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ABSTRACT

This study was designed to provide information about factors that influenced career decisions and career development patterns of contemporary engineers. Graduate engineers (N=2835) and beginning student engineers (N=980) completed survey instruments designed to measure demographic, cognitive, affective, and behavioral factors. Subjects also completed Strong-Campbell Interest Inventory (SCII) and/or Purdue Interest Questionnaire. Included in this report are major research issues/questions, methodology, results, and conclusions. Two of the findings reported indicate that the subjects' career decisions and job values were strongly influenced by intrinsic and extrinsic work-related factors and that behavioral descriptions of typical engineers and student engineers (based on the SCII) are similar. Supporting documentation and statistics are provided in six appendices. This information includes marginal percentages for total engineering graduate group and for total student group on, item-response percentages by sex, ethnic group, employment field (for graduate survey), and major field (for student survey), and survey highlights sent to participants. The last appendix is a collection of eight complete research papers presented to professional organizations and articles submitted for publication. Each paper/article includes study rationale, methodology, results, conclusions, and implications. (JN)

NATIONAL ENGINEERING CAREER DEVELOPMENT STUDY
ENGINEERS' PROFILES OF THE EIGHTIES*

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*Not included in all reports. Available from Educational Resources Information Center (ERIC) or conference Proceedings.

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William K. LeBold

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ABSTRACT

The 1981 National Career Development Study was designed to provide specific information about the factors that influenced the career decisions and career development patterns of contemporary engineers. Large numbers of graduate engineers (N=2853) and beginning student engineers (N=980) from all over the country completed one of two survey instruments, both designed to measure many demographic, cognitive, affective and behavioral factors. Subjects also completed the Strong-Campbell Interest Inventory (SCII) and/or the Purdue Interest Questionnaire (PIQ).

Both graduate and beginning student engineers indicated that their career decisions and job values were influenced strongly by intrinsic and extrinsic work-related factors. Moreover, male graduates and students were more influenced by technical activities and hobbies than women graduates and students were; women were influenced by a wider variety of factors. Graduates and beginning students in general also expressed relatively high self-images, especially regarding their mathematical, science and problem-solving abilities. Most graduate engineers were satisfied with their work. Only a few sex, ethnic and field differences were noted in the employment and professional activities of the graduates. Women engineers with 10 or more years of experience reported lower salaries and were less likely than their male peers to have managerial positions. Many other interesting results were generated by the graduate and student engineer surveys.

SCII results suggested that behavioral descriptions of the typical graduate and student engineers are similar. However, graduates tended to have more interest in practical-scientific endeavors and less interest in social-persuasive roles than did student engineers. Scores for men and women students and graduates tended to diverge most on the Realistic and Artistic Theme Scales. Men and women students and graduates had interest profiles similar to SCII male and female engineering norm groups. It was apparent that different norms for men and women are required for the two SCII Engineer Scales. Results also indicated that the PIQ is particularly useful in identifying differences in interests among graduates and beginning students in various engineering fields. New valid and reliable scales for the PIQ were developed to identify identify functional and educational interests.

The national graduate and beginning student samples also provided cross-validation for the PIQ which was normed and validated on Purdue University engineering and nonengineering transfer students. Engineering Specialty Scales were effective in discriminating among aeronautical, agricultural, chemical, civil, electrical, environmental, industrial, mechanical, nuclear and resource engineers. Therefore, employed together, the PIQ and SCII provide complementary information useful in making engineering-related career decisions.

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NATIONAL ENGINEERING CAREER DEVELOPMENT STUDY
ENGINEERS' PROFILES OF THE EIGHTIES

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Although representation of women and minorities in engineering has been increasing markedly during the past decade, relatively little is known about the specific factors that influenced their career choices. There is also a need to understand the employment characteristics and professional activities of engineers, because prospective students, school counselors and others frequently ask what engineers really do. Knowledge of the factors that influenced the career decisions of both women and minority professional engineers will be an important tool for guiding more women and minorities toward careers in engineering. Consequently, the present study was designed to provide specific information about factors that influenced the career decisions of contemporary professional engineers and beginning engineering students.

MAJOR RESEARCH ISSUES AND QUESTIONS

People tend to select occupations that are congruent with their personal orientations. These, in turn, are determined by their interests, the influence of parents and/or other significant persons, achievement and motivation patterns, vocational images and so forth. In career development research, much attention has been paid to the study of occupational interests, and the interest inventory is one of the major tools that counselors employ in helping individuals explore, clarify and solidify their career decisions. However, the use of interest inventories for guiding women into non-traditional fields has received a great deal of criticism during the past decade because of inadequate normative data for this population. Normative data based upon minority populations also are inadequate.

Another issue of importance to career development research is that variables related to situational and institutional constraints upon career choice have not been emphasized (Sweet, 1974). Social class, race/ethnic group, sex and other situational-status factors may be important in influencing and determining occupational choice, but studies rarely isolate these factors in testing theories of career development (Tittle & Denker, 1977). Consequently, the goals of career exploration for both women and men might be achieved more completely than they are at present if relevant information were available. These data should indicate the inter-relationships among occupational interests, situational-status variables, behavioral variables (e.g., work experiences, hobbies, educational level, professional activities, recreational activities, etc.), cognitive variables (e.g., grades and aptitude test scores) and such affective characteristics as career commitment, level of aspiration and perceptions of self and others.

In view of the dynamic and changing roles of both women and men in contemporary society, existing information concerning factors affecting career decisions may be so dated that it has little or no value for helping people to make realistic career choices. Moreover, very little career information, even outdated information, is available for the various fields of engineering. The following observations are relevant to the problems involved in attempting to improve access to engineering and science careers for women and minorities.

1. Interest inventories are one of the primary counseling tools used for career counseling in the United States and Canada.

2. Current interest inventories are being criticized for their possible sex and ethnic biases, because existing normative data are based largely upon white males, especially in engineering and science fields.

3. Information is needed regarding not only current and potential sex and ethnic biases in interest inventories but also methods for eliminating such biases.

4. Current interest inventories have limited value for helping engineering students make career decisions regarding a specific field or function within engineering.

5. Information is needed concerning possible similarities and differences in career development patterns between men and women engineering students and professional engineers and between those within the various fields and functions of engineering.

The present investigation is focused upon these issues.

Purposes of the Present Study

It was expected that this study would provide a great deal of contemporary information regarding the above issues by (1) providing up-to-date normative data on the interests of both women and men engineering professionals and students for each major field of engineering, (2) identifying and eliminating any sex or ethnic bias already existing in selected interest inventories and (3) examining possible relationships between the interests of professional and student engineers and selected situational-status, cognitive, affective and behavioral variables concerning career choice and career development.

Specific Research Questions

The following specific research questions were investigated in the present study:

1. When classified according to (a) sex identification, (b) ethnic identification and (c) major fields of engineering (e.g., chemical, civil, electrical and mechanical), how do professional engineers differ from each other in terms of their responses to selected situational-status, cognitive, affective and behavioral factors related to career choice, as measured by the National Engineering Career Development Survey for graduate engineers?

2. When ordered according to (a) sex identification, (b) ethnic identification and (c) preferred major engineering field (e.g., chemical, civil, electrical and mechanical), how do beginning engineering students differ from each

other in selected situational-status, cognitive, affective and behavioral factors related to career choice, as measured by the Pre-Engineering Career Survey for student engineers?

3. How do beginning engineering students differ from professional engineers in terms of selected career-development factors, as measured by their respective survey instruments?

4. In what ways do professional engineers differ from each other in terms of their inventoried interests, as measured by the Strong-Campbell Interest Inventory (SCII) and the Purdue Interest Questionnaire (PIQ), when engineers are classified by (a) sex identification, (b) ethnic identification and (c) major fields of engineering?

5. When classified according to (a) sex identification, (b) ethnic identification and (c) preferred major engineering field, how do beginning engineering students differ from each other in terms of their inventoried interests, as measured by the SCII and PIQ?

6. In what ways, if any, do professional engineers differ from beginning engineering students in inventoried interests?

7. Are the inventoried interests of the contemporary sample of professional engineers congruent with current SCII normative data derived from an early sample of professional engineers and with PIQ normative data obtained from Purdue engineering students?

8. Do beginning engineering students who have expressed their commitment to engineering differ from those who have not committed themselves to a career in engineering in terms of their interests and selected situational-status, cognitive, affective and behavioral factors related to career choice?

In addition to the above questions, another issue was examined in the first phase of this study. This question concerned the value of the SCII and PIQ for assisting special groups of pre-college students (11th-grade men, women and minority students) and first-year college engineering students (women and minority groups) in formulating plans for and making commitments to engineering. The data for these groups were presented in the Progress Report presented to the National Science Foundation in December 1981.

IMPLEMENTATION OF THE STUDY

Project Management

The personnel who worked on this project remained essentially the same as identified in the initial proposal for this study and its subsequent modification. Dr. William K. LeBold served as the overall director and coordinator of the project. Dr. Kathryn W. Linden, co-principal investigator in charge of the professional engineer phases of this study, served primarily as consultant to the project because of illness during most of the past two years. Dr. Carolyn M. Jagacinski, who earned her Ph.D. in Education and Psychology from the University of Michigan in 1978, was in charge of the professional engineer phases of this study in place of Dr. Linden. Kevin D. Shell, who recently completed his Ph.D. in Psychology at Purdue (1982), has been responsible for the freshman engineering phases.

Plan of the Report

This report will focus primarily on the results of our analyses of the surveys of graduate engineers and engineering students and the interest inventories employed with both groups in the major study. However, a summary of the 1980-1981 pilot studies is presented first in order to highlight the work that was needed to set the stage for the major study. Following a short description of the design and development of the major studies, the results of the graduate engineer survey are presented. A comparable section describing the results for the freshman engineering student sample is presented next. Primary analyses of the surveys concerned comparisons of responses when respondents were classified by sex, ethnic group and field of engineering. Graduate engineers and students are then compared on selected survey items.

Results derived from the two interest measures are presented and discussed next, first for graduate engineers and then for students. Comparisons between graduate and student engineers are made with respect to the various interest scales studied. Analyses of the interest inventory data are focused upon sex and field differences, as well as upon comparisons of the current interest data base with available interest normative data.

SUMMARY OF 1980-1981 PILOT STUDIES

During the first year of this two-year project, the following tasks were accomplished: (1) all subjects were identified for both initial (pilot) and primary studies of graduate engineers and freshman engineering students; (2) the preliminary and final forms of the survey instruments were designed and developed for students and professional engineers; (3) the initial pilot phase of the professional engineer study was initiated and completed; (4) the primary phase of the professional engineer study was initiated; (5) the first stage of the primary phase of the freshman engineer study was initiated and partially completed; and (6) several field studies of pre-college and first-year engineering seminars were completed. Details regarding each of the above accomplishments were presented in the Progress Report submitted to the RISE program of the National Science Foundation in December, 1981. Problems associated with initial sampling procedures and survey instruments were identified and discussed in detail in the Progress Report. However, these problems are summarized here in order that the sampling procedures and survey instruments employed for the final phases of this study may be understood clearly.

Problems in Sampling Procedures for Pilot Studies

Graduate Engineers. Several problems were identified in an attempt to obtain a representative sampling of four major engineering fields (chemical, civil, electrical and mechanical), an appropriate sex balance within field and a minority balance within field by sex. For chemical engineers, it was not possible to obtain an age-experience balance between men and women, because the membership directory from which the names were obtained did not contain information on year of membership. Probably more serious than this problem, however, is the fact that it was extremely difficult to obtain an accurate list of minority engineers. The only source available (Black Engineers in the United States) was very dated (1973), and racial identification is not a factor included in the member descriptions presented in engineering society directories. In addition, attempts at obtaining mailing lists from minority engineering societies were not successful.

Still another problem concerned identifying the sex of engineers when only names were available. The sex identification of approximately 10 percent of the engineers who participated in the pilot study proved to be erroneous, based upon first names usually associated with a given sex in the United States. Finally, the problem of inadequate mailing addresses was also significant. The addresses of approximately 20 percent of all subjects identified for the preliminary study turned out to be incorrect. Although the addresses of approximately 10 percent of these "lost" engineers were obtained finally by using first-class mailings in the follow-up conditions, a significantly large number of prospective graduate participants could not be located.

All three of these problems were viewed to be serious enough to merit special attention in the sampling design intended for the primary study. The details regarding our attempts to deal with these problems are presented later in this report.

Beginning Engineering Students. The most serious problem associated with the preliminary sampling of beginning engineering students concerned difficulties in collecting data from some of the institutions. Consequently, minority representation within the total sample was much less than had been planned. A second, and possibly less serious, problem concerned the inclusion of sophomore and upper-class students in the sample. Non-freshman accounted for approximately 10 percent of the total sample. Perhaps not a problem, but certainly an issue to be dealt with, involved gathering both end-of-year and beginning-of-year freshman data. These two samples were eventually pooled in order to increase the size of the undergraduate sample.

Problems and Revision of Survey Instruments

The major problem associated with the preliminary forms of the National Engineering Career Development Survey for Graduate Engineers concerned a need to adjust the length. The short form did not include a sufficient number of the factors specifically associated with career choice and career development, and the long form contained several items to which relatively few responses were made. However, even though the return rates for both forms of the preliminary survey form differed significantly when no follow-up procedure was employed, the return rates for both were quite similar when follow-up procedures were employed.

Decisions were made (1) to retain all items that reflected content relevant to career choice and career development and (2) to delete those items that drew relatively few responses from engineers in the preliminary survey. Several items were edited in order to clarify the content, and some items were rearranged. A facsimile of the final form of the graduate survey instrument is presented in Appendix A, together with marginal percentages for each item.

Results derived from the three forms of the Engineering Career Development Survey for Students, employed for end-of-year beginning engineering students, also suggested that length of the survey was a problem. Consequently, a new two-page form of the survey was designed for beginning engineering students. Survey questions were deleted which had little relevance to the purposes of the study or which were inappropriate to beginning engineering students (who were without significant engineering experiences). A facsimile of the student survey is presented in Appendix B, together with marginal percentages for each item. No apparent problem arose from the efforts made to obtain representative samples of women freshman engineering students. However, the minority sample was smaller than expected.

DESIGN AND DEVELOPMENT OF THE MAJOR STUDIES

In this section, the sampling procedures for the primary studies are described, as well as the survey instruments used. The research design and analysis procedures also are described.

Sampling Procedures for Graduate Engineers

In the early spring of 1981, a letter was sent to each of the major engineering societies requesting mailing labels for 500 male and 500 female engineers, matched by grade of membership (associate, member or fellow) and by year of initial society membership. Three of the societies (Institute of Electrical and Electronic Engineers, American Institute of Industrial Engineers, Inc. and American Society of Mechanical Engineers) were able to provide the requested separate lists of men and women, from which subsamples of members were drawn randomly.

The American Nuclear Society provided a list of all of its women members who then were matched with a comparable group of male nuclear engineers. Four other societies (American Society of Chemical Engineers, American Society of Civil Engineers, American Society of Agricultural Engineers and the American Institute of Mining, Metallurgical and Petroleum Engineers, Inc.) were not able to provide separate lists of men and women. Instead, these four societies sent lists of recently affiliated members (approximately 2000 members over the past 10 years), from which all women engineers in these societies were selected. A random sample of male engineers was then drawn from the engineering society membership lists and matched whenever possible with the women by year of membership affiliation. If the sample of women in a given society contained fewer than 100 names, an additional sample of men was selected randomly in order to increase the size of the total sample for a given society.

The American Institute of Aeronautics and Astronautics was unable to provide us with mailing labels. Therefore, the membership directory was employed to select a random sample of 100 women engineers and a matched sample of 100 men engineers. An additional group of 50 Members and 10 Fellows was selected randomly from this society (a procedure used also for obtaining the pilot sample of professional engineers).

Special efforts were made to obtain adequate minority representation in the final group of professional engineers. The directors of minority programs in engineering schools that were identified by the "diversity score" procedure, used for the freshman engineer phase of this study, were contacted, and their cooperation was requested. They were asked to provide the names and current addresses (if known) of five women and five men who had graduated each year for the past 10 years. If less than these numbers of minority engineers had graduated during a given year, more recent graduates were to be substituted to make up a total of 100 women and 100 men. Eight schools agreed to participate and subsequently sent in their lists of names. A small honorarium was paid to each minority director or their designate for this service.

All of the above procedures were employed in efforts to control for sex balance by field and for minority balance by sex by field. It was hoped that the problems associated with using names alone to match men and women, as encountered in the initial phase of this study, might also be alleviated by these procedures. Over 5,000 professional engineers were identified as potential participants in this study.

Mailing Conditions: Primary Phase. The final form of the graduate survey instrument and one interest measure were mailed to the final sample of professional engineers in June, 1981. The Purdue Interest Questionnaire (PIQ) was sent to approximately 80 percent of the engineers, and the Strong-Campbell Interest Inventory (SCII) was sent to the remainder. This PIQ-SCII imbalance was selected because another study (Shell, 1982) and the pilot study for the present research indicated that the PIQ could make better discriminations among engineering fields than could the SCII. A cover letter and return envelope (with postage) were also included in each package of materials. Bulk mail rate was used, with a request for address corrections whenever possible.

Follow-up procedures, strongly suggested by the results of the preliminary survey, were employed with all engineers who did not respond to the initial mailings. One follow-up was sent in mid-July (1981), with a final follow-up in September, 1981. For the first and third mailings, the executive director of the society or Director of Minority Programs of the college/university co-signed the cover letter. In several cases, the society or college/university letterhead was used.

Returns-Primary Phase. Of the 5,142 engineers identified for our final sample, 4,781 had valid addresses. Approximately seven percent of the engineers in the final sample could not be reached, because the address we had on file was inaccurate, or the individual had moved and no forwarding address was available. Table 1 presents the return rates based on valid addresses ordered by society or university and sex. Overall, there was a 50 percent return rate. The return rates were generally higher for the societies (52% for males and 57% for females across all societies) than they were for the schools (31% for males and 30% for females across all universities/colleges). Most of the minorities in our sample were drawn from the universities and colleges; consequently, the low return rates from these groups were disappointing and limited our subsequent analyses of minority data.

Sampling Procedures for Freshman Engineering Students

During the spring of 1981, the first phase of the survey of engineering students was completed. The same complex sampling procedure was employed for the primary phase as was used in the first phase of the study of student engineers. Although these procedures are described in the Progress Report (LeBold, Linden, Jagacinski & Shell, 1981), it seemed wise to include them here because of their complexity. Based upon the total number of full-time enrollments of students in engineering during the fall of 1979 (provided by the Engineering Manpower Commission of the American Association of Engineering Societies), all institutions having engineering programs were ranked according to the percentage of women enrolled. This rank-ordered list was then divided into four strata, with each stratum representing approximately 25 percent of the total number of women studying engineering.

The first stratum included 16 institutions; the second involved 33 institutions; the third contained 52 institutions; and the fourth held 169

TABLE 1

Response Rates of Graduate Engineers by Sex and Society/Institution

ENGINEERING FIELD (SOCIETY)	SEX	VALID ADDRESSES	NUMBER RETURNED	PERCENT RETURNED
Aeronautical (AIAA)	M	136	75	55%
	F	88	28	32
Agricultural (ASAE)	M	296	177	60
	F	91	57	63
Chemical (AIChE)	M	367	235	64
	F	88	52	59
Civil (ASCE)	M	293	165	56
	F	289	189	65
Electrical (IEEE)	M	296	114	39
	F	284	137	48
Mining/Geological (SME of AIME)	M	226	80	35
	F	94	39	41
Industrial (AIIE)	M	338	167	49
	F	285	171	63
Mechanical (ASME)	M	281	150	53
	F	285	171	60
Nuclear (ANS)	M	80	49	61
	F	80	46	58
Society Subtotal	M	2313	1212	52%
	F	1641	934	57
MINORITY SAMPLE INSTITUTION				
City College of New York	M	76	13	17%
	F	8	2	25
New Mexico State University	M	155	45	29
	F	14	11	79
University of Michigan	M	74	35	47
	F	15	7	47
Purdue University	M	53	25	47
	F	12	6	50
University of Florida	M	84	35	42
	F	5	2	40
Tuskeege University	M	53	13	25
	F	23	4	17
University of Texas, El Paso	M	88	26	30
	F	12	3	25
Illinois Inst. of Technology	M	108	22	20
	F	47	6	13
Institution Subtotal	M	691	214	31%
	F	136	41	30
Total	M	3004	1426	47%
	F	1777	975	55
Grand Total	M+F	4781	2401	50%

institutions. The fourth stratum was eliminated from sampling consideration because of the relatively small number of engineering students (including women and minorities) in these institutions. From each of the three remaining strata, 16 institutions were selected randomly for this study. To this list of 48 institutions were added institutions with a wide diversity of engineering specialty programs and a large representation of underrepresented minorities.

A scale was designed for the purpose of determining which engineering schools have the widest diversity with respect to number of different engineering branches, specialties or fields. This scale was examined separately with respect to women and to each minority group. The six schools from each sampling stratum obtaining the highest "diversity" scores overall were selected for possible inclusion in this study. To these 18 schools were added seven others that had high minority representation and high diversity scores, bringing the total number of schools to be sampled to six first-stratum, eight second-stratum and eleven third-stratum institutions.

In the winter of 1981, the Dean of Engineering at each of the 25 schools was contacted by letter and by telephone in order to request their cooperation for this study. Five first-stratum, five second-stratum and ten third-stratum institutions agreed to participate, making a total of 20 cooperating institutions. Data for this first phase were collected primarily to pre-test the procedure, survey forms and items. Data were obtained from 17 of the 20 institutions which had agreed to cooperate, for a total of 1,424 student respondents. Based on the pre-test analysis, an abbreviated short survey form was developed and the same institutions were invited to participate. This new sample was to be surveyed early in the fall before the beginning engineering students had much exposure to the engineering curriculum. Nineteen of the original 20 institutions agreed to participate in Phase Two of the study.

Mailing Procedures-Phase Two. In the latter part of August, 1981, 19 University coordinators were sent packets of materials to be given to freshman students at their respective schools within one month of the beginning of classes. All packets contained a 2-page survey form, the Pre-Engineering Career Survey, the PIQ and a cover letter. In addition, 10% of the packets included the SCII. Copies of the survey form with marginal item percentages is presented in Appendix B. A total of 2,886 packets were sent. No follow-up procedure was used, because such a procedure would have placed an unreasonable demand on the coordinators. A time limit of four weeks was placed upon data collection, in order to minimize the possible influence of exposure to specific knowledge of engineering upon pre-college choice of engineering as a field. This time limit also contributed to the decision not to use a follow-up procedure.

Phase 2 Returns. Of the 2,706 packets that were sent, 980 (35%) were returned. Most packets were returned during the first month of school, although some were returned as late as two months after classes started. Table 2 presents the return rates by institution. These rates varied from approximately 5 to 77 percent. Overall, the return rate was judged to be minimally satisfactory, considering that it was not feasible to use follow-up procedures.

TABLE 2

Response Rate by Institution for the Pre-Engineering Career Survey

INSTITUTION*	PACKETS SENT	NUMBER RETURNED	PERCENT RETURNED
A	494	252	51%
B	99	41	41
C	100	11	11
D	100	47	47
E	140	82	59
F	120	23	19
G	98	29	30
H	119	31	26
I	100	25	25
J	180	14	8
K	90	69	77
L	130	68	52
M	90	28	31
N	150	78	52
O	106	26	25
P	90	25	28
Q	150	52	35
R	150	7	5
S	200	72	36
TOTAL	2706	980	35%

*Names of individual institutions have been deleted in order to protect their privacy.

