

CORRELATES OF ADULT ACCOMPLISHMENT AMONG
ENGINEERING GRADUATES OF KANSAS STATE UNIVERSITY

by 4589

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requirements for the degree

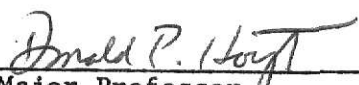
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Chapter I

INTRODUCTION

Although considerable research has been conducted on the prediction of academic success in college, relatively little work has been done on the prediction of adult success. A direct relationship is commonly assumed between academic achievement in college and occupational success. It is this assumption which underlies the widespread use of academic achievement measures to determine eligibility for admission into many programs of professional preparation. Such measures are also commonly used to exclude low achieving students from further opportunity to attend college. And employers frequently use grades to judge the desirability of applicants. In short, academic achievement has been heavily relied upon as an indicator of future success in many areas of life.

Whether this reliance is justified is of interest to several groups. Employers need to know how to interpret academic transcripts. Educators need to know whether their academic standards have meaning for their students' futures. Counselors and clients are frequently concerned with long range plans, and thus need to know the predictive implications both of academic achievement and of other student characteristics. College policy makers need to know whether assumptions about the meaning of grades are tenable.

The primary purpose of this study is to examine the relationship between academic achievement and occupational success in the field of Engineering. The hypothesis that "better" students become more "well-rounded" citizens is also examined. Finally, the study investigates the relationship between selected characteristics of college freshmen and their subsequent occupational and non-occupational success.

The problem of defining and measuring adult success has never been satisfactorily resolved. There are numerous aspects to adult life--occupational life, family life, community life--and there is no reason to believe that success in one is necessarily related to success in another. In fact, in some cases, success in one may preclude success in another, as in the case of the ambitious professional who has no time for his family or the individual who chooses a picnic with the family over overtime at the office.

Beyond this, the way in which success is demonstrated varies from situation to situation. The "success" of a sales engineer and of a design engineer must be judged by different standards since they do different kinds of work. Similarly, individual differences among family or community circumstances makes it hazardous to establish universal standards for judging the degree of success attained in these spheres.

Finally, the frame of reference introduces a confounding variable. Society at large, colleagues, or neighbors perceive the individual from an external frame of reference. These perceptions may be quite disparate with those made from an internal frame. The discrepancies are dramatized in daily life when the suicide of a prominent and "successful" citizen is reported or when a cheerful and capable employee declines an unusual opportunity to "get ahead" because he's "satisfied" with what he has.

No attempt was made to resolve in any final sense the problems posed by these considerations. Rather, it was decided to develop several measures of success each of which focused on one aspect of the problem. Since the major interest was in occupational success, most of the measures related to this dimension of life. Some measures of non-occupational success were also developed. For each of these, measures were developed from both

the external and internal frames of reference.

In summary, this study is concerned with the prediction of adult accomplishments, categorized into occupational and non-occupational success. The major predictors used are academic achievement in college. Selected measures of scholastic aptitude, personality, and vocational interests were also employed. The results of this study should be of value to college students, counselors, educators, and employers.

The following questions provide a statement of the problem:

Question 1. Is there a relationship between adult success (both occupational and non-occupational) and academic achievement among Engineering graduates of Kansas State University?

Question 2. Is there a relationship between adult success (both occupational and non-occupational) and selected measures of scholastic aptitude, personality, and vocational interests among Engineering graduates of Kansas State University?

Before describing the approaches taken to these questions, a review of pertinent literature is offered to highlight the issues and to guide the inquiry.

Chapter II

REVIEW OF RELEVANT LITERATURE

This chapter is divided into two parts. The first part deals with studies relating college grades to occupational achievement in Engineering.

The second part reviews research relating grades to participation in non-occupational activities.

Relationship of College Grades to Occupational Success in Engineering

In an early study, Rice (1913) followed-up graduates of Pratt Institute who had received degrees in 2-year programs in electrical and mechanical courses. Graduates reported their salaries four to six years after gaining their engineering degrees. Correlations between college grade average and salary were computed for both types of graduates in each of three classes of salary (average, upper fifth, lower fifth). The range of correlations was from .16 to .46; two of the six were significantly greater than zero, as was the weighted average of the six (.27).

Gambrill (1922) studied 20 engineers who were graduates of 5 colleges. She computed two correlations between overall grades and salary. One of these ignored differences among colleges, while the other treated each college separately and obtained an average value. The first method assumed that the grading standards of the 5 colleges were not different; the rank order correlation between salary and grades was $-.22$. In the second method, she computed the correlation between overall grade average and salary for each college separately and obtained an average correlation (weighted by the number of subjects from each college) of $-.23$. Neither correlation was significantly different from zero.

Beatty and Cleeton (1928) followed up 90 engineering graduates from the 1923 and 1924 classes at the Carnegie Institute of Technology. Two criteria of occupational success were used; salary and a rating on the importance of present position. Scholastic standing correlated .03 and .08 with these criteria; neither correlation was significantly different from zero. No information was supplied to permit an evaluation of how the "importance of present position" was measured.

Pierson (1947) studied graduates of the School of Engineering at the University of Utah from 1932 to 1941. The faculty member "best qualified to evaluate his particular accomplishments" rated occupational success on a five point scale. Ratings were obtained for 320 of the 463 graduates. Engineering GPA correlated .43 with these ratings, leading the author to conclude that scholastic achievement was a valid predictor of success in the practice of engineering.

In 1948 the National Advisory Committee for Aeronautics studied more than 200 of their scientists and engineers, comparing their college scholastic standings with their job performance ratings (Taylor, Smith, and Ghiselin, 1963). Analysis showed that the greatest number of personnel receiving the highest job performance rating were not in the top 25% scholastic group but, rather, were in the second and third scholastic quarters. NACA has refused to release the report in which their analyses were contained.

Martin and Pachares (1956) used 99 engineers in a Hughes Aircraft Company research laboratory to compare scholastic standing with salary. For the engineers with four years experience, there was barely significant positive correlation between class standings and salary; no correlation was found for those with six or eight years of experience nor for the total group.

Believing that differences among colleges may have confounded the relationship, the investigators asked another group of engineers to rate the colleges from which the subjects received their degrees as "superior," "average," and "inferior." Then a comparison was made between the school groupings and the salary level of the 99 engineers. No significant correlation was obtained.

The relationship between salaries and a combination of the school grouping and class standing was also studied. Weighted decile standings were not significantly related to salary.

Four of the six studies used salary as a criterion; the weight of the data suggests that it is unrelated to college grades. The only study where a positive relationship was found was done in 1913 and involved graduates of two-year programs.

In the other two studies, performance ratings served as the criterion, with conflicting results. The NACA study used supervisory ratings and found no relationship to grades; the Pierson study used professor's ratings and found a positive correlation with grades. It is impossible to determine if Pierson's criterion was contaminated by the raters' knowledge of the subjects' academic performance.

There are two major reasons why these studies cannot be considered conclusive.

1. The criterion problem was not handled in a sophisticated or comprehensive way. Salary has limitations as a criterion due to differences among companies, engineering specialties, and regions. Gross ratings by supervisors may ignore specific areas in which the individual excels or fails. Subjective dimensions of success were not examined.

2. The studies employed overall grade average as the independent

variable. There are a priori reasons for believing that some types of grades may be more important than others. Grades in core courses, specialty courses, or courses in the senior year may contain more predictive value than a measure of overall academic achievement.

Relationship of College Grades to Adult Accomplishments in Non-Occupational Areas

In a study reported by Plasse (1951), Time Magazine collected data on 9046 college graduates; over 1000 colleges cooperated in supplying names and addresses of all living graduates whose last name began with "Fa." Subjects reported their academic achievement in college; they also answered questions about their civic participation, their current events information, their social activity (clubs, organizations), and the satisfactoriness of their home life. Correlations of academic achievement with these non-vocational accomplishments ranged from .01 to .07.

Mann (1959) carefully selected a sample of 290 University of Wisconsin graduates of 1949 who were followed-up 8 years later. Mann's questionnaire yielded criterion measures in three non-vocational areas: social status of the home, citizenship activities, and cultural interests. Total GPA and the discrepancy between senior GPA and freshman GPA were correlated with these three criteria. None of the correlations were significantly different from zero.

Lewis (1970) examined political involvement, participation in community activities and participation in cultural activities as a function of academic achievement among graduates of the University of Iowa. No significant relationships were found among any of the samples between reported involvement in political activities and undergraduate GPA. Male graduates

reporting a large degree of community involvement had significantly lower undergraduate GPA's than their less active counterparts.

In one of Lewis' four samples, a significant difference was found in the grades of culturally active and culturally inactive men. The mean undergraduate GPA was 2.70 for 1967 male graduates who participated in seven or more cultural activities and 2.38 for 1967 males who reported participating in zero to two activities.

The literature in this area is too sparse to draw generalizations with confidence. None of the three studies found a positive relationship between grades and civic participation, and Lewis' data suggested the relationship may be negative. In general, cultural participation was also unrelated to grades, although an exception occurred in one of Lewis' four samples.

Because college goals are often stated in terms like developing community leaders, increasing cultural and intellectual appreciation, and stimulating responsible citizenship, it is important to know whether measures of college success are related to measures of adult success in these areas. Again, improved criterion measures are needed; in particular, it seems desirable to broaden the types of activities which define non-occupational success. None of the studies have included items indicative of intellectual curiosity about science, for example. Nor have religious or social service contributions been considered.

On the basis of this review, the present inquiry seems justified. Several different approaches and dimensions of occupational success are derived, and more refined measures of "college grades" are employed. Likewise on the non-occupational level, different areas and dimensions are examined, and for both types of success, predictors other than college grades

are utilized. In general, this study makes a more comprehensive attempt to predict adult accomplishment than was true of previous studies.

Chapter III

PROCEDURE AND DESIGN

Sample

Subjects were chosen from the freshman classes of 1956, 1957, and 1958; only those who graduated from the College of Engineering at Kansas State University were included. A total of 272 individuals met these criteria. Of these, 71 were excluded from the study because they had achieved an advanced degree, had unknown addresses, or were deceased. Addresses for the remaining 201 were obtained from the Alumni Office. All had been out of college for five to ten years.

A letter was written to the 201 subjects, asking for a description of their present employment and for their cooperation in obtaining further information both from themselves and from their employer. After two follow-ups, 155 of the 201 subjects (77%) responded. Of these, 17 declined to participate in any part of the study, or held positions completely unrelated to Engineering. Of the remaining 138, 93 agreed both to answer a more detailed questionnaire and to authorize the author to seek a rating from the subject's supervisor. The other 45 agreed to the questionnaire but not to the supervisory rating.

Returns were received from 127 (92%) of the 138 who had agreed to the questionnaire, and from 90 (97%) of the 93 supervisors who were contacted. The sample is assumed to be representative of bachelor level engineering graduates from Kansas State University who have 5-10 years of post-college experience.

To help establish the representativeness of the sample, respondents and non-respondents were compared on eight of the independent variables

used in the study.¹ Differences between the two groups were examined by means of the t test. The means, standard deviations, and t values are shown in Table 1.

TABLE 1
Means, Standard Deviations, and t Values for the Respondents
and Non-Respondents on Eight Independent Variables

Independent Variable	Respondents (N=134)		Non-Respondents (N=63)		t
	M	S.D.	M	S.D.	
Overall GPA	2.48	.47	2.39	.47	1.37
Senior GPA	2.62	.53	2.48	.54	1.54
ACE Q	49.8	9.4	49.4	8.1	.30
ACE L	67.1	14.6	63.2	13.3	1.90
EPPS ACH.	15.8	3.7	15.9	3.8	.16
EPPS AFF.	14.5	4.1	13.2	4.6	1.87
SVIB Group II	2.2	1.2	2.4	1.3	.90
SVIB Group V	4.2	.91	4.3	.85	1.21

Since there were no significant differences, there is little reason to believe that the respondent sample was unrepresentative of the total group.

Instruments

Criteria

1. Occupational Success (external frame of reference). Thirteen measures of occupational success were obtained from a specially constructed

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1. The independent variables are described in a later section of this chapter (see Predictors).

supervisor rating form. A copy of this form is included in Appendix A-6.

Consultants from the College of Engineering at Kansas State University identified ten factors believed to be important to the successful performance of any Engineering-related job. These factors were: Scientific-Technical Knowledge, Understanding of Engineering Problem Solving Methodology, Creativity-Originality, Persuasiveness, Interpersonal Competence, Managerial Skill, Written Communication, Oral Communication, Precision-Care, and Practical Judgment.

Supervisors were asked to rate subjects on each of the ten factors. Five-point rating scales were used, with a different descriptive phrase defining the meaning of each point. Two examples are given below:

CREATIVITY-ORIGINALITY

/	/	/	/	/	/
Highly Inventive	Generally Resourceful	Occasionally Displays Originality	Seldom Resourceful	Routine Worker	

ORAL COMMUNICATION

/	/	/	/	/	/
Expresses Self Clearly and Concisely	Seldom is Misunderstood	Generally is Understandable	Occasionally Ambiguous	Frequently Confusing or Misleading	

The supervisor also was given the option to check "No Opportunity to Observe" for each factor.

For each scale, the most favorable rating was scored "5," the least favorable rating "1," and intermediate ratings were scored as "4," "3," or "2." The scores on each of the ten factors were used to represent a measure of occupational success.

In addition to these ten measures, three overall measures were developed from the Supervisor's rating. Two of these were his rating of overall

quality and quantity of the employee's work; again, a five-point scale was used. The final measure obtained from this form combined the supervisor's rating of the subject's status on each factor with his rating of the importance of each factor to the performance of the subject's job. Importance ratings varied from "Essential" (scored "4") to "Of Minor or No Importance" (scored "1"). The "importance" and "status" ratings for each factor were multiplied, and the sum of these products was divided by the sum of the "importance" ratings to obtain an index of overall performance on relevant factors.

