987	3.3398	3.3369	3.2578	3.1731	3.0660
Language	English	Hindi	Chinese	Arabic	O.Latin	Korean	Tsai	Japanese
1st relation	-------			----------				
2nd relation		----------					----------	
3rd relation				----------			-------	

Table 18. Tabled values of the graduate language categories

Between	t values
Chinese and Latin	1
Chinese and Arabic	1
Chinese and Tsai	1.98*
Chinese and Yoruba	1
Chinese and Korean	1
Chinese and Japanese	2.41*
Arabic and Tsai	1.44
Arabic and Korean	1.40
Arabic and Yoruba	1.39
Arabic and Latin	1.37*
Arabic and Japanese	1.96*
Original Latin and Japanese	2.03*
Original Latin and Tsai	1.53
Original Latin and Korean	1.49
Original Latin and Yoruba	1.44
Yoruba and Tsai	1
Yoruba and Korean	1
Yoruba and Japanese	1.25
Korean and Tsai	1
Korean and Japanese	1.07
Tsai and Japanese	1
Hebrew and English	1
Hebrew and Original Latin	1.15
Hebrew and Hindi	1.13

Table 18. (Continued)

Between	t value
Hebrew and Chinese	1.11
Hebrew and Arabic	1.9
Hebrew and Tsai	1.64
Hebrew and Yoruba	1.61
Hebrew and Korean	1.57
Hebrew and Japanese	1.92*
English and Latin	2.46*
English and Arabic	2.05*
English and Chinese	1.36
English and Hindi	1.31
English and Yoruba	1.57
English and Tsai	2.92**
English and Korean	1.71
English and Japanese	3.19**
Hindi and Latin	1.87
Hindi and Chinese	1.84
Hindi and Arabic	1.81
Hindi and Yoruba	1.34
Hindi and Tsai	2.58**
Hindi and Korean	1.49
Hindi and Japanese	2.91**
Table t value at 327 df	.05 = 1.96 .01 = 2.57

On the basis of the previous findings, the third and fifth null hypotheses of no significant differences in the academic achievement of foreign students on the basis of their native languages and marital status, respectively, were rejected at the graduate level while there was insufficient evidence to reject the first, the second, the fourth, the sixth, or the seventh null hypotheses of no significant differences in the foreign students' academic achievement when the observations were grouped on the

basis of the sex, age, field of study, year of study, or the source of support variables, respectively, at the graduate level.

Analysis of Variance-Selected Two-Way Classification

Analysis of variance-two-way classification was used to test for significance of the main effect as well as the interaction effect between variables on both undergraduate and graduate levels. The following three tables are shown as examples for the obtained results:

Table 19. Analysis of variance of academic achievement of undergraduates by sex and age

Source	df	Sum of squares	Mean square	F value
Sex	1	0.0558	0.0558	
Age	1	3.2369	3.2369	
Sex and age	1	0.7359	0.7359	1.90
Error	113	43.7109	0.3869	
Total	116	47.9395		
				.05 = 3.93
		Table $F_{1,113}$ value		.01 = 6.87

Table 20. Analysis of variance of academic achievement of undergraduates by age and language

Source	df	Sum of squares	Mean square	F value
Age	1	2.4995	2.4995	
Language	7	2.3196	0.3314	
Age and language	6	1.5891	0.2649	Less than one
Error	102	41.5313	0.4072	
Total	116	47.9395		
	.05 = 2.19			.05 = 3.93
Table $F_{6,102}$ value			Table $F_{1,102}$ value	
	.01 = 2.99			.01 = 6.89

Table 21. Analysis of variance of academic achievement of undergraduates by marital status and support

Source	df	Sum of squares	Mean square	F value
Marital status	1	2.4573	2.4573	
Support	1	0.7634	0.7634	
Marital status and support	1	0.2861	0.2861	Less than one
Error	113	44.4327	0.3932	
Total	116	47.9395		
		Table $F_{1,113}$ value	.05 = 3.93	
			.01 = 6.87	

Similar analysis was made to test the other interactions as shown in the summary table below.