Description of Survey Instruments

The final form of the National Engineering Career Development Survey for graduate engineers contains 43 sets of questions, or items, classified into six categories: (1) demographic characteristics; (2) employment characteristics; (3) job satisfaction; (4) perceived employment opportunities for women and minorities; (5) career development factors and influences; and (6) self-perceptions of abilities and other personal characteristics. Some of the items merely require a check mark and or circle to indicate choice of response. Others require ratings on a given scale, and a few items have blanks for writing in appropriate responses. The final-item set permits respondents to write in their reactions to the graduate survey form, the interest inventory taken and other issues related to engineering.

A new two-page form of the student survey instrument was designed for beginning freshman engineering students. This instrument, entitled Pre-Engineering Career Survey, contains 21 sets of questions classified into six categories: (1) demographic characteristics of students; (2) general and specific career goals; (3) factors encouraging pursuit of engineering as a career; (4) perceived career field characteristics; (5) self-perceptions of abilities, habits and other personal characteristics; and (6) parental attitudes, education levels and occupations. Several of these item-sets parallel similar questions on the graduate survey instrument.

Interest Measures

The two interest inventories used in this study were the Strong-Campbell Interest Inventory SCII) and the Purdue Interest Questionnaire (PIQ). The SCII is one of the most commonly used interest inventories today. It is conservatively estimated that at least 1/2 million are administered annually and that its primary use is in providing guidance for college-bound students, college students and college-educated adults. The SCII (Campbell, 1974) represents an integration of the Strong Vocational Interest Blank for Men (SVIB-M) with the Strong Vocational Interest Blank for Women (SVIB-W) and was designed to eliminate sex bias in the wording of items.

The 325 items on the SCII are organized into seven categories: (1) occupations; (2) school subjects; (3) activities; (4) amusements; (5) types of people; (6) preference between two activities; and (7) your characteristics. The SCII purports to measure six general Occupational Themes (Realistic, Investigative, Artistic, Social, Enterprising and Conventional), 23 Basic Interest Scales organized by the six themes, 162 Occupational Scales representing 85 specific occupations and two nonoccupational Specific Scales.

The third edition of the Manual for the SVIB-SCII (Campbell & Hansen, 1981), for use with the revised and expanded 1981 profile, reports standardization results based upon 162 occupational samples, half of which were men and half were women, containing a total of 40,197 people. Each occupational sample consisted of people who were "experienced, satisfied, capably functioning, and typically engaged workers of that occupation (Campbell & Hansen, 1981, p. vi)." The 1981 SCII profile used in this study contains separate sex norms for the various Occupational Scales and combined sex norms for the general Occupational Themes and Basic Interest Scales. However, means, standard deviations and standard-score interpretive boundaries for men- and women-in-general samples are presented in the 1981 Manual for the general Occupational Themes and Basic Interest Scales. Although the SCII has separate engineering occupational scales for men and women, the inventory has not been useful in distinguishing between engineers in different specialities or fields of engineering (Hansen, 1981).

The Purdue Interest Questionnaire (LeBold, 1976; LeBold, Shell, & DeLauretis, 1977; Shell & LeBold, 1978) is a relatively new interest inventory that was designed specifically to assist engineering students in making educational and career decisions regarding college major and field of specialization. It was conceived as an instrument for alleviating the inadequacies of the general occupational interest inventories when used with various engineering specializations, rather than engineering in general. This was done by comparing and contrasting their interests with interests of Purdue students in various engineering and non-engineering majors. More specifically, scales were developed in order to assist students in identifying the following: (1) appropriate specializations within engineering which are relevant for students planning to remain in engineering; (2) appropriate non-engineering fields which are relevant for students planning to transfer out of engineering; and (3) general educational orientations concerning either persistence in engineering or transfer out of engineering. Therefore, the Purdue Interest Questionnaire (PIQ) initially included scales designed for 11 engineering specializations, five nonengineering transfer fields and two general scales for engineering persistence and engineering transfer.

Our National Engineering Career Development Study has enabled us to develop and extend the value and usefulness of the Purdue Interest Questionnaire in the following ways:

1. to determine the validity of the engineering scales (developed on Purdue engineering students) with the interests of graduate engineers in various engineering fields (e.g. aeronautical, chemical, civil, electrical and mechanical);

2. to develop two new sets of engineering scales and norms based upon graduate data that focus upon engineering functional responsibilities (e.g. research, development, design, production, management, etc.) and educational level (BS, MS, MBA, Ph.D.);

3. to determine the validity of the engineering scales (developed on Purdue engineering students) for a national sample of engineering students;

4. to examine sex and ethnic differences on the Purdue Interest Questionnaire using national samples of both engineering students and graduates; and

5. to establish national norms for the major engineering fields (chemical, civil, electrical and mechanical engineering) using both students and graduates.

Research Design

One major purpose of this study was to examine sex, ethnic and field differences in survey responses and in interest inventory scale scores of graduate engineers. These same issues were examined with a beginning engineering student sample. In addition, comparisons were made between beginning engineering students who were committed to a career in engineering and those who were still uncertain.

The specific research questions for this study were presented in the first section of this report. The independent variables used in the analyses included sex, ethnic group (Black Americans,, Hispanic Americans, White Americans, and Foreign Nationals) and field of engineering. Nine fields of engineering were examined, including aeronautical, agricultural, chemical, civil, geological/mining, electrical, industrial, mechanical and nuclear. In addition, for the beginning engineering student sample, students were classified as committed or not committed to a career in engineering. The dependent variables examined were: (1) situational-status, behavioral, cognitive and attitudinal variables derived from survey responses; (2) scores on the Occupational, Basic Interest, and Holland-type Scales of the SCII; and (3) scores on the specialization and general scales of the PIQ.

Each of the independent variables was examined separately for the graduate sample and for the student sample. Chi-square or analysis of variance procedures were used to examine differences on the dependent variables. Additional analyses were conducted in order to compare graduate engineers and beginning engineering students on the scales of the interest inventories and to look at items of special interest which appeared on both graduate and student survey instruments.

Finally, special analyses were conducted on the interest inventory data. Scores on the SCII scales for the graduate sample were compared to the currently available normative data and to scale data derived from the student engineering sample. In addition, the ability of the currently available PIQ scales to discriminate professional engineers in different fields was examined. Graduate PIQ data were also employed to generate two new sets of engineering scales and norms that focus upon engineering functional responsibilities and educational levels. Moreover, sex and ethnic differences on the PIQ were examined using national samples of both engineering students and graduates. Finally, national norms were established on the PIQ for nine engineering fields (aeronautical, agricultural, chemical, civil, electrical, industrial, interdisciplinary, mechanical and nuclear) for both graduates and students.

In order to increase the available data for analyses of the interest inventories, Phase One and Phase Two samples were combined for graduates and students. Furthermore, because there was no reason to expect the responses of the Phase One (pilot) graduates to differ from those of the Phase Two (main study) graduates, these two samples were pooled whenever the exact same item appeared on both the Phase One and Phase Two survey forms.

HIGHLIGHTS OF THE ENGINEERING GRADUATE AND STUDENT SURVEYS

Graduate Engineers

This section is concerned with the major findings of the National Engineering Career Development Survey of graduate engineers. Appendix C contains the item-response percentages for the total group classified by sex, ethnic group and field of current job. This section summarizes survey findings in the areas of (1) demographic characteristics of engineers, (2) employment, (3) job satisfaction, (4) perceived employment opportunities for women and minorities, (5) career development and (6) self-perceptions. The focus of this presentation is upon highlighting significant differences by sex, ethnic group and field of employment. As noted earlier, marginal percentages for survey items are presented in Appendix A for graduate engineers and Appendix B for students. Cross-tabulations of the results of the graduate and student surveys by sex, ethnic background and field of engineering are presented in Appendix C and Appendix D, respectively.

Demographic characteristics. Some of the major demographic and situational-status characteristics of the graduate engineer sample are presented in Table 3. Of the engineers who responded to the graduate survey instrument, 37% were women (N=1080) and 63% (N=1720) were men. A large majority of respondents were White Americans (84%), while approximately five percent were Black Americans (N=128), five percent were Hispanic Americans (N=133) and four percent were Asian or Pacific Islanders (N=114). Three percent of the respondents (N=79) were Foreign Nationals (foreign citizenship regardless of ethnic identification). Although 40% of the White respondents were women, a smaller percentage of respondents from the other ethnic groups were women (26% Black Americans; 17% Hispanic Americans; 13% Foreign Nationals).

The professional engineers in this study sample were relatively young, with 74 percent reporting their current age as being 30 years of age or less (1981). Women in the sample tended to be slightly younger than the men (median for women=26 years; median for men=31 years). There was also some variation across fields in the average age of the respondents. Aeronautical engineers tended to be slightly older than engineers in other fields, while agricultural engineers in our sample tended to be slightly younger than were engineers in other fields. Most of the engineers in the sample who were 36 years of age or older were White American males.

A larger proportion of men than women reported being married (70% vs. 49%) and having families with one or more children (61% vs. 24%). This difference is probably, in part, a function of the difference in age of men and women in our sample. However, with age controlled, men are still more likely than women to be married and to have children (LeBold, Jagacinski, Linden & Shell, 1982; Jagacinski, LeBold, Linden & Shell, 1983). Among those who were married, women were more likely to be married to engineers than were men (51% vs. 2%). No appreciable difference in marital status or family size by ethnic group or field of employment was discerned.

Most of the engineers in our sample came from middle- and upper-middle-class families. Generally, over one-half of the engineers reported their

TABLE 3

Background Information on Engineers Classified by Sex and Ethnicity

	PERCENTAGES						
	TO-	SEX		ETHNICITY			
	TAL	MA	FE	BL	HI	WH	FN
SEX							
1. Male	63	100	0e	74	83	60	87e
2. Female	37	0	100	26	17	40	13
RACE OR ETHNIC IDENTIFICATION							
1. American Indian	*	*	*e	0	0	0	0e
2. Asian or Pacific Islander	4	5	3	0	0	0	49
3. American Black	5	6	3	100	0	0	4
4. Mexican American	2	3	1	0	49	0	1
5. Puerto Rican	*	*	*	0	6	0	0
6. American Cuban	1	2	*	0	23	0	3
7. Other Hispanic	2	2	1	0	22	0	16
8. White, Not Hispanic	84	80	90	0	0	100	19
9. Other	1	2	1	0	0	0	9
CITIZENSHIP							
1. U.S. Native-born	91	88	95e	98	67	98	0e
2. U.S. Naturalized	5	7	3	2	33	2	0
3. Foreign National	4	5	1	0	0	0	100
YEAR OF BIRTH (AGE OF RESPONDENT)							
1. 1901 to 1934 (46 or older)	10	14	3e	6	2	11	1e
2. 1935 to 1945 (36 to 45)	14	17	9	9	6	14	16
3. 1946 to 1950 (31 to 35)	17	20	12	27	28	16	28
4. 1951 to 1955 (26 to 30)	33	32	33	34	31	33	43
5. 1956 to 1960 (20 to 25)	26	16	43	24	33	27	13
MARITAL STATUS							
1. Single	33	26	43e	41	40	32	356
2. Married now	62	70	49	48	57	63	63
3. Separated, Divorced	5	4	7	11	2	5	3
4. Widowed	*	*	*	0	1	*	0
TOTAL NUMBER OF CHILDREN							
1. 0	52	39	76e	42	44	53	51c
2. 1	15	18	11	32	18	14	22
3. 2	19	26	7	15	22	19	24
4. 3 or more	14	18	6	11	16	14	4
(No. of cases)	(2739)	(1720)	(1080)	(128)	(133)	(2273)	(79)

* is less than .5%

a=p<.05, b=p<.01, c=p<.001, d=p<.0001, e=p<.00001 based on Chi-Square Analysis of Frequencies.

MA - Male
FE - Female
BL - Black
HI - Hispanic
WH - Majority
FN - Foreign National
AE - Aeronautical Engineering
AG - Agricultural Engineering
CH - Chemical Engineering

fathers' occupations as being at the professional level (during the time the respondent was in college) and their mothers as being homemakers. This was less true for the Black American engineers. While only 26% of the Black American engineers reported their fathers' occupations at the professional level, compared to 58 percent for the entire sample, 25 percent of the Black American engineers reported their mothers' occupation as being at the professional level, compared to 17 percent for the entire sample. Women were more likely than were men to report that their fathers were engineers (23% vs. 12%).

In terms of parents' education, a larger proportion of women than men reported that their fathers (48% vs. 29%) and mothers (30% vs. 20%) had a college degree. Several differences among the ethnic groups were also observed. Black American (19%) and Hispanic American (21%) engineers were less likely to report that their fathers had college degrees, as compared to White American (37%) and Foreign National engineers (40%). In terms of mothers' education, Black American (20%) and White American (25%) engineers were more likely to report that their mothers had a college degree than were Hispanic Americans (11%) and Foreign National engineers (13%). (These data are presented in Appendix C; see Item 24.)

Employment. Eighty-one percent (81%) of the respondents (N=2268) were employed full time in engineering. Ten percent (10%) of the graduate sample (N=284) had full-time non-engineering positions, with the rest being self-employed, employed part-time, retired or unemployed.

Table 4 presents the percentages of engineers, classified by sex, ethnic group and field of current job, for (1) different types of employers, (2) different job functions and (3) educational relevance. The majority of the graduate engineers worked in manufacturing firms; however, civil, geological/mining and nuclear engineers tended to be working in nonmanufacturing organizations. It is interesting to note that almost one-third of the agricultural engineers in our sample were employed by educational institutions. A relatively large percentage of Foreign National engineers (17%) were also employed by educational institutions. A few other ethnic differences were found. For example, a relatively large percentage of Foreign National engineers (22%) worked for chemical or petroleum firms, and a relatively large percentage of Hispanic American engineers (22%) worked in government or health services.

As may be noted in Figure 1, the majority of the engineers in each field had received their BS degree in the same field. However, a relatively large percentage of respondents working in the fields of aeronautical (24%) and nuclear (22%) engineering had received their BS degrees in mechanical engineering (see Appendix C, Item 29).

The most frequently reported job functions for engineers as a total group were technical management, development and design (see Table 4). Differences between men and women appear to be slight; however, more men than women were involved in technical management (18% vs. 11%). It is possible that assignment to positions in technical management is a function of experience. The difference in years of experience for men and women in our sample may partially account for the difference in the percentages involved in technical management. A few ethnic differences were also found. While a substantial percentage of engineers from all ethnic groups were involved in design (20%), a relatively

TABLE 4

Type of Employer, Principal Function and Relevance of Educational Background for Present Job of Graduate Engineers by Sex, Ethnic Group and Field

								PERCENTAGES									
	TO-	SEX		ETHNICITY				CURRENT FIELD OF EMPLOYMENT									
TYPE OF EMPLOYERS	TAL	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE
Manufacturing																	
Aircraft	4	4	3	2	4	4	0e	51	0	0	1	4	2	3	6	0
Chemicals/Petroleum/Ordnance	10	11	9	7	6	11	22	1	1	55	3	3	2	5	11	0
Electrical/Electronic equip	10	9	12	19	20	10	7	4	2	0	0	39	0	17	8	4
Fabricated/Primary metals	4	3	4	1	1	5	1	0	2	2	2	1	8	11	6	0
Machinery (except elec.)	4	5	3	2	2	5	3	0	22	1	0	2	0	3	15	0
All manufacturing	12	9	14	18	3	11	12	1	4	8	2	6	3	32	18	5
Other Kinds of Business																	
Agri., forest., & fisheries	1	2	1	0	1	1	1	0	17	0.	1	0	0	1	0	0
Construction	3	4	3	1	6	3	3	3	2	1	12	1	0	0	2	6
Engr. or Arch. services	16	16	16	6	12	17	12	7	2	14	42	11	13	3	14	43
Mining and petrol. extract.	3	3	2	1	2	3	4	0	0	4	2	0.	44	1	0.	0
Trans., comm., & util.	7	6	7	10	6	7	5	0	1	0.	7	14	1	4	5	9
Other Private Business	9	9	11	14	15	9	15	7	8	7	5	8	10	7	9	21
Government & Health Services	12	10	13	15	21	10	0	21	14	3	19	7	13	8	5	10
Educational Institutions	5	6	4	4	2	5	17	3	29	3	3	4	2	6	3	2
PRINCIPAL FUNCTION																	
Pre-Professional	2	1	3	0	7	2	0 e	0	1	0	3	1	2	2	0	3e
Research	9	9	8	5	2	9	22	15	29	14	5	7	19	3	9	6
Development	11	10	13	10	7	11	14	16	4	19	3	22	11	5	13	14
Design	20	21	20	27	20	20	18	16	36	22	33	24	9	1	34	18
Operations	7	6	8	3	7	7	4	6	3	10	3	4	7	22	2	6
Production & maintenance	7	6	7	8	6	7	5	4	5	8	1	4	3	17	10	2
Testing & inspection	3	2	3	3	10	2	1	0	4	1	3	4	2	1	4	5
Construction	4	4	3	1	9	4	3	0	1	1	14	1	0	0	4	6
Sales & service	3	4	2	3	5	3	0	0	2	1	0.	4	4	0	2	1
Teaching	3	3	2	6	1	3	8	3	4	2	2	3	2	5	2	3
Technical management	16	18	11	15	12	16	13	31	5	13	11	16	22	26	12	16
Non-technical management	3	4	3	8	4	3	0	1	0	1	2	2	0	2	1	2
Consulting	7	8	8	1	3	8	9	3	2	3	15	4	12	10	3	14
Other	7	6	9	10	5	7	4	4	6	6	4	5	6	6	6	5
RELEVANCE OF EDUCATIONAL BACKGROUND																	
Must have	39	39	39e	35	35	39	42b	44	39	49	53	38	43	28	41	36e
Very important	23	25	19	23	24	23	18	22	27	23	21	27	25	24	20	26
Important	23	23	23	19	27	23	31	23	24	20	18	21	19	31	26	25
Some importance	11	10	13	16	9	11	7	9	7	8	8	10	13	10	10	11
Little importance	2	2	4	1	3	2	1	3	2	0.	0.	2	0	5	3	1
Unnecessary	1	1	2	6	2	1	1	0	2	0	0.	2	0	1	1	0

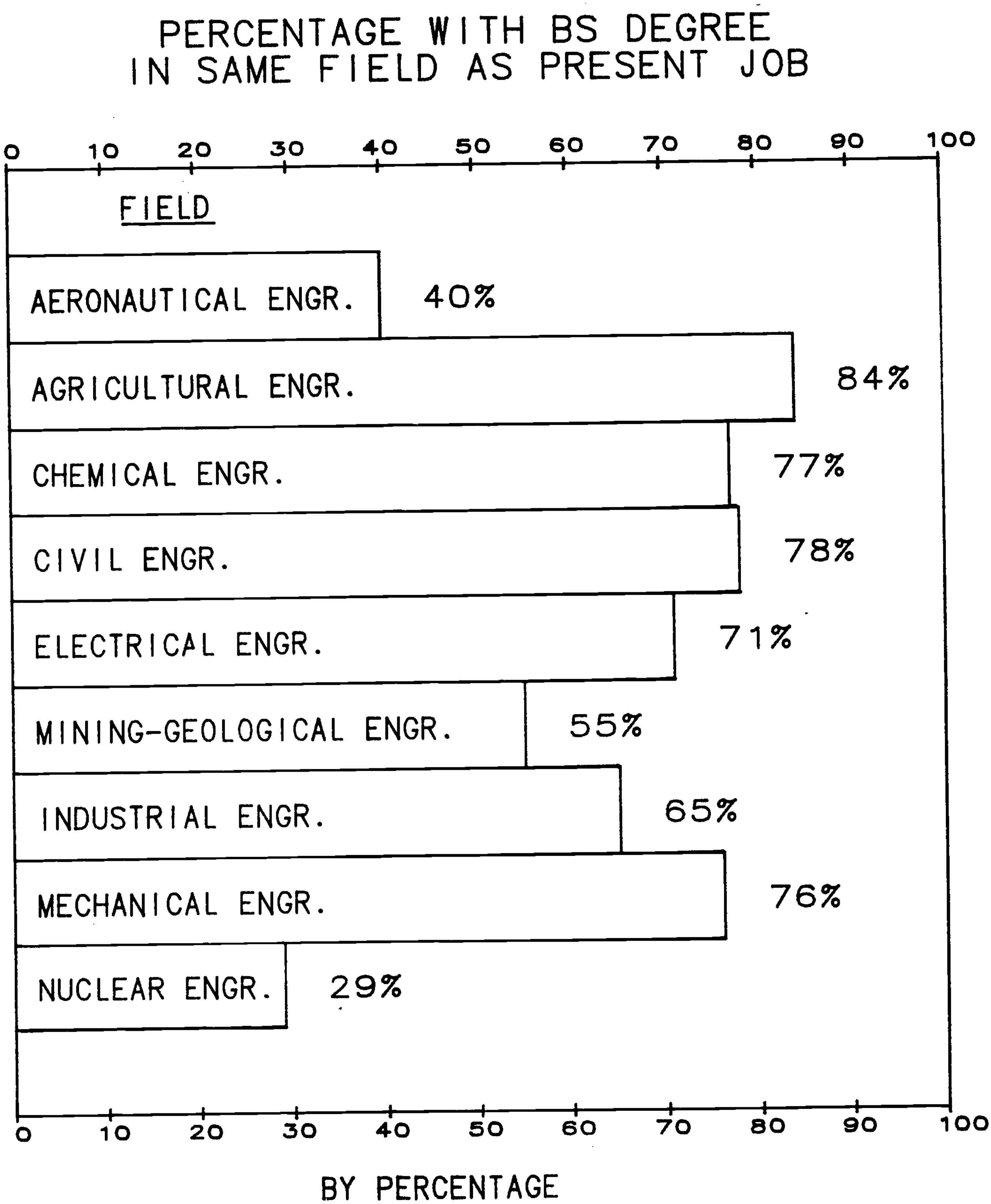

Figure 1 Percentage of Engineers Working in Each Major Field Who Received Their BS Degree in the Same Field.

larger percentage of Foreign National engineers (36%) than of other ethnic groups was involved in research and development. Black American and White American engineers tended to work in management positions, while the tendency for Hispanic American engineers was to work in testing and inspection or construction.

Substantial variations across fields were observed in the job functions reported by respondents. Some of the field differences in reported job functions appear to be related to other factors. For example, a larger percentage of aeronautical engineers (31%) than engineers in general (16%) were involved in technical management; however, aeronautical engineers tended to be older than engineers in other fields. Moreover, a relatively large percentage of agricultural engineers (29%) worked in research, perhaps because of the large percentage of agricultural engineers (29%) working for colleges or universities. Other field differences appeared to be related to specific field requirements. For example, civil engineers were more likely than others to report design, consulting or construction as their principal function.

Table 4 also illustrates that the vast majority of graduate engineers believed that their educational background was necessary for their present job. A greater percentage of men (88%) than women (80%) rated their educational background as being important. Across the fields, chemical and civil engineers tended to rate their educational background as being more important to their jobs than did engineers in other fields.

Figure 2 presents the percentages of men and women engineers reporting high levels of technical responsibility (complex to pioneering tasks) by years since BS degree. As can be seen in this figure, the percentages of engineers reporting high technical responsibility levels tended to increase with experience, and comparable percentages of men and women reported high levels. On the other hand, men and women did not report comparable increases in levels of supervisory responsibility. Figure 3 presents the percentages of men and women supervising professionals by years since BS degree. After approximately eight years of experience, the percentage of men who supervise professionals and managers continues to increase with experience, but it remains relatively stable for women. These differences are also reflected in salaries.

Median salaries (1981) for men and women by years since BS degree are illustrated in Figure 4. The median salaries of men and women are comparable up to 5 or 6 years after the BS degree. However, beyond that point, the salary curves begin to diverge, with men reporting higher median salaries than did women. These observed differences in salary levels may, in part, reflect the differences in supervisory responsibility depicted in Figure 3.