A fourteenth measure of occupational success from the external frame of reference utilized the subject's responses to two open-ended questions: "Describe the one or two professional achievements of which you are most proud" and "Describe briefly the most challenging aspect of your present position." Faculty members from the department in which the subject received his degree made a single rating of his occupational success on the basis of responses to these questions. The ratings were: 4 for an "exceptional" achievement, 3 for "above average," 2 for "average," and 1 for "below average." The raters made no rating if they felt that there was an insufficient basis for judging success. The identity of individual subjects was protected, and the raters were not permitted to read any other part of the questionnaire.

The final measure of occupational success from an external frame of reference was self-reported salary. Subjects indicated their base salary for the current year on a scale which used \$2000 increments. The extremes were "below \$8000," and "\$20,000 or more." The value of 1 was assigned to "below \$8000," 2 for "\$8000-\$9999," and so on. The highest rating, "\$20,000 or more," was scored 8.

2. Occupational Success (internal frame of reference). Subjects were asked to rate their own occupational success compared to that of other men in their profession with similar amounts of training and experience. A five-point classification was provided. "In the top 2%" (scored 5); "In the top 10%, but not in the top 2%" (scored 4); "In the top 25%, but not in the top 10%" (scored 3); "In the top half, but not in the top 25%" (scored 2); and "In the lower half" (scored 1).

Subjects were then asked to indicate how they thought their former classmates would rate them. This question was designed to explore the meaningfulness of the distinction between internal and external frames of reference. In particular, do subjects themselves make such a distinction? The rating and evaluation procedures were the same as for the previous measure.

3. Non-Occupational Success (external frame of reference). Five measures were developed of non-occupational success from the external frame of reference. Subjects were asked which of 31 activities they had engaged in during the past 12 months. The activities represented participation in five categories: Scientific-Technical, Social Science, Humanistic, Political, and Civic-Religious. Sample questions of each of the five types of activities are given below:

- Attended a scientific/engineering exhibit (Scientific-Technical)
- Read a book on psychology, sociology, or history (Social Science)
- Attended a music recital or concert (Humanistic)
- Worked actively in a political campaign (Political)
- Worked actively in a charity drive (Civic-Religious)

A copy of the complete questionnaire is included in Appendix A-4. A total of five items were included in the scientific-technical area, seven in social science, seven in the humanistic area, five in political participation, and seven in the civic-religious area. Raw scores (number

of "Yes" responses) were used as measures of success in each of these non-occupational areas.

4. Non-Occupational Success (internal frame of reference). Subjects were also asked to rate how successful they had been in life in general by means of the following question: "Success in life means different things to different people. For some people, it may mean success in one's occupation; for others, it is based mostly on a satisfying family life. For most, it is probably a synthesis of how satisfying various aspects of their life has been. What degree of success do you feel you have attained in life in general?" The five-point rating scale followed the same format which was used to obtain self-ratings of occupational success.

Predictors

The major concern of the study was the relationship of academic success to adult success. Hence the major independent variables were academic grades. Because of the potential importance of the outcomes to professional counselors, it was also decided to examine the relationship of selected ability, interest, and personality characteristics to success as an adult.

1. Academic Achievement Measures. Four college grade-point averages were used: (1) total college grade point average; (2) senior year grade point average; (3) Engineering "core courses" average; and (4) the average of two senior year design courses--or two courses that were judged by the Engineering faculty to be critical to the type of work performed by graduates of specific departments. Since eight departments were represented (Agricultural, Architectural, Chemical, Civil, Electrical, Industrial, Mechanical, and Nuclear), the "core courses" and design courses were not the same for all subjects. The particular courses selected for each individual were designated by College of Engineering officials.

The total college grade-point average was included because it was the most comprehensive measure of academic success in college. Some students are alleged to be "late bloomers," demonstrating much higher levels of achievement in the last part of their academic careers. To examine the implications of the pattern, senior grade-point average was employed as a second predictor. Core courses presumably contain the basic understandings necessary for successful professional functioning. Hence, the average grade in these courses may be closely related to professional success. Finally the senior year design courses presumably provide content directly related to particular engineering specialities, and grades in them may be especially indicative of occupational success.

2. Freshman characteristics. Two aptitude test scores were used: the American Council on Education Psychological Examination (ACE) Quantitative (Q) score, and the ACE Linguistic (L) score. These scores measure the subject's ability in mathematical and verbal skills, both of which are presumably important to success in any Engineering field.

Two scores from the Edwards Personal Preference Schedule (EPPS) were used: Achievement and Affiliation. The Achievement score presumably measures motivation to achieve, while the affiliation score presumably reflects needs for interpersonal relations. The former was expected to be related to occupational success in general, while the latter was hypothesized to be related to such elements as interpersonal competence and managerial skill as well as the "people oriented" non-occupational measures (political, civic-religious).

Two vocational interest ratings were used, one for Group II of the Strong Vocational Interest Blank (SVIB), and one for Group V of the same instrument. Group II describes the interests of physicists, chemists,

mathematicians, and engineers, while Group V included men involved in social service positions (social workers, educators, ministers, etc.). The interest ratings were based on five-point scale--primary (majority of scores were A or B+), secondary (majority of scores were B+ or B), tertiary (majority of scores were B or B-), no pattern, or reject (all scores were C or C+). Primary patterns were given a value of "1," secondaries "2," and so forth; reject patterns were given a value of "5." Group II interests were expected to be related to occupational success in general. Group V was selected for the same reasons that Affiliation was selected from the EPPS.

Hypotheses and Statistical Treatment

The questions which guided this investigation were stated in Chapter I. They are repeated here for the reader's convenience:

Question 1. Is there a relationship between adult success (both occupational and non-occupational) and academic achievement among Engineering graduates of Kansas State University?

Question 2. Is there a relationship between adult success (both occupational and non-occupational) and selected measures of scholastic aptitude, personality, and vocational interests among Engineering graduates of Kansas State University?

These questions can be put in the form of statistical hypotheses. Thus the null hypothesis for the first question is that there is no relationship between measures of academic success and measures of occupational and non-occupational success. Likewise, for the second question, the null hypothesis is that there is no relationship between the freshman characteristics and occupational and non-occupational success.

Since the hypotheses concern relationships between predictors (grades,

test scores) and criteria (ratings, questionnaire scores), techniques for establishing the degree of relationship were used to test them. Distributions were developed for each predictor and each criterion measure. Pearson product-moment correlations were computed between variables that, by inspection, were judged to be normally distributed. Multiple correlations were computed between predictors of a given type (e.g., academic achievement) and individual criterion measures that were normally distributed. Multiple correlations were also computed between normally distributed criterion measures and the entire set of normally distributed predictors.

The chi square technique was used to test hypothesis involving variables whose distributions were not normal.

Chapter IV

RESULTS AND DISCUSSION

As indicated in Chapter III, null hypotheses were tested by means of the Pearson product-moment correlation for normally distributed variables and by the chi square technique for non-normally distributed variables.² Eight of the ten predictors were normally distributed. The exceptions were the Group II and Group V of the SVIB.

Results are presented according to type of success (occupational or non-occupational) and frame of reference (external or internal).

Occupational Success: External Frame of Reference

Five of the measures of occupational success as viewed from the external frame of reference were normally distributed: Achievement Rating, Salary, Quality of Work, Quantity of Work, and the Overall Occupational Rating. The intercorrelations of these measures are presented in Table 2.

2. Means and standard deviations for normally distributed variables are shown in Appendix B-1. Distributions for non-normally distributed variables are shown in Appendices B-2 and B-3.

TABLE 2
Intercorrelations of Occupational Success Measured from External
Frame of Reference

	<u>Achievement</u>	<u>Salary</u>	<u>Quality</u>	<u>Quantity</u>	<u>Overall</u>
Achievement	-	68	12	25	23
Salary	(73)	-	23	28	25
Quality	(50)	(81)	-	44	69
Quantity	(50)	(81)	(90)	-	56
Overall	(50)	(81)	(90)	(90)	-

Intercorrelations shown above the diagonal (decimal points omitted)
Number of Cases given in () below the diagonal

p .05 for 50 d.f. = .27

p .05 for 70 d.f. = .23

p .05 for 80 d.f. = .22

p .05 for 90 d.f. = .21

There appears to be a degree of communality in the various measures, but not enough to conclude that they represent a single factor. Achievement Rating and Salary overlapped markedly, despite the fact that those making the Achievement Rating were instructed to ignore salary information. There was also a high correlation between Overall Occupational Rating and the rating of Quality. None of the intercorrelations was so high that the findings for one criterion would necessarily hold for another. Therefore, it was decided to examine each as a separate measure of occupational success.

Table 3 shows the relationship between the eight normally distributed predictors and the five normally distributed "external" measures of occupational success.

TABLE 3

Relationships Between Eight Independent Variables and Five Measures
Of Occupational Success From the External Frame of Reference

Predictor	Criteria									
	Achievement		Salary		Quality		Quantity		Overall	
	<u>r</u>	<u>(N)</u>	<u>r</u>	<u>(N)</u>	<u>r</u>	<u>(N)</u>	<u>r</u>	<u>(N)</u>	<u>r</u>	<u>(N)</u>
Overall GPA	15	(74)	11	(124)	14	(90)	09	(90)	13	(90)
Senior GPA	28*	(74)	16	(124)	12	(90)	15	(90)	23*	(90)
Core GPA	07	(74)	01	(124)	05	(90)	08	(90)	04	(90)
Design GPA	16	(74)	26*	(124)	01	(90)	03	(90)	11	(90)
ACE Q	10	(74)	12	(124)	12	(90)	08	(90)	26*	(90)
ACE L	22	(74)	09	(124)	03	(90)	-07	(90)	03	(90)
EPPS ACH	-15	(72)	-07	(119)	-07	(88)	04	(88)	02	(88)
EPPS AFF	25*	(72)	16	(119)	08	(88)	10	(88)	12	(88)

Decimal points omitted in correlations

*p < .05

Only 5 of the 40 correlations were significantly different from zero--Senior GPA with Achievement Rating and Overall Occupational Success, Design GPA with Salary, ACE Q with Overall, and Affiliation with Achievement Rating. None of the correlations with Quality and Quantity ratings was significant.

For the three criteria where at least one significant correlation was found, a series of four step-wise multiple regression analyses were performed.³

3. Intercorrelations among the predictors are shown in Appendix B-4.

The first considered the four GPA measures, the second included the two aptitude measures (ACE), the third included the two personality measures, and the fourth involved all eight predictors. In only one instance was more than one beta weight significantly different from zero. The exception occurred on the Achievement Rating criterion, where significant betas occurred for both Senior GPA and the EPPS Affiliation score. The resulting multiple correlation was .40.

The two SVIB scores were not normally distributed. Hypotheses regarding their relationship to the criteria were tested by chi square. Of the ten null hypotheses, only one was rejected. The significant finding is shown in Table 4. Complete data for all tests involving the two SVIB scores are given in Appendices B-5 and B-6.

TABLE 4
Relationship of SVIB Group V Scores to Achievement Rating of
Occupational Success (in Percentages)

Achievement Rating	Group V		
	High N = 13	Average N = 36	Low N = 25
Low	23	56	64
High	77	44	36
Total	100	100	100

$\chi^2 = 5.97$
 d.f. = 2
 P < .05
 Contingency Coefficient = .27

As Table 4 shows, the higher the Group V score the higher the Achievement rating.

Table 5 shows the intercorrelations of the 10 occupational factor ratings and their correlation with the Overall Occupational Rating.

TABLE 5

Intercorrelations of Ratings on Individual Occupational Factors, and Their Correlation with the Overall Supervisory Rating

	<u>Sci-Tech</u>	<u>P.S.</u>	<u>C-O</u>	<u>Per</u>	<u>IPC</u>	<u>MS</u>	<u>WC</u>	<u>OC</u>	<u>PC</u>	<u>PJ</u>	<u>Overall</u>
Sci-Tech.	-	52	31	24	16	31	29	29	31	35	53
Prob-Solv	(85)	-	44	30	28	54	33	39	38	48	68
Crea-Orig.	(86)	(85)	-	44	12	44	13	32	31	44	56
Persuas.	(87)	(86)	(89)	-	48	52	30	54	47	51	69
Interp.Com.	(87)	(86)	(89)	(90)	-	48	37	51	33	49	66
Mgr. Skill	(85)	(84)	(87)	(88)	(88)	-	44	53	53	64	79
Writ. Com.	(86)	(85)	(88)	(89)	(89)	(88)	-	41	38	30	59
Oral Com.	(87)	(86)	(89)	(90)	(90)	(88)	(89)	-	40	46	70
Prec.-Care	(87)	(86)	(89)	(90)	(90)	(88)	(89)	(90)	-	55	70
Prac. Judg.	(87)	(85)	(90)	(90)	(90)	(88)	(89)	(90)	(90)	-	76
Overall	(87)	(86)	(89)	(90)	(90)	(88)	(89)	(90)	(90)	(90)	-

Intercorrelations shown above the diagonal (decimal points omitted)
Number of cases give in () below the diagonal

The results cannot be interpreted with any precision, since many of the factor ratings were markedly skewed. It does appear that, since all ratings are correlated positively, some halo effect is probably present. However, the correlations with overall success are generally higher than the

intercorrelations among factor ratings. This suggests that the 10 item scale did ask about factors relevant to engineering success. The most important of these appears to be Managerial Skill ($r = .79$) and Practical Judgment ($r = .76$). However, for a given individual or position, any one factor may be crucial.

Because these ratings were frequently skewed, chi square was used to test the hypotheses that they were unrelated to predictor measures. Of the 100 chi square tests, the null hypothesis was rejected 5 times. The significant findings are shown in Tables 6-10, while the complete data for all tests involving occupational factors are given in Appendices B-7 through B-16.