Table 22. Summary table of the results of the interaction tests

Level of study	Interaction	F value
Undergraduate	Sex X age	1.90
"	Sex X language	Less than one
"	Sex X marital status	"
"	Sex X support	"
"	Age X language	"
"	Age X marital status	"
"	Age X support	"
"	Language X marital status	"
"	Language X support	1.18
"	Marital status X support	Less than one
Graduate	Language X marital status	5.42**

From the previous analysis results reported in Table 22, it was found that there was no significant difference in the academic achievement of the undergraduate foreign students due to the interaction between the tested variables. In other words, there was insufficient evidence to reject the first, the second, the third, the fourth, the fifth, the sixth, the seventh, the eighth, the ninth, and the tenth null hypotheses of no difference between the mean GPA of foreign students resulting from the interaction between sex and age, sex and native language, sex and marital status, sex and support, age and language, age and marital status, age and support, language and marital status, language and support, and marital status and support variables, respectively, at the undergraduate level. However, testing the main effect of the age variable showed a significant difference where the older undergraduate students (25 years old or over) were achieving significantly better than the younger undergraduates. Consequently, the first, the fifth, and the seventh null hypotheses of no significant difference between the mean GPA due to the age main effect were rejected at the undergraduate level. It should be mentioned for the purpose of clarification:

1. Sex by language interaction: No females were found in three language categories (Hindi, Hebrew, and Tsai).
2. Age by language interaction: No one in the age category of 25 years or over was found in the language category of Tsai.
3. Language by marital status interaction: There were no married students under the language categories of Hindi or Tsai.

4. Language by support interaction: No student under the language categories of Hindi, Hebrew, or Tsai was found under the "government supported" category.

Therefore, the degrees of freedom for the interaction tests were reduced from 7 to 4 (for sex by language and support by language), from 7 to 6 (for age by language), and from 7 to 5 (for language by marital status. At the graduate level, and as shown in Table **22,** a highly significant difference was found between the mean GPA of foreign students resulting from the interaction between the native language and the marital status variables.

Table 23 The mean grade-point averages of foreign graduate students by native languages and marital status

Native languages	Marital Status	
	Single	Married
Korean	3.1200	3.2750
English	3.4258	3.5405
Original Latin	3.2727	3.4114
Arabic	3.3326	3.3467
Hindi	3.3575	3.6150
Chinese	3.3055	3.5161
Japanese	3.8100	2.3220
Hebrew	------	3.6650
Tsai	3.1507	3.3300
Yoruba	3.2528	3.3525

It is obvious from Table 30 that the mean GPA of the married students in all the language categories is higher than the mean GPA of the single students except in the Japanese category. The t tests based on the formula:

$$t = \frac{D}{S_{\overline{D}}}$$

where $\bar{D}$ = the average difference between two means. $S_{\bar{D}} = S\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}$ indicated that the average single graduate Japanese GPA was significantly higher than that of the married student under the language categories of Original Latin, Arabic, and Korean but not significantly higher than the mean GPA of the married students under the language categories of Hebrew, Hindi, English, Chinese, Yoruba, or Tsai.

Table 24. Tabled values of the graduate students by native language and marital status

Between	t value
Single Japanese and Married Latin	2.17*
Single Japanese and Married English	1.50
Single Japanese and Married Hebrew	1.47
Single Japanese and Married Hindi	1.44
Single Japanese and Married Chinese	1.52
Single Japanese and Married Yoruba	1.75
Single Japanese and Married Arabic	2.36*
Single Japanese and Married Tsai	1.12
Single Japanese and Married Korean	2.41*
Single Japanese and Married Japanese	6.04**
Tabulated t value	.05 = 1.96
	.01 = 2.57

The eighth null hypothesis of no difference in the academic achievement of the foreign students due to the interaction between the native language and the marital status variables was rejected at .01 level for the graduate students. However, no significant difference was found in the graduate students' academic achievement due to the main effect of either the language or the marital status variables and the same null hypotheses were tenable at the graduate level as far as the main effects were concerned. As was

shown in Table 23, no graduate student under the "Hebrew" language category was found under the "single" marital status category, a fact that necessitated reducing the degrees of freedom of the interaction from 9 to 8.

Also, it should be noted that the sums of squares were not constant for any given variable when it was used as the main effect. This was because these sums of squares were really the adjusted sums of squares in order to take into account the unequal numbers of the observations in the cells of the two-way classification.