Table 5 illustrates the percentages of engineers rating various areas of national concern as being of "major" or "critical" importance, together with the percentages of involvement to at least a "minor" extent. As a group, engineers most frequently viewed energy as an important problem, followed by crime prevention and education. No appreciable sex difference was found for these ratings, and only a few ethnic differences were noted. Black American engineers were more likely than others to view welfare/family services and community development as being important, and White American engineers were least likely to view these issues as being important. A few differences were associated with the

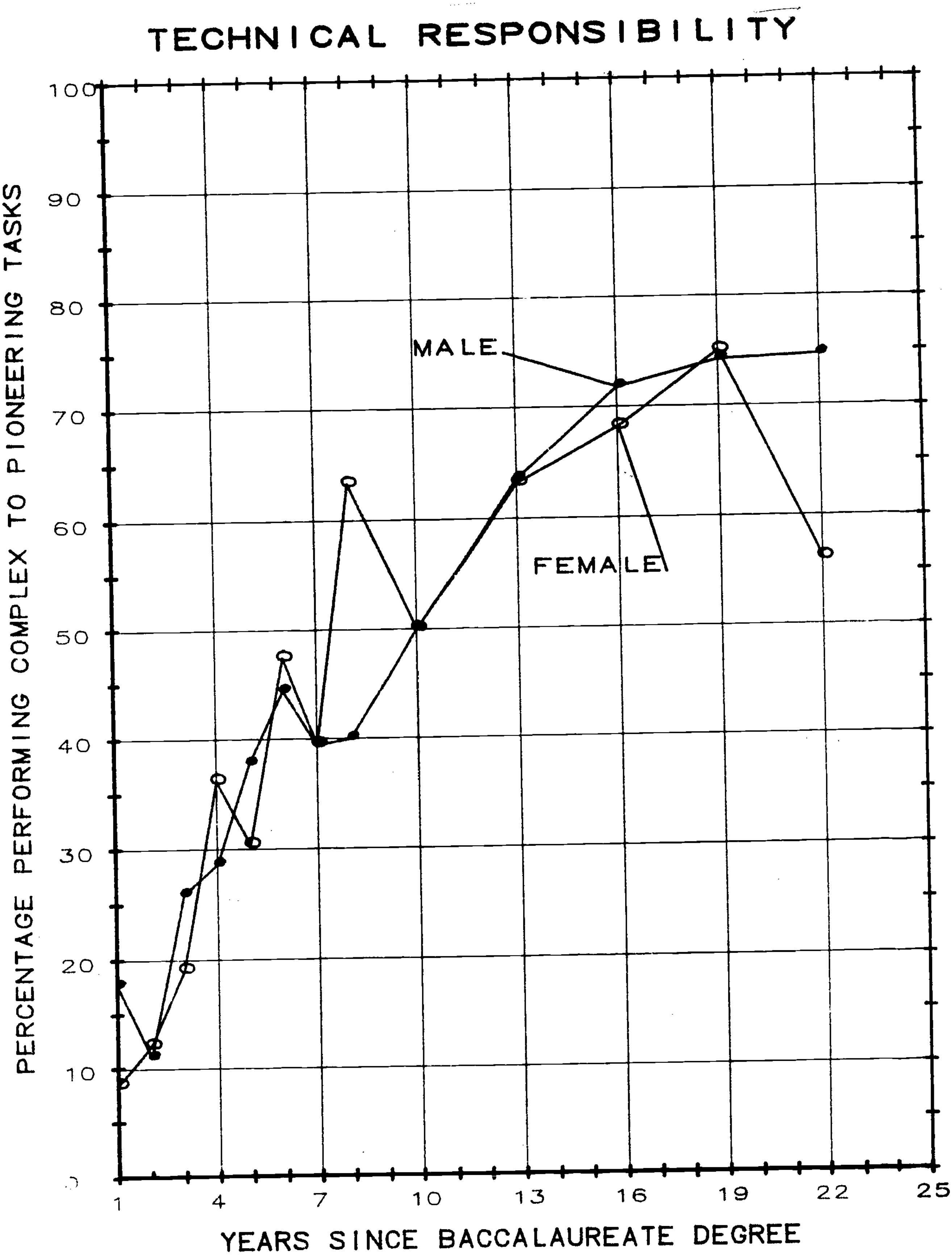

Figure 2 Percentage of Men and Women Engineers Reporting High Technical Responsibility by Years Since BS Degree.

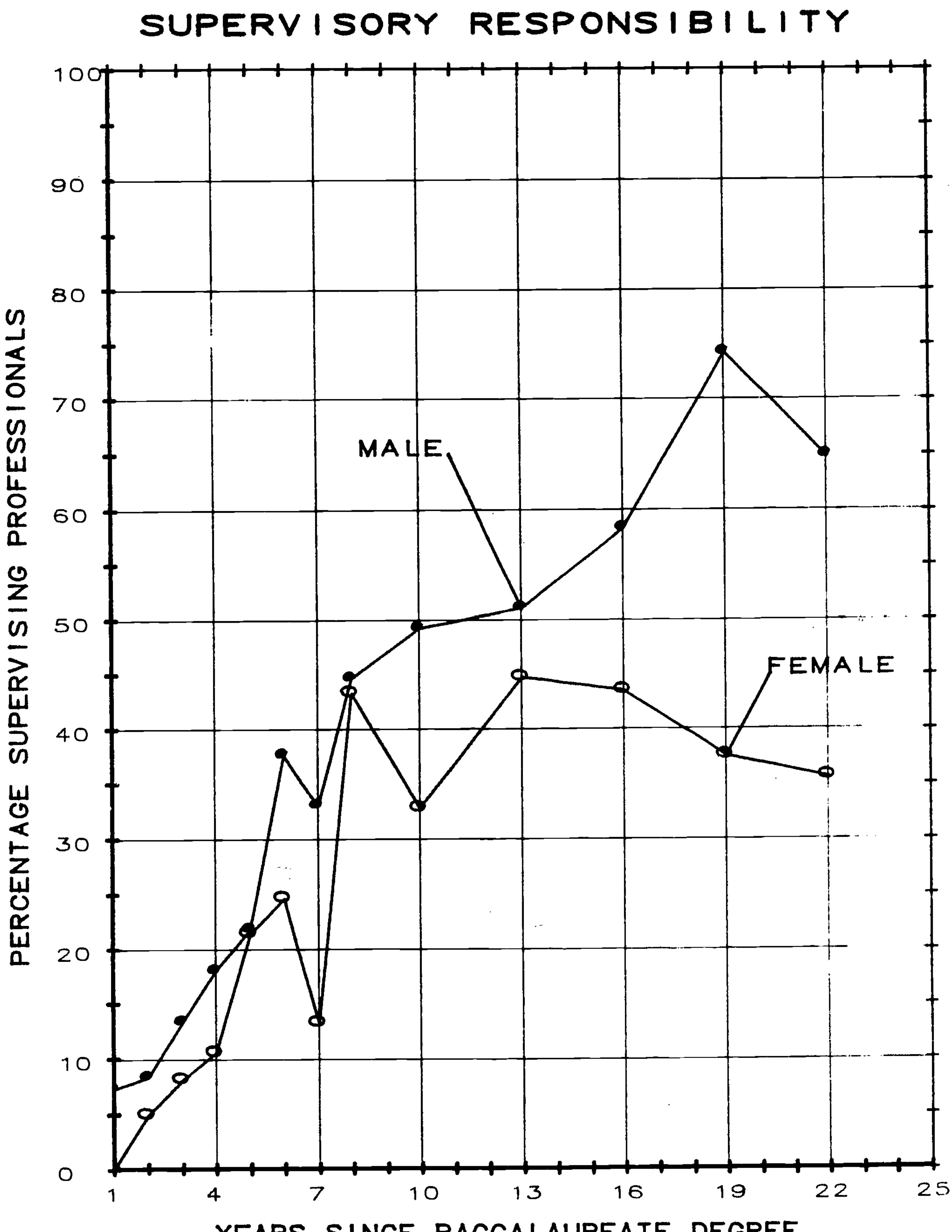

Figure 3 Percentage of Men and Women Engineers Supervising Professional or Managerial Personnel by Years Since BS Degree.

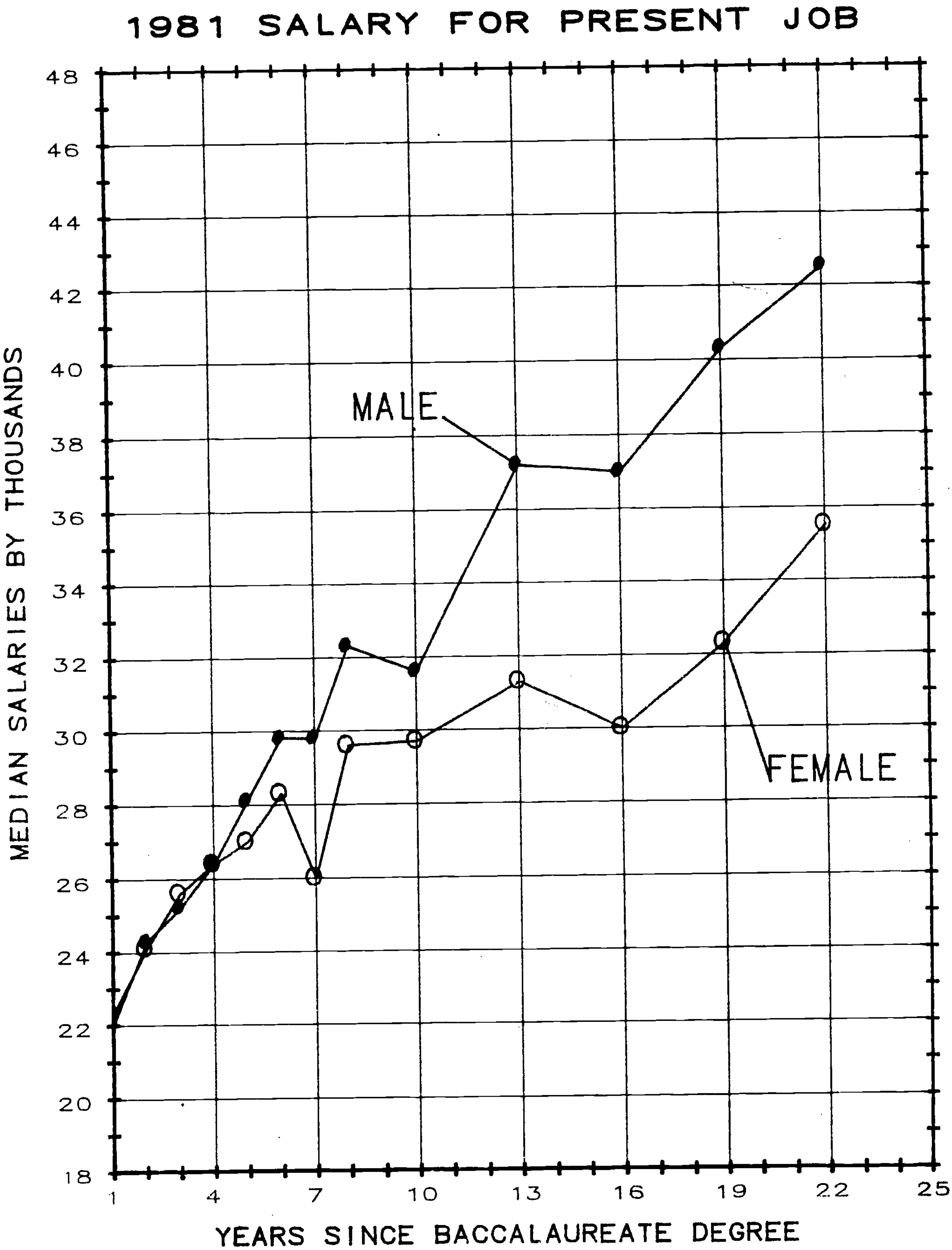

Figure 4 Median Salaries in Thousands of Dollars for Men and Women Engineers by Years Since BS Degree.

TABLE 5

Graduate Engineer Ratings of the Importance of Various Current National Problems and Their Degrees of Professional Involvement

	TO-	SEX		ETHNICITY				CURRENT FIELD OF EMPLOYMENT								
Percentage indicating current national problems to be of a "Major" or "Critical" nature	TAL	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE
Energy and fuel supplies	98	98	98	97	99	98	96	97	99	99	98	99	100	98	97	99
Crime prevention and control	86	86	87	88	91	86	86	86	84	85	88	88	93	90	86	85
Education	85	85	86	93	92	84	85c	82	89	80	87	84	92	86	87	87
Environmental protection	81	78	84c	86	85	80	86	73	82	85	88	80	80	77	78	77b
Defense	79	81	76a	79	81	80	59c	95	69	76	78	79	88	81	81	75b
Agricultural production	74	76	71b	78	80	74	69	65	97	75	77	70	84	70	74	65e
Health	73	72	75	85	75	72	85c	67	75	74	77	76	71	78	70	68
Other	66	67	65	76	47	66	71	78	59	68	53	83	93	65	60	70
Transportation	65	64	66	73	71	64	67	62	56	62	70	68	68	61	63	57
Space	55	56	54	58	65	55	45	73	56	45	50	64	66	52	56	55e
Communications	51	50	53	64	63	49	61d	46	46	40	54	58	51	52	48	43b
Community development	42	42	43	73	57	39	49e	29	45	41	53	44	37	43	37	26e
Welfare and family services	38	36	43c	77	47	35	48e	36	41	35	39	44	33	43	36	33
Percentage indicating "Minor", "Some", or "Major" professional involvement in the current national problems																
Energy and fuel supplies	68	73	59e	49	54	69	77e	53	78	87	65	63	92	56	72	99e
Environmental protection	62	67	54e	52	61	63	60	32	69	84	81	43	92	46	58	79e
Education	42	46	36e	51	42	41	59b	41	62	37	39	42	48	44	34	41d
Defense	32	35	28c	36	43	32	14c	92	11	22	28	45	33	28	32	43e
Health	32	34	29a	29	34	33	31	15	32	36	39	25	27	34	27	35c
Other	32	36	28	48	21	31	31	23	48	39	33	35	48	25	22	26
Transportation	31	34	26d	32	28	31	25	48	18	23	48	26	30	28	26	20e
Community development	30	32	26b	48	35	29	19d	25	36	19	49	24	22	27	20	21e
Communications	28	28	28	46	33	26	23e	28	13	14	22	50	16	34	14	16e
Agricultural production	22	27	15e	10	18	23	31b	12	95	19	23	17	23	15	19	7e
Space	17	19	15b	22	25	16	8b	75	5	7	7	27	18	15	16	14e
Crime prevention and control	11	13	7e	23	25	9	10e	10	6	7	9	17	5	5	6	8e
Welfare and family services	8	10	6d	20	15	7	10e	7	13	5	8	9	2	8	4	4a

fields of engineering. Aeronautical engineers were more likely than others to indicate space as an important national concern, and agricultural engineers were more likely than others to indicate agricultural production as an important concern.

Much more variation was found in the respondents' degree of professional involvement in these areas of national concern (see Table 5). For most of the areas, a larger percentage of men than of women indicated some degree of involvement. Foreign national and White American engineers were more likely than were other engineers to be involved in the energy area, while Black American and Hispanic American engineers were more likely to be involved in crime prevention, welfare and family services and communications than were White Americans and Foreign Nationals. Many differences in involvement in national issues were found when engineers were compared by field of current job. For example, aeronautical engineers were more likely than most to be involved in defense, space and transportation. Other differences were also consistent with expectations.

In Table 6, the percentage of respondents who engaged in each of a number of professional activities during the past year is presented. More than half of the respondents subscribed to engineering periodicals and read about or discussed new developments in engineering. Only a small proportion (11%) of the engineers were likely to have presented one or more technical papers during the past year. While women were somewhat more likely than men to have subscribed to engineering periodicals and to have completed a graduate course in engineering, men were more likely than women to have purchased and read new books on engineering or science and to have attended national technical meetings and presented papers.

Several ethnic differences were also found, among which Foreign Nationals were more likely than others to have engaged in the specified activities. Comparisons across fields led to statistically significant differences for each activity. For most of the activities showing significant differences, geological/mining engineers had the highest, or one of the highest, rates of participation. Agricultural engineers represented the largest percentage that completed a graduate course in engineering, and industrial engineers were the most likely group to have attended a short course on management.

Table 6 also shows the percentage of engineers in each group who were registered. Approximately one-half of the respondents were registered (48%). Among the ethnic groups, White American engineers were most likely to be registered. Comparisons across fields showed that civil and agricultural engineers had the highest rates of registration, while aeronautical and industrial engineers had the lowest rates of registration.

Job Satisfaction. The majority of engineers in the sample were satisfied with their choice of engineering as a career and with the progress they had made in their career, as may be noted in Table 7. However, in comparing the sexes, a greater percentage of men than of women was satisfied with their career progress. There was also a tendency for women to be less satisfied than men with the work in their current job, although a large majority of women were satisfied (75%). Black American engineers were also more likely to report dissatisfaction with the work in their current position than were engineers from other ethnic

TABLE 6

Professional Activities of Graduate Engineers Classified by Sex, Ethnicity and Current Field

Percentage engaging in each activity during the past year	TOTAL	SEX		ETHNICITY				CURRENT FIELD OF EMPLOYMENT								
		MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE
Discuss new engr developments	68	69	66	62	60	69	62a	78	85	73	63	72	85	72	68	74e
Read about new engr developments	79	79	79	83	80	79	88	82	91	79	76	82	93	82	78	80c
Subscribe to engr periodicals	79	78	82b	66	71	81	84e	86	90	81	72	78	93	89	77	86e
Read new books on engr or sci	40	44	34e	44	42	39	55a	54	51	44	41	49	57	31	36	44e
Purchased new books on engr/sci	40	43	35d	44	41	38	65e	38	48	41	46	50	62	26	40	34e
Attended local technical meetings	46	46	47	36	39	47	54a	42	58	49	45	46	66	57	44	50d
Took non-grad credit engr course	16	15	16	18	14	15	24	20	14	19	15	22	21	13	15	14a
Completed grad courses in engr	15	13	17b	23	17	14	33e	18	32	8	14	21	12	12	17	10e
Attended national tech meeting	28	30	24b	20	13	29	37e	32	33	33	16	27	53	27	24	40e
Presented one or more tech papers	11	13	8e	5	6	12	18b	16	18	15	6	10	23	8	8	22e
Attended short course on mgmt	28	27	30	35	26	28	23	28	18	25	20	24	39	43	26	35e
Percentage Indicating Professional Registration																
Registered Professional Engineer	14	20	5	5	10	15	19e	9	11	12	23	12	17	9	17	17e
Registered Engineer in Training	34	30	40	16	29	37	15	12	62	33	60	21	13	13	45	20
Not a Registered Engineer	52	50	55	79	61	48	66	79	27	55	17	67	70	78	38	63

TABLE 7

Graduate Engineers' Satisfaction With Career Choice, Career Progress And Work

	PERCENTAGES															
	TO-	SEX		ETHNICITY				CURRENT FIELD OF EMPLOYMENT								
	TAL	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE
How satisfied are you with your choice of occupation?																
Still uncertain	1	1	2b	1	2	1	4	0	2	1	0	1	2	0	1	0
Not satisfied; reconsidering	5	4	7	10	5	5	8	4	7	4	3	3	4	6	6	7
Satisfied, some doubts	21	20	24	22	26	21	25	26	25	21	25	23	18	19	20	22
Made best choice	47	48	45	44	44	48	46	41	47	48	46	46	45	51	52	52
Fully satisfied	25	26	23	23	24	26	18	29	20	27	26	28	31	24	21	20
How satisfied are you with your progress in your occupation?																
Not satisfied	15	13	18e	28	15	14	19b	13	15	15	11	16	15	16	14	15
Fairly satisfied	24	22	28	22	23	24	29	23	19	27	26	24	23	28	27	25
Feel I'm doing well	45	46	41	38	49	45	38	46	48	43	46	42	46	42	49	50
Fully satisfied	16	18	13	12	13	17	14	17	18	17	18	18	15	14	10	10
General level of satisfaction with work in present job.																
Very satisfied	30	33	26e	20	28	31	17e	29	24	28	32	33	39	29	23	22
Satisfied	50	51	49	46	52	50	63	52	55	56	48	49	44	48	57	62
Neutral	14	12	15	20	15	13	13	12	17	12	15	12	14	15	13	13
Dissatisfied	5	4	7	7	2	5	6	4	3	4	5	6	1	6	6	3
Very dissatisfied	1	1	2	7	3	1	1	3	1	1	1	1	1	2	1	0

CE - Civil Engineering
EE - Electrical Engineering
GM - Geological Mining
IE - Industrial Engineering
ME - Mechanical Engineering

groups.

Survey respondents rated a list of 36 job factors in terms of how important each was to them personally and to what extent each factor was characteristic of their present job. In Table 8, these characteristics have been rank-ordered according to the percentage of respondents rating each factor as being "Very Important", as well as the percentage rating each factor as being "Very Characteristic." This table also lists (1) the rank of each factor in terms of characteristic ratings, (2) the difference between the item rank based on importance ratings and the item rank based on characteristic ratings and (3) the difference in the percentages of respondents rating each item as "Very Important" and "Very Characteristic". The column of rank differences illustrates discrepancies in relative ordering of the 36 job factors in terms of (1) importance to the individual and (2) the extent to which the factors are characteristic of the job.

The rank-order correlation between "importance" and "characteristic" ratings was moderate in strength (rho=.63). Three factors were judged to be very important to the respondents, but less characteristic of their jobs. These factors included "a position where people are interested in working together and not encouraging petty jealousies," "company is well-managed and progressive" and "participation in important work-related decisions." It is clear from Table 8 that the majority of factors were more important to the respondents than they were characteristic of their job, as might be expected.

Field, sex and ethnic differences are not illustrated for the importance and characteristic ratings because few differences were found (see Appendix C, Item 36). However, women did indicate that certain factors were more important than did men, including the opportunity to work with people, preparation for top level careers, flexible working hours and the availability of personal leave. In terms of the characteristic ratings, women rated their jobs lower than did men with respect to opportunity to innovate, to exercise leadership and to participate in work-related decisions.

Employment opportunities for women and minorities. Graduate engineers were asked about their perceptions of employment opportunities in engineering for minorities relative to White Americans. These data are presented in Table 9 and in Appendix C, Item 41. Overall, engineers were divided fairly equally in their opinions on this issue, with roughly 41 percent of the engineers indicating that minorities have better opportunities than White Americans and 39 percent endorsing the opposite viewpoint. There was no significant difference in opinions by sex or field, although some ethnic differences were found. While Black American and Foreign National engineers were quite strong in their view that White Americans have better opportunities than minorities, White American engineers were somewhat more likely to view minorities as having better opportunities. Hispanic American engineers were about evenly divided in viewing the opportunities as equal or better for White Americans.