TABLE 6
Relationship Between Creativity-Originality Ratings and
Overall Grade Point Average (in Percentages)

Creativity-Originality Ratings	Overall Grade Point Average			
	Below 2.13 (N = 21)	2.13-2.41 (N = 21)	2.42-2.75 (N = 22)	2.76+ (N = 23)
Low	43	19	23	23
Average	52	76	68	65
High	5	5	9	12
Total	100	100	100	100

$$\chi^2 = 12.76$$

$$d.f. = 6$$

$$p < .05$$

$$\text{contingency coefficient} = .36$$

TABLE 7

Relationship Between Creativity-Originality Ratings and Senior Year
Grade Point Average (in Percentages)

Creativity-Originality Ratings	Senior Grade Point Average			
	Below 2.22 (N = 21)	2.22-2.59 (N = 21)	2.60-3.00 (N = 23)	3.01+ (N = 23)
Low	52	15	13	13
Average	38	81	78	65
High	10	5	9	22
Total	100	100	100	100

$$\chi^2 = 17.59$$

$$\text{d.f.} = 6$$

$$p < .01$$

$$\text{contingency coefficient} = .41$$

TABLE 8

Relationship Between Precision-Care Ratings and Core Courses Grade
Point Average (in Percentages)

Precision-Care Ratings	Core Courses Grade Point Average			
	Below 1.72 (N = 14)	1.73-2.26 (N = 21)	2.28-2.76 (N = 29)	2.77+ (N = 14)
Low	43	35	9	22
Average	38	61	61	39
High	19	4	30	39
Total	100	100	100	100

$$\chi^2 = 14.53$$

$$\text{d.f.} = 6$$

$$p < .05$$

$$\text{contingency coefficient} = .40$$

TABLE 9

Relationship Between Persuasiveness Ratings and ACE Q Scores (in Percentages)

Persuasiveness Ratings	ACE Q Scores			
	Below 43 (N = 20)	44-49 (N = 22)	50-55 (N = 22)	56+ (N = 22)
Low	55	41	32	15
Average	45	46	64	54
High	0	13	4	32
Total	100	100	100	100

$\chi^2 = 16.38$
 d.f. = 6
 $p < .05$
 contingency coefficient = .40

TABLE 10

Relationship Between Written Communication and ACE Q Scores (in Percentages)

Written Communication Ratings	ACE Q Scores			
	Below 43 (N = 20)	44-49 (N = 22)	50-55 (N = 21)	56+ (N = 22)
Low	55	23	38	9
Average	40	50	48	68
High	5	27	22	23
Total	100	100	100	100

$\chi^2 = 13.24$
 d.f. = 6
 $p < .05$
 contingency coefficient = .37

Only 5 of 100 chi square tests were significant. This is the exact number of "significant" results which would be expected by chance. There appears to be no strong relationship between the predictors and the specific occupational factors.

Occupational Success: Internal Frame of Reference

Both measures of occupational success from the internal frame of reference (self-rating of occupational success and perceived ratings by others of occupational success) were normally distributed. They correlated .76 with each other. Both correlated significantly with the Achievement Rating ($r = .32$ and $r = .43$), and the Self-Rating correlated significantly with Quantity of work rating ($r = .26$) and with the Overall Occupational Rating ($r = .25$). Thus, occupational success from the internal frame of reference was not entirely independent of occupational success from the external frame of reference.

Table 11 shows the relationship of the two "internal" measures of occupational success to the eight normally distributed independent variables.

TABLE 11

Relationship of Measures of Occupational Success from Internal Frame
of Reference with the Eight Normally Distributed Predictors

	<u>Self-Rating</u>		<u>Perception of Others</u>	
	<u>r</u>	<u>(N)</u>	<u>r</u>	<u>(N)</u>
Overall GPA	-03	(120)	05	(117)
Senior GPA	08	(120)	18	(117)
Core GPA	-12	(120)	-03	(117)
Design GPA	14	(120)	20*	(117)
ACE Q	09	(120)	12	(117)
ACE L	08	(120)	10	(117)
EPPS ACH	03	(115)	10	(112)
EPPS AFF	-12	(115)	-15	(112)

*p < .05

Relationships between the two "internal" measures of success and SVIB ratings were explored by the chi square technique. Two of the four analyses resulted in rejecting the null hypothesis. The significant findings are shown in Tables 12 and 13; complete data for all tests are given in Appendices B-17 and B-18.

TABLE 12

Relationship of SVIB Group V Scores and Self-Ratings of
Occupational Success (in Percentages)

<u>Self Ratings</u>	<u>SVIB Group V Scores</u>		
	<u>High (N = 17)</u>	<u>Average (N = 53)</u>	<u>Low (N = 50)</u>
Low	0	23	20
Average	12	43	40
High	88	34	40
Total	100	100	100

$\chi^2 = 16.23$
 d.f. = 4
 $p < .01$
 contingency coefficient = .34

TABLE 13

Relationship of SVIB Group V Scores and Perceived Ratings
By Others of Occupational Success (in Percentages)

<u>Perceived Ratings By Others</u>	<u>SVIB Group V Scores</u>		
	<u>High (N = 16)</u>	<u>Average (N = 51)</u>	<u>Low (N = 50)</u>
Low	0	33	28
Average	38	47	38
High	62	20	34
Total	100	100	100

$\chi^2 = 13.00$
 d.f. = 4
 $p < .05$
 contingency coefficient = .32

The SVIB Group V scores were directly related to occupational success from the internal frame of reference.

Non-Occupational Success: External Frame of Reference

All of the measures of non-occupational success from the external frame of reference were non-normally distributed; hence chi square analysis was used to test the hypotheses. Of the 50 tests, only 1 showed a significant relationship, as is shown in Table 14. Complete data are reported in Appendices B-19 through B-23.

TABLE 14
Relationship of SVIB Group V Scores to the Humanistic
Index of Non-Occupational Success (in Percentages)

<u>Humanistic Scores</u>	<u>SVIB Group V Scores</u>		
	<u>High (N = 19)</u>	<u>Average (N = 54)</u>	<u>Low (N = 53)</u>
Low (0)	21	35	51
Low Average (1,2)	21	17	21
High Average (3)	16	30	21
High (4,5,6)	42	18	7
Total	100	100	100

$\chi^2 = 15.03$
d.f. = 6
 $p < .05$
contingency coefficient = .33

Non-Occupational Success: Internal Frame of Reference

The one measure of non-occupational success from the internal frame of reference was normally distributed. No significant correlations were

obtained with the eight normally distributed predictors, and no significant chi square results were obtained with the two SVIB predictors. Complete data are available in Appendices B-24 and B-25.

DISCUSSION

Limitations

The more obvious limitations of this study are those which are inherent in the use of measuring instruments with unknown characteristics. A prime question concerns reliability of the scales. It would have been desirable to have had two raters evaluate each subject or to have obtained two ratings from the same supervisor. However, practical considerations mitigated against such procedures.

Whether or not the substantial number of non-respondents were significantly different from respondents in their occupational histories could not be determined. The indirect evidence suggests that this is an unlikely source of error, but such evidence is far from conclusive.

It was necessary to assume comparability among raters and comparability among salary levels. Neither assumption is necessarily tenable. Likewise salary scales reflect regional differences and type of employment (e.g., governmental versus private). Such differences among raters and employment situations constituted a source of uncontrolled error.

Non-occupational success was defined largely as the degree of participation in various areas: social science, political, civic-religious. Such an operational definition is undoubtedly incomplete.

It should be acknowledged that the range of success being dealt with was a restricted one. It is probable that "colossal failures" would not be employed 5-10 years after graduation. Likewise, a disproportionate

number of subjects with extremely high academic averages likely pursued an advanced degree, and thus were excluded from this study. These restrictions probably attenuated correlational results somewhat. However, as noted in Table 1, a considerable degree of variability was present in the sample.

The distributions of the ratings were frequently skewed. While this may reflect a restricted range of success, it would be desirable to modify the rating scale in such a way that more normal distributions would be obtained.

Other limitations are related to the population for whom the study is applicable. It applies only to bachelor level graduates of the College of Engineering of Kansas State University who have been out of college for the time period specified.

The findings of the study were generated from a single sample. Without cross-validation they should be considered as tentative.

The null hypothesis was tested throughout. In most cases it was accepted. Caution should be employed in interpreting such negative findings. Data consistent with the null hypothesis do not prove it; they simply do not disprove it.

These limitations provide the framework for the following discussion.

Grades as a Predictor

Four types of grades were related to 15 measures of occupational success measured from the external frame of reference. In 6 instances, a significant positive relationship was found; in 54 instances, the null hypothesis was accepted.

Since the null hypothesis was tested at the 5 percent level of

confidence, one would expect to reject it three times purely on the basis of chance fluctuations. That is, if no true relationship existed, a "significant" one would be announced on the average 3 times in 60 tests. This, together with the very modest level of "significant" relationships which were found, suggests that academic achievement is not related in an important way to the occupational success of KSU Engineering graduates.

Senior GPA was significantly related to 3 of the 15 occupational criteria measures from the external frame of reference. It correlated .28 with Achievement Rating, .23 with Overall Occupational Rating, and was significantly related to supervisory judgments of Creativity-Originality (contingency coefficient = .41; $r = .30$). Those with outstanding academic records as seniors were somewhat more likely than low achievers to be perceived by supervisors as creative or original and as performing well on the most important aspects of their jobs; they were also rated as more successful by College of Engineering faculty members. On the other hand, they did not earn more money, were not seen as producing more work or work of better quality, and were not rated any higher than low achievers on 9 of the 10 factors believed to be related to success as an engineer. In brief, the power of senior GPA to predict occupational success is limited both by the modest size of the three significant relationships and by the absence of relationship to 12 of the 15 criteria.

Design GPA was significantly related to Salary ($r = .26$), but not to the other 14 criteria of occupational success from the external frame of reference. Since a significant correlation will be found once in every 20 tests between two unrelated variables, even this finding is suspect. Especially surprising was the failure of Design GPA to relate to Creativity-Originality ratings since, ostensibly, the two appear to focus on similar characteristics.

The other two measures of academic achievement--Overall GPA and Core Courses GPA--were also significantly related to only 1 of the 15 criteria. Again, the prospect that these rejections of the null hypothesis represent errors of the first type cannot be ignored (Johnson, 1949).

For Overall GPA, the only significant relationship was with Creativity-Originality ratings ($C = .36$; $r = .21$). Forty-three percent of those with Overall GPA's below 2.13 were rated low on this criterion; for the other three GPA groups, the corresponding figure was about 20 percent. Thus the relationship was not strong, and probably not linear. Subjects whose grades were in the lowest quartile received the lowest ratings on creativity; but ratings for the 3rd, 2nd, and 1st quartile students did not differ appreciably from each other.

Core Courses GPA was significantly related only to Precision-Care ratings ($C = .40$; $r = .17$). As Table 8 shows, about 40 percent of those whose core course grades were below average were rated "low" while about 10 percent were rated "high." The comparable figures for subjects with above average core course grades were approximately 15 percent and 35 percent. The tentative nature of the finding is highlighted by the fact that the lowest ratings were given to subjects whose Core GPA's were in the third quartile while the highest ratings were given to the second quartile subjects. This anomaly is reflected in the sizeable difference in the size of the contingency coefficient and the correlation coefficient for the same data.

When these measures of academic achievement were related to the two measures of occupational success from the internal frame of reference, the null hypothesis was accepted seven times and rejected once. None of the GPA's was significantly related to self-rating of success. Design GPA

was correlated significantly ($r = .20$) with the perception of how classmates would judge the subject's success. In other words, about four percent in the variation in these ratings could be accounted for by differences in Design GPA. With this as the only significant finding, it seems clear that subjective feelings of occupational success cannot be accurately forecast by measures of academic performance in college.

None of the four measures of grades was significantly related to the five measures of non-occupational success (external frame of reference) or the one measure of this variable from the internal frame of reference.

In summary, college grades were generally unrelated to measures of post college achievement for graduates of the KSU College of Engineering. A total of 92 null hypotheses were tested; 85 were accepted. Six of the seven instances where the hypothesis was rejected concerned occupational success from the external frame of reference. In each instance, the relationship was modest, at best. None of the estimated correlations exceeded .30.

Scholastic Aptitude as a Predictor

Two measures of scholastic aptitude were related to the 15 "external" measures of occupational success. Significant relationships were found in 3 instances, while the null hypothesis was accepted on the other 27 occasions. The ACE Q score was involved in three significant findings. It correlated .26 with Overall Occupational Rating, and was significantly related to supervisory judgments of Persuasiveness ($C = .40$; $r = .31$) and Written Communication ($C = .37$; $r = .20$).

Those who were high on the ACE Q score were perceived as performing well on the most important aspects of their job. Yet they did not earn

especially high salaries or receive high Achievement Ratings or recognition for the quality and quantity of their work. In short, Q was not consistently related to the global measures of occupational success. Since the correlation between the ACE Q score and the Overall Supervisory Rating is so modest, and since it did not correlate significantly with the other global measures of success, its predictive power with respect to general occupational success appears to be limited, at best.

ACE Q scores were also significantly related to Persuasiveness and Written Communication. These results are inconsistent with theoretical expectations. Persuasiveness was expected to reflect verbal fluency and interpersonal skill, while written communication was defined as clarity and conciseness of writing. Logically, it should have been L, not Q, which predicted these criteria.

It is possible that, in an engineering environment, the most persuasive individuals are those who display tight mathematical logic. If this were true, the relationship with Q would be reasonable. However, the data of Table 5 do not support this logic. Persuasiveness was most closely related to Oral Communication, Practical Judgment, and Managerial Skill and least related to Scientific-Technical Knowledge and Problem Solving Ability.

Both the difference between \bar{C} and \bar{r} and the data of Table 10 suggest that the relationship between Q and Written Communication may be non-linear. Those in the lowest quartile on Q consistently received low ratings on Written Communication; but there was little difference among the other three quartiles. Perhaps, in Engineering, some minimal level of quantitative ability is needed before one can produce effective written communications. Beyond that minimum, additional increments of quantitative ability may be irrelevant.

As noted earlier, occasionally a null hypothesis will be rejected when, in fact, no relationship existed. In explaining the "significant" relationship between Q and these two occupational factor ratings, this "false positive" interpretation seems as plausible as the alternatives which were offered previously.

None of the four correlations between academic ability and occupational success from the internal frame of reference was significantly different from zero.

No significant relationships existed between measures of academic ability and measures of non-occupational success regardless of the frame of reference used to judge the latter.