The Regression Analysis

Regression analysis was computed for all seven variables and not on only the ones which were found to be significant from the first stage (analysis of variance-single classification) and the second stage (analysis of variance-two-way classification) as was previously planned. The reason for that change in the plan was the striking inconsistency of the results in the sums of squares depending on one- or two-way classification in the previous analysis of variance, which makes it more meaningful to run the regression analysis on all the seven variables and not only on particular ones. Also, the previous research, as was found after the review of the literature, showed that all these variables were relevant in the studies conducted on foreign students and, hence, they should all be included in the analysis. This, besides the author's interest to test the contribution of a single variable after controlling the other six, was the justification for running the regression analysis on all the seven variables of interest in this study.

Table 25. Summary of analysis of regression computations for undergraduate students. Contribution added by each variable after the other six

Source	df	Sum of squares	Mean square	F value
Total regression	18	15.420818		
Sex	1	0.246924	0.246924	Less than one
Age	1	1.478528	1.478528	4.46*
Native language	7	2.771277	0.395897	1.19
Field of study	4	1.072159	0.268040	Less than one
Year of study	3	0.158872	0.052957	Less than one
Source of support	1	1.030353	1.030353	Less than one
Marital status	1	1.767240	1.767240	5.34*
Residual	98	32.518659	.331823	
Table $F_{1,98}$ value	.05 = 3.94		Table $F_{7,98}$ value	.05 = 2.10
	.01 = 6.90			.01 = 2.82

As shown in Table 25 above, dropping either the age or the marital status variable showed a significant loss. Therefore, these were assumed to be the significant factors in terms of their predictive ability as far as the undergraduate students' academic achievement was concerned.

At the graduate level, Table 26 revealed that dropping either the native language or the year of study variable resulted in a significant loss. This indicated that these were the variables which should be included in the prediction equation of the graduate students' academic achievement because of the significance of their predictive ability. But it was found that there was a low multiple correlation between the dependent and independent variables. The estimated multiple R^2 on the graduate level was found to be .12785, while on the undergraduate level it was .32167. Due to that small amount of common variation, any reduced model would show even less common variation. To clarify this point, it can be

Table 26. Summary of analysis of regression computations for graduate students. Contribution added by each variable after the other six

Source	df	Sum of squares	Mean square	F value
Total regression	19	7.297750	0.384093	
Sex	1	0.094531	0.094531	Less than one
Age	1	0.300444	0.300444	1.91*
Native language	9	3.071278	0.341253	2.17*
Field of study	4	0.984090	0.246022	1.57**
Year of study	2	1.705803	0.852901	5.43**
Source of support	1	0.003551	0.003551	Less than one
Marital status	1	0.169184	0.169184	1.08
Residual	317	49.7823	0.157042	
Table $F_{1,317}$ value		.05 = 3.87 .01 = 6.73	Table $F_{4,317}$ value	.05 = 2.40 .01 = 3.38
Table $F_{9,317}$ value		.05 = 1.91 .01 = 2.48	Table $F_{2,317}$ value	.05 = 3.03 .01 = 4.68

said that any partial correlation, whether a first order partial correlation coefficient as in the formula:

$$r_{12.3} = \frac{r_{12}-r_{13}r_{23}}{\sqrt{(1-r_{13})^2(1-r_{23})^2}}$$

attempting to measure the correlation between the first and the second variables independent of the third variable or a second order partial correlation coefficient based on the formula:

$$r_{12.34} = \frac{r_{12.3}-r_{14.3}r_{24.3}}{\sqrt{(1-r_{14.3})^2}\sqrt{(1-r_{24.3})^2}}$$

which measures the correlation between the first and the second variables independent of the third and fourth variable, either of these or any other

partial correlation will result in a lower amount of correlation indicating a less common variation in any reduced model. Therefore, there will be no attempt to include or exclude any of the seven variables in order to set up the predictive equation as was planned early in this study since dropping any of the variables from the model will result in a smaller, if not the same, R^2.