Several significant differences were found in respondents' opinions concerning opportunities for men and women (see Table 9 and Item 42 in Appendix C). Men were divided in their opinions, with 40 percent of them endorsing the view that women have better opportunities than men and 44 percent of the men endorsing the opposite viewpoint. Women tended to indicate that men have better

TABLE 8

Rank Order of Various Job Factors in Terms of Importance and Degree to Which They Characterize Present Jobs of Graduate Engineers

Percentage Rating Job Factors as "Very Important" or "Very Characteristic"	VERY IMPORTANT	VERY CHARACTERISTIC	RANK IMPORTANCE	RANK CHARACTERISTIC	RANK DIFFERENCE	PERCENT DIFFERENCE
Engage in satisfying work	82%	37%	1	15	-10	45
Opportunity to use my skills	80	43	2	5	-3	37
People working together, no petty jealousies	73	27	3	21	-18	46
An income to live comfortably	71	41	4	7	-3	30
Company is well-managed and progressive	66	21	5	28	-23	45
Delegate responsibility	66	43	6	4	2	23
Opportunity to innovate	64	38	7	10	-3	26
Pleasant people to work with	62	41	8	8	0	21
Freedom to manage own work	61	42	9	6	3	19
Participation in work-related decisions	61	25	10	25	-15	36
Opportunity to advance economically	53	27	11	22	-11	26
Desirable geographical location	52	45	12	2	10	7
Work with ideas	52	31	13	16	-3	21
Opportunity to keep abreast	52	28	14	20	-6	24
Know exactly my work responsibilities	51	30	16	17	-1	21
Freedom from pressure to conform	50	33	17	14	3	17
Problems with no ready made solutions	49	44	18	3	15	5
Company realizes family responsibilities	49	29	19	19	0	20
Wide variety of technical work	48	34	20	13	7	14
Availability of personal leave	47	40	21	9	12	7
Job security due to technical attainments	46	31	22	15	7	15
Opportunity to move into management	46	35	23	12	11	11
Exercise leadership	45	25	24	24	0	20
Opportunity to work with people	44	50	25	1	24	-6
Flexible work hours	38	26	26	23	3	12
Preparation for top level careers	36	10	27	35	-8	26
Opportunities to help others	34	20	28	29	-1	14
Colleagues interested in latest developments	33	19	29	31	-2	14
Significant contributions to society	33	14	30	33	-3	19
Opportunity to work with things	30	24	31	26	5	6
Freedom from pressure to excel	28	15	32	32	0	13
Assigned to different areas in the company	25	19	33	30	3	6
Freedom to select projects	22	9	34	36	-2	13
Opportunity to enhance social status	20	13	35	34	1	7
Opportunity to travel	20	21	36	27	9	-1

TABLE 9

Attitudes Toward Women's Roles and Opportunities for Minorities and Women of Graduate Engineers Classified by Sex, Ethnicity and Career Fields

Percentage who "Strongly Agree" or "Agree" with statements regarding women	TO-TAL	SEX		ETHNICITY				CURRENT FIELD OF EMPLOYMENT								
		MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE
1. Women can be successful engineering competitors	95	92	99e	96	92	95	90	94	95	92	95	95	94	98	93	97
2. Women are good self-confident engineers	92	89	98e	94	89	93	82b	96	90	89	93	92	89	95	90	89a
3. Women can assume industry leadership roles	91	88	95e	90	89	92	79c	92	83	90	90	92	91	92	90	92a
4. Women engineers do not have to sacrifice femininity	85	80	93e	85	80	86	73a	88	78	79	88	89	82	88	83	86a
5. Pregnancy does not make women less effective engineers	70	61	85e	77	66	70	65	76	66	65	74	70	61	71	69	81a
6. Wife's career more important than helping husband in his career	59	53	70e	60	57	59	56	56	56	64	58	65	57	56	56	62
7. Full-time employed mother as good as mother not employed	56	41	80e	67	46	56	44b	49	45	51	56	58	54	63	54	63a

opportunities (53%), although a sizable percentage (28%) did indicate that women have better opportunities than men. Significant differences in the opinions of ethnic groups were also found. Black American (76%) and Foreign National (66%) engineers tended to view men as having better opportunities in engineering than women. While all of the ethnic groups examined were more likely to indicate that men have better opportunities than women, larger percentages of Hispanic American (32%) and White American (37%) engineers endorsed the opposing viewpoint, compared to Black Americans (20%) and Foreign Nationals (17%).

Engineers were also asked to agree or to disagree with a number of statements concerning the role of women in the work force. No ethnic or field difference in these opinions was found; however, there were significant sex differences (see Appendix C, Item 39). The vast majority of both men and women agreed that (1) women should assume leadership positions in industry as often as men, (2) women are competitive enough to be successful engineers and (3) women possess enough self-confidence to be good engineers. While 85 percent of the women indicated that the possibility of pregnancy did not make them less desirable as employees, and 80 percent of them believed that full-time employed mothers could be just as good as nonemployed mothers, men were less likely than women to agree with these statements. Only 61 percent of the men agreed that the possibility of pregnancy did not make women less desirable as employees, and only 41 percent agreed that full-time employed mothers could be as good as unemployed mothers. Opinions were also divided concerning whether it is more important for a wife to have her own career or to help her husband with his career. Seventy percent (70%) of the women believed it was important for a wife to have her own career, rather than to help her husband with his, while only 53 percent of the men agreed with this viewpoint.

Career development. Graduate engineers were asked to indicate on their survey instrument the time when they had first considered a career in engineering and when they made a final decision to go into engineering. Table 10 presents the results for these questions. The largest percentage of engineers first considered and then finally decided on a career in engineering during the 11th or 12th grades. However, while 76 percent of the graduates had considered engineering by the end of high school, only 53 percent had made a final decision concerning a career in engineering by that time. In general, women made their career decisions later than did men. Black American engineers were more likely than were engineers from other ethnic groups to make their final decision to become an engineer while in high school. There were also some variations across engineering fields, with geological/mining engineers making their career decision later than did engineers in other fields and aeronautical engineers first considering engineering earlier than most.

Factors influencing decisions to pursue a career in engineering are shown in Table 11. The most influential factors tend to be characteristic of, or intrinsic to, the type of work associated with engineering ("challenge" or "liking for problem solving"). Men were influenced more by hobby activities than were women, while women were influenced somewhat more by a wider variety of job characteristics than were men (e.g., "independence"and "challenge"). Women were also more likely than were men to have been influenced by using a computer. Variations across fields were generally consistent with expectations. For example, chemical engineers were influenced more than others by college chemistry courses, aeronautical engineers by flying aircraft and electrical engineers by

TABLE 10

Time of First Consideration and Final Decision of an Engineering Career for Graduate Engineers Classified by Sex, Ethnicity and Career Field

PERCENTAGES

	TO-	SEX		ETHNICITY				CURRENT FIELD OF EMPLOYMENT								
First Consideration	TAL	MA	FE	BL	HI	WH	FN	AE	AG	CH	CV	EE	GM	IE	ME	NE
Before High school	18	22	11e	32	18	17	20b	39	11	18	12	22	17	14	20	21
During grades 9 or 10	19	23	12	14	24	18	18	14	22	24	18	17	12	14	22	13
During grades 11 or 12	39	38	41	33	42	40	36	26	25	41	43	33	33	45	43	33
During 1st year of college	11	10	14	15	13	11	9	8	11	6	15	14	13	11	9	13
During 2nd year of college	5	3	9	3	2	6	5	3	6	4	7	5	13	7	5	7
During 3rd/4th year of college	3	2	5	1	1	4	8	6	3	5	2	3	11	3	1	7
After college	5	2	8	3	1	5	4	5	2	3	4	7	2	6	1	6
Final Decision																
Before High school	4	5	2e	14	5	3	9e	14	3	4	3	6	1	4	5	7e
During grades 9 or 10	6	8	3	14	9	6	4	5	3	8	3	8	4	6	7	2
During grades 11 or 12	43	48	34	44	46	43	42	41	49	46	40	41	28	39	51	37
During 1st year of college	19	18	21	10	28	19	20	11	21	15	24	18	20	17	18	21
During 2nd year of college	12	10	17	11	9	13	7	11	13	11	17	9	14	15	12	11
During 3rd/4th year of college	7	5	10	5	3	7	10	5	8	6	7	10	16	9	4	6
After college	9	6	12	2	0	9	9	13	4	10	6	8	17	10	3	17

TABLE 11

Percentage of Graduate Engineers Rating Various Factors as of "Very" or "Some" Importance in Influencing Their Decision to Study Engineering

	TO-	SEX		ETHNICITY				CURRENT FIELD OF EMPLOYMENT								
WORK	TAL	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE
Like problem solving	85	84	88b	85	82	86	83	83	87	84	81	87	89	86	87	91
Challenge	83	81	89e	83	87	84	90	81	85	80	84	84	86	84	86	91
Being curious or creative	83	83	82	88	82	82	84	79	88	83	78	86	80	85	83	90
Salary	75	74	77	82	72	75	73	62	71	77	77	74	79	74	77	82
Creativity	74	73	76	75	74	74	86	79	80	74	70	77	70	73	73	79
Independence	68	62	78e	70	73	68	73	57	67	61	73	67	75	72	66	68a
Type of work	64	63	65	53	58	65	58a	59	73	65	67	57	62	62	63	68
Prestige	62	62	63	58	72	61	73a	44	57	62	64	60	54	68	63	62
Security	61	59	64b	64	64	61	68	48	59	65	62	61	54	67	64	62
Leadership	56	54	60b	57	69	55	70b	44	56	52	63	54	47	62	51	49b
Relevant work experience	42	46	36e	44	36	42	35	43	51	34	36	43	51	38	41	41b
Rapid advancement	48	45	53c	53	61	46	62c	44	56	52	63	54	47	62	51	49c
Wanting to be of service	45	44	46	47	49	43	59a	24	65	41	53	40	43	44	39	49e
SCHOOL RELATED																
College engineering courses	75	74	76	80	79	74	79	69	76	74	82	76	74	73	77	78
High School science courses	69	71	66a	80	69	69	69	75	68	79	63	67	72	66	73	72b
High School math courses	67	66	68	79	71	66	69a	75	68	70	62	65	62	70	69	67
Career or occupational infor.	57	57	58	66	67	56	57a	49	63	56	59	51	61	65	57	50a
College math courses	55	53	59b	66	66	53	62b	63	49	52	53	60	56	58	54	66
College science courses	50	52	47a	60	63	49	60c	48	54	53	50	52	69	41	51	63b
College physics courses	48	49	46	61	62	46	54d	57	48	49	45	49	54	39	54	66c
Aptitude tests	45	45	45	47	39	46	40	37	49	38	43	40	43	55	48	41b
College chemistry courses	35	37	33	51	41	34	45c	26	23	64	35	31	46	27	30	42e
Interest inventory results	24	25	23	25	16	25	21	16	33	16	22	21	25	33	26	25c
Career education courses	17	19	14b	30	25	16	17d	12	20	12	20	15	10	21	17	21
Pre-college seminars	10	8	12c	20	12	9	8c	8	14	10	8	9	3	6	12	6
PEOPLE																
Father (or male guardian)	61	60	61	50	59	62	58	60	56	62	61	59	55	59	65	62
H.S. math or sci. teacher(s)	48	49	47	53	48	48	57	55	53	55	44	45	54	44	51	48
College teacher(s)	44	41	50e	44	44	44	49	40	55	42	47	39	47	42	45	48
Mother (or female guardian)	44	41	49d	52	46	44	38	39	47	43	47	44	44	42	44	55
Friends	36	37	34	41	35	35	49	31	34	32	39	32	37	36	38	43
Male engineer(s)	32	32	32	26	37	31	43	23	29	29	38	32	30	31	31	38
Other relative	27	27	27	30	38	25	41c	24	30	29	33	29	30	23	26	20
High School counselor(s)	22	24	18b	37	19	22	6	22	27	19	23	22	26	20	24	19
College counselor(s)	22	21	26b	34	31	21	26c	14	33	14	25	21	17	28	25	18c
Female engineer(s)	8	4	15e	11	10	8	6	7	7	5	8	11	12	8	9	8
ACTIVITIES, HOBBIES																
Using a computer	32	28	39e	42	42	31	39b	27	35	26	28	48	18	33	29	37e
Construction hobbies	31	40	16e	40	39	30	32a	37	41	23	35	30	33	20	37	27e
Mechanical hobby	29	40	12e	40	36	28	43c	40	50	20	16	28	33	20	49	24e
Science Fiction	23	24	20a	39	33	21	30e	29	15	22	16	33	33	17	23	26e
Technical publications	21	25	14e	28	27	18	43e	33	22	22	16	23	24	13	19	27b
Building electrical devices	20	26	12e	48	28	18	32e	16	24	12	7	54	12	13	17	18e
Outdoor activities	19	21	17a	19	22	19	22	11	41	12	32	10	49	13	15	12e
Building model airplanes	18	26	5e	31	26	16	30e	42	9	13	12	21	16	14	23	20e
Science Fair participation	16	18	12c	30	12	14	32e	16	18	20	9	19	18	16	15	13a
Farm Experiences	15	20	8e	11	18	15	11	3	82	6	13	10	15	10	15	9e
Hobby Magazines	15	22	4e	27	17	14	23c	31	19	14	8	20	8	10	20	9e
Flying aircraft	12	14	8e	20	17	10	15c	27	6	6	8	15	10	8	17	13e
Science Clubs	12	13	11	25	10	11	23e	8	11	18	7	13	21	11	11	19c
Junior Achievement	4	5	3	11	7	3	17e	2	4	3	3	5	5	7	3	2

using a computer.

Finally, graduate engineers were asked to indicate the extent to which a list of factors had an impact on their career development. The percentages of respondents rating each factor as having a "major" or "moderate" impact upon their career are shown in Table 12. The factor having an impact on approximately one-half of the total engineer group (51%) was the geographical location of jobs. Next in importance was "other demands on your time" (47%), such as family responsibilities and social activities. No major difference across fields in the ratings of the career-development factors was found, although some differences between men and women and among ethnic groups were observed.

Men were more likely than were women (28% and 16%, respectively) to view the presence of small children in the home to be a problem. However, as mentioned before, the women in the sample were less likely than men to have started a family. Women were more likely than were men to be concerned with lack of household help (16%) and demands of spouse's career (29%), although less than one-half of the women (45%) rated these combined factors as having a major or moderate influence. A larger percentage of Foreign Nationals than of other ethnic groups rated "little financial incentive to work," "unfavorable attitudes of co-workers" and "poor personal health" as having major or moderate impact on their career development.

In addition to the issues already discussed, education plays an important role in career development. Table 13 presents information concerning the present and planned levels of education of graduate engineers, as well as their attitudes towards post-baccalaureate work. Sixty-four percent (64%) of the engineers had already begun or completed post-baccalaureate work. A larger percentage of Foreign National engineers (71%) than engineers from other ethnic groups (63%) had already completed a MS or Ph.D. in engineering. Furthermore, 81% of all engineers expected to continue their education.

It is interesting to note that a fairly large number of engineers (20%) planned to obtain a Master's Degree in Business Administration, with women and Black American engineers being more likely than others to plan for a MBA. This preference for further education in administration is reflected in answers to the question regarding what type of graduate program engineers would prefer. Fifty-six percent (56%) of the engineers indicated that they would prefer a management-oriented program, while 21 percent indicated design and 17 percent selected research. In answering the questions regarding their attitudes toward the need for further education, it is clear that, although a small majority of the engineers (56%) did not believe that graduate education is necessary, yet a majority of them had pursued, or were planning to pursue, graduate education. This finding deserves further exploration, especially because opinion is divided about the type of program needed. (Additional data are presented in Appendix C, Items 26-28.)

Self-Perceptions. Several items were included in the survey instrument in order to examine engineers' self-perceptions of their abilities and personal characteristics. Table 14 presents the percentages of engineers in each group rating themselves on a number of abilities as being above average or in the upper ten percent of a college-educated population. More than one-half of the engineers rated themselves as being above average on most of these abilities.

TABLE 12

Percentage of Graduate Engineers Rating Various Factors as Having a Major/Moderate Influence on Their Career Development

FACTORS	TO-TAL	SEX		ETHNICITY				CURRENT FIELD OF EMPLOYMENT								
		MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE
Presence of small children	24	28	16e	28	26	23	26	33	20	21	20	25	36	26	20	31b
Other demands of your time	47	47	45	53	49	46	39	51	52	38	48	48	46	49	49	49
Demands of spouse's career	24	21	29e	24	26	24	26	23	24	26	22	23	28	29	20	31
Unsatisfactory work opportunities	34	35	33	49	37	32	42c	29	27	34	30	30	30	42	31	35a
Geographical location of jobs	51	51	51	48	57	51	45	49	47	54	54	51	52	47	52	58
Hiring policy against husband & wife	6	4	8e	6	6	5	7	11	2	4	6	6	11	6	6	10
Lack of adequate household help	10	7	16e	13	9	10	12	11	5	8	10	10	8	10	12	20
Little financial incentives to work	15	18	11e	21	19	13	34e	15	17	15	18	14	13	14	17	28
Unfavorable attitudes of co-workers	14	13	16a	20	16	13	31e	14	20	18	11	14	15	13	13	17
Unfavorable attitudes of family	7	8	6	13	7	6	16c	6	9	7	5	8	6	9	7	13
Unfavorable attitudes of friends	4	4	3	7	4	3	8b	5	7	3	2	4	4	3	4	9a
Travel demands of your job	15	17	12c	16	11	14	21	17	14	17	13	12	25	14	11	17
Poor personal health	6	6	6	9	7	5	18e	9	9	7	4	8	6	6	4	9

TABLE 13

Current and Planned Education and Attitudes Toward Graduate Work of Graduate Engineers Classified by Sex, Ethnicity and Career Field

PERCENTAGES

	TO-	SEX		ETHNICITY				CURRENT FIELD OF EMPLOYMENT								
CURRENT EDUCATIONAL LEVEL	TAL	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE
No degree	1	1	0.e	1	0	1	0e	0	0	0	0	1	1	0.	1	0e
Bachelor's, no grad work	35	33	39	36	56	35	9	22	43	13	44	38	42	34	45	28
Bachelor's, some non-engr grad work	16	14	18	27	22	15	8	23	11	5	14	15	19	22	17	20
Bachelor's, some engr grad work	5	4	6	3	1	5	3	1	6	3	6	7	2	2	6	3
Master's in engr	25	27	21	16	13	25	54	30	28	56	27	21	15	19	19	31
Master's in business admin	5	6	4	1	2	6	4	0	1	9	1	3	2	10	3	4
Master's in other non-engr	3	3	3	5	0	3	3	1	0	3	1	2	13	3	1	0
Master's in engr and another field	2	2	2	2	0	2	3	1	0	3	1	3	0	1	2	6
Doctorate, engr	5	6	2	0	1	4	14	10	7	7	3	5	2	6	3	6
Doctorate, non-engr	1	1	1	2	0	1	0	1	0	1	0	1	3	1	0	1
Other	3	3	5	7	6	3	4	9	5	1	4	4	0	3	5	1
PLANNED EDUCATIONAL LEVEL																
None	19	24	10e	4	14	20	19e	37	18	23	13	12	17	23	14	21e
Some grad work in engr	20	21	18	14	15	21	14	15	20	26	21	23	31	18	18	19
Some grad work in non-engr	12	13	10	16	13	12	9	10	10	13	9	8	13	15	11	14
Master's in engr	12	10	15	11	20	12	6	12	14	6	22	14	7	6	16	3
Master's in management	20	17	26	30	23	20	17	7	14	17	16	23	18	28	24	21
Master's in non-engr	2	1	3	0	2	2	3	3	2	2	1	1	2	2	2	7
Master's in engr and another field	4	2	6	3	5	4	1	6	1	3	5	4	2	2	4	6
Doctorate in engr	7	7	6	8	2	6	19	6	16	6	7	9	3	4	7	6
Doctorate in non-engr	2	2	2	3	0	2	4	2	2	2	1	2	1	1	1	2
Other	4	4	4	9	6	3	8	3	3	3	3	4	5	1	4	1
PREFERRED GRADUATE PROGRAM																
Design oriented engr program	21	22	19a	21	29	20	20a	26	35	21	32	26	17	9	22	14e
Research oriented engr program	17	17	17	13	11	17	29	26	32	25	15	16	21	7	20	17
Management oriented program	56	56	56	59	57	56	46	44	30	49	48	53	54	78	53	61
Other	6	5	7	7	2	6	5	5	4	5	5	5	8	6	6	8
Percentage who "Strongly Agree" or "Agree" regarding the need for graduate work or continuing education in employment																
Graduate study is not needed	59	59	59	60	61	59	42a	57	56	61	61	58	55	62	68	48
"On Job" training is sufficient	47	47	46	57	55	46	32b	48	41	47	42	48	48	41	50	43
Non-credit courses are sufficient	56	56	56	51	46	57	59	56	55	57	56	52	65	56	59	49
Mgmt Graduate work is needed	50	49	51	49	60	50	47	34	40	34	46	51	51	65	50	52e
Math & Sci Graduate work is needed	31	32	30	30	30	30	47a	47	41	26	27	36	41	22	25	43e
Engr Graduate work is needed	47	48	46	41	47	46	74e	55	64	45	59	57	48	36	44	55e

Engineers in the sample rated themselves highest on problem-solving ability (89%), academic ability (84%), mathematical ability (81%) and drive to achieve (80%). Several sex differences emerged in these ratings. A larger percentage of men than of women rated themselves as being above average on mechanical ability, originality, intellectual self-confidence and visualization ability. A greater percentage of women than of men rated themselves above average in mathematical ability (85% and 78%, respectively).

Few differences in these ability ratings were observed among ethnic groups and fields of engineering. Larger percentages of White American and Foreign National engineers rated themselves high on academic ability (86% and 90%, respectively) than did Black American or Hispanic American engineers (74% and 70%, respectively). However, larger percentages of Black American or Hispanic American engineers rated themselves high on social self-confidence (69% and 60%, respectively) than did White American and Foreign National engineers (45% and 52%, respectively). Among career fields, geological/mining engineers tended to rate themselves lower than did others on mathematical ability. Industrial engineers rated their mechanical ability lower than did others, and agricultural engineers rated their writing ability lower than did most. (For details concerning other significant sex, ethnic and career-field differences, please refer to Table 14 and to Items 34-35 in Appendix C.)

In another question, engineers rated themselves on a number of personal characteristics, including several that have been classified as "instrumental" or "expressive" (Spence & Helmreich, 1978). These characteristics and their corresponding data are presented in Table 15. Generally, relatively few significant differences were observed in self-ratings on these characteristics. However, there were significant sex differences on four of the eight instrumental characteristics. Men rated themselves higher than did women in terms of standing up under pressure, feeling superior, having self-confidence and being able to make decisions easily. For the expressive characteristics, women rated themselves as being more emotional than did men, but no other difference was found on the expressive characteristics.

Occupational Theme ratings. Survey respondents were asked to rate how well each of the six Holland (1959) Occupational Themes (realistic, investigative, artistic, social, enterprising, and conventional) described themselves and the typical engineer in their field. The percentages of men and women engineers rating each Theme as "very" or "somewhat similar" to the typical engineer in their field and to themselves are illustrated in Figure 5. Both men and women agreed that the typical engineer is realistic, investigative and conventional. In addition, they rated themselves as being most similar to these same three Themes. All engineers rated themselves higher on the Artistic and Social Themes than they rated the typical engineer in their field, while women rated themselves as being more similar to the Artistic Theme than did men. Men were more likely than women to view themselves as being enterprising. White engineers were less likely than engineers from other ethnic groups to view the typical engineer as being social or artistic. Comparisons across fields indicated that engineers in all fields rated themselves and the typical engineer in their field highest on the realistic, investigative and conventional themes. (Complete data are presented in Appendix C, Item 43).