In summary, scholastic aptitude measures were generally unrelated to measures of post college achievement for graduates of the KSU College of Engineering. A total of 46 null hypotheses were tested; 43 were accepted. The ACE L score did not relate significantly with any measure of success. The ACE Q score related significantly to three measures of occupational success, none of which lend themselves to consistent and compelling explanation.

Personality as a Predictor

Two measures of personality variables were related to the 15 "external" measures of occupational success. A significant relationship was found in one instance, while the null hypothesis was accepted on the other 29 occasions. The only significant relationship existed between the EPPS Affiliation score and the Achievement Rating ($r = .25$).

One significant relationship is less than one would expect to find by chance fluctuations alone. This, together with the very modest level of the "significant" relationship which was found, suggests that personality

variables are not related in an important way to occupational success from the external frame of reference.

None of the four correlations between the personality variables and occupational success from the internal frame of reference was significantly different from zero.

No significant relationships existed between the personality variables and measures of non-occupational success regardless of the frame of reference used to judge the latter.

In summary, personality variables were unrelated to measures of post college achievement for graduates of the KSU College of Engineering. A total of 46 null hypotheses were tested; 45 were accepted. The EPPS Achievement score did not relate significantly with any measure of success. The EPPS Affiliation score related significantly to only one measure of success, a finding which could easily be explained by chance fluctuations.

Vocational Interest as a Predictor

Two measures of vocational interest were related to the 15 measures of occupational success assessed from the "external" frame of reference. In one instance, a significant positive relationship was found; in 29 instances the null hypotheses was accepted. The one significant relationship was between the SVIB Group V score and the Achievement Rating ($C = .27$). Again, the relationship between the two variables was extremely modest, and since by chance at least one significant relationship out of 30 is expected, the data suggest that vocational interest measures do not relate in an important way to occupational success measured from the external frame of reference.

When these two measures of vocational interest were related to the two measures of occupational success from the "internal" frame of reference, the null hypothesis was accepted twice and rejected twice. The two significant relationships were between the SVIB Group V rating, on one hand, with the Self-Rating of occupational success ($C = .34$) and Perceived Rating by Others of occupational success ($C = .32$) on the other. Although the relationships are not very strong, they suggest that interest in helping others (as measured by the Group V score) is related to subjective feelings of occupational success.

Tables 12 and 13 show that subjects with "high" SVIB Group V ratings uniformly rated their occupational success as "high." No important differences were found in the self-ratings of "Average" and "Low" Group V subjects. Perhaps those who express interest in helping others are distinguished from those who don't on the basis of self-esteem. Such an intervening variable would help explain why Group V was related to subjective feelings of success.

From the practical point of view, it is important to note that very few members of the sample displayed Group V interests. Only 19 of 126 had a high rating, defined as a primary, secondary, or tertiary pattern; 54 had no pattern (most scores of C or C+ with an occasional higher score) and 53 had reject patterns (all scores C or C+). Thus, only a small percent would be affected by the favorable prognosis implied by a high Group V rating.

One significant relationship existed between vocational interests and non-occupational success from the external frame of reference, while nine relationships were not significant. No significant relationships

were found between measures of vocational interest and non-occupational success from the "internal" frame of reference.

The one significant relationship was between the Group V rating and the Humanistic score ($C = .33$). Although this relationship is not strong, it shows a tendency for those interested in helping others to become involved in cultural activities such as art and music. The "self-esteem" interpretation of Group V, offered earlier, is consistent with this finding, since those with this characteristic would be expected to feel free to explore a wide range of interests.

It was expected that the Civic-Religious score would be related to Group V. Its failure to do so may be due to the fact that the Civic-Religious scale measures two aspects of the same area. It seems desirable to separate civic from religious activities in future studies.

In summary, vocational interest variables were not strongly related to measures of post college achievement for graduates of the KSU College of Engineering. A total of 46 null hypotheses were tested; 42 were accepted. The SVIB Group II rating did not correlate significantly with any measure of success. Group V showed modest relationships with occupational success measured from the internal frame of reference and with Humanistic activities. A "self-esteem" interpretation of Group V seems consistent with these findings.

Chapter 5

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

Summary

The study was concerned with the prediction of occupational and non-occupational success. Both were evaluated from external and internal frames of reference. The major predictors used were academic achievement in college. Selected measures of scholastic aptitude, personality, and vocational interests were also employed.

Subjects were chosen from the Kansas State University freshman classes of 1956, 1957, and 1958; only those who graduated from the College of Engineering were included. A total of 138 of 201 possible subjects agreed to participate; of these, 127 returned questionnaires describing their adult accomplishments and activities. Supervisor ratings were obtained for 90 of the 93 who authorized this type of appraisal. The sample was assumed to be representative of bachelor level engineering graduates from Kansas State University who have 5-10 years of post-college experience.

Measures of success were obtained from the questionnaire and the supervisor rating. Fifteen measures of occupational success from the external frame of reference were obtained; 13 of these employed the supervisory rating. Subjects were rated by their supervisor in 10 factors related to the successful performance of their job; 3 global measures of their occupational success were also made by their supervisor. Engineering faculty members rated occupational success on the basis of responses to two questionnaire items. The final measure was self-reported salary.

Two measures of occupational success from the internal frame of reference were obtained--a self-rating of occupational success, and a rating of how subjects thought former KSU classmates would rate them.

Five measures of non-occupational success from the external frame of reference were obtained by assessing the degree of participation in "free time" activities classified as Scientific-Technical, Social Science, Humanistic, Political, and Civic-Religious.

One measure of non-occupational success from the internal frame of reference was obtained by asking the subjects to estimate how successful they felt they had been in life in general.

Ten predictors were used: four measures of academic achievement, two of scholastic aptitude, two of personality, and two of vocational interest. Academic achievement measures were: Overall Grade Point Average, Senior year GPA, Core Courses GPA, and Design Courses GPA. The two measures of academic aptitude were the ACE Quantitative and ACE Linguistic test scores. The two personality variable measures were the Achievement and Affiliation scores of the Edwards Personal Preference Schedule. The measures of vocational interest were the Group II and Group V ratings from the Strong Vocational Interest Blank. Aptitude, personality, and interest measures were all obtained just prior to the subject's freshman year in college.

Two questions served as guidelines for the investigation. They were:

Question 1. Is there a relationship between adult success (both occupational and non-occupational) and academic achievement among Engineering graduates of KSU?

Question 2. Is there a relationship between adult success (both occupational and non-occupational) and selected measures of scholastic aptitude,

personality, and vocational interest among Engineering graduates of KSU?

The null hypothesis for both questions was that no relationship existed between the criteria and the independent variables.

Conclusions drawn from this investigation should be interpreted in light of its several limitations. Comparability among raters was assumed. It was not possible to adjust salaries for differences due to type of work or region. No estimates of the reliability of the criterion scales were available. The range of success being dealt with was restricted. It was assumed that the results would not be different if all eligible members of the sample had participated. Finally, the findings pertained only to bachelor level graduates from one university in one academic area.

Conclusions

1. Four types of independent variables were used to predict adult accomplishment; academic achievement, scholastic aptitude, personality, and vocational interests. A total of 230 tests for significant relationships between predictors and criterion measures were conducted; 15 (6 percent) were found to be significant. Since five percent would be found to be "significant" purely on the basis of chance fluctuations, it was concluded that the independent variables used in this study were not importantly related to adult accomplishment.

2. Four types of academic achievement were related to 23 measures of adult accomplishment. Seven were significant and 85 were non-significant.

- a. Overall GPA was significantly related to the supervisor rating of Creativity-Originality.

- b. Senior GPA was significantly related to the Achievement Rating by faculty, Overall Supervisory Rating, and the supervisory rating of Creativity-Originality.
- c. Core Courses GPA was significantly related to the supervisory rating of Precision-Care.
- d. Design Courses GPA was significantly related to the Perceived Rating by Others of occupational success and to Salary.
- e. Non-occupational success was not significantly related to any measure of academic achievement.

No consistent relationship was evident between any measure of academic achievement and the various measures of adult accomplishment. The relationships that were significant were modest at best; the number of significant relationships found was about what would be expected by chance. The conclusion is that academic achievement and adult accomplishment are largely independent.

3. Two types of scholastic aptitude measures were related to 23 measures of adult accomplishment. Three relationships were significant, 43 were non-significant.

- a. ACE Q scores were significantly related to the Overall Supervisor Rating, and the supervisory ratings of Persuasiveness and Written Communication.
- b. ACE L scores were not significantly related to any measure of adult accomplishment.
- c. Non-occupational success was not significantly related to any measure of scholastic aptitude.

No systematic pattern was evident in the relationships between scholastic aptitude and adult accomplishment. The relationships that were found to be

significant were too low to be of practical value. Again, the number of significant relationships found was about what could be accounted for by chance. It was concluded that scholastic ability was unrelated to adult success.

4. Two types of personality variables were related to 23 measures of adult accomplishment. One relationship was significant, 45 were non-significant.

- a. EPPS Achievement scores were not significantly related to any measure of adult accomplishment.
- b. EPPS Affiliation scores were related to the Achievement Rating.
- c. Non-occupational success was not significantly related to either measure of personality.

The one significant finding showed only a low degree of relationship. On the basis of chance factors alone, at least two "significant" findings would be expected. The conclusion is that these personality variables are not related to adult accomplishment.

5. Two types of vocational interest measures were related to 23 measures of adult accomplishment. Significant relationships were found in 4 instances; non-significant relationships were found in 42 instances.

- a. The SVIB Group II scores were not significantly related to any measure of adult accomplishment.
- b. The SVIB Group V scores were significantly related to the Achievement Rating, Self-Rating of occupational success, Perceived Rating by Others of occupational success, and the Humanistic index of non-occupational success.
- c. These results seem consistent with the interpretation that Group V scores are an indirect measure of self-esteem.

In general, the significant relationships were not strong, and the number of significant relationships found was only slightly above what one

would expect to obtain by chance. The conclusion is that selected measures of vocational interest bear low positive relationships to a few dimensions of occupational success; however, in general, these interest ratings are not predictive of adult accomplishment.

6. The findings suggest that occupational success is more predictable than non-occupational success.

- a. A total of 150 relationships were tested between predictors and measures of occupational success from the external frame of reference. Eleven were significant; 139 were non-significant.
- b. Of 20 tests of the relationship between predictors and measures of occupational success from the internal frame of reference, 3 were significant and 17 were non-significant.
- c. A total of 50 relationships were tested between predictors and measures of non-occupational success from the external frame of reference. One was significant; 49 were non-significant.
- d. None of the 10 tests of relationship between predictors and non-occupational success from the internal frame of reference was significant.

Implications

For employers. The results give little comfort to those employers who use academic achievement as a measure of occupational potential. Informal observation suggests that many employers are in this category. Perhaps the popularity of the GPA as a selection device reflects its convenient and objective character. This study suggests that employers of Engineering graduates would do well to treat the GPA as a largely irrelevant variable. Senior GPA was of some value in predicting overall success, but the magnitude of the relationship was too small to have practical value except in cases where a

high ratio exists between applicant and vacancies.

Since the results of this study indicate that academic success is not importantly related to occupational success, it would be prudent for the employer to assess other characteristics of more predictive relevance. Regrettably, this investigation gives no clues as to what these characteristics are.

Many companies have developed their own selection batteries of tests normed on successful men in the field. Since an employer is interested in productive employees, assessing applicants on those factors which productive employees possess seems eminently sensible. The development of valid selection batteries through personnel research will probably serve employers better than does the transcript of grades.

As a general rule, the best predictor of future behavior is past behavior of a similar type. Employers might do well to consider this generalization. It seems likely that the success of a prospective sales engineer could be predicted more accurately on the basis of his past experience with sales activities than on the basis of past academic achievement. A systematic biographical inquiry on the part of employers may permit them to determine which students have demonstrated interest and skill in areas closely related to particular job opportunities.

Employers might also consider asking faculty members for more structured ratings of their students. Grades probably represent the faculty member's judgment of how well course content was mastered. They may not reflect his observations of the student's originality, dependability, precision and care, etc. Perhaps such factors are observed by professors but are not reflected in assessments of academic accomplishment.

For Guidance. Counselors would be wise to recognize the limitations of the tests they administer to students. The ACE Q and L tests have established value in predicting success in class work calling for quantitative and linguistic skills; but in this study they were not valid predictors of adult success. The few significant relationships which were found were too small to have practical value in individual prediction.

The EPPS also has established validity for some situations, but its validity should not be generalized widely. In this study, need for achievement was not related to adult achievement nor was affiliation related to people-oriented accomplishments. A need and its behavioral counterpart should not be assumed to be related in all situations. In this study the strength of psychological needs of college freshmen did not predict manifest behavior in the corresponding area 5 to 10 years after graduation.

Counselors can be reassured about the value of the Strong Vocational Interest Blank in predicting future occupation. Over two-thirds of the sample obtained either a primary or a secondary pattern on Group II, while less than 15 percent obtained a primary, secondary, or tertiary pattern on Group V. But the study reinforces earlier research which concluded that interest does not predict level of success. Those with high Group II ratings were no more successful in any area than those with low Group II ratings.

Some unexpected findings emerged when Group V was related to the criteria. Engineers with tertiary or higher patterns expressed unusually high subjective ratings of success and tended to be rated as successful by the faculty. If these results can be replicated, it may be possible to use ostensibly irrelevant scores on the SVIB to help engineering students plan their future.

Counselors should be aware of the lack of relationship between grades and adult success. A student must earn a minimum grade average to graduate and gain entry into an engineering field. Beyond that, the level of grades was generally unrelated to adult success. The few significant relationships were of too low a magnitude to have practical implications for individual counseling.

For Educational Evaluation. Of prime importance to the Engineering faculty is the finding that grades were generally unrelated to adult success. It is erroneous to believe that there is a direct relationship between academic performance and subsequent occupational or non-occupational performance. Insofar as grades are intended to appraise professional promise, this finding should be of considerable concern.

Previous research has shown that academic achievement is a relatively consistent matter. High school grades correlate with college grades; freshman grades correlate with sophomore grades; grades in one course correlate with grades in another. In brief, grades seem to measure some quality with a high degree of consistency. It is suggested here that the quality measured is intellectual mastery of subject matter. It is related to the ability to read and to manipulate verbal and quantitative symbols.