DISCUSSION

Although the basic objective of this study, which was to test the seven variables to see if they could be used for prediction of academic achievement of foreign students was achieved, it can be said that the present study revealed the importance of certain limitations which should be avoided in future studies. It seems that some types of academic ability measures, such as mental ability or high school background and academic achievement, should be controlled before investigating the relationship between academic achievement and other relevant variables. In this study, it was not possible to set up a meaningful prediction equation for the academic achievement of the foreign students. This was due to the low correlation between the criterion and the independent variables which indicated a low amount of common variation. Any reduced model should be explored after having some ability measures in order to set up a meaningful equation for the prediction of foreign students' academic achievement.

When the findings of the different studies reported in the literature were compared with each other or when they were compared with the findings of the present study, obvious agreements and contradictions were apparent.

In the two studies conducted by the author, it was found that there was a significant relationship between the sex of the foreign student and his academic achievement at the undergraduate but not the graduate level (favoring the female category). Hountras (13) found that the sex variable had no significant relationship with the academic achievement. Also, although the age and academic achievement of the foreign student were found to be significant in the present study at the undergraduate level but not

at the graduate level, the opposite was found in the author's (8) 1968 study. At the same time, the same relationship was not significant in the studies conducted by Forstat (9), Hountras (13), and Putnam (27). The nature of the same variable was more complicated in terms of the results of the interaction between the age and the marital status of the undergraduate students where the main effect of the variable was found to be highly significant in favor of the older students. In the area of the native languages, significant differences were found favoring the Chinese, the English, the Hindi, the Arabic, and the Original Latin categories. This finding contradicted the result of Hountras' (13) study. He found that students from the Far East, Near East, and Latin America were more likely to be on temporary enrollment than were those from other parts of the world. No significant relationship was found in the studies conducted by either the author (8) or Putnam (27) concerning the same variable.

Categorizing the foreign students on the basis of either the field or the year of study resulted in no significant differences in their academic achievement in both the present and the 1968 study (8). These findings were found to be in agreement with the results of Forstat's study (9) but in contradiction with Hountras' (13) where it was found that students in the social and physical sciences were more apt to incur probation than were those in the other broad academic area. He also found that academic difficulties were concentrated in the first and second terms of enrollment.

The results of the marital status variable were found to be consistent where it was found that the married students were achieving significantly better than the single ones, a finding that was consistent with the results reported by Hountras (13) and Clark (4).

The most puzzling variable in terms of the findings was the source of support factor. In this study, it was found that the government-supported undergraduates had a significantly higher mean GPA than the self-supported ones, and although the same conclusion was reported in Clark's (4) study, this finding was found to be contradictory to that reported in the 1968 study (8). It was found that the self-supported students were the better achieving ones. Besides this, the same variable was not found to be significant at the graduate level in either the present or the 1968 study (8). Concerning the interaction effect, it was found that the only significant interaction was between the marital status and the native language variables. The age variable main effect was found to be constantly significant when the variable was tested in terms of its interaction with either the sex, the language, or the source of support variables.

Finally, it should be recognized that there is still some confusion and contradiction existing between the findings of the studies conducted on the relationship between the seven variables and the academic achievement of the foreign student, a fact which indicates the persistent need for more studies to be made in this area in order to cast more light about the nature of this relationship.

COUNSELING AND ADMINISTRATIVE IMPLICATIONS

How may this study help the foreign students, and how may it help those who are responsible for them?

First: In the author's opinion and according to the results of this study, the following categories of foreign students are expected to encounter less academic difficulties than others:

1. Female undergraduate students rather than male undergraduates.
2. The older undergraduates rather than the younger ones.
3. The married rather than the single graduate or undergraduate students.
4. The government-supported rather than the self-supported undergraduate students.
5. The graduate Chinese rather than the graduate Arabic, Original Latin, Korean, Tsai, or the Japanese students.
6. The Hindi rather than the Tsai or the Japanese categories of graduate students.
7. The graduate Arabic rather than the Original Latin or the Japanese categories.
8. The undergraduate Chinese rather than the Original Latin, the Arabic, the Hindi, or the Yoruba categories.

Second: In counseling the foreign students, less attention should be given to the length of stay in the United States or to the field of study since these two factors had no significant relationship with the academic achievement of the foreign students.

These recommendations are given on the basis of the results of this study about the prediction of academic achievement of foreign students.