TABLE 14

Self-Perceptions of Abilities
of Graduate Engineers Classified by Sex, Ethnicity and Career Field

Percentage rating themselves as "Above Average" or "Highest 10%" when compared with the average adult attending college	TOTAL	SEX		PERCENTAGES ETHNICITY				CURRENT FIELD OF EMPLOYMENT								
		MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	IE	ME	NE	NE
1. Problem solving ability	89	89	90	82	87	90	91a	89	87	94	89	91	81	91	85	83b
2. Academic ability	84	82	87c	74	70	86	90e	87	81	94	83	83	77	81	84	85c
3. Mathematical ability	81	78	85e	76	75	81	88	84	76	90	79	83	60	83	80	85e
4. Drive to achieve	80	80	81	90	80	79	89b	75	70	86	78	82	78	78	74	82a
5. Self-confidence(intellectual)	75	78	70e	82	74	74	84	81	68	83	71	73	72	76	64	79e
6. Leadership ability	73	75	71a	79	71	73	72	78	60	77	71	72	72	76	69	75a
7. Visualization ability	71	74	66e	72	72	71	71	75	64	75	68	69	73	68	70	74
8. Understanding of others	68	66	71b	80	76	66	72b	70	59	69	65	68	69	70	65	71
9. Mechanical ability	64	70	54e	61	55	65	53a	80	72	60	57	62	63	47	80	71e
10. Originality	63	67	58e	64	58	63	65	78	61	70	56	67	78	57	59	62d
11. Writing ability	62	59	67c	58	49	63	55b	67	44	68	54	61	70	60	59	69c
12. Verbal ability	56	55	56	57	46	57	46a	59	45	64	50	57	61	54	50	61b
13. Self-confidence(social)	47	47	49	69	60	45	52e	50	32	44	50	51	47	50	42	45a
14. Public speaking ability	45	46	44	48	34	47	29c	48	40	45	39	48	46	45	40	42
15. Athletic ability	41	47	32e	50	51	40	32b	34	43	44	45	43	52	44	37	37
16. Sensititity to criticism	37	35	40a	30	41	36	45	37	42	31	36	37	37	33	39	47
17. Artistic ability	28	26	32c	35	29	27	24	27	23	23	33	31	28	22	29	32

TABLE 15

Self Perceptions of Personal Characteristics of Graduate Engineers
Classified by Sex, Ethnicity and Current Field of Employment

Percentage rating themselves as "Similar" or "Moderately" on the following personal characteristics	TOTAL	SEX		ETHNICITY				CURRENT FIELD OF EMPLOYMENT								
INSTRUMENTAL CHARACTERISTICS		MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	IE	ME	NE	NE
Very independent	26	23	32	33	25	26	38a	25	25	23	31	29	31	20	30	28
Very active	54	53	65	60	62	53	63a	55	51	53	53	55	57	53	51	48
Never give up easily	70	73	66b	76	76	70	71	82	68	74	69	68	69	72	68	75
Very competitive	61	62	60	62	69	60	70	57	49	68	60	60	62	67	58	70
Very self confident	63	69	55e	70	68	62	79a	57	57	70	63	57	65	60	62	61
Can make decisions easy	60	64	53e	69	71	58	67b	67	58	59	56	55	66	67	58	62
Stands up well under pressure	70	74	63e	81	78	68	75a	59	76	72	68	68	76	69	65	62
Feel very superior	42	46	34e	52	45	41	50a	44	39	45	40	39	41	43	37	45
EXPRESSIVE CHARACTERISTICS																
Very kind	73	74	71	83	73	73	84	64	78	70	76	77	71	73	66	79
Very helpful to others	77	78	76	89	78	77	88a	76	81	81	76	80	69	78	76	78
Very understanding of others	69	68	71	78	73	69	85a	69	65	71	76	69	67	70	68	66
Very aware of other's feelings	68	67	72a	74	64	68	75	56	73	65	73	73	60	72	66	68
Very warm/relations with others	52	49	57c	63	57	51	65a	52	55	39	55	54	47	58	56	46
Very gentle	48	48	50	45	41	49	58	54	47	48	53	50	39	48	47	53
Able to devote self to others	45	47	42a	44	49	44	51	47	52	44	50	41	37	46	44	36
Very emotional	37	32	44e	25	33	37	45a	25	31	41	44	37	35	35	36	30
COGNITIVE CHARACTERISTICS																
Very high problem solving ability	83	84	80a	76	79	84	82	88	84	88	83	82	73	84	81	86
Very high visualization ability	63	68	55e	66	67	63	55	71	64	63	59	64	74	59	65	63
Very high verbal ability	52	51	53	59	50	52	37a	49	39	55	46	53	63	51	49	61
Very high mechanical ability	51	57	43e	57	50	52	39	57	61	47	41	48	59	39	70	57
Very high math ability	72	70	75a	76	65	72	78	78	72	83	73	75	53	72	74	76
Very highly creative	59	62	54c	62	64	58	68	70	58	63	52	64	69	54	58	55
Very artistic	26	23	32e	33	25	26	38a	25	25	23	31	29	31	20	30	28
Very Tolerant of ambiguity	21	23	17c	32	30	19	34e	21	18	26	15	25	24	23	22	19

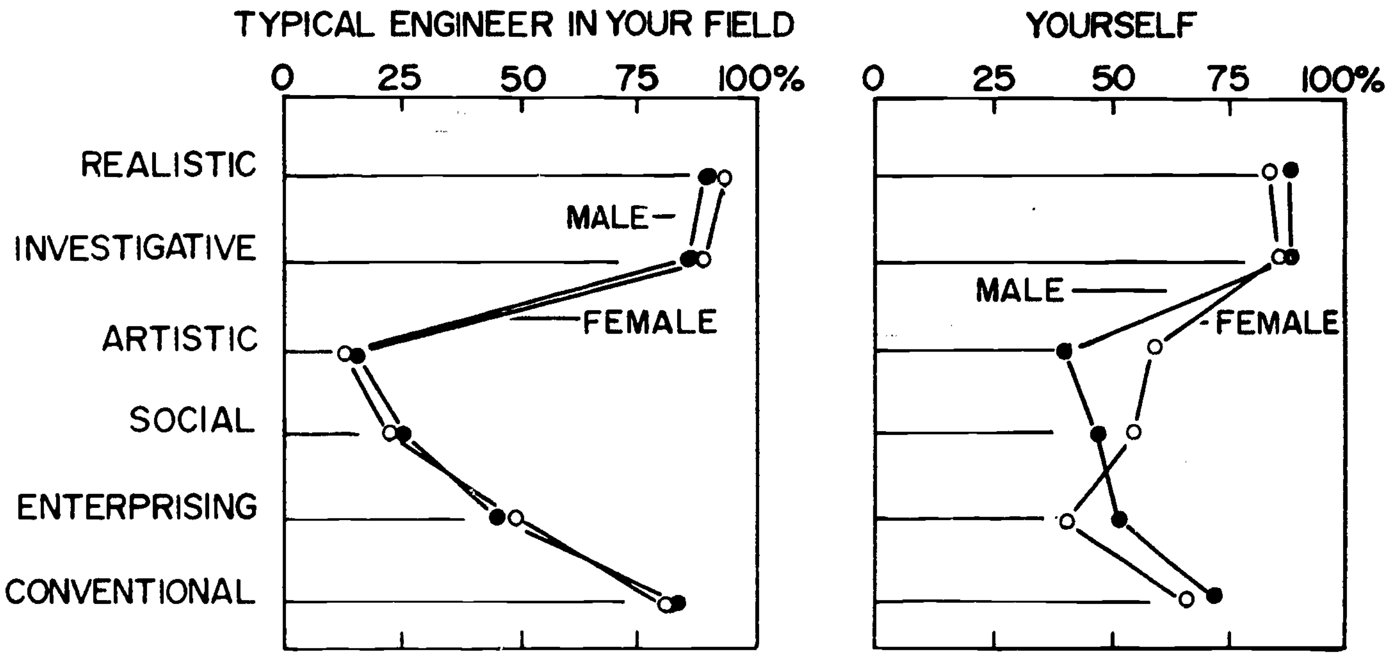

Figure 5 Percentage of Men and Women Engineers Who Rated Various Occupational Themes as "Very Similar" or "Similar" to the Typical Engineer in Their Field and to Themselves.

Student Engineers

Early in the fall semester of 1981, 863 students in 19 engineering schools nationwide responded to the Pre-Engineering Career Survey for students and one interest inventory. Nearly all of these students (91%) are native U.S. citizens. A facsimile of the student survey instrument, containing marginal percentages based upon the total number of students responding to each survey item is presented in Appendix B. Additional survey data for the student group classified by sex, ethnic group and current career choice are presented in Appendix D. In this section of the report, only selected significant differences among the various subsamples (e.g., sex groups, ethnic groups, etc.) will be presented and discussed, not only because some of the subsample groups are very small and generalization to other engineering student groups would be questionable but also because some data are not particularly relevant to the original questions proposed for this study.

Demographic characteristics of students. As indicated in Table 2, 569 men (66%) and 294 women (34%) comprised the engineering student study group. No significant within-sex difference was observed for any ethnic group (see Appendix D, Items 14-16). Most (70%) of the student respondents were White Americans (N=597). This group is labeled Majority (Ma) on Table 16, in Appendix B and in Appendix D. Other ethnic groups consisted of 197 Black Americans (16%), 86 Hispanic-Americans (10%) and 29 Foreign Nationals (3%). It should be noted that Black Americans, Hispanic Americans and women are over-represented in this student sample. However, Appendix D does provide a weighted sample category that can be employed to generalize the results for the overall 1981 beginning engineering student population nationwide by providing proportions quite similar to the national averages (81% men, 19% women; 85% White Americans, 6% Black Americans, 4% White Americans and 5% Foreign Nationals).

At the time that the data were collected, most (73%) of the students were 18 years of age. No sex or career-field difference was related to age, but there was a larger percentage of Foreign Nationals (38%) than of the other ethnic groups in the 19-year-old group. Eighty percent (N=677) of the students had been in a college-preparatory program in high school, and another 18 percent (N=153) came from general-education programs. No sex or career-field difference was observed relative to type of high-school educational program, but smaller percentages of Hispanic Americans (16%) and White Americans (16%) than of Black Americans (15%) and Foreign Nationals (31%). took general-education programs.

General and specific career goals. Engineering students as a group tended to consider a college education first before their high-school years, with a larger percentage of women (93%) than men (83%) considering a college education at that time (see Appendix D, Item 1). The final decision regarding a college education also tended to be made by a majority (54%) of the students before high school. Again, a larger percentage of women (6[illegible]) than men (49%) made their final decision at that time. As expected, choosing engineering as their college major was made somewhat later in time than making the decision to go to college. A majority (55%) of the students made the decision regarding an engineering career first before the 11th grade in high school, and their final decision was made somewhat later in time. Nearly all of the students (86%) had made their final decision before or during the 12th grade.

TABLE 16

Demographic Characteristics of Fall '81 Freshman and Sophomore Engineering Students

CHARACTERISTIC	TOTALS		SEX		ETHNICITY				CURRENT MAIN CAREER CHOICE								
SEX	WT	UW	MA	FE	BL	HI	WH	FN	AE	AR	BE	CH	CE	CO	EE	IE	ME
Male	81	66	100	0	60	69	66	79	78	65	36	48	78	60	79	36	82
Female	19	34	0	100	40	31	34	21	22	35	66	52	22	40	21	64	18e
ETHNIC GROUP																	
Black	6	16	15	19	100	0	0	0	4	6	21	8	10	24	27	9	22c
Hispanic	4	10	11	10	0	100	0	0	9	18	13	10	19	7	11	18	12
Majority (White, Asian, Pac. Isl.)	85	70	70	70	0	0	100	0	83	77	66	81	64	67	58	68	63
Foreign national	5	3	4	2	0	0	0	100	4	0	0	1	8	3	5	5	3
CITIZENSHIP																	
U.S. native	91	91	90	93	93	86	96	0e	90	88	92	97	90	92	89	91	87
U.S. naturalized	4	6	6	5	7	14	4	0	6	12	8	2	2	6	7	5	10
Foreign national:	5	4	4	2	0	0	0	100	4	0	0	1	8	3	5	5	3
Europe/Other English speaking	3	6	6	8	0	0	11	75	0	0	50	0	40	0	0	0	0
Latin America/S. America/Carribean	61	50	57	31	0	100	0	44	40	0	0	50	20	75	60	50	80
Asia	33	40	31	61	0	0	89	41	40	0	50	50	40	25	33	50	20
Middle East	1	2	3	0	0	0	0	4	20	0	0	0	0	0	0	0	0
Africa	2	2	3	0	0	0	0	4	0	0	0	0	0	0	7	0	0
YEAR OF BIRTH																	
1962	22	23	25	21	19	21	24	38e	13	29	21	22	27	21	26	18	23
1963	75	73	71	75	70	76	74	48	83	65	74	74	71	74	70	77	72
1964	3	4	4	4	12	3	2	14	4	6	5	5	2	5	4	5	5
TYPE OF HIGH SCHOOL EDUCATION PROGRAM																	
General education	20	18	19	16	25	16	16	31b	13	6	16	12	19	21	16	23	20
Vocational education	3	2	3	1	3	1	2	10	3	0	3	0	5	3	5	5	0
College preparatory	77	80	78	83	72	83.	82	59	84	94	81	89	76	76	79	73	80
TYPE OF HIGH SCHOOL																	
Church-related	6	8	8	8	11	19	6	7	9	6	11	7	13	8	7	0	12
Private: Nonsectarian	5	5	5	4	7	4	4	17	7	6	3	8	7	5	4	0	6
Public	88	86	85	87	81	74	89	76	84	77	84	85	81	87	88	96	82
Military/Other	0.	1	0.	1	1	3	1	0	0	12	3	0	0	0	1	5	0
COLLEGE IN YOUR (PARENTS') HOME STATE																	
YES	72	69	70	68	42	70	77	46e	65	77	61.	63	74	66	70	73	70
HOW CLOSE TO CAMPUS IS PARENTS' HOME																	
Less than 25 miles	27	24	21	28b	26	36	21	35e	12	35	24	18	42	18	28	27	19b
25-100 miles	21	23	26	16	15	16	26	21	27	24	19	26	18	15	24	14	26
101-200 miles	22	21	21	19	14	5	26	7	33	18	14	20	15	20	19	18	19
201-500 miles	17	19	18	19	25	20	17	10	9	6	16	18	13	33	21	18	23
Over 500 miles	14	14	13	17	21	24	11	28	19	18	27	17	13	15	9	23	14
(No of Cases.)	(848)	(863)			(139)	(90)	(605)	(29)	(59)	(17)	(38)	(87)	(63)	(76)	(200)	(22)	(103)

NOTE: SAMPLE SIZES ARE IN PARENTHESES.

It is apparent that at least some of the students made their final decision to study engineering before they understood the nature of an engineering career. Of special importance is the observation that 15 percent of the men and 23 percent of the women reported their lack of understanding the nature of engineering after beginning college as engineering students (see Appendix D, Item 1). This lack of understanding could explain, at least in part, attrition from engineering by some students after becoming more familiar with a given engineering program. Moreover, 16 percent of the students reported that they will not, or probably will not, become an engineer (see Appendix D, Item 12). A larger percentage of women (22%) than men (11%) was in this group.

Most students (85%), however, were at least somewhat certain about becoming an engineer, with 36 percent of them being definite about their plans (see Appendix D, Item 12). Men were more likely than women to express at least some certainty about becoming an engineer (88% vs. 78%, respectively). Of the ethnic groups, larger percentages of Hispanic Americans (55%) and Foreign Nationals (45%) than of Black Americans (35%) and Majority students (19%) were definite in their plans to become engineers.

When asked about the highest educational degree level they either desired or expected (see Appendix D, Item 3), a majority (71%) of the students desired at least a Master's degree, but only 45 percent expected to attain such a high degree. Only small sex differences were found with respect to highest degree level desired, with slightly more men (29%) than women (24%) desiring a doctorate. No sex difference in expected degree level was observed for these students, nor was any significant ethnic difference or career-field difference found in degree level aspirations. Only a few small, but significant, differences were observed among career-field groups for educational level expectations.

With respect to the number of times that students had changed their general career goals (see Appendix D, Item 5), 37 percent of the students responded with no change, and another 27 percent had changed goals only once. It is interesting, and perhaps not surprising, to note that more men (42%) than women (28%) had not changed their general career goal. However, when asked to indicate how many times students had changed their specific career goals since entering high school, the largest percentage of students (41%) indicated no change in specific career goal. No sex difference was found for this question. Moreover, no ethnic or career-field difference was found for either one of these two questions.

The largest percentage of students (23%) chose electrical engineering as their main career-field choice. Table 17 presents these data for choices of engineering fields only. Complete data are presented in Appendix D, Item 6. The other choices drawing fairly sizable numbers were mechanical engineering (12%), chemical engineering (10%), computer engineering (9%), aeronautical engineering (8%) and civil engineering (7%). More women than men selected chemical engineering (16% vs. 7%, respectively), biomedical engineering (9% vs. 2%, respectively) and computer engineering (10% vs. 8%, respectively). On the other hand, more men than women selected electrical engineering (28% vs. 15%, respectively), mechanical engineering (15% vs. 6%, respectively) and aeronautical engineering (9% vs. 5%, respectively).

TABLE 17

Response Percentages of Current Main Career Choice
of Fall '81 Students

CURRENT MAIN CAREER CHOICE	TOTALS WT	TOTALS UW	SEX MA	SEX FE	ETHNIC GROUP BL	ETHNIC GROUP HI	ETHNIC GROUP WH	ETHNIC GROUP FN
Electrical Engineering	24	23	28	15	40	23	19	32
Computer Science/Programming	18	2	1	3	3	1	2	0
Mechanical Engineering	12	12	15	6	17	13	11	11
Chemical Engineering	12	10	7	16	5	10	12	4
Computer Engineering	11	9	8	10	13	6	8	7
Aeronautical Engineering	9	8	9	5e	2	7	10	11
Civil Engineering	7	7	9	5	4	13	7	18
Undecided/Unknown	4	5	4	6	0	2	6	7
Bio-Medical Engineering	3	4	2	9	6	6	4	0
Other Engineering	2	2	2	3	2	1	3	0
Mining/Materials/Metall. Engineering	2	2	2	1	1	4	2	0
Architectural Engineering	2	2	2	2	1	3	2	0
Petroleum Engineering	1	0.	υ.	1	1	0	1	0
Nuclear Engineering	1	1	1	2	0	1	2	4
Medicine	1	1	1	2	2	1	1	0
Mathematics/Statistics	1	0.	0	0	0	0	0.	0
Law	1	0.	0.	1	1	1	0.	0
Industrial Engineering	1	3	1	5	1	4	2	4
Environmental Engineering	1	1	1	2	0	0	1	0
Engineering Science	1	1	1	1	0	0	1	0
Electrical/Electronics Technology	1	1	1	1	1	1	1	4
Agricultural Engineering	1	1	1	1	0	0	1	0
Management	0.	1	0.	1	0	1	1	0
Geological/Mineral Engineering	0.	0.	0.	0	0	0	0.	0
Education	0.	0.	0.	0	0	0	0.	0
Creative Arts	0.	0.	0.	0	0	0	0.	0
Construction Technology	0.	1	1	3	0	0	1	0
(No. of Cases)	(841)	(855)	(566)	(289)	(136)	(90)	(601)	(28)

When asked about possible career alternatives, for which more than one alternative could be selected, electrical engineering and computer engineering were chosen more often (49% and 45%, respectively) than other engineering and nonengineering fields. Men selected electrical engineering more frequently than did women (55% and 36%, respectively), but no sex difference was found for computer engineering.

A large number of sex, ethnic group and main career-field differences were also observed for career alternative choices (see Appendix D, Item 6). However, while only a few differences were observed in main occupational choices, the profiles of occupational choices were appreciably different across the major groupings. This diversity of occupational choices, which infers diversity of occupational interests, might be very useful in explaining differences in career planning and in other career-related behavior (e.g., engineering retention and transfer).

Factors influencing the pursuit of engineering careers. Students were asked to rate 49 factors with respect to their importance for encouraging them to study engineering. Ratings were made by using a five-point scale ranging in importance from "none" to "extreme". Data for this survey question, based upon "moderately" to "extremely" ratings on the importance dimension are presented in Appendix D as Item 2. Table 18 presents the rank order of the factors based upon the percentages of students rating each factor as "moderate", "great" or extreme" in importance. The most frequently cited factors were work-related characteristics, both extrinsic and intrinsic, followed by school-related factors, people-related factors and activity/hobby-related factors.

Some of the extrinsic factors rated very high in importance were job opportunities (93%), salary (90%), job security (85%), job flexibility (80%), rapid advancement (75%) and prestige/status (68%). Important intrinsic factors were challenge (88%), creativity (85%), curiosity (84%), independence (78%), problem-solving activities (83%), type of work (81%) and the interesting nature of the work itself (81%). Important school-related factors included high-school mathematics and science courses (66% and 69%, respectively) and career information (67%). People-related factors of importance included wanting to contribute to society (65%) and to be of service to people (58%) and the influence of a student's father or male guardian (57%). Of particular interest to this study is the fact that only 33 percent of the students indicated the importance of interest inventories. Moreover, only 34 percent indicated the importance of pre-college special seminar programs.

Of the 44 career-influence factors examined, 19 of them yielded significant sex differences, 34 factors indicated significant ethnic differences and only 11 factors yielded significant career-field differences (see Table 18). In general, women seemed to be influenced by a greater diversity of factors than did men. Specifically, larger percentages of women than of men seemed to be influenced by work characteristics, engineering-related subject matter and by people other than friends. Larger percentages of men than of women indicated the important influences of engineering-related hobbies, technical publications and friends with similar interests.

Overall, larger percentages of students in minority groups than in the majority group indicated the important influence of many of the significant

TABLE 18

Career Influence Factors of Students by Sex, Ethnicity and Current Career Field

PERCENTAGES

Factors that "Moderately" to "Extremely" influenced students to pursue an engineering career:	WT TO	UW TO	SEX MA	SEX FE	ETHNICITY BL	ETHNICITY HI	ETHNICITY WH	ETHNICITY FN	CURRENT FIELD OF EMPLOYMENT AE	AR	BE	CH	CE	CO	EE	IE	ME
PEOPLE:																	
Father (m. guardian)	57	57	58	55	41	56	61	55c	44	53	61	67	59	55	55	64	68
Friends with similar interests	49	51	55	44b	51	62	49	62	43	65	50	57	44	50	56	54	51
MALE H.S. math/sci. teacher(s)	45	46	44	49	50	58	43	59b	45	47	45	61	40	42	47	32	53
MALE practicing engineer(s)	41	44	44	43	44	56	42	41	39	24	45	48	47	33	47	68	49
Mother (f. guardian)	37	38	36	44a	38	46	37	38	35	41	39	41	41	34	39	45	41
MALE engineering student	34	37	36	37	45	51	32	45c	32	24	32	40	32	28	43	73	40b
Other relative	31	32	33	30	34	40	30	31	32	18	26	30	37	26	35	41	41
FEMALE H.S. math/sci. teacher(s)	25	28	24	35c	36	48	23	31e	17	41	21	38	30	29	31	27	27
MALE H.S. counselor	21	24	24	25	36	22	22	28b	32	23	16	25	22	26	27	32	22
FEMALE engineering student	18	19	15	27d	28	32	15	28e	15	29	24	23	19	13	20	32	19
FEMALE H.S. counselor	18	22	20	26	30	33	19	21c	17	18	24	21	24	22	26	36	19
FEMALE practicing engineer(s)	11	13	9	22e	23	20	9	21e	10	18	24	15	10	11	12	23	14
COURSES:																	
H.S. science course(s)	70	69	69	69	67	69	69	72	67	65	63	94	54	66	74	59	67e
H.S. math course(s)	66	66	64	71a	67	70	65	83	65	76	55	79	60	64	70	54	63
Career education course	23	27	26	28	41	37	21	34e	22	47	37	29	35	28	33	27	17a
GUIDANCE AND TESTING:																	
Career information	67	67	66	68	77	66	64	66a	62	71	71	70	60	72	66	73	73
Aptitude test	45	42	44	38	42	59	40	52b	42	41	37	45	41	41	45	46	50
Interest inventory	35	33	34	32	35	41	31	52a	32	35	29	33	30	33	34	41	39
Pre-college special seminars	29	34	28	45e	52	55	26	38e	22	53	50	40	32	37	39	46	34
ACTIVITIES:																	
Related work experience	26	28	29	25	27	46	25	31c	16	53	29	28	35	21	36	27	29a
Outdoor activities	22	25	26	22	19	42	23	41d	29	23	21	17	40	13	22	18	37c
Science fair activity	15	14	15	12	18	19	11	31c	16	18	18	9	14	12	17	14	17
Science club(s)	11	11	11	11	17	25	8	14e	17	6	13	17	3	8	13	4	16
Farm experiences	6	9	9	8	4	12	9	17	7	23	8	2	14	8	7	18	15b
"Junior Achievement"	5	7	6	8	13	13	3	24e	6	0	11	3	6	5	10	14	8
HOBBIES:																	
Using a computer	47	42	45	37a	46	54	39	55a	41	29	34	38	[illegible]	[illegible]	55	27	25e
Electrical/mechanical hobby	43	37	48	17e	44	45	34	52b	26	29	18	[illegible]	[illegible]	[illegible]	62	18	58e
Construction hobby	33	32	40	18e	34	45	29	55c	32	53	[illegible]	[illegible]	[illegible]	13	43	27	49e
Hobby magazine	16	16	18	11b	19	24	13	24a	23	12	[illegible]	[illegible]	14	10	22	18	22
INTRINSIC VALUES:																	
Challenge	87	88	85	94d	96	94	86	83c	81	94	87	93	94	88	89	91	90
Like problem-solving	83	83	80	89c	87	91	81	79	80	94	90	89	86	82	83	96	80
Curiosity	83	84	82	88a	90	91	82	76b	83	94	90	87	81	83	82	91	85
Creativity	83	85	84	86	94	89	81	97c	88	100	89	82	82	85	86	86	89
Interesting work	82	81	81	82	85	91	79	93b	74	77	82	78	89	80	86	82	85
Type of work	81	81	81	82	83	88	79	83	84	88	79	87	89	78	79	86	86
Independence	76	78	75	83b	85	89	74	79b	70	71	82	82	87	72	78	86	84
Wanted to contribute to society	61	65	63	68	74	81	60	72d	59	77	74	70	75	57	63	55	69
Wanted to be of service	50	58	55	64b	66	74	53	55c	42	76	66	55	68	47	57	59	60a
EXTRINSIC VALUES:																	
Job opportunities	91	93	92	95	96	93	93	83	85	88	89	99	95	91	94	95	97a
Salary	90	90	90	92	94	90	90	76a	88	94	89	95	90	87	90	91	94
Job security	82	85	83	88a	91	88	84	55e	75	88	84	92	84	80	83	95	87
Job flexibility	78	80	78	85b	84	90	77	86b	75	82	89	84	86	68	81	82	83
Rapid advancement	74	75	73	77	83	87	71	76c	68	71	76	82	78	76	72	86	84
Prestige/status	64	68	66	73a	74	80	66	66a	65	65	71	74	71	62	65	73	73

career-influence factors. Specific ethnic-group differences on the 34 significant career-influence factors are indicated in Table 18. These differences appear to be divided somewhat evenly among the four categories (work-related, school-related, people-related and activity/hobby-related). However, the 11 factors for which significant career-field differences were found are primarily people-related and activity/hobby-related factors.