Occupational success in engineering appears to have little in common with academic success. It is of interest to note that ratings of "Scientific-Technical Knowledge" correlated lower with "Overall Occupational Success" than any of the other nine individual factor ratings. "Managerial Skill," "Practical Judgment," "Precision-Care," "Oral Communication," and "Persuasiveness" appeared to be key elements in occupational success.

Intellectual accomplishment, as reflected in grades, may be a worthy goal to be valued in its own right. But it should not be used seriously as a forecaster of professional success.

Since most faculty seek to provide preparation for professional work, they would probably like to provide more relevant appraisals of professional promise. Results of this investigation suggest that this might better be accomplished by rating factors like "Practical Judgment" and "Precision-Care" than by traditional measures of academic achievement.

A major goal of higher education is to produce better citizens--more civic-minded, culturally-oriented individuals. The university attempts to inculcate these ideals in its students. Its appraisal of their progress, however, appears to be unrelated to adult manifestations of "well-roundedness." Students with higher grades were no more involved in scientific-technical, social science, humanistic, political, or civic-religious activities than their counterparts with lower grades.

Again, the evidence suggests that academic achievement represents one sphere of success and behaviors descriptive of liberal education ideals represent another sphere of success. There is no reason to assume that the former should lead to the latter, or that any causal relationship exists. From this study, universities should not encourage students to achieve academically as the first step toward achieving fulfillment and enrichment in life. Rather, academic motivation might better be encouraged for the intrinsic pleasures and satisfactions afforded by intellectual activity. Academic achievement should not be construed as a prerequisite to becoming a "good citizen" or "well-rounded" individual.

For Further Research. It would be helpful to replicate this study with a different sample both from KSU and from other universities. Although the consistency of the findings in this study with those previously reported makes it unlikely that the major conclusions would be altered, the matter is sufficiently important to merit further study.

It would be desirable to strengthen subsequent studies by refining the rating scales and establishing their reliability. Likewise, it would be helpful to include certain other measures of academic success. Grades in freshman composition courses and in speech courses should be explicitly related to the Written and Oral Communication criteria. Grades in liberal arts electives might profitably be related to the non-occupational criteria.

Negative results are never very satisfying. It is important to discover the correlates of occupational success in Engineering (or in any other field). Other predictors available for study might include biographical data which focus on activities and experiences (in jobs, the extracurriculum, hobbies) which have ostensible counterparts in occupational performance. It would also be instructive to explore the predictive value of faculty ratings of characteristics like those used to judge occupational success.

The student, his advisers and teachers, his employers, and his educational institution will profit from improved ways of assessing his progress in programs of preparation.

Non-occupational success has been a difficult area in which to work. Perhaps because it is so difficult to predict, one might do well to find individuals who have attained success in non-occupational areas, and attempt to trace the paths to success, or look for "common denominators." Previous research has started with assumed indicators of non-occupational success. Perhaps it would be more fruitful to approach the problem from the opposite direction. Because higher education is intended to develop individuals broadly, not just professionally, it seems critical to discover factors which foster or interfere with behavior consistent with liberal education ideals.

APPENDIX A
Written Materials

APPENDIX A-1

Initial Letter to Graduates

Dear KSU Alumnus:

This is not a dun; please read on.

In cooperation with the College of Engineering and the Office of Educational Research, I am conducting a study which will hopefully culminate in my Master's thesis. Briefly, the study is concerned with the relationship between educational and occupational experiences. I need your assistance. Please use the enclosed postcard to answer the following questions:

Question I. What type of work are you currently doing? (e.g., Research, Design, Development, Sales and Technical Services, Management, Consulting (private practice), Teaching, Manufacturing and Production, or Other (specify).

Question II. Are you willing to give the name and address of your immediate supervisor, so he may supply us with confidential ratings of your job performance? If you are willing to do so, please list his name and address under Question II on the postcard. These ratings will be used for group comparisons; ratings of individuals will be seen only by myself. If you are unwilling to have me ask for ratings, write "No" after Question II.

Question III. Would you be willing at a later date to answer a brief questionnaire about your academic experiences at KSU and your present occupation? Only 10-15 minutes would be required. Please indicate "Yes" or "No" under Question III on the postcard.

I hope you are willing to assist. In any case, I would appreciate your filling out and returning the enclosed postcard at your earliest convenience.

Sincerely,

Paul Muchinsky
Graduate Assistant

APPENDIX A-2

Postcard Accompanying Initial Letter to Graduates

I. Type of Work _____			
II. Supervisor Name _____			
Position _____			
Firm _____			
Address _____			
City		State	Zip
III. Further Info. <input type="checkbox"/> Yes <input type="checkbox"/> No			
Your Name _____		Street and No. _____	
City		State	Zip

APPENDIX A-3

Letter Accompanying Alumni Questionnaire

Dear KSU Alumnus:

I appreciate your willingness to participate in our survey of engineering graduates.

The questionnaire asks about your present occupational position, your reactions to Kansas State University, and some of your non-occupational activities. Although your answers will be held in strict confidence, feel free to omit questions which you feel impose unduly upon your rights to privacy.

Like most graduate students, I am working on a tight schedule. I hope you can return your completed questionnaire in the near future. A self-addressed stamped envelope is enclosed for your convenience.

Sincerely,

Paul M. Muchinsky
Graduate Assistant

APPENDIX A-4

Alumni Questionnaire

Part I. Your Present Position

1. Title of present position _____
2. Describe briefly the one or two professional achievements of which you are most proud.

3. Describe briefly the most challenging aspect of your present position.

4. How would you rate your own occupational success compared to other men in your profession with similar amounts of training and experience?
 ___ In the top 2% ___ In the top 10%, but not in the top 2%
 ___ In the top 25%, but not in the top 10% ___ In the top half, but not in the top 25% ___ In the lower half
5. How successful do you think your former classmates would rate your occupational success in comparison to that of others with similar training and experience?
 ___ In the top 2% ___ In the top 10%, but not in the top 2%
 ___ In the top 25%, but not in the top 10% ___ In the top half, but not in the top 25% ___ In the lower half
6. What is your approximate base salary for the current year?
 ___ Below \$8000 ___ \$8000-\$9999 ___ \$10,000-\$11,999
 ___ \$12,000-\$13,999 ___ \$14,000-\$15,999 ___ \$16,000-\$17,999
 ___ \$18,000-\$19,999 ___ \$20,000 or more

Part II. Activities other than work

Indicate which of the following activities you engaged in during the past 12 months.

Section A

	<u>NO</u>	<u>YES</u>		<u>NO</u>	<u>YES</u>
1. Attended a scientific/engineering lecture	—	—	17. Read a book on psychology, sociology, or history	—	—
2. Attended a scientific/engineering exhibit	—	—	18. Voted in a local or state election	—	—
3. Read a technical journal or scientific article	—	—	19. Worked actively in a political campaign	—	—
4. Discussed a scientific/engineering theory or event with friends	—	—	20. Wrote a "letter to the editor" regarding a social or civic problem	—	—
5. Regularly read popular accounts of scientific/technical advances (in <u>Time</u> , <u>Newsweek</u> , etc.)	—	—	21. Wrote a letter to a state legislator or U.S. representative or senator about pending or proposed legislation	—	—
6. Discussed merits of political-economic systems (e.g., communism, socialism) with friends	—	—	22. Worked actively in a special study group for the investigation of a social or political issue	—	—
7. Visited an art exhibit	—	—	23. Worked actively on a charity drive	—	—
8. Watched four or more TV news specials	—	—	24. Worked actively in a service group or organization	—	—
9. Attended a stage play	—	—	25. Worked as a volunteer on a civic improvement project	—	—
10. Read six or more articles in <u>Atlantic</u> , <u>Commonwealth</u> , <u>Harpers</u> , and/or <u>Saturday Review</u>	—	—	26. Developed and followed a program of reading of poetry, novels, biographies	—	—
11. Attended a lecture on a current social, economic, or political problem	—	—	27. Read scholarly journals in the humanities	—	—
12. Discussed art or music with friends	—	—	28. Taught in a church, synagogue etc.	—	—
13. Read the editorial column of a newspaper at least once a week	—	—	29. Participated in a religious study group	—	—
14. Read an article or book analyzing in depth a political or social issue	—	—	30. Worked to raise money for a religious institution or group	—	—
15. Read a biography or autobiography of a political or social reform leader	—	—	31. Did voluntary work for a religious institution or group	—	—
16. Attended a music recital or concert	—	—			

Section B

Success in life means different things to different people. For some people, it may mean success in one's occupation; for others, it is based mostly on a satisfying family life. For most, it is probably a synthesis of how satisfying various aspects of their life have been. What degree of success do you feel you have attained in life in general?

___ In the top 2% ___ In the top 10%, but not in the top 2%

___ In the top 25%, but not in the top 10% ___ In the top half, but not in the top 25%

___ In the lower half

APPENDIX A-5

Letter Accompanying Supervisor Rating Form

Dear _____:

_____, a KSU alumnus, has named you as his immediate supervisor and given me permission to seek your confidential opinion of his work. We will compare your ratings with some measures of abilities, interests, and personality which were collected when our sample were freshmen at KSU. We will also relate several measures of their educational success at KSU to your ratings. We hope to learn how to improve our guidance and educational programs by this process.

The enclosed rating sheet lists a set of ten factors which are commonly involved in engineering work. You are asked to make two ratings of each factor. First, how important is it to successful functioning in the individual's position? Second, how much of each factor does the individual possess? You are also asked to make overall ratings of the quality and quantity of the work produced by the individual.

Your assistance will not only help us improve KSU programs, but will permit me to write a master's thesis. I hope you can return your completed ratings in the near future. A self-addressed stamped envelope is enclosed.

Sincerely,

Paul Muchinsky
Graduate Assistant

Employee _____

1. How important are each of the factors listed below to the successful performance of this employee's job? Use the following key:

E = Essential VI = Very Important I = Important M = Minor or No Importance

	E	VI	I	M
Scientific-Technical Knowledge	—	—	—	—
Understanding of Engineering Problem Solving Methodology . . .	—	—	—	—
Creativity-Originality	—	—	—	—
Persuasiveness	—	—	—	—
Interpersonal Competence (ability to get along with others) .	—	—	—	—
Managerial Skill (ability to plan, organize, allocate resources and responsibilities)	—	—	—	—
Written Communication (memos, manuals, letters, reports, etc.)	—	—	—	—
Oral Communication (ability to express yourself clearly and to understand others)	—	—	—	—
Precision-Care (freedom from error)	—	—	—	—
Practical Judgment (ability to make sound decisions in the face of uncertainties)	—	—	—	—

2. Rate the employee's status on each factor by checking the most appropriate point on the following scales:

Ratings on Specific Characteristics

Sci.-Tech.Know.	/	/	/	/	/	No opportunity to observe
	Frequently used as a consultant by others	Seldom needs to consult authorities	Occasionally must "study up" or seek help	Frequently needs to review or relearn	Only minimally informed in scientific-technical matters	
Underst. Engin. Problem-Solving Methodology	/	/	/	/	/	No opportunity to observe
	Proposes sound attack on problems	Seldom has trouble in designing approach	Occasionally needs help in attacking a problem	Often needs help in attacking a problem	Usually must be told how to proceed on a problem	
Creativity-Origin.	/	/	/	/	/	No opportunity to observe
	Highly inventive	Generally resourceful	Occasionally displays originality	Seldom resourceful	Routine worker	
Persuasiveness	/	/	/	/	/	No opportunity to observe
	Very convincing	Usually obtains a good hearing	Neither strong nor weak	Seldom influences his listeners	Generally turns them off	
Interper. Comp.	/	/	/	/	/	No opportunity to observe
	Well-liked by most	Generally viewed positively	Neither rejected nor sought out by most	Creates negative impression in many	Disruptive force	
Managerial Skill	/	/	/	/	/	No opportunity to observe
	Plans and organizes work exceptionally well	Generally organizes activities to get job done	Neither strong nor weak	Occasionally disorganized and lacking in foresight	Uses time and manpower ineffectively	
Written Commun.	/	/	/	/	/	No opportunity to observe
	Highly effective	Usually clear and interesting	Comprehensible	Inclined to be ambiguous and/or dull	Frequently confusing or misleading	
Oral Communic.	/	/	/	/	/	No opportunity to observe
	Expresses self clearly and concisely	Seldom is misunderstood	Generally is understandable	Occasionally ambiguous	Frequently is misunderstood	
Precision-Care	/	/	/	/	/	No opportunity to observe
	Work always done with care and precision	Seldom makes errors	Work requires normal degree of supervision	Work tends to be careless or imprecise	Work is frequently too imprecise to be accepted	
Practical Judgment	/	/	/	/	/	No opportunity to observe
	Almost always makes sound judgments	His judgment is generally good	Judgment about average	Only occasionally makes good judgments	Seldom displays sound judgment	

3. Check the point on the scales below which best describe the overall quality and quantity of the employee's work.

	Exceptional	Above Average	Average	Below Average	Poor
Quality	—	—	—	—	—
Quantity	—	—	—	—	—

Your cooperation is appreciated. Return completed rating to Paul Muchinsky, Office of Educational Research, Kansas State University, Manhattan, Kansas.

APPENDIX A-7

Initial Follow-up Letter to Graduates

Dear KSU Alumnus:

Several weeks ago, a graduate student named Paul Muchinsky sent you a letter asking you if you would participate in a study of KSU engineering alumni. We believe his study will provide information which will help us strengthen our College. I hope you will participate.

On the chance that his original letter was mislaid, I am enclosing another postcard. It asks three questions: (1) What type of work are you doing? (e.g., Research, Design, Development, Sales and Technical Services, Management, Consulting (private practice), Teaching, Manufacturing and Production, or Other (specify). (2) If you don't object, he would like to obtain some confidential ratings from your supervisor so that these can be related to the guidance tests you took as a freshman; for this purpose, his name and address are needed. If you object to Muchinsky's contacting him, simply write "No" in those spaces. (3) Are you willing to answer a brief questionnaire about your present activities and your KSU experiences?