SUMMARY

The purpose of this study was to explore the possibility of predicting the academic achievement of the foreign students coming to Iowa State University. The relationship between the academic achievement as measured by the GPA and the foreign students' sex, chronological age, native language, field of study, year of study, and source of support were investigated. The data about the independent and dependent variables were collected for all the foreign students enrolled at Iowa State University in the 1968-69 school year (454 students) through the use of the foreign students' permanent records, the Foreign Students' Adviser's records, and personal interviews.

In the statistical analysis, analysis of variance, both single and two-way classification were employed as a preliminary stage after which regression analysis was run in an attempt to test the predictive association between the criterion variable and the seven variables under consideration. Testing the different null hypotheses in this study resulted in the following conclusions:

1. The null hypothesis of no difference in the academic achievement of foreign students on the basis of either their sex or their chronological age was rejected at the undergraduate level, but there was insufficient evidence to reject it at the graduate level.
2. For the native language variable, it was found that the null hypothesis of no difference between the mean GPA of foreign students when they were categorized on the basis of either their

marital status or their native languages was rejected for both graduate and undergraduate students.

3. There was insufficient evidence to reject the null hypothesis of no difference in the academic achievement of foreign students on the basis of either their field or year of study at both graduate and undergraduate level.
4. At the graduate level, the null hypothesis of no difference between the mean GPA of foreign students on the basis of their source of support was tenable but was rejected at the undergraduate level.
5. The only significant interaction was found between the marital status and the native language variables at the graduate level. In addition, the main effect of the first variable was found to be significant in the test of interaction between that variable and the source of support. Also, the main effect of the age variable was significant in the interaction test between that variable and each of the sex, native language, and source of support variables.
6. Finally, due to the low amount of a common variation which was indicated by the low correlation between the dependent and the independent variables, it was decided that no attempt should be made toward setting up a predictive equation as was previously planned.

SUGGESTIONS FOR FURTHER STUDY

1. It is recommended that additional studies be conducted investigating the success of foreign students' academic achievement but after taking into consideration the variance of academic or mental ability of the foreign students which should be controlled for by using some kinds of ability measures before considering or testing the predictive ability of any other variable.
2. The findings of the present study should be checked by some cross-validation studies about the academic achievement of foreign students in some other educational institutions in order to determine the extent of the reliability of the results.
3. A further study should be done to investigate the relationship between the foreign students' mental ability (IQ) and his academic success in the various fields of study at Iowa State University or at some other institutions in order to clarify the nature of the relationship between that factor and the academic achievement in the different fields of study.
4. Finally, the communicative ability and the degree of motivation may be considered as other variables related to the academic achievement of foreign students and worthy of investigation.

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APPENDIX

The Coding System

In this study and for the facilitation of the statistical analysis, each of the seven variables of investigation was divided into sub-categories, and each category was given a coding number as follows:

On the Undergraduate Level

1 - The Sex Variable

Male = 1 Female = 2

2 - The Age Variable

Under 25 years = 1 25 years or over = 2

3 - The Native Language Variable

English = 1 Original Latin = 2

Arabic = 3 Hindi = 4

Chinese = 5 Hebrew = 6

Tsai = 7 Yoruba = 8

4 - The Marital Status Variable

Single = 1 Married = 2

5 - The Field of Study Variable

Agriculture = 1 Engineering = 2

Science and Humanities = 3 Home Economics = 4

Veterinary Medicine = 5

6 - The Year of Study Variable

Freshman = 1 Sophomore = 2

Junior = 3 Senior = 4

7 - The Source of Support Variable

Government-support = 1 Self-support = 2

On the Graduate Level

1 - The Sex Variable

Male = 1 Female = 2

2 - The Age Variable

Under 25 years = 1 25 years or over = 2

3 - The Native Language Variable

Korean = 0 English = 1

Original Latin = 2 Arabic = 3

Hindi = 4 Chinese = 5

Japanese = 6 Hebrew = 7

Tsai = 8 Yoruba = 9

4 - The Marital Status Variable

Single = 1 Married = 2

5 - The Field of Study Variable

Agriculture = 1 Engineering = 2

Science and Humanities = 3 Home Economics = 4

Veterinary Medicine = 5

6 - The Year of Study Variable

One year or less = 1 More than one year but less than three = 2

Three years or more = 3

7 - The Source of Support Variable

Government-support = 1 Self-support = 2