Participation in special high-school programs. Overall, most students had not participated in any special career-oriented program while in high school (see Appendix D, Item 9). Slightly more than one-third of the students (36%) were involved in science or math contests. Even smaller numbers of students participated in college recruitment programs for their expected career fields (22%), high-school science fairs (19%), summer engineering seminars (16%) and summer math or science seminars (10%). However, one-third to one-half of the students reported that such programs were not even available, except for regional or national science fairs.

A few significant differences among ethnic groups and career-field groups were observed. Not surprisingly, a larger percentage of Foreign Nationals than of the other ethnic groups indicated that each of these programs was not available to them. Black American and Hispanic American students were more likely than the other ethnic groups to have participated in college recruitment programs in engineering, including summer mathematics and science programs. Women students also tended to report having participated in pre-college summer recruitment programs more frequently than did men. On the other hand, Majority students reported participation in national and regional science and mathematics contests more frequently than did other ethnic groups. Science or mathematics contests were more available to all students than were the other special programs. It would appear that the impact of special pre-college career-oriented programs for high-school students has been effective primarily for women and minority students.

Influence of career-oriented interest measurement. The roles of interest inventories in influencing career decisions was examined by several questions on the student survey instrument. These questions and their accompanying data are presented as Item 4 in Appendix D. Overall, only 33 percent of the students reported that they had taken an interest inventory, and another 27 were uncertain about having taken one. Of the 280 students who had taken an interest measure, 26 percent had the Strong-Campbell Interest Inventory, 19 percent had the Self-Directed Search, 12 percent had a Kuder interest measure and 47 percent indicated "some other" interest measure. (It is speculated that this latter group probably could not remember which interest measure they had taken). None indicated having taken the Purdue Interest Questionnaire. With respect to the impact of the various interest inventories, most of the respondents indicated that these measures had uncertain or no value for them. However, they did tend to indicate that these interest measures reflected their interests and that the interpretative materials or procedures were generally understandable and helpful.

Perceived career-field characteristics. Students rated a large number of work characteristics with respect to how important each characteristic was to them personally in considering and/or selecting their particular career fields. A five-point scale, ranging from "none" to "extreme," was employed to rate each of 56 work, or job, characteristics. Table 19 presents the percentages of students rating each work characteristic as having "great" or "extreme" importance for the total group classified by sex, ethnic group and career-field choice (also see Appendix D, Item 10). The importance of having an income that permits comfortable living was indicated by the largest number of students (87%). Next in importance were the intrinsic characteristics of engaging in satisfying work (84%), using one's special abilities and aptitudes (81%) and engaging in challenging and stimulating work (78%). Work that permits having a pleasant home and family life also was viewed to be important by a large number (82%) of students. In contrast, relatively few students indicated the importance of the presence of either many fine detailed tasks (29%) or only a few fine detailed tasks (11%), being told what to do (9%) and being told how to do one's work (7%).

Only a few highly significant sex, ethnic group and career-field differences were found for many work characteristics (see Table 19). For the characteristics indicating sex and ethnic differences, Women, Black Americans and Hispanic Americans placed higher priority than did others on altruistic factors, e.g., contributing to society and helping people. A few work characteristics also yielded highly significant differences among students classified by main career choice. Outdoor work was important to civil (52%) and agricultural (47%) engineering majors, compared to the total group (24%). Dealing with things and machines was important for 67 percent of the mechanical and 62 percent of the electrical engineering majors, compared to 48 percent overall, and controlling expenses (71%) and moving into management (92%) were important for industrial engineers, compared to the total student group (26% and 37%, respectively). Details concerning all of the other significant differences can be focused upon by examining Table 19 and/or Appendix 10, Item 10.

Self-perceptions of abilities, habits and other personal characteristics. Student's perceptions of their abilities relative to their same-age peers were examined in various areas. A seven-point scale ranging from the lowest 25 percent to the highest five percent, was employed to rate 13 abilities. Table 20 presents the percentages of students rating each ability as above average to highest five percent, with data presented for the total group classified by sex, ethnic group and career-choice field (also see Appendix D, Item 13).

More than 80 percent of the students rated themselves as being above average in math ability (86%), science ability (84%) and problem-solving ability (83%). Reading ability was rated above average by 73 percent of the students, with personal relations ability drawing 72 percent of the students. Mechanical ability and spatial visualization ability were rated above average by 71 percent of the students, and management ability drew 70 percent. Leadership ability also was rated above average by many students (69%). All of the abilities examined received above average ratings by more than 50 percent of the students, except for public speaking ability (44%) and artistic ability (42%).

Significant sex differences were found for mechanical ability and athletic ability, for which more men (78% and 67%,respectively) than women (59% and 50%, respectively) indicated above average ratings. On the other hand, more women than men indicated that they were above average in reading ability (80% and 69%, respectively) and in writing ability (66% and 56%, respectively).

TABLE 19

Importance of Work Characteristics of Students by Sex, Ethnicity and Current Career Choice

Percentage indicating each as "Greatly" or "Extremely" Important for their career	TOTALS		SEX		ETHNICITY				CURRENT FIELD OF EMPLOYMENT								
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AR	BE	CH	CE	CO	EE	IE	ME
An income allowing comfortable living	85	87	86	87	92	88	85	86	82	82	92	88	83	85	91	95	88
Engage in satisfying work	83	84	81	90c	85	82	83	90	81	94	86	86	79	83	80	95	88
Use my special abilities and aptitudes	81	81	78	85b	85	88	78	86	78	76	78	88	75	83	84	76	80
Pleasant home and family life	80	82	83	80	83	81	82	76	80	88	89	80	79	80	84	86	81
Engage in challenging/stimulating work	80	78	75	83b	77	86	78	69	77	82	84	83	72	84	80	81	75
Advance myself economically	74	75	73	77	77	78	74	69	75	76	70	74	77	78	78	95	71
Employment stability	71	74	71	81b	77	76	73	75	66	88	73	72	75	66	79	95	76
Innovate and propose new ideas	70	67	69	65	77	74	63	83c	67	71	68	70	61	72	71	52	72
Company acknowledges family respons	67	69	70	69	70	69	70	57	54	76	59	78	63	63	73	71	77a
Live in desirable geographic location	66	67	66	69	64	75	66	65	65	65	81	66	63	71	66	86	66
Work with interesting people	65	71	65	81e	75	77	68	83	62	71	76	73	77	67	69	91	69
Know what work responsibilities are	61	65	62	70a	73	74	61	79b	59	88	68	65	64	60	67	76	71
Manage my own work with much freedom	58	59	58	60	61	73	55	76c	62	59	49	57	53	63	57	57	62
Problems with no ready-made solutions	53	50	52	47	58	63	45	76e	57	41	54	47	48	54	55	24	53
Deal with ideas/theories/principles	51	48	48	48	58	54	45	59b	49	47	49	51	43	51	52	29	52
Travel	48	52	45	64e	56	60	49	65a	58	71	54	58	56	55	48	52	42
Exercise leadership	45	51	49	55	63	64	46	45c	48	59	57	53	56	46	51	76	48
Perform duties under flexible hours	43	46	42	53b	51	47	44	48	42	65	54	49	49	43	46	57	36
Make contributions to society	43	51	46	60d	67	59	46	55d	52	41	59	56	52	49	48	48	51
Deal with things or machines	43	48	52	42b	64	62	42	59e	45	35	32	37	39	58	62	33	67e
Participate in work-related decisions	42	47	42	54c	54	54	44	48	43	53	35	43	47	47	49	71	43
Take personal leave (e.g., maternity)	41	43	37	54e	46	49	42	32	35	47	57	49	41	37	38	43	46
Help people	41	49	45	56b	60	63	43	59e	48	59	68	45	48	37	47	52	44
Prepare for top-level career	40	47	42	57d	56	57	43	55b	43	47	46	50	44	49	49	48	39
Set up research pilot projects	39	40	40	39	45	49	38	35	61	23	38	36	36	40	41	33	41a
Develop a working model	39	43	43	41	51	60	38	34d	52	24	49	40	34	37	48	29	56b
Interact a great deal with other people	37	45	38	59e	56	57	40	62d	38	65	54	34	50	45	42	75	48b
Enhance my social status and prestige	37	43	41	45	50	52	40	52a	43	59	46	39	45	51	42	52	43
Deal with people	36	44	37	58e	56	57	39	55d	38	53	68	48	57	36	33	64	47d
Trouble shoot and/or meet emergencies	35	36	34	39	40	41	35	28	46	53	32	36	31	32	39	19	36
Engage in variety of technical work	35	41	40	42	51	48	37	48b	36	65	40	39	36	38	55	33	43b
Plan best use of equipment/materials	33	41	39	44	50	44	37	54b	43	53	34	39	44	39	43	31	49a
Develop/test hypotheses/generalizations	32	34	31	37	43	41	30	45b	38	24	27	39	18	36	38	24	40
Be assigned to diverse areas of company	31	36	30	49e	45	44	33	38a	25	29	39	38	36	31	39	52	36
Move into a management career	30	37	34	43a	47	38	35	35	16	41	46	37	38	39	38	91	39e
Presence of many fine detail tasks	29	30	30	29	29	45	27	46c	38	59	24	23	48	23	31	33	32b
Develop economical product/process	29	33	31	38a	42	38	30	31a	28	24	38	36	31	31	32	52	37
Evaluate performance	27	32	31	35	36	43	30	31a	36	35	30	29	38	32	31	48	35
Work outdoors	26	24	26	20	12	31	25	45d	33	47	14	21	52	11	22	9	22e
Work with a small group	25	27	26	27	29	30	25	28	23	18	22	33	29	21	32	15	28
Simplify production method	25	29	28	33	33	34	27	45	29	29	19	27	28	32	31	71	34b
Evaluate ideas/theories/principles	25	28	27	32	35	38	25	34b	32	12	24	36	25	20	30	24	33
Sell ideas to people	23	25	24	28	32	32	22	34a	17	35	19	29	21	23	28	38	28
Do basis scientific research	22	23	22	25	30	34	19	38c	20	18	31	[illegible]	8	18	28	19	19a
Control expenses	19	26	23	32b	37	28	23	17b	13	41	22	24	34	20	23	71	33e
Little pressure to perform well	18	22	20	26	32	35	17	36e	25	29	13	21	15	20	25	33	24
Work by myself	17	18	17	18	20	22	16	31	16	23	24	23	18	11	20	14	17
Perform departmental liaison work	17	25	20	35e	32	33	22	36b	17	35	30	26	20	31	26	67	25b
Work with customer rep's	16	18	15	24c	20	24	17	21	10	29	11	18	20	17	17	52	21b
Take part in in-service courses	16	18	16	21	20	22	16	21	17	23	17	19	21	16	24	14	11
Routine operations/calculations/etc	16	20	17	25b	22	31	17	32b	19	12	25	25	25	15	21	38	14
Work indoors	14	18	17	20	26	38	12	35e	6	18	19	17	21	25	25	32	15a
Presence of few/no fine detail tasks	12	11	10	13	11	10	12	11	13	6	13	14	10	5	11	14	8
Conduct negotiations	11	17	14	22b	22	28	13	24c	15	18	22	24	20	13	15	19	21
Be told what work to do	8	9	8	10	11	12	7	10	6	12	8	7	13	7	9	9	9
Be told how to do my work	5	7	6	9	11	8	6	17a	4	12	5	11	8	5	6	0	9
(No. of Cases)	(816)	(326)	(544)	(282)	(132)	(89)	(576)	(28)	(68)	(17)	(37)	(85)	(59)	(73)	(193)	(21)	(98)

TABLE 20

Above Average Ratings of Various Abilities of Fall '81 Student Engineers
by Sex, Ethnicity and Current Career Choice

	TOTALS		SEX		ETHNICITY				CURRENT FIELD OF EMPLOYMENT								
ABILITIES	WT	UW	MA	FE	BL	HI	WH	FN	AE	AR	BE	CH	CE	CO	EE	IE	ME
Math ability	88	86	86	85	76	86	87	100c	91	88	84	91	82	85	88	86	84
Science ability	88	84	85	82	72	87	86	86c	88	82	86	95	73	79	87	82	76b
Mechanical ability	76	71	78	59e	62	73	74	69a	81	77	78	70	65	66	77	48	87c
Problem-solving ability	85	83	83	81	74	80	84	93b	84	81	81	87	75	88	84	77	86
Spatial visualization ability	74	71	73	67	61	74	72	80a	84	77	74	72	68	68	74	70	72
Athletic ability	63	62	67	50e	66	60	61	59	64	59	51	67	77	57	62	54	62
Artistic ability	40	42	40	46	49	45	40	43	42	82	38	30	53	46	40	32	45b
Leadership ability	65	69	67	72	77	71	67	55a	73	71	69	70	63	71	68	91	66
Public speaking ability	44	44	44	45	56	43	42	45a	39	24	38	45	44	50	48	59	38
Writing ability	60	59	56	66b	61	57	60	45	59	65	68	64	47	65	54	55	57
Personal relations ability	69	72	70	76	75	78	72	52a	74	82	76	70	68	71	72	91	73
Reading ability	72	73	69	80c	75	76	73	45b	71	59	81	76	69	80	69	73	70
Management ability	70	70	69	73	70	74	70	75	63	59	62	69	68	76	76	91	70
(No. of Cases)	(774)	(786)	(517)	(269)	(123)	(85)	(553)	(25)	(67)	(17)	(34)	(81)	(53)	(71)	(183)	(20)	(93)

Ethnic differences were found for 9 of the 13 ability self-ratings. A larger percentage of Black Americans than of the other ethnic groups rated themselves above average on leadership ability (77%) and public speaking ability (56%). On the other hand, Black American students had the lowest percentages of above-average self-ratings, compared to other ethnic groups, on math ability (76%), science ability (72%), mechanical ability (62%) and spatial visualization (61%). These percentages of endorsements for Black Americans were still substantial. As expected, Foreign Nationals had the highest percentages of above-average ratings on math (100%) and problem solving (93%) and the lowest percentages of above average self-ratings on personal relations ability (52%) and reading ability (45%).

Only three significant differences among current career-choice fields were observed for above-average self-ratings of specific abilities. As might be expected, a larger percentage of students in architectural engineering (82%) than in other career fields rated themselves as being above average in artistic ability, and chemical engineering students had the largest percentage of above average self-ratings for science ability (95%). It is interesting to note that students in industrial engineering had a much lower percentage of above-average ratings for mechanical ability (48%), and mechanical engineering students had the highest (87%) compared to those of the other career-field groups.

Several questions related to study habits and to other behavioral situations were rated by students relative to the extent that each behavior was characteristic of themselves. A five-point scale, ranging from "none" to "extreme", was employed to rate each behavior. The results for these questions, based upon each of the five scale points, are presented in Item 11 of Appendix B for the total student group. Item 11 of Appendix D contains only the "great" and "extreme" rating categories for students classified by sex, ethnic group and career-field choice. However, when ratings in the moderate category are added to those in the two highest categories, the results reflect behaviors that are conducive to good adjustment.

In general, students reported that they tend to relate facts or concepts from one course to another when studying (92%), and few students (7%) reported failure to finish an assignment because of "day dreaming" or "putting it off". Many students indicated that they thought about applications of the material when studying (86%) and that they tended to memorize facts (78%). When asked about what they did in high school for hard-to-understand or hard-to-solve problems, 84 percent of the students reported that they kept at the problems until they were understood and/or solved. Fairly large numbers of students also indicated (1) that they usually asked someone to show them how to look at or to solve problems (77%) and (2) that they spoke to people about problems in the hope of gaining new insight into a given problem (79%).

In unpleasant situations, a large majority of the students (89%) reported that they try to react immediately and figure out the best solution. Moreover, they tended to take advantage of opportunities that were presented to them (91%). Many students characterized themselves as being friendly and easy-going (91%), but they also tended to enjoy themselves when alone (77%). Some students characterized themselves as striving to satisfy the expectations of others (44%) and as not worrying about things (44%). Overall, very few students responded in the "greatly" or "extremely" characteristic direction to the behavioral statements having negative connotations (see Appendix D, Item 11). Few of the questions concerning particular personal behaviors demonstrated significant sex, ethnic-group or career-field differences, and the observed differences were not very strong. Pursuit of such questions in other research studies of graduates in other career fields could prove to be both interesting and fruitful, but it is beyond the scope of this project.

Parental education levels, occupations and attitudes. A majority of the students surveyed had parents who had attended college (68% fathers; 59% mothers). A small majority (54%) of the students had fathers with college degrees, and 39 percent of the mothers of students held college degrees. More graduate degrees were held by students' fathers (23%) than by students' mothers (11%). No difference in the educational levels attained by parents was observed when students were grouped by sex and by career-choice field (see Appendix D, Item 20). The fathers of majority students were more likely to have graduated from high school (92%) and college (58%) than were the fathers of students in the other ethnic groups. The mothers of Black American and Majority students were more likely to have graduated from high school (87% and 95%, respectively) and college (41% for each group) than were the mothers of Hispanic Americans (77% high school; 30% college) and Foreign Nationals (72% high school; 41% college).

With regard to parental occupations, more fathers (66%) than mothers (35%) held professional or managerial positions (see Appendix D, Item 21). No sex difference related to parental occupations was observed, and the only significant ethnic-group and career-field differences concerned the professional/managerial occupational level. Seventy-two percent of the majority students and 67% of the Foreign Nationals had fathers who held professional or managerial positions, compared to Black Americans (53%) and Hispanic Americans (46%). In contrast, a significantly larger percentage of the Black American students (45%) had mothers in professional or managerial positions compared to Majority (34%), Hispanic American (34%) and Foreign National (32%) students. No practical difference among the career-field groups was noted for the occupational levels of student mothers. Overall, students' fathers tended to have slightly higher educational levels and occupational levels than did the mothers of students in this study. Complete data regarding these issues are presented in Appendix D, Item 20 and Item 21.

Students were also asked about the attitudes of their parents toward going to college and toward studying engineering. These data are presented in Item 8 of Appendix D. Students reported that their parents intended to press them about going to college but permitted them to make the final decision. Moreover, most students also indicated that the decision to study engineering was their own, even though their parents were interested in their selections of engineering majors. No significant sex or ethnic group difference was found concerning these questions, nor was there any meaningful difference among career fields for these questions.

Comparisons Between Graduate And Student Engineers

Although the surveys used for the graduate and undergraduate phases of the study were quite different, there was some overlap among the items. In particular, on both surveys, respondents rated their abilities in certain areas, the importance of various factors in their decision to study engineering and the importance of various job characteristics. Because the response scales for these common items were different on the graduate and undergraduate forms, no direct statistical comparison could be made. However, the items could be rank-ordered within each group, and the relative orderings were then compared.

Self-perceptions of abilities. Table 21 presents the percentages of graduate engineers and undergraduate engineering students rating themselves as being above average on a variety of abilities. The relative orderings of the abilities for both graduates and students are quite similar. For both groups, the highest rated abilities were in the areas of mathematics and problem solving. It is interesting to note that the majority of respondents for both samples rated themselves above average on most of the items. However, for both samples, less than one-half of the respondents rated themselves as being above average on artistic and public speaking abilities. Somewhat more students than graduates seemed to rate their athletic abilities high (relative to other abilities). Similar sex differences were found for graduates and students, with more men than women rating themselves high on athletic and mechanical abilities and more women than men rating themselves high on writing ability. Significant differences among the ethnic groups were generally not consistent across samples.

Factors influencing decisions to study engineering. Both graduates and students rated the importance of various factors in influencing their decisions to study engineering. Items that were rated by both samples are presented in Table 22. The percentages presented in Table 22 are not comparable across samples, but the rank-ordering of the items within categories can be compared. It is evident that these relative orderings are very similar. For both groups, characteristics of the work were most influential. More students than graduates rated salary and security as being important to their decisions regarding engineering careers. However, both groups rated challenge and creativity very high. Hobbies and activities were less influential than other factors for both graduates and students, especially the women in these groups. Pre-college seminars were somewhat more influential for students than for graduates. This may be because pre-college seminars are more frequent today than in the past; thus, they were not available for many engineers in the graduate sample (nor were they available to many of the undergraduates).

Sex differences among the factors that influenced career decisions were generally consistent across graduate and student samples. More women than men tended to rate the importance of their mothers and female engineers and of pre-college seminars. Women in both groups also rated challenge, liking for problem solving and independence significantly higher than did men. In the areas of hobbies and activities, sex differences were generally in the direction of men rating them as being more important than did the women.

As in the previous section, ethnic differences were generally not consistent across samples. A notable exception involved ratings for pre-college seminars. More Black and Hispanic respondents in both samples rated pre-college seminars to be important than did White and Foreign National respondents.