Of course, neither I nor other members of the Engineering faculty will see the returns for individuals. Results for the group as a whole, however, will be available to us.

I hope we will hear from you in the near future. In addition to assisting the College, the study will be used as the basis for Mr. Muchinsky's master's thesis; I'm sure you can appreciate the time pressures he is encountering.

Sincerely,

Ralph G. Nevins
Dean

APPENDIX A-8

Second Follow-up Letter to Graduates

Dear KSU Alumnus:

Uncertain mail delivery and your own busy schedule have probably combined to prevent you from replying to my earlier requests for assistance. However, my graduate committee insists that my return rate be increased. Therefore, I will appreciate it if you will fill out the enclosed card and return it to me.

It asks three questions: (1) What type of work are you doing? (e.g., Research, Design, Development, Sales and Technical Services, Management, Consulting (private practice), Teaching, Manufacturing and Production, or Other (specify). (2) If you don't object, I would like to obtain some confidential ratings from your supervisor so that these can be related to some guidance tests you took as a freshman; for this purpose, his name and address are needed. If you object to my contacting him, simply write "No" in those spaces. (3) Are you willing to answer a brief questionnaire about your present activities and your KSU experiences?

Of course I hope you will participate in the study, but regardless of your decision, please fill out and return the enclosed postcard. All returns will be strictly confidential.

I apologize for being so persistent and hope this request will not impose unduly upon your time.

Sincerely,

Paul Muchinsky
Graduate Assistant

APPENDIX A-9

Third Follow-up Letter to Graduates

Dear _____:

My study of KSU Engineering alumni is proceeding well. However, to insure representativeness, my committee has asked me to make another attempt to obtain a completed questionnaire from you. Another copy is enclosed, together with another self-addressed, stamped envelope.

I apologize for the imposition on your time and hope you will find satisfaction in the knowledge that your responses will help KSU provide an improved educational program.

Sincerely,

Paul Muchinsky
Graduate Assistant

APPENDIX A-10

Initial Follow-up Letter to Supervisors

Dear _____:

Several weeks ago you were sent a brief form to rate one of your employees who agreed to the rating. Both the troubled mail situation and your busy schedule have contributed to the fact that I have not yet received the rating form. In case you have accidentally misplaced the form, I have enclosed another.

This rating will serve as part of my master's thesis so I hope you can return it as soon as possible. A self-addressed stamped envelope is enclosed for your convenience.

Sincerely,

Paul Muchinsky
Graduate Assistant

APPENDIX A-11

Second Follow-up Letter to Supervisors

Dear _____:

I apologize for troubling you again, but in the interests of reaching maximally valid conclusions (and of satisfying my committee) I am trying to obtain complete data for all members of my alumni sample. Since we have not yet received your ratings, I am enclosing another form and a self-addressed stamped envelope.

Your assistance will be greatly appreciated.

Sincerely,

Paul Muchinsky
Graduate Assistant

APPENDIX B

Basic Data

APPENDIX B-1

Means and Standard Deviations For Normally Distributed Variables

Variable	Mean	Standard Deviation
Overall GPA	2.49	.49
Senior GPA	2.62	.55
Core GPA	2.32	.72
Design GPA	2.59	.71
ACE Q	49.8	9.6
ACE L	67.2	14.9
EPPS ACH.	15.8	3.7
EPPS AFF.	14.5	4.1
Ach. Rating	2.51	.67
Self-Rating	3.26	.81
Perceived Rating	3.04	.84
Salary	4.92	1.19
Quality Rating	4.12	.42
Quantity Rating	4.04	.73
Overall Rating	3.93	.57
Success in Life	3.18	.90

APPENDIX B-2

Distributions of Non-Normally Distributed Occupational Factor Ratings

Score	Factors									
	I	II	III	IV	V	VI	VII	VIII	IX	X
1	0	0	1	0	0	1	1	0	0	1
2	5	4	1	3	7	3	5	5	3	0
3	35	29	18	29	15	15	22	26	21	13
4	24	31	59	47	26	43	46	42	45	55
5	23	22	10	11	42	26	15	17	21	21

I	Scientific-Technical Knowledge
II	Understanding of Engineering Problem-Solving Methodology
III	Creativity-Originality
IV	Persuasiveness
V	Interpersonal Competence
VI	Managerial Skill
VII	Written Communication
VIII	Oral Communication
IX	Precision-Care
X	Practical Judgment

APPENDIX B-3

Distributions of Non-Normally Distributed SVIB Scores and Scores of Non-Occupational Success Measures

Scores	SVIB	SVIB	Non-Occupational Factors				
	Group II	Group V	I	II	III	IV	V
0	-	-	0	1	22	12	37
1	52	1	3	8	29	75	24
2	33	9	8	15	24	34	24
3	25	10	25	35	30	5	12
4	17	59	35	37	13	1	13
5	6	54	56	17	8	0	10
6	-	-	-	10	1	-	4
7	-	-	-	4	0	-	3

- I Scientific-Technical
 II Social Science
 III Humanistic
 IV Political
 V Civic-Religious

APPENDIX B-4

Intercorrelation of the Eight Normally Distributed Independent Variables

	I	II	III	IV	V	VI	VII	VIII
I	-	82	87	58	34	40	10	-24
II	(134)	-	61	68	28	31	09	-13
III	(134)	(134)	-	43	25	25	06	-18
IV	(134)	(134)	(134)	-	17	17	10	-09
V	(134)	(134)	(134)	(134)	-	58	02	-07
VI	(134)	(134)	(134)	(134)	(134)	-	05	-20
VII	(129)	(129)	(129)	(129)	(129)	(129)	-	-21
VIII	(129)	(129)	(129)	(129)	(129)	(129)	(129)	-

Intercorrelations above diagonal (decimal points omitted)

Number of cases in () below diagonal

- I Overall GPA
 II Senior GPA
 III Core GPA
 IV Design GPA
 V ACE Q
 VI ACE L
 VII EPPS ACH.
 VIII EPPS AFF.

APPENDIX B-5

SVIB Group II Scores Versus Five Normally Distributed Occupational Success Measures From the External Frame of Reference

Variable	Score	Group II				χ^2	p	H_0
		1	2	3	4,5			
Achievement Rating	1,2	17	11	6	5	5.10	>.16	accept
	3,4	14	4	7	10			
Salary	3,4	22	11	7	9	5.36	>.49	accept
	5	15	11	12	6			
	6,7,8	13	8	3	7			
Quality	2,3	6	2	0	4	9.06	>.17	accept
	4	21	13	14	6			
	5	6	4	7	6			
Quantity	2,3	10	4	4	2	6.96	>.32	accept
	4	14	7	13	11			
	5	9	8	4	3			
Overall Supervisor Rating	3.63-	28	20	6	11	11.39	>.24	accept
	3.64 - 3.97	9	4	5	4			
	4.00 - 4.35	7	6	7	2			
	4.42+	8	3	7	5			

APPENDIX B-6

SVIB Group V Scores Versus Five Normally Distributed Occupational Success Measures From the External Frame of Reference

Variable	Score	Group V			χ^2	p	H_0 reject
		1,2,3	4	5			
Achievement	1,2	3	20	16	5.97	<.05	reject
Rating	3,4	10	16	9			
Salary	3,4	2	23	24	8.96	>.08	accept
	5	9	20	15			
	6,7,8	8	11	12			
Quality	2,3	0	8	4	7.38	>.11	accept
	4	9	21	24			
	5	6	12	5			
Quantity	2,3	2	9	9	3.82	>.43	accept
	4	8	24	13			
	5	5	8	11			
Overall Supervisor Rating	3.63-	6	28	31	7.66	>.26	accept
	3.64 - 3.97	3	9	10			
	4.00 - 4.35	5	9	8			
	4.42+	6	12	5			

Scientific-Technical Knowledge Versus Ten Independent Variables

Independent Variable	Scores	Scientific-Technical Knowledge			χ^2	p	H_0
		1,2,3	4	5			
Overall GPA	2.12-	10	7	4	3.33	>.70	accept
	2.14 - 2.41	10	5	5			
	2.42 - 2.75	11	6	5			
	2.77+	8	5	9			
Senior GPA	2.21-	8	7	6	5.70	>.40	accept
	2.23 - 2.59	10	8	2			
	2.61 - 3.00	11	5	7			
	3.03+	10	4	8			
Core GPA	1.75-	9	7	5	7.34	>.20	accept
	1.76 - 2.28	12	7	2			
	2.29 - 2.77	12	4	7			
	2.78+	7	6	9			
Design GPA	2.00-	5	7	2	6.05	>.40	accept
	2.14 - 2.50	9	6	5			
	2.57 - 3.00	13	6	9			
	3.14+	4	3	6			
ACE Q	43-	11	5	3	4.35	>.60	accept
	44 - 49	11	4	6			
	50 - 55	10	6	5			
	56+	7	9	6			
ACE L	57-	10	6	6	.75	>.99	accept
	58 - 66	10	6	5			
	67 - 76	8	6	6			
	77+	12	6	5			
EPPS ACH.	12-	7	4	3	5.44	>.48	accept
	13 - 14	17	4	8			
	15 - 18	6	6	2			
	19+	9	6	7			
EPPS AFF.	11-	8	1	4	4.90	>.55	accept
	12 - 14	12	9	6			
	15 - 16	11	4	6			
	17+	7	6	7			
SVIB Group II	1	16	6	9	2.37	>.88	accept
	2	9	6	4			
	3	9	5	6			
	4,5	6	6	4			
SVIB Group V	1,2,3	5	4	5	2.26	>.68	accept
	4	20	12	8			
	5	15	7	10			

Understanding of Engineering Problem Solving Methodology Versus Ten
Independent Variables

Independent Variable	Scores	Understanding of Engineering Problem Solving Methodology			χ^2	p	H_0
		1,2,3	4	5			
Overall GPA	2.12-	8	9	3	3.06	>.80	accept
	2.14 - 2.41	9	5	7			
	2.42 - 2.75	8	8	6			
	2.77+	7	8	6			
Senior GPA	2.21-	8	8	5	1.64	>.94	accept
	2.23 - 2.59	7	8	3			
	2.61 - 3.00	9	7	7			
	3.03+	8	8	7			
Core GPA	1.75-	5	12	3	8.76	>.18	accept
	1.76 - 2.28	12	5	5			
	2.29 - 2.77	8	8	7			
	2.78+	8	6	7			
Design GPA	2.00-	5	5	4	.97	>.98	accept
	2.14 - 2.50	7	7	4			
	2.57 - 3.00	10	11	7			
	3.14+	5	4	5			
ACE Q	43-	7	9	3	5.46	>.48	accept
	44 - 49	7	9	5			
	50 - 55	11	4	7			
	56+	6	8	6			
ACE L	57-	9	10	3	11.41	>.07	accept
	58 - 66	5	7	10			
	67 - 76	6	8	5			
	77+	13	6	3			
EPPS ACH.	12-	5	6	3	3.05	>.80	accept
	13 - 14	14	8	7			
	15 - 18	5	6	2			
	19+	7	8	7			
EPPS AFF.	11-	4	5	4	10.11	>.11	accept
	12 - 14	12	9	7			
	15 - 16	12	4	3			
	17+	3	10	7			
SVIB Group II	1	13	13	5	6.17	>.40	accept
	2	9	5	4			
	3	5	7	9			
	4,5	6	5	4			
SVIB Group V	1,2,3	3	3	8	9.07	>.05	accept
	4	16	14	9			
	5	14	13	5			

Creativity-Originality Versus Ten Independent Variables

Independent Variable	Scores	Creativity-Originality			χ^2	p	H_0
		1,2,3	4	5			
Overall GPA	2.12-	9	11	1	12.76	<.05	reject
	2.14 - 2.41	4	16	1			
	2.42 - 2.75	5	15	2			
	2.77+	2	15	6			
Senior GPA	2.21-	11	8	2	17.59	<.01	reject
	2.23 - 2.59	3	17	1			
	2.61 - 3.00	3	18	2			
	3.03+	3	15	5			
Core GPA	1.75-	6	14	1	4.46	>.61	accept
	1.76 - 2.28	6	16	1			
	2.29 - 2.77	4	14	4			
	2.78+	4	15	4			
Design GPA	2.00-	6	5	2	8.57	>.19	accept
	2.14 - 2.50	7	12	2			
	2.57 - 3.00	5	21	3			
	3.14+	1	10	3			
ACE Q	43-	6	11	3	7.30	>.29	accept
	44 - 49	4	17	1			
	50 - 55	7	14	1			
	56+	2	15	4			
ACE L	57-	8	12	3	5.89	>.43	accept
	58 - 66	3	17	3			
	67 - 76	6	11	2			
	77+	3	18	2			
EPPS ACH.	12-	3	9	2	4.18	>.65	accept
	13 - 14	5	23	1			
	15 - 18	3	9	3			
	19+	6	14	3			
EPPS AFF.	11-	3	9	2	7.65	>.26	accept
	12 - 14	5	21	2			
	15 - 16	6	15	0			
	17+	3	13	5			
SVIB Group II	1	5	24	4	3.40	>.76	accept
	2	5	12	2			
	3	6	14	1			
	4,5	4	9	3			
SVIB Group V	1,2,3	1	10	4	5.94	>.20	accept
	4	11	27	3			
	5	8	22	3			

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Persuasiveness Versus Ten Independent Variables