Importance of job characteristics. The last set of items that could be compared across samples concerns the relative importance of various job characteristics. Table 23 presents the rank-orderings of these factors according to the total group of graduates and the total group of students. The relative

TABLE 21

The Importance of Perceptions of Ability of Graduate and Student Engineers by Sex and Ethnicity

	PERCENTAGES													
	GRADUATES							STUDENTS						
	TO-	SEX		ETHNICITY				TO-	SEX		ETHNICITY			
ABILITIES	TAL	MA	FE	BL	HI	WH	FN	TAL	MA	FE	BL	HI	WH	FN
Athletic	41	47	32e	50	51	40	32b	62	67	50	66	60	61	59
Artistic	28	26	32c	35	29	27	24	42	40	46	49	45	40	43
Leadership	73	75	71a	79	71	73	72	69	67	72	77	71	67	55a
Mathematical	81	78	85e	76	75	81	88	86	86	85	76	86	87	100c
Mechanical	64	70	54e	61	55	65	53a	71	78	59e	62	73	74	69a
Problem-Solving	89	89	90	82	87	90	91a	83	83	81	74	80	84	93b
Public Speaking	45	46	44	48	34	47	29c	44	44	45	56	43	42	45a
Writing	62	59	67c	58	49	63	55b	59	56	66b	61	57	60	45
Visualization	71	74	66	72	72	71	71	71	73	67	61	74	72	80a

TABLE 22

Ratings of Graduates and Students of the Importance of Various Factors Influencing Their Decisions to Pursue an Engineering Career

Percentage indicating factors were "Very" or of "Some" importance	GRADUATES							STUDENTS						
	TO-TAL	SEX		ETHNICITY				TO-TAL	SEX		ETHNICITY			
		MA	FE	BL	HI	WH	FN		MA	FE	BL	HI	WH	FN
WORK														
Like problem solving	85	84	88b	85	82	86	83	83	80	89c	87	91	81	79
Challenge	83	81	89e	83	87	84	90	88	85	94d	96	94	86	83c
Salary	75	74	77	82	72	75	73	90	90	92	94	90	90	76a
Creativity	74	73	76	75	74	74	86	85	84	86	94	89	81	97c
Independence	68	62	78e	70	73	68	73	78	75	83b	85	89	74	79b
Type of work	64	63	65	53	58	65	58a	81	81	82	83	88	79	83
Prestige	62	62	63	58	72	61	73a	68	66	73	74	80	66	66a
Security	61	59	64b	64	64	61	68	85	83	88a	91	88	84	55e
Relevant work experience	42	46	36e	44	36	42	35	28	29	25	27	46	25	31c
Rapid advancement	48	45	53c	53	61	46	62c	75	73	77	83	87	71	76c
Wanting to be of service	45	44	46	47	49	43	59a	58	55	64b	66	74	53	55c
SCHOOL RELATED														
High School science courses	69	71	66a	80	69	69	69	69	69	69	67	69	69	72
High School math courses	67	66	68	79	71	66	69a	66	64	71a	67	70	65	83
Career or occupation infor.	57	57	58	66	67	56	57a	67	66	68	77	66	64	66a
Aptitude tests	45	45	45	47	39	46	40	42	44	38	42	59	40	52b
Interest inventory results	24	25	23	25	16	25	21	33	34	32	35	41	31	52a
Career education courses	17	19	14b	30	25	16	17d	27	26	28	41	37	21	34c
Pre-college seminars	10	8	12c	20	12	9	8c	34	28	45e	52	55	26	38e
PEOPLE														
Father (or male guardian)	61	60	61	50	59	62	58	57	58	55	56	41	61	55c
Mother (or female guardian)	44	41	49d	52	46	44	38	38	36	44a	38	46	37	38
Male engineer(s)	32	32	32	26	37	31	43	44	44	43	44	56	42	41
Other relative	27	27	27	30	38	25	41c	32	33	30	34	40	30	31
Female engineer(s)	8	4	15e	11	10	8	6	13	9	22e	23	20	9	21e
ACTIVITIES, HOBBIES														
Using a computer	32	28	39e	42	42	31	39b	42	45	37a	46	54	39	55a
Construction hobbies	31	40	16e	40	39	30	32a	32	40	18e	34	45	29	55c
Outdoor activities	19	21	17a	19	22	19	22	25	26	22	19	42	23	41d
Science Fair participation	16	18	12c	30	12	14	32e	14	15	12	18	19	11	31c
Farm Experiences	15	20	8e	11	18	15	11	9	9	8	4	12	9	17
Hobby Magazines	15	22	4e	27	17	14	23c	16	18	11b	19	24	13	24a
Science Clubs	12	13	11	25	10	11	23e	11	11	11	17	25	8	14e

TABLE 23

Rank Order of Importance Ratings of Various Job Characteristics
for Graduate and Student Engineers

	GRADUATES								STUDENTS							
		TO-	SEX		ETHNICITY					TO-	SEX		ETHNICITY			
Percentage indicating various statements as "Very" important to them personally	RANK	TAL	MA	FE	BL	HI	WH	FN	RANK	TAL	MA	FE	BL	HI	WH	FN
Engage in satisfying work	1	82	81	85a	85	81	83	78	2	84	81	90c	85	82	83	90
An income to live comfortably	2	71	72	67b	87	76	69	74d	1	87	86	87	92	88	85	86
Opportunity to innovate	3	64	67	58e	75	64	62	76b	6	67	69	65	77	74	63	83c
Participation/work related decisions	4	61	61	60	66	63	60	63	15	47	42	54c	54	54	44	48
Freedom to manage own work	5	61	61	62	68	64	60	70	8	59	58	60	61	73	55	76c
Opportunity to advance economically	6	53	55	49b	63	63	51	57b	3	75	73	77	77	78	74	69
Desireable geographical location	7	52	51	53	57	61	52	44	5	67	66	69	64	75	66	65
Know exact work responsibilities	8	51	52	50	64	71	48	72e	7	65	62	70a	73	74	61	79b
Problems and no ready made solutions	9	49	53	44d	52	48	49	65a	12	50	52	47	58	63	45	76e
Co. realizes family responsibilities	10	49	50	49	56	58	48	49	4	69	70	69	70	69	70	57
Wide variety of technical work	11	48	47	48	51	49	47	57	19	41	40	42	51	48	37	48b
Availability of personal leave	12	47	42	57e	62	56	46	54c	18	43	37	54e	46	49	42	32
Opportunity to move into mgmt	13	46	46	46	50	54	45	50	20	37	34	43a	47	38	35	35
Exercise leadership	14	45	47	43a	59	52	44	47b	11	51	49	55	63	64	46	45c
Flexible work hours	15	38	34	44e	54	41	36	47c	16	46	42	53b	51	47	44	48
Preparation for top level careers	16	36	33	41e	56	45	33	45e	14	47	42	57d	56	57	43	55b
Opportuntities to help others	17	34	35	33	49	47	32	50e	13	49	45	56b	60	63	43	59e
Significant contributions to society	18	33	35	31a	47	50	30	54e	10	51	46	60d	67	59	46	55d
Freedom from pressure to excell	19	28	27	29	33	46	25	42e	21	22	20	26	32	35	17	36e
Assigned to different areas	20	25	21	31e	44	31	23	24e	21	36	30	49e	45	44	33	38a
Opportunity to enhance social status	21	20	22	17	33	25	18	38e	17	43	41	46	50	52	40	52a
Opportunity to travel	22	20	18	22a	32	19	18	31c	9	52	45	64e	56	60	49	65a

orderings of the factors are quite similar for the graduates and students. The top two factors for both groups of respondents included satisfying work and a comfortable income. These factors point out the importance of both intrinsic and extrinsic concerns. Third in importance for the student sample was economic advancement, an extrinsic concern. The graduates, on the other hand, rated the opportunity to innovate third in importance, with economic advancement sixth.

The tendency for the students to place somewhat greater emphasis on extrinsic factors is consistent with the comparisons of the relative importance of work factors in influencing students and graduates to pursue a career in engineering. Aside from the most highly rated factors, there were rank differences of at least for several factors. Factors rated more highly by students than by graduates included the opportunity to travel, to make a significant contribution to society and to work for a company that realizes employees have family responsibilities. Graduates, on the other hand, rated the following factors relatively higher in importance than did the students: participation in work-related decisions, opportunity to engage in a wide variety of technical work, opportunity to move into management and the availability of personal leave. These differences appear to reflect a greater concern by graduates than by undergraduates for career advancement.

Sex differences across the samples were less consistent than they were for the previous comparisons noted above. While there were 12 significant differences for the graduates and 11 for the students, only six of these differences occurred in both samples with the direction of the difference being consistent. Women in both samples rated the following factors as being more important than did the men: satisfying work, flexible working hours, availability of personal leave, preparation for top level careers, opportunity to be assigned to different areas of the company and the opportunity to travel. It is likely that women see these factors as being important in helping them to balance a professional career with family life.

There was also some consistency between the two samples in the pattern of differences across ethnic groups. There were 15 significant differences for the graduate sample and 13 for the students. Nine differences were consistent across samples, with a similar pattern of results. For two of the factors, Black American and Hispanic American respondents gave higher importance ratings than did White American and Foreign National respondents. These factors included the opportunity to exercise leadership and to be assigned to different areas of the company. These differences may reflect concern of under-represented minorities with the opportunities for advancement in their jobs.

The other seven factors which involved significant ethnic differences across samples were rated lower in importance by White American respondents than by other ethnic groups. These factors included: the opportunity to innovate, to know exact work responsibilities, opportunity for travel, to make a significant contribution to society, to help others, preparation for top level careers and an opportunity to enhance social status and prestige. There were only two items in the general pool dealing with social responsibility, and both of these factors were rated lower by White American respondents than by other ethnic groups. However, the other factors showing ethnic differences represent a wide variety of areas and do not generally reflect a lack of concern by White American respondents for one particular area.

In summary, comparisons across graduate and undergraduate engineering samples demonstrated a high degree of similarity between the groups. The new embryo engineers who are launching their careers in the 1980's are not very different from professional engineers with respect to (1) the factors that influenced them toward careers in engineering, (2) self-perceptions of their abilities and (3) work values, or characteristics. More women than men in both samples indicated the importance of factors which could facilitate juggling the demands of career and family (e.g. flexible hours). Finally, there appears to be an increase in the influence of pre-college seminars in attracting women and minorities to engineering, which lends support to the viability of these programs.

MEASURED INTERESTS OF GRADUATE AND STUDENT ENGINEERS

Strong-Campbell Interest Inventory (SCII): Graduate Profiles

A global view of a person's occupational orientation is provided by the six General Occupational Theme scores of the SCII. High scores suggest the general activities that a person will enjoy, the type of occupational environment that he or she will find most comfortable, the problems that he or she will be most willing to attempt and the kind of people who will be most appealing as co-workers (Campbell & Hansen, 1981). Thus, these theme scores offer an immediate and useful overview of an individual's interests. According to Campbell and Hansen (1981), engineers score high on the Realistic Theme Scale and low on the Social Theme Scale.

The Basic Interest Scales of the SCII were developed in order to help consumers in the difficult task of interpreting SCII profile scores. These scales are particularly useful in providing "direct information about major themes in the individual's interest, which can be mapped into the occupational world via scores on the Occupational Scales (Campbell & Hansen, 1981, p. 44)." SCII norm-group engineers scored high on the Mathematics Scale (Investigative Theme) and low on the Social Service Scale (Social Theme). Of the 162 Occupational Scales representing 85 occupations, only the results obtained for the Male and Female Engineer Scales are focused upon here. However, scores for selected Occupational Scales representative of the various general themes are also presented. Graduate engineer data for these SCII scales are presented in Table 24, with engineers classified into sex, ethnic and career-field subgroups.

Occupational Themes. Engineers who took the SCII scored highest on the Realistic and Investigative Themes (see Table 24) and scored lowest on the Social and Artistic Themes. As indicated in an earlier section of this report, engineers also rated themselves and the typical engineer in their fields as being most similar and least similar, respectively, to these same Occupational Themes.

According to Holland's typology of personal orientation regarding career choice (Holland, 1966, 1973), engineers in this study described themselves behaviorally, by both their ratings on the graduate survey and their interest choices on the SCII, as persons who exhibit aggressive behavior, who emphasize activities involving motor coordination, who prefer concrete "down-to-earth" activities and who avoid interpersonal contact (Realistic Theme) and as persons who think rather than act, who organize and understand rather than dominate or persuade and who avoid close interpersonal contact (Investigative Theme). They also described themselves behaviorally as being least like persons who need attention, who seek interpersonal relations and who avoid problem solving, use of physical skills and highly-ordered activities (Social Theme) and like persons who have a strong desire for self-expression, who dislike structure, who have little self-control, who are feminine and expressive of emotion and who like tasks that emphasize physical skills or interpersonal interactions (Artistic Theme).

Basic Interest Scales. In addition to the Occupational Theme Scores, Table 24 also presents the typical pattern of basic interests of engineering graduates

TABLE 24

Strong-Campbell Interest Inventory Means and Standard Deviations for the Graduate Engineering Group Classified by Sex, Ethnicity and Current Career Field

SCALE	NORMS		TO-	SEX		ETHNICITY				CURRENT FIELD OF EMPLOYMENT												STAN-
OCCUPATIONAL THEMES:	MA	FE	TAL	MA	FE	BL	HI	MA	FN	AE	AG	CH	CE	EE	EN	IE	ME	NE	RE	MG	CS	DEV.
Realistic Theme	60	56	57	58	54e	54	56	57	51	54	63	53	57	56	59	55	59	54	61	59	46e	9
Investigative Theme	57	57	55	55	55	55	55	55	55	55	56	57	52	56	54	52	55	54	57	52	53d	8
Artistic Theme	45	51	45	43	49e	46	45	45	48	47	44	47	43	47	42	45	45	44	48	42	53	10
Social Theme	44	43	43	43	43	46	43	43	42	43	45	44	45	43	41	41	41	43	41	44	47	10
Enterprising Theme	48	47	47	47	46	49	49	47	47	45	46	46	45	47	48	47	46	47	46	52	47	8
Conventional Theme	51	50	50	50	50	51	51	50	47	48	52	49	49	51	52	53	48	49	48	50	52	8
BASIC INTEREST SCALES:																						
R Agriculture	53	50	51	52	49e	45	51	51	51a	45	59	49	55	50	49	49	51	47	58	52	42e	10
Nature	49	53	49	48	52e	44	45	50	46c	49	56	49	50	49	49	49	50	42	57	47	48d	11
Adventure	52	51	53	54	50e	52	56	53	51	54	52	51	53	52	55	49	53	51	56	58	47a	9
Military Activities	53	50	50	51	47e	49	51	50	48	52	51	49	51	49	56	51	51	49	54	48	46	9
Mechanical Activitie	61	57	58	59	55e	57	58	58	51a	56	62	55	56	59	58	56	61	57	59	58	51d	9
I Science	59	57	56	56	55	55	56	56	54	57	58	58	53	58	55	53	57	55	57	52	53e	8
Mathematics	60	60	60	60	59	59	59	60	59	61	60	60	58	61	57	61	59	60	59	57	58a	6
Medical Science	51	52	50	49	51	52	48	50	48	51	50	52	48	52	53	48	49	47	55	50	48a	10
Medical Service	46	47	46	45	46	46	47	46	42	46	47	46	46	46	45	44	44	42	48	45	45	7
A Music/Dramatics	44	52	46	43	50e	48	46	46	47	49	45	47	43	47	41	46	46	46	48	43	52	10
Art	44	52	45	42	50e	47	44	45	47	44	44	45	43	47	43	44	45	43	48	42	50	10
Writing	44	50	43	41	46e	43	43	43	48	44	43	46	42	44	41	43	42	44	44	42	50	10
S Teaching	48	45	45	45	46	45	45	45	44	47	47	46	48	47	43	43	43	43	45	41	50c	9
Social Service	40	42	41	40	42d	44	41	40	43	39	42	42	41	41	41	41	39	41	38	41	46	9
Athletics	50	45	49	52	45e	52	52	49	44	53	51	47	53	48	51	47	49	45	51	49	49c	10
Domestic Arts	43	51	46	43	51e	45	43	47	42	47	46	45	47	48	45	48	46	43	46	43	52	10
Religious Activities	46	45	45	44	45	51	44	45	39c	45	49	44	45	45	40	44	45	46	42	44	42	10
E Public Speaking	47	47	47	47	46	51	48	47	48	47	47	47	47	47	47	45	46	47	47	51	46	9
Law/Politics	49	48	48	48	48	51	48	48	49	49	49	49	48	47	49	47	48	51	47	52	49	9
Merchandising	46	48	46	45	47c	47	47	46	47	42	44	45	45	46	45	49	45	45	46	51	49a	9
Sales	48	46	46	47	45d	48	50	46	48	43	45	45	46	48	49	46	46	46	44	53	44d	8
Business Management	50	49	49	49	49	49	50	49	52	43	49	48	48	48	52	53	49	50	49	57	53d	9
C Office Practices	45	46	44	44	45b	44	43	45	41	43	45	43	45	46	44	45	43	44	43	45	49	7
OCCUPATIONAL SCALES:																						
F Engineer	54	50	50	53	47e	49	51	50	49	48	53	49	46	50	53	49	55	51	53	52	41e	10
M Engineer	50	41	43	45	40e	40	42	43	37	43	47	41	40	44	41	41	47	43	45	39	31e	11
SPECIAL SCALES:																						
Academic Comfort	51	54	48	46	52e	49	46	48	50	50	49	53	45	51	47	45	47	47	51	41	51d	13
Introvert-Extrovert	56	54	56	56	55	52	54	56	54	58	57	56	56	56	56	57	58	56	55	52	53	11

who took the SCII, ordered by sex, ethnic group and field. Engineers tended to score above average, as compared to the SCII norm group, on the Mechanical Activities Scale (Realistic Theme), Mathematics Scale (Investigative Theme) and Science Scale (Investigative Theme). They scored below average as a group on the Writing Scale (Artistic Theme), Social Service Scale (Social Theme) and Office Practices Scale (Conventional Theme).

Occupational Scales. The two Occupational Scales for engineers (male and female versions) on the SCII, classified as belonging to the Investigative and Realistic Themes, drew significantly different performances from the engineers in our study. Moreover, these differences were not in the expected direction. The average score for our engineers was significantly higher on the female version (T-score of 50) of the Engineering Scale than on the male version (T-score of 43) of this Scale. These results suggest that the engineers in this study may be somewhat different than the engineers upon whom the SCII Male Engineer Scale was developed and normed. In other words, our engineers endorsed fewer of the interests included in the male version of the Engineer Scale than was true of the male engineers in the SCII norm group. It is possible that the low score obtained by our engineers was the result of including female engineers with male engineers for this analysis. However, this conclusion is not valid, as will be seen subsequently in the discussion of sex differences.

Special Scales. With respect to the two non-occupational Special Scales on the SCII, the typical engineer in our study scored near average (T-score of 48) on the Academic Comfort Scale and slightly above average (T-score of 56) on the Introversion-Extroversion Scale, as compared to SCII norms. These results suggest that the typical engineer in our study tends to be oriented toward the pursuit of higher education but not to the extent of pursuing a Ph.D. degree (Academic Comfort). Moreover, our typical engineer tends to prefer individual activities rather than group activities more than does the average professional person (Introversion end of Introversion-Extroversion Scale).

Sex Differences. The SCII profiles for the men (N=344) and women (N=222) engineers in our study are presented in Figure 6 for Occupational Themes and Basic Interest Scales. Overall, the interest profiles of women and men are quite similar in their patterns, except for their Artistic and Realistic Theme Scores and the Basic Interest Scale scores for these two Themes. For the Artistic Occupational Theme Scale and its three Basic Interest Scales, women engineers scored significantly higher than did the male engineers in our study. However, the scores for women were merely average in level compared to the norm group of women engineers. The opposite was true for the Realistic Theme and its five Basic Scales: women engineers scored significantly lower than did men, except for the Nature Scale. It is interesting to note here that the women engineers also rated themselves on the graduate survey instrument as being more artistic and slightly less realistic than did their male counterparts (see Figure 5). Significant differences were also found for several other Basic Interest Scales, but the male-female profiles were similar in shape for these scales.

Male-female engineer profiles for representative Occupational Scales for each of the six Occupational Themes and the two Special (or administrative) Scales are presented in Figure 7. Again, the shapes of the two profiles are similar, but several significant differences were found. Of particular

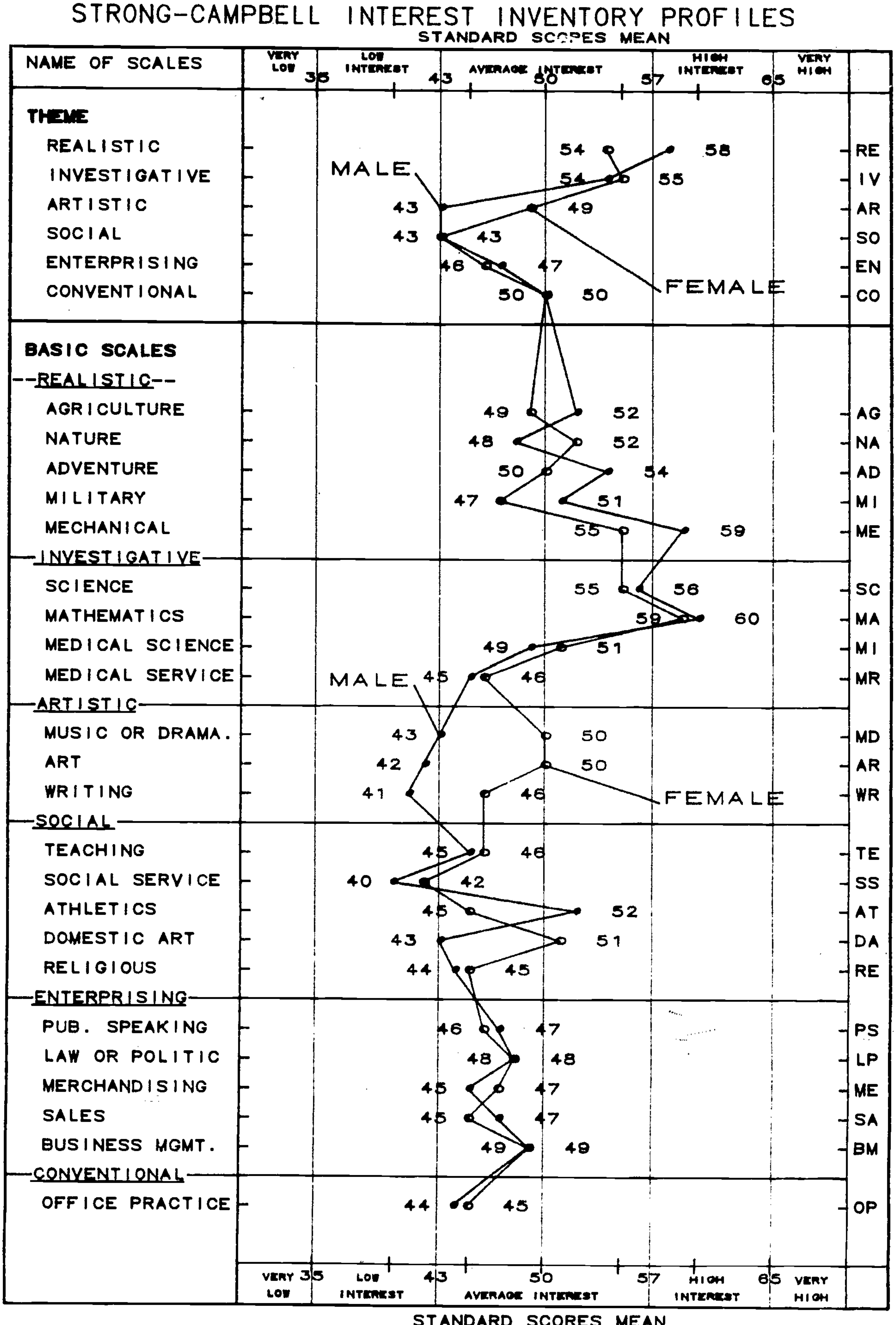

Figure 6 Male/Female Mean Profiles for Graduates on the Occupational Themes and Basic Interest Scales of the Strong-Campbell Interest Inventory.