Independent Variable	Scores	Persuasiveness			χ^2	P	H_0
		1,2,3	4	5			
Overall GPA	2.12-	10	9	2	3.25	>.77	accept
	2.14 - 2.41	6	13	2			
	2.42 - 2.75	7	13	3			
	2.77+	9	10	4			
Senior GPA	2.21-	8	11	2	1.11	>.98	accept
	2.23 - 2.59	7	12	2			
	2.61 - 3.00	9	12	3			
	3.03+	7	12	4			
Core GPA	1.75-	6	13	2	3.79	>.70	accept
	1.76 - 2.28	10	11	2			
	2.29 - 2.77	7	11	5			
	2.78+	9	12	2			
Design GPA	2.00-	3	7	4	7.79	>.25	accept
	2.14 - 2.50	7	13	1			
	2.57 - 3.00	12	14	3			
	3.14+	2	10	2			
ACE Q	43-	11	9	20	16.38	<.02	reject
	44 - 49	9	10	22			
	50 - 55	7	14	22			
	56+	3	12	22			
ACE L	57-	8	14	1	6.82	>.33	accept
	58 - 66	8	12	3			
	67 - 76	8	11	1			
	77+	8	9	6			
EPPS ACH.	12-	5	8	2	7.82	>.25	accept
	13 - 14	8	17	4			
	15 - 18	6	5	4			
	19+	10	13	0			
EPPS AFF.	11-	7	6	1	4.13	>.65	accept
	12 - 14	9	14	5			
	15 - 16	8	11	2			
	17+	5	14	2			
SVIB Group II	1	15	17	1	7.78	>.25	accept
	2	8	9	2			
	3	5	11	5			
	4,5	4	10	2			
SVIB Group V	1,2,3	2	9	4	8.33	>.08	accept
	4	15	21	5			
	5	15	17	1			

Interpersonal Competence Versus Ten Independent Variables

Independent Variable	Scores	Interpersonal Competence			χ^2	p	H_0
		1,2,3	4	5			
Overall GPA	2.12-	6	4	11	4.07	> .66	accept
	2.14 - 2.41	3	8	10			
	2.42 - 2.75	5	6	12			
	2.77+	7	8	8			
Senior GPA	2.21-	3	7	11	3.42	> .75	accept
	2.23 - 2.59	7	5	9			
	2.61 - 3.00	4	8	12			
	3.03+	7	6	10			
Core GPA	1.75-	5	4	12	4.49	> .61	accept
	1.76 - 2.28	4	10	9			
	2.29 - 2.77	7	5	11			
	2.78+	6	7	10			
Design GPA	2.00-	1	2	11	8.30	> .21	accept
	2.14 - 2.50	5	8	8			
	2.57 - 3.00	9	9	11			
	3.14+	3	3	8			
ACE Q	43-	7	5	8	9.61	> .14	accept
	44 - 49	4	7	11			
	50 - 55	6	10	6			
	56+	3	4	15			
ACE L	57-	7	6	10	2.02	> .91	accept
	58 - 66	4	9	10			
	67 - 76	5	5	10			
	77+	6	6	11			
EPPS ACH.	12-	5	3	7	2.67	> .84	accept
	13 - 14	8	8	13			
	15 - 18	3	4	8			
	19+	4	9	10			
EPPS AFF.	11-	5	4	5	11.17	> .08	accept
	12 - 14	2	10	16			
	15 - 16	6	8	7			
	17+	6	2	13			
SVIB Group II	1	8	9	16	4.06	> .66	accept
	2	5	4	10			
	3	3	8	10			
	4,5	6	5	5			
SVIB Group V	1,2,3	3	5	7	3.98	> .40	accept
	4	11	8	22			
	5	8	13	12			

Managerial Skill Versus Ten Independent Variables

Independent Variable	Scores	Managerial Skill			χ^2	p	H_0
		1,2,3	4	5			
Overall GPA	2.12-	5	13	2	7.81	>.25	accept
	2.14 - 2.41	5	10	5			
	2.42 - 2.75	5	11	7			
	2.77+	4	8	11			
Senior GPA	2.21-	5	12	2	7.69	>.26	accept
	2.23 - 2.59	4	12	5			
	2.61 - 3.00	5	11	8			
	3.03+	4	8	11			
Core GPA	1.75-	2	15	3	10.47	>.10	accept
	1.76 - 2.28	8	9	6			
	2.29 - 2.77	4	11	7			
	2.78+	5	8	10			
Design GPA	2.00-	2	10	1	7.47	>.27	accept
	2.14 - 2.50	3	10	8			
	2.57 - 3.00	8	12	8			
	3.14+	2	6	6			
ACE Q	43-	5	12	2	10.70	>.09	accept
	44 - 49	4	13	4			
	50 - 55	6	8	8			
	56+	3	8	11			
ACE L	57-	5	14	4	3.75	>.70	accept
	58 - 66	5	10	7			
	67 - 76	3	8	8			
	77+	6	11	6			
EPPS ACH.	12-	4	6	5	2.61	>.85	accept
	13 - 14	7	15	7			
	15 - 18	4	8	3			
	19+	3	10	8			
EPPS AFF.	11-	3	8	3	6.50	>.36	accept
	12 - 14	3	14	10			
	15 - 16	8	8	5			
	17+	3	11	6			
SVIB Group II	1	10	15	7	11.69	>.06	accept
	2	5	6	8			
	3	2	15	3			
	4,5	2	7	7			
SVIB Group V	1,2,3	2	6	6	2.30	>.68	accept
	4	8	21	11			
	5	9	16	8			

Written Communication Versus Ten Independent Variables

Independent Variable	Scores	Written Communication			χ^2	p	H_0
		1,2,3	4	5			
Overall GPA	2.12-	7	10	4	8.19	>.22	accept
	2.14 - 2.41	10	9	1			
	2.42 - 2.75	7	11	5			
	2.77+	3	15	5			
Senior GPA	2.21-	9	10	2	7.08	>.31	accept
	2.23 - 2.59	9	9	3			
	2.61 - 3.00	6	12	5			
	3.03+	3	15	5			
Core GPA	1.75-	6	12	3	5.25	>.51	accept
	1.76 - 2.28	10	9	3			
	2.29 - 2.77	8	12	3			
	2.78+	4	13	6			
Design GPA	2.00-	4	8	2	4.86	>.56	accept
	2.14 - 2.50	7	10	4			
	2.57 - 3.00	8	17	3			
	3.14+	1	9	4			
ACE Q	43-	11	8	1	13.24	<.04	reject
	44 - 49	5	11	6			
	50 - 55	8	10	3			
	56+	2	15	5			
ACE L	57-	11	9	3	11.59	>.07	accept
	58 - 66	7	13	3			
	67 - 76	5	7	7			
	77+	5	16	2			
EPPS ACH.	12-	4	6	5	8.67	>.19	accept
	13 - 14	13	12	4			
	15 - 18	4	9	1			
	19+	6	15	2			
EPPS AFF.	11-	3	9	2	1.96	>.92	accept
	12 - 14	9	13	6			
	15 - 16	8	10	3			
	17+	7	11	3			
SVIB Group II	1	12	17	4	4.65	>.59	accept
	2	6	7	5			
	3	5	12	4			
	4,5	5	10	1			
SVIB Group V	1,2,3	3	11	1	5.08	>.28	accept
	4	12	22	6			
	5	13	13	7			

Oral Communication Versus Ten Independent Variables

Independent Variable	Scores	Oral Communication			χ^2	p	H_0
		1,2,3	4	5			
Overall GPA	2.12-	9	9	3	1.49	>.96	accept
	2.14 - 2.41	6	11	4			
	2.42 - 2.75	8	10	5			
	2.77+	7	12	4			
Senior GPA	2.21-	7	9	5	9.44	>.15	accept
	2.23 - 2.59	10	11	0			
	2.61 - 3.00	5	11	8			
	3.03+	8	11	4			
Core GPA	1.75-	6	11	4	1.23	>.97	accept
	1.76 - 2.28	9	11	3			
	2.29 - 2.77	8	10	5			
	2.78+	8	10	5			
Design GPA	2.00-	3	8	3	3.63	>.73	accept
	2.14 - 2.50	7	10	4			
	2.57 - 3.00	12	11	6			
	3.14+	3	9	2			
ACE Q	43-	9	10	1	6.76	>.34	accept
	44 - 49	8	8	6			
	50 - 55	8	10	4			
	56+	4	12	6			
ACE L	57-	10	9	4	4.23	>.64	accept
	58 - 66	8	12	3			
	67 - 76	7	7	6			
	77+	6	13	4			
EPPS ACH.	12-	4	8	3	.76	>.99	accept
	13 - 14	10	14	5			
	15 - 18	6	6	3			
	19+	8	11	4			
EPPS AFF.	11-	5	7	2	5.80	>.44	accept
	12 - 14	6	14	8			
	15 - 16	9	11	1			
	17+	7	10	4			
SVIB Group II	1	13	15	5	6.06	>.41	accept
	2	8	7	4			
	3	6	9	6			
	4,5	4	11	1			
SVIB Group V	1,2,3	3	8	4	3.74	>.44	accept
	4	13	20	8			
	5	15	14	4			

Precision-Care Versus Ten Independent Variables

Independent Variable	Scores	Precision-Care			χ^2	p	H_0
		1,2,3	4	5			
	2.12-	10	8	3			
Overall GPA	2.14 - 2.41	5	14	2	11.51	>.07	accept
	2.42 - 2.75	5	11	7			
	2.77+	3	12	8			
Senior GPA	2.21-	8	8	5	4.59	>.59	accept
	2.23 - 2.59	7	10	4			
	2.61 - 3.00	6	13	5			
	3.03+	3	13	7			
Core GPA	1.75-	9	8	4	14.53	<.03	reject
	1.76 - 2.28	8	14	1			
	2.29 - 2.77	2	14	7			
	2.78+	5	9	9			
Design GPA	2.00-	4	7	3	1.55	>.95	accept
	2.14 - 2.50	5	10	6			
	2.57 - 3.00	7	14	8			
	3.14+	2	9	3			
ACE Q	43-	10	8	2	10.51	>.10	accept
	44 - 49	3	14	5			
	50 - 55	6	11	5			
	56+	4	10	8			
ACE L	57-	5	12	6	1.87	>.93	accept
	58 - 66	6	13	4			
	67 - 76	6	8	6			
	77+	7	11	5			
EPPS ACH.	12-	1	7	7	10.54	>.10	accept
	13 - 14	10	17	2			
	15 - 18	4	7	4			
	19+	6	11	6			
EPPS AFF.	11-	3	7	4	1.99	>.92	accept
	12 - 14	8	15	5			
	15 - 16	7	9	5			
	17+	4	12	5			
SVIB Group II	1	10	18	5	5.95	>.42	accept
	2	7	8	4			
	3	2	12	7			
	4,5	5	7	4			
SVIB Group V	1,2,3	1	11	3	5.64	>.22	accept
	4	13	17	11			
	5	10	17	6			

Practical Judgment Versus Ten Independent Variables

Independent Variable	Scores	Practical Judgment			χ^2	p	H_0
		1,2,3	4	5			
Overall GPA	2.12-	4	14	3	7.77	>.25	accept
	2.14 - 2.41	5	14	2			
	2.42 - 2.75	1	14	8			
	2.77+	4	12	7			
Senior GPA	2.21-	4	12	5	2.92	>.81	accept
	2.23 - 2.59	2	16	3			
	2.61 - 3.00	3	14	7			
	3.03+	4	13	6			
Core GPA	1.75-	2	15	4	4.49	>.61	accept
	1.76 - 2.28	6	13	4			
	2.29 - 2.77	2	14	7			
	2.78+	4	13	6			
Design GPA	2.00-	3	8	3	2.26	>.89	accept
	2.14 - 2.50	3	11	7			
	2.57 - 3.00	4	18	7			
	3.14+	1	14	7			
ACE Q	43-	3	16	1	9.51	>.14	accept
	44 - 49	5	10	7			
	50 - 55	5	12	5			
	56+	1	14	7			
ACE L	57-	3	16	4	2.57	>.86	accept
	58 - 66	2	15	6			
	67 - 76	4	11	5			
	77+	5	13	5			
EPPS ACH.	12-	5	5	5	6.87	>.33	accept
	13 - 14	4	19	6			
	15 - 18	2	8	5			
	19+	3	16	4			
EPPS AFF.	11-	2	10	2	2.66	>.85	accept
	12 - 14	3	19	6			
	15 - 16	5	12	4			
	17+	2	14	5			
SVIB Group II	1	6	20	7	5.48	>.48	accept
	2	5	11	3			
	3	2	15	4			
	4,5	1	9	6			
SVIB Group V	1,2,3	1	8	6	5.22	>.26	accept
	4	7	24	10			
	5	6	23	4			

SVIB Group II Scores Versus Two Measures of Occupational Success From the
Internal Frame of Reference

Variable	Scores	SVIB Group II				χ^2	p	H_0
		1	2	3	4,5			
Self-Rating	1,2	6	6	5	5	8.48	>.20	accept
	3	25	7	8	5			
	4,5	19	16	7	11			
Perceived Rating by Others	1,2	13	6	7	5	1.81	>.93	accept
	3	21	13	6	9			
	4,5	16	8	6	7			

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SVIB Group V Scores Versus Two Measures of Occupational Success From the
Internal Frame of Reference

Variable	Scores	SVIB Group V			χ^2	p	H_0
		1,2,3	4	5			
Self-Ratings	1,2	0	12	10	16.23	<.01	reject
	3	2	23	20			
	4,5	15	18	20			
Perceived Rating by Others	1,2	0	17	14	13.00	<.02	reject
	3	6	24	19			
	4,5	10	10	17			

Scientific-Technical Scores Versus Ten Independent Variables

Independent Variable	Scores	Scientific-Technical				χ^2	p	H_0
		1,2	3	4	5			
Overall GPA	2.12-	1	6	6	14	6.50	>.68	accept
	2.14-2.41	4	6	8	15			
	2.42-2.75	3	7	13	10			
	2.77+	2	6	7	17			
Senior GPA	2.21-	1	8	7	13	10.40	>.31	accept
	2.23-2.59	6	3	12	11			
	2.61-3.00	2	7	8	16			
	3.03+	2	6	8	16			
Core GPA	1.75-	2	5	5	20	14.28	>.11	accept
	1.76-2.28	5	6	10	10			
	2.29-2.77	3	9	11	8			
	2.78+	1	5	9	17			
Design GPA	2.00-	2	4	5	9	9.09	>.42	accept
	2.14-2.50	2	6	13	9			
	2.57-3.00	3	8	9	17			
	3.14+	2	4	3	16			
ACE Q	43-	2	7	5	11	5.91	>.74	accept
	44 - 49	3	7	7	13			
	50 - 55	4	6	7	16			
	56+	2	5	14	14			
ACE L	57-	3	9	5	11	13.96	>.12	accept
	58 - 66	5	8	6	15			
	67 - 76	2	5	9	14			
	77+	1	2	14	16			
EPPS ACH.	12-	1	3	4	11	8.06	>.52	accept
	13 - 14	4	4	10	20			
	15 - 18	3	6	9	8			
	19+	2	10	9	13			
EPPS AFF.	11-	1	3	6	12	5.87	>.75	accept
	12 - 14	2	6	8	19			
	15 - 16	4	7	11	12			
	17+	4	7	8	10			
SVIB Group II	1	4	7	15	25	10.55	>.30	accept
	2	1	6	12	12			
	3	4	6	2	10			
	4,5	2	6	5	9			
SVIB Group V	1,2,3	2	3	4	10	3.78	>.70	accept
	4	6	8	16	24			
	5	3	14	14	22			