STRONG-CAMPBELL INTEREST INVENTORY PROFILES

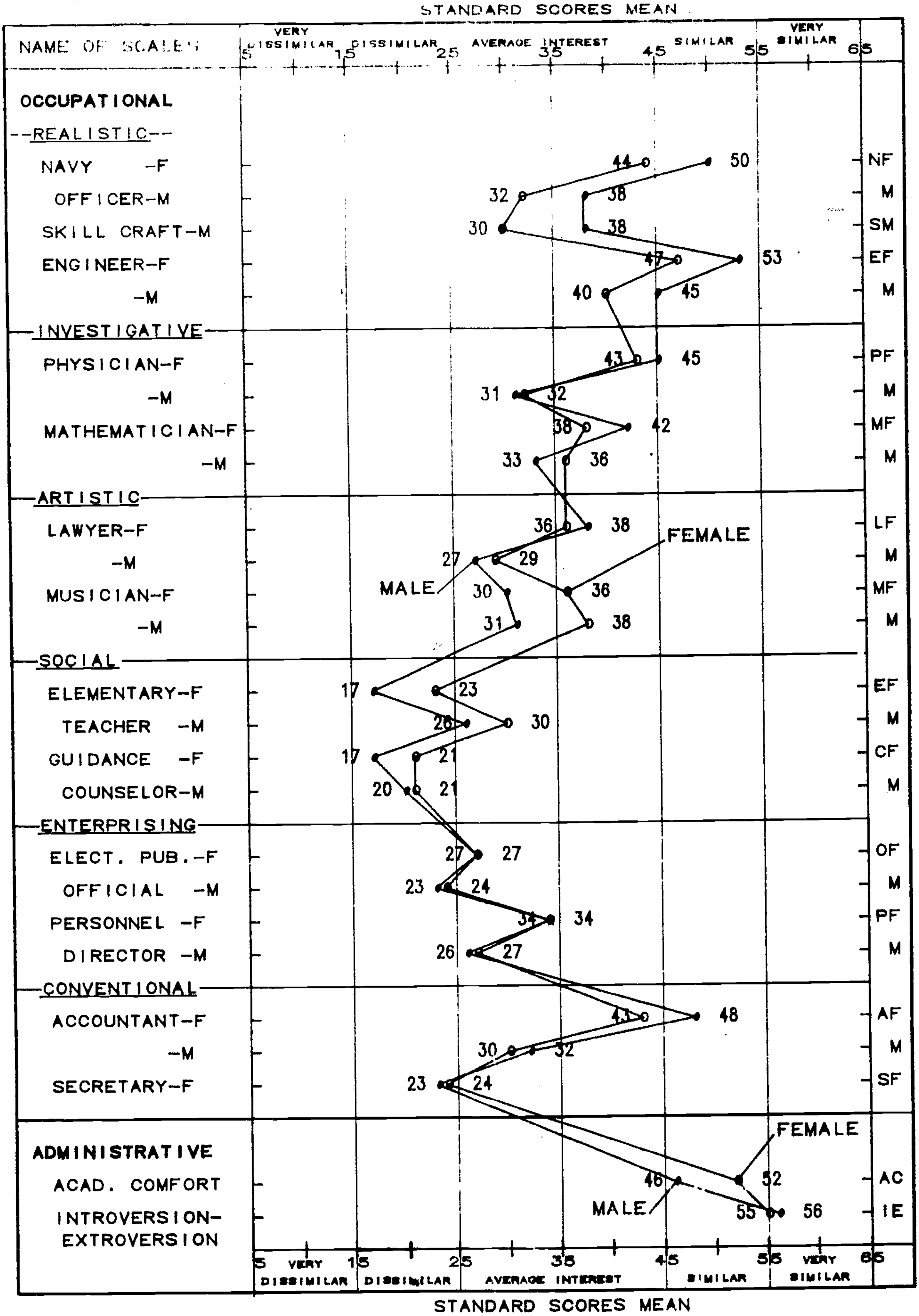

Figure 7 Male/Female Mean Profiles for Graduates on Selected Occupational Scales and Special Scales of the Strong-Campbell Interest Inventory.

importance for this study is the significant difference between male and female engineers on both Male and Female Engineer Scales. Male engineers in our study scored significantly higher than did women engineers on both versions of the Engineer Scale. However, male engineers in the SCII norm group also scored higher on both sex-related Engineer Scales than did women engineers in the SCII norm-group. Of particular interest to this study are the findings that our women engineers scored slightly lower on the average (T-score 47) than did the norm group women engineers (T-score=50) on the Female Engineer Scale, and our male engineers scored significantly lower (T-score=45) than their norm-group counterparts (T-score=50) on the Male Engineer Scale.

It should be noted that the sizes of our male and female engineer samples are somewhat larger than their corresponding SCII norm-group engineer samples. However, the SCII norm groups of engineers are restricted to people who (1) were between 25 and 55 years of age, (2) had been in their occupation for at least three years, (3) reported that they enjoyed their work, (4) met at least some minimal standard of occupational performance and (5) pursued their occupation with the typical tasks and duties, rather than in some unusual way (Campbell & Hansen, 1981, p. vi). The addition of the SCII data on the engineers in our study to the existing data for engineers in the SCII norm groups might provide engineer norms for the SCII that are more representative of engineers in the profession today than may now be the case.

One other sex difference should be noted. Women engineers in our study scored significantly higher (T-score=52) than did men (T-score=46) on the Academic Comfort Scale. Moreover, men in our study also scored significantly lower on this scale than did male engineers in the SCII norm group (T-score=51). These results suggest that our male engineers may be less inclined to pursue further academic work than were both men and women in the SCII engineer norm group and also the women in our study. Perhaps the male engineers in this study are quite satisfied with their present position and/or do not need additional academic work in order to do what they want to do. This interpretation is supported, at least to some extent, by the higher level of satisfaction expressed by male engineers with their progress in their careers and with the nature of the work in their present positions (see Table 5). Moreover, more men than women indicated that they actually planned no further graduate work (see Table 13).

Ethnic differences. Significant differences among ethnic groups were found for only the Realistic Theme Scale, three Basic Interest Scales (Agriculture, Mechanical Activities and Religious Activities) and the Male Engineer Scale. Foreign Nationals tended to score lower on the Realistic Theme Scale than did the other ethnic groups. Black Americans scored lowest on the Agriculture Scale and Foreign Nationals scored lowest on the Mechanical Activities Scale, both scales representing the Realistic Theme. Blacks Americans scored significantly higher than did the others on the Religious Activities Scale (representing the Social Theme), and Foreign Nationals scored lowest on the Male Engineer Scale. However, the sizes of the ethnic groups are somewhat small, except for White American engineers; consequently, these ethnic differences may not be generalizable to other ethnic-group engineer samples. It will be remembered from the previous section of this report that there was no significant difference among the ethnic groups as to how they rated themselves, or the typical engineer in their field, on the Realistic Theme (see Table 24), even though there were rating differences on some of the other themes.

Career-field differences. When the engineers in this study were ordered according to their current career field in engineering, significant differences were observed on several of the SCII scales (see Table 24). Three of the Occupational Theme Scales yielded differences among the various engineering fields: Realistic Theme, Investigative Theme and Enterprising Theme. Engineers in agricultural engineering and resource engineering (T-scores of 63 and 61, respectively) scored highest on the Realistic Theme Scale, and people working in computer science scored significantly lower (T-score=46) on this Scale than did all of the other groups. Agriculture engineers and resource engineers also scored highest (T-score=57) on the Investigative Theme Scale, and engineers in management scored highest (T-score=52) on the Enterprising Theme Scale. However, scores for the various fields on the latter two scales (ranging from 57-52 and from 52-45, respectively) were much less variable than were scores on the Realistic Theme Scale (T-scores ranging from 63-46).

Significant differences among engineers in various fields were found for 11 of the 23 Basic Interest Scales. Of particular importance are the differences found for three of the five Occupational Scales representing the Realistic Theme. As would be expected, engineers working in agricultural engineering and resource engineering scored highest on the Agriculture Interest Scale (T-scores of 59 and 58, respectively). Persons in aeronautical engineering and computer science scored lowest on the Agriculture Scale (T-scores of 45 and 42, respectively). Agricultural engineers and resource engineers also scored highest (T-scores of 56 and 57, respectively) on the Nature Interest Scale, while nuclear engineers scored lowest (T-score of 42) on this scale. On the Mechanical Activities Interest Scale, agricultural engineers and mechanical engineers scored highest (T-scores of 62 and 61, respectively), and persons in computer science scored lowest (T-score of 51).

High scores were obtained for all career fields on the Mathematics Interest Scale, ranging from 61 (electrical engineering and industrial engineering) to 57 (management). The Science Interest Scale yielded above average scores for all of the career fields, except for civil engineering (T-score=53), industrial engineering (T-score=53), computer science (T-score=53) and management (T-score=52). However, even these low scores on the Science Interest Scale were slightly higher than were the average scores of the persons-in-general norm group for the SCII.

Significant differences among the career fields were observed also for both Male and Female Engineer Occupational Scales and for the Academic Comfort Scale. It is interesting to note that scores were lower across all fields on the Male Engineer Scale than were scores on the Female Engineer Scale. Not surprisingly, people in computer science scored much lower on both engineering interest Scales than did people in other career fields. If we disregard the scores of people in management and computer science on the Engineer Scales, we find that mechanical engineers scored highest (T-score=55) and aeronautical engineers scored lowest (T-score=48) on the Female Engineer Scale. Moreover, both agricultural engineers and industrial engineers scored highest (T-scores of 47) and civil engineers scored lowest (T-score of 40) on the Male Engineer Scale. Differences in the numbers of men and women in the various fields might account for these results. For example, the numbers of men and women in mechanical engineering are both large and fairly equal, while there are many more men than women in agricultural engineering. Nevertheless, discrepancies in sample sizes do not appear to be the only explanation for the observed differences in scores on the two Engineer Scales.

The Academic Comfort Scale also yielded significant differences among engineers in the various career fields, with those in management obtaining the lowest average score (T-score=41) and chemical engineers scoring highest (T-score=53). Thus, people in management seem to have less interest in academic work than do the people in other fields. Although chemical engineers scored highest (T-score=53) on this scale, they probably are not oriented more toward academic work than are the electrical engineers (T-score=51) and resource engineers (T-score=51). No significant difference among career fields was observed for the Introversion-Extroversion Scale.

It should be noted here that some of the significant career-field differences presented above may not be generalizable to new engineer field samples. Several of the career-field samples are quite small, less than 30 persons in each group: e.g., aeronautical engineering (N=8), agricultural engineering (N=21), environmental engineering (N=10), nuclear engineering (N=17) and computer science (N=7). However, the results obtained for the major engineering fields (e.g., chemical, civil, electrical, mechanical and industrial) may hold up with new samples of engineers in these fields, because of these current, fairly large national samples of engineers.

Strong-Campbell Interest Inventory: Student Profiles

Presented in Table 25 are the average standard score (T-score) results for the Strong-Campbell Interest Inventory that were generated by the freshman and sophomore engineering students in this study. These results are based upon the total group ordered by sex, ethnic group and current career-choice in engineering. On the Occupational Theme Scales, student engineers scored highest, relative to the SCII norm group, on the Realistic Theme Scale (T-score of 55) and lowest on the Social (T-score of 5) and Artistic (T-score of 46) Theme Scales. These results suggest that behavioral descriptions of the typical student engineer are similar to those of the typical graduate engineer in this study.

Compared to graduate engineers, however, student engineers as a group scored lower on the Investigative Theme Scale (T-score of 52 compared to 55 for graduate engineers) and higher on the Enterprising Theme Scale (T-score of 49 compared to 46 for graduates). Thus, student engineers tended to have less interest in scientific endeavors (Investigative Theme) and more interest in Social-persuasive roles (Enterprising Theme) than did the graduate engineers in our study.

Results for student engineers as a group on the Basic Interest Scales of the SCII point to above-average interests (compared to SCII norms) in Mechanical Activities (T-score=57) and Adventure (T-score=56), which are categorized as belonging to the Realistic Theme, and Mathematics (T-score=58) and Science (T-score=56), classified as Investigative Theme interests. Scores on the other Basic Interest Scales were within the average-score range, as compared to SCII norms, except for the below average scores for Teaching (T-score=42) in the Social Theme and for Writing (T-score=44) in the Artistic Theme. Although not

TABLE 25

Strong-Campbell Interest Inventory Means for Student Engineers Classified by Sex, Ethnicity, Current Career Choice and Certainty of Choice

SCALE	TOTAL	SEX		ETHNIC GROUP							CURRENT FIELD OF EMPLOYMENT ENGINEERING*																SCIENCE**			CERTAINTY CHOICE***		
OCCUPATIONAL THEME	UW	MA	FE	BL	MA	HI	AI	AP	WH	FN	AE	AG	AR	BE	CH	CE	CO	EE	ES	EN	IE	ME	NU	RE	OT	TC	MG	BI	CI	PH	UN	PE	DE
Realistic Theme	55	57	53	49	61	53	56	52	56	59	57	51	58	54	53	58	55	56	54	45	51	58	53	55	53	63	56	55	43	58	52	55	57
Investigative	52	52	53	50	55	50	54	53	52	58	54	51	47	56	56	51	52	51	56	51	52	52	55	53	49	52	57	62	43	55	50	52	54
Artistic Theme	46	43	50	48	47	44	52	42	45	47	45	39	46	52	45	46	46	43	48	42	48	44	45	42	45	46	53	53	40	54	48	46	45
Social Theme	45	42	49	49	51	42	52	32	44	46	41	45	48	47	46	47	41	43	32	53	49	42	42	45	45	42	47	50	45	45	46	44	45
Enterprising	49	48	50	50	52	48	52	41	48	51	43	51	56	47	48	51	48	48	39	48	52	48	45	50	48	49	54	49	44	49	47	48	49
Conventional	52	50	55	54	57	52	52	44	51	56	49	48	57	51	52	53	55	53	45	53	55	50	50	52	51	45	61	52	53	51	49	51	53
BASIC INTEREST SCALES:																																	
R Agriculture	49	50	49	45	51	46	50	45	50	50	52	63	52	48	49	52	45	48	46	51	48	49	48	51	52	54	46	55	39	54	50	49	49
Nature	47	45	51	43	51	42	50	47	48	46	49	51	48	50	50	47	46	44	44	51	50	46	47	49	52	45	55	55	43	53	50	48	46
Adventure	56	58	54	50	56	54	60	54	57	59	60	50	58	55	57	56	56	56	61	56	52	58	51	56	54	64	49	60	39	58	55	56	57
Military Act	52	52	51	54	50	53	56	54	51	56	55	41	54	54	53	52	51	51	51	51	49	51	54	50	49	55	45	54	44	52	49	51	53
Mechanical Act	57	59	55	53	62	56	57	54	57	50	58	54	58	56	54	57	58	61	62	43	51	61	54	54	54	65	56	55	50	59	53	57	60
I Science	56	56	56	53	58	55	56	58	55	59	57	57	49	60	59	52	55	56	60	52	53	56	59	56	53	57	56	59	49	55	53	55	57
Mathematics	58	57	58	56	59	59	56	57	58	63	57	58	54	55	59	59	59	59	56	57	57	58	58	57	57	54	56	59	57	59	55	58	59
Med.Science	49	48	51	48	52	46	50	55	49	50	49	42	46	57	52	46	49	46	53	48	50	46	49	52	45	49	60	60	45	53	49	48	50
Med.Service	50	48	53	53	56	48	51	52	49	51	48	46	51	55	52	49	50	50	48	55	51	47	46	52	47	48	52	54	51	48	50	49	51
A Music/Drama	47	44	53	52	50	47	51	40	47	49	45	42	47	57	48	47	47	45	50	46	52	45	48	42	48	49	51	53	44	53	51	47	47
Art	46	42	52	48	49	44	47	45	46	46	45	33	53	50	45	47	47	43	47	46	48	45	44	43	46	42	58	48	44	54	48	46	45
Writing	44	41	48	44	43	43	53	37	44	47	45	44	39	50	43	43	43	41	42	42	47	42	50	43	43	44	51	51	39	50	46	44	43
S Teaching	42	41	45	44	48	40	47	32	42	46	39	38	43	47	41	44	41	41	32	47	46	42	41	44	42	37	45	48	39	45	44	42	42
Social Service	44	41	49	49	49	44	46	33	43	45	40	39	46	46	44	46	45	42	37	56	49	41	42	44	44	44	52	48	47	46	45	44	43
Athletics	52	53	50	54	53	48	51	50	52	53	51	50	55	48	52	53	48	52	48	52	50	52	50	54	51	50	47	54	46	53	51	51	53
Domestic Arts	47	43	55	52	53	44	46	37	47	45	43	41	54	53	48	46	46	45	33	56	54	45	41	51	53	46	54	51	50	52	49	47	47
Religious Act	48	47	50	54	50	46	53	40	48	43	48	49	50	49	50	49	45	48	37	53	49	45	51	44	46	49	53	47	53	43	49	48	48
E Public Speaking	48	47	50	51	48	49	57	42	47	52	46	45	49	51	48	50	47	47	38	42	51	45	52	51	45	47	45	55	45	44	48	47	49
Law/Politics	48	47	50	50	49	47	52	40	48	52	46	47	48	53	49	51	47	46	41	45	52	46	53	51	45	46	50	57	38	44	46	48	49
Merchandising	47	45	50	48	50	48	49	42	46	49	41	50	54	46	46	49	48	45	39	48	52	46	44	49	49	43	55	47	42	47	46	47	47
Sales	49	49	49	50	51	50	51	45	48	54	45	49	55	46	47	53	47	49	41	45	51	49	45	49	49	50	51	46	47	49	47	48	50
Business Mgmt	48	47	49	49	52	48	51	41	47	55	42	49	55	48	48	50	48	47	38	44	56	48	46	48	48	44	57	48	43	44	45	48	49
C Office Pract	48	46	52	51	55	48	49	42	47	51	45	44	56	48	47	48	50	49	40	51	52	45	47	49	48	42	55	45	54	48	46	48	49
OCCUPATIONAL SCALES:																																	
F Engineer	45	49	40	36	43	46	44	49	46	50	49	48	36	42	45	44	46	49	55	25	38	51	45	41	41	50	37	45	33	48	39	45	48
M Engineer	37	40	31	29	38	37	32	40	37	41	40	37	30	35	37	35	37	42	46	19	27	42	35	32	33	40	29	33	28	37	30	36	40
SPECIAL SCALES:																																	
Academ.Comfort	43	41	48	42	47	42	49	41	43	49	46	38	31	54	48	41	43	41	45	39	46	41	51	44	41	40	51	56	35	51	44	43	44
Intro-Extrovert	54	57	50	49	52	58	48	62	55	52	59	54	52	48	53	53	55	57	61	53	48	57	53	53	54	58	47	44	60	51	55	54	54
(No. of Cases)	(395)	(244)	(151)	(38)	(26)	(18)	(5)	(5)	(259)	(17)	(24)	(2)	(12)	(12)	(36)	(37)	(28)	(71)	(4)	(3)	(13)	(46)	(6)	(14)	(15)	(7)	(3)	(9)	(5)	(4)	(55)	(175)	(133)

Additional Symbols:

* ES - Engineering Science
OT - Other Engineering Fields
TC - Technology

** BI - Biological Science
CI - Computer Science
PH - Physical Science

*** UN - Undecided
PE - Probably Engineering
DE - Definitely Engineering

identical, these results are, in general, similar to those obtained for graduate engineers on the Basic Interest Scales.

Among the many specific Occupational Scales of the SCII, only the results of the two Engineer Scales (male and female) are presented here. The scores on these scales reflect the same pattern for engineering students as was found for graduate engineers; i.e., a higher score was obtained on the SCII Female Engineering Scale than on the Male Engineering Scale. However, student engineers scored lower on each respective scale than did graduate engineers. Compared to the SCII norm-group engineer, students in this study scored low-average (T-score=45) on the Female Engineer Scale and far below average (T-score=37) on the Male Engineer Scale, whereas the typical graduate engineer in this study yielded an average score (T-score=50) on the female scale and a slightly below-average score (T-score=44) on the male scale. At least two possible explanations for the student engineer results on the two engineer scales can be proposed: (1) the low scores may reflect the impact of lack of experience; and/or (2) the student group does, in fact, contain a large number of students who will not become graduate engineers. It is indeed a fact that the base rate for dropouts from undergraduate engineering programs is approximately 60 percent nationwide.

With respect to the two SCII Special Scales, student engineers scored below average compared to SCII norms on the Academic Comfort Scale (T-score=43) and high average on the Introversion-Extroversion Scale (T-score=54). Thus, as was true of the typical graduate engineers, the average student engineer expressed no particular liking for group activities (Introversion end of Introversion-Extroversion Scale). Unlike graduate engineers, however, the student engineers in this study expressed themselves as having relatively little persistence in academic endeavors, compared to both SCII norms and present graduate results. The fact that the present student engineer sample undoubtedly contains many students who will not persist in engineering probably biases these results. It would be interesting and informative to measure the interests of this student group again when they are seniors. Data derived at that point in time should help to clarify the present results.

Sex Differences. Significant sex differences were found for student engineers on most of the SCII Scales investigated (see Table 25). Therefore, it seems expedient to focus first upon scale similarities rather than scale differences. On only two of the six Occupational Theme Scales were male and female student engineers similar, the Investigative Theme Scale and the Enterprising Theme Scale. Men and women scored at the average level on both scales when compared to SCII norms.

Men engineering students scored significantly lower than women on the Artistic and Social Theme Scales. Moreover, the scores for men on these scales were below average compared to SCII norms, while the scores for women students were average in level. Men also scored lower than women on the Conventional Theme Scale and higher than women on the Realistic Theme Scale. Thus, male student engineers represented themselves as having no strong desire for self-expression or structure (Artistic Theme) and as having no particular need for attention or for seeking interpersonal relations (Social Theme), compared to women students or SCII norms. On the other hand, women engineering students expressed more concern for rules and regulations and more need for structure and order (Conventional Theme) compared both to their male counterparts in this study and to SCII norms. Women students also appeared to have less preference for concrete "down to earth" activities and aggressive behavior (Realistic Theme) than did men. However, the interests of women for realistic activities were in the average level compared to SCII norms, while men were above average in this area. Previous studies have shown that scores for men and women tend to diverge most on the Realistic and Artistic Scales, which supports the need for separate interpretative statements for men and women on these scales. This need is supported by both graduate and undergraduate sex differences found in this study.

Similar interests were expressed by women and men students on only five of the twenty-three Basic Interest Scales. Women and men students expressed above average interests on the Science and Mathematics Scales (Investigative Theme), average-level interests on the Agriculture and Military Activities Scales (Realistic Theme) and the Sales Scale (Enterprising Theme), as compared to SCII norms.

The largest sex differences for undergraduates were found on the scales classified as belonging to the Social and Artistic Themes. Women students tended to score at the average level on these scales, compared to SCII norms. Men students scored below average, except for their Athletics and Religious Activities (Social Theme) scores, which were average in level. On the other Basic Interest Scales for which significant sex differences were found, women students tended to score higher than the men, except for the Adventure and Mechanical Activities Scales (Realistic Theme) and Athletics Scale (Social Theme) on which men scored higher than women.

It is interesting to remember that a large number of sex differences were also found on the Basic Interest Scales (13 of 23) for graduate engineers in this study. Moreover, the direction and level of the Basic Interest Scale scores for undergraduate engineers ordered by sex are generally similar to those found for our graduate engineers and for SCII male and female norm groups.

Scores obtained by men and women students on the two Engineer Occupational Scales and the two Special Scales (Academic Comfort and Introvert-Extrovert) were similar in direction to that of scores on these scales derived from graduate engineers. Significant differences between men and women students were observed on all four scales, whereas men and women graduate engineers did not differ significantly on the Introvert-Extrovert Scale. On both Engineer Scales, women students scored lower than did men, and both sets of