Social Science Scores Versus Ten Independent Variables

Independent Variable	Scores	Social Science				χ^2	p	H_0
		0,1	2,3	4,5	6,7			
Overall GPA	2.12-	1	14	9	3	4.45	>.87	accept
	2.14 - 2.41	3	11	16	3			
	2.42 - 2.75	3	12	13	5			
	2.77+	2	11	16	3			
Senior GPA	2.21-	2	12	12	3	8.99	>.43	accept
	2.23 - 2.59	3	14	12	3			
	2.61 - 3.00	0	15	12	6			
	3.03+	4	9	17	2			
Core GPA	1.75-	0	16	12	4	7.02	>.63	accept
	1.76 - 2.28	4	13	12	2			
	2.29 - 2.77	2	11	15	3			
	2.78+	3	10	15	4			
Design GPA	2.00-	2	8	6	4	6.60	>.67	accept
	2.14 - 2.50	1	10	16	3			
	2.57 - 3.00	1	15	18	3			
	3.14+	3	8	11	3			
ACE Q	43-	1	10	10	4	6.03	>.73	accept
	44 - 49	2	11	13	4			
	50 - 55	5	14	12	2			
	56+	1	14	16	4			
ACE L	57-	1	13	10	4	5.85	>.75	accept
	58 - 66	4	15	11	4			
	67 - 76	2	11	15	2			
	77+	2	10	17	4			
EPPS ACH.	12-	2	8	8	1	4.88	>.84	accept
	13 - 14	2	15	15	6			
	15 - 18	2	12	8	4			
	19+	2	11	18	3			
EPPS AFF.	11-	3	8	8	3	5.08	>.82	accept
	12 - 14	4	14	13	4			
	15 - 16	1	13	17	3			
	17+	1	13	11	4			
SVIB Group II	1	3	17	26	5	4.99	>.84	accept
	2	2	13	14	2			
	3	2	9	7	4			
	4,5	2	10	7	3			
SVIB Group V	1,2,3	0	7	8	4	10.31	>.11	accept
	4	6	16	24	8			
	5	3	26	22	2			

Humanistic Scores Versus Ten Independent Variables

Independent Variable	Scores	Humanistic				χ^2	p	H_0
		0,1	2	3	4,5,6			
Overall GPA	2.12-	12	7	5	3	8.16	>.51	accept
	2.14 - 2.41	14	7	7	5			
	2.42 - 2.75	8	6	11	8			
	2.77+	16	4	6	6			
Senior GPA	2.21-	9	7	8	5	6.04	>.73	accept
	2.23 - 2.59	15	5	7	5			
	2.61 - 3.00	11	6	11	5			
	3.03+	15	6	4	7			
Core GPA	1.75-	14	6	8	4	4.32	>.88	accept
	1.76 - 2.28	15	7	6	3			
	2.29 - 2.77	10	6	8	7			
	2.78+	12	5	8	7			
Design GPA	2.00-	10	4	5	1	11.91	>.21	accept
	2.14 - 2.50	10	5	12	3			
	2.57 - 3.00	13	6	7	11			
	3.14+	11	6	4	4			
ACE Q	43-	11	4	7	3	2.62	>.97	accept
	44 - 49	12	6	6	6			
	50 - 55	12	7	7	7			
	56+	15	5	10	5			
ACE L	57-	12	8	5	3	8.33	>.50	accept
	58 - 66	16	2	8	8			
	67 - 76	10	7	9	4			
	77+	13	6	8	6			
EPPS ACH.	12-	11	4	2	2	7.24	>.61	accept
	13 - 14	12	9	10	7			
	15 - 18	12	3	6	5			
	19+	13	4	10	7			
EPPS AFF.	11-	9	3	6	4	10.35	>.32	accept
	12 - 14	14	11	7	3			
	15 - 16	13	3	8	10			
	17+	10	7	8	4			
SVIB Group II	1	22	7	15	7	10.05	>.34	accept
	2	13	6	9	3			
	3	8	5	4	5			
	4,5	7	6	2	7			
SVIB Group V	1,2,3	4	4	3	8	15.03	<.03	reject
	4	19	9	16	10			
	5	27	11	11	4			

Political Participation Scores Versus Ten Independent Variables

Independent Variable	Scores	Political Participation			χ^2	p	H_0
		0	1	2,3,4			
Overall GPA	2.12-	2	15	10	1.13	>.98	accept
	2.14 - 2.41	3	21	9			
	2.42 - 2.75	3	20	10			
	2.77+	4	18	10			
Senior GPA	2.21-	2	16	11	2.61	>.85	accept
	2.23 - 2.59	3	22	7			
	2.61 - 3.00	4	18	11			
	3.03+	3	18	11			
Core GPA	1.75-	2	19	11	2.01	>.91	accept
	1.76 - 2.28	3	17	11			
	2.29 - 2.77	4	20	7			
	2.78+	3	19	10			
Design GPA	2.00-	1	12	7	1.37	>.96	accept
	2.14 - 2.50	4	18	8			
	2.57 - 3.00	3	23	11			
	3.14+	2	15	8			
ACE Q	43-	3	15	7	5.64	>.46	accept
	44 - 49	3	14	13			
	50 - 55	1	24	8			
	56+	4	20	11			
ACE L	57-	4	18	6	4.29	>.63	accept
	58 - 66	1	22	11			
	67 - 76	3	17	10			
	77+	4	17	12			
EPPS ACH.	12-	1	12	6	4.14	>.65	accept
	13 - 14	4	23	11			
	15 - 18	3	11	12			
	19+	2	22	10			
EPPS AFF.	11-	3	12	7	2.18	>.90	accept
	12 - 14	2	21	12			
	15 - 16	4	18	12			
	17+	2	19	8			
SVIB Group II	1	9	26	16	9.78	>.13	accept
	2	1	22	8			
	3	2	11	9			
	4,5	0	15	7			
SVIB Group V	1,2,3	0	11	8	7.52	>.11	accept
	4	3	32	19			
	5	9	31	13			

Civic-Religious Scores Versus Ten Independent Variables

Independent Variable	Scores	Civic-Religious				χ^2	p	H_0
		0	1,2	3,4	5,6,7			
Overall GPA	2.12-	8	11	7	1	11.51	>.24	accept
	2.14 - 2.41	8	15	4	6			
	2.42 - 2.75	10	7	9	7			
	2.77+	11	14	4	3			
Senior GPA	2.21-	9	10	8	2	13.54	>.13	accept
	2.23 - 2.59	10	11	5	6			
	2.61 - 3.00	5	12	8	8			
	3.03+	13	14	4	1			
Core GPA	1.75-	10	13	5	4	14.26	>.11	accept
	1.76 - 2.28	6	14	9	2			
	2.29 - 2.77	10	7	5	9			
	2.78+	11	14	5	2			
Design GPA	2.00-	6	7	5	2	2.13	>.98	accept
	2.14 - 2.50	10	10	7	3			
	2.57 - 3.00	11	14	7	5			
	3.14+	10	9	3	3			
ACE Q	43-	6	7	8	4	7.05	>.63	accept
	44 - 49	7	13	5	5			
	50 - 55	8	15	7	3			
	56+	13	13	4	5			
ACE L	57-	7	9	8	4	8.08	>.52	accept
	58 - 66	10	10	8	6			
	67 - 76	12	12	4	2			
	77+	8	16	4	5			
EPPS ACH.	12-	5	8	5	1	5.81	>.75	accept
	13 - 14	10	15	8	5			
	15 - 18	5	11	5	5			
	19+	14	10	6	4			
EPPS AFF.	11-	7	5	7	3	13.21	>.15	accept
	12 - 14	6	20	7	2			
	15 - 16	12	12	4	6			
	17+	6	10	7	6			
SVIB Group II	1	20	16	10	5	15.11	>.08	accept
	2	8	15	7	1			
	3	3	11	3	5			
	4,5	5	6	5	6			
SVIB Group V	1,2,3	5	5	3	6	8.53	>.20	accept
	4	14	21	14	5			
	5	17	22	8	6			

Correlation of Success in Life With Eight Normally Distributed Independent Variables

Independent Variable	r	(N)
Overall GPA	04	(124)
Senior GPA	07	(124)
Core GPA	00	(124)
Design GPA	10	(124)
ACE Q	16	(124)
ACE L	16	(124)
EPPS ACH.	05	(119)
EPPS AFF.	04	(119)

Decimal points omitted in correlations

APPENDIX B-25

Success in Life Versus Two Non-Normally Distributed Independent Variables

Independent Variable	Scores	Success in Life			χ^2	p	H_0
		1,2	3	4,5			
SVIB Group II	1	12	19	20	9.06	>.17	accept
	2	11	7	12			
	3	4	7	11			
	4,5	2	12	7			
SVIB Group V	1,2,3	1	5	12	8.72	>.06	accept
	4	16	22	16			
	5	12	18	22			

BIBLIOGRAPHY

1. Beatty, J. D., and Cleeton, G. U. Predicting achievement in college and after graduation. Personnel J., 1928, 6, 344-351.
2. Gambrill, Bessie L. College achievement and vocational efficiency. New York: Teachers College, Columbia University, 1922.
3. Johnson, P. O. Statistical methods in research. New York: Prentice-Hall, Inc., 1949, Chapter 4.
4. Lewis, J. W. A study of the achievements and activities of selected liberal arts graduates. Unpublished doctoral dissertation, University of Iowa, 1970.
5. Mann, Sister M. Jacinta. Relationship among certain variables associated with college and post-college success. Unpublished doctoral dissertation, University of Wisconsin, 1958.
6. Martin, R. A., and Pacheres, J. "Good scholars not always best," cited in research section of Business Week, 1962, Feb. 24, 77-78.
7. Pallett, J. E. Definition and prediction of success in the business world. Unpublished doctoral dissertation, University of Iowa, 1965.
8. Pierson, G. A. School marks and success in engineering, Educ. psychol. Measmt., 1947, 7, 612-617.
9. Plasse, W. Comparison of factors in achievement in college and adult life. Unpublished doctoral dissertation, Syracuse University, 1951.
10. Rice, D. E. A study of incomes of technically trained men. Sci. Amer., 1913, 109, 116-117.
11. Super, D. E. The psychology of careers. New York: Harper and Brothers, 1957, 177-183.
12. Taylor, C. W., Smith, W. R., and Ghiselin, B. The creative and other contributions of one sample of research scientists. In C. W. Taylor and F. Barron (Eds.), Scientific creativity: its recognition and development. New York: Wiley and Sons, 1963. Pp. 53-76.

CORRELATES OF ADULT ACCOMPLISHMENT AMONG
ENGINEERING GRADUATES OF KANSAS STATE UNIVERSITY

by

PAUL MICHAEL MUCHINSKY

A. B., Gettysburg College, 1969

AN ABSTRACT OF A THESIS

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The investigation was concerned with the prediction of occupational and non-occupational success. These were evaluated from both the external and internal frames of reference. The major predictors used were academic achievement in college. Selected measures of scholastic aptitude, personality, and vocational interests were also employed.

Subjects were chosen from the Kansas State University freshman classes of 1956, 1957, and 1958; only those who graduated from the College of Engineering were included. A total of 138 of 201 possible subjects agreed to participate; of these, 127 returned questionnaires describing their adult accomplishments and activities. Supervisor ratings were obtained for 90 of the 93 who authorized this type of appraisal. The sample was assumed to be representative of bachelor level engineering graduates from Kansas State University who have 5-10 years of post-college experience.

Measures of success were obtained from the questionnaire and the supervisor rating. Fifteen measures of occupational success were obtained from the external frame of reference, and two from the internal frame of reference. Five measures of non-occupational success were obtained from the external frame of reference, and one from the internal frame of reference.

Ten predictors were used: four measures of academic achievement (Overall Grade Point Average, Senior Year GPA, Core Courses GPA, and Design Courses GPA), two of scholastic aptitude (the ACE Quantitative and ACE Linguistic scores), two of personality (the Achievement and Affiliation scores of the Edwards Personal Preference Schedule), and two of vocational interests (the Group II and Group V ratings from the Strong Vocational Interest Blank).

Two questions guided the investigation.

Question 1. Is there a relationship between adult success (both occupational and non-occupational) and academic achievement among Engineering graduates of Kansas State University?

Question 2. Is there a relationship between adult success (both occupational and non-occupational) and selected measures of scholastic aptitude, personality, and vocational interests among Engineering graduates of Kansas State University?

The 4 measures of academic achievement were each related to 23 indices of adult accomplishment. Seven relationships were significant and 85 were non-significant. When the two measures of scholastic aptitude were related to the 23 measures of adult accomplishment, 3 relationships were significant and 43 were non-significant. When the 2 measures of personality were related to the 23 measures of adult accomplishment, 1 relationship was significant and 45 were non-significant. And for the vocational interest measures, significant relationships were found in 4 instances; non-significant relationships were found in 42 instances.

In all, 230 tests were made of the relationship between predictors and criterion measures; 15 (6 percent) were found to be significant. Since five percent would be found to be "significant" purely on the basis of chance fluctuations, it was concluded that the independent variables used in this study were not importantly related to adult accomplishment.

Implications of these results were explored for employers, guidance, educational evaluation, and further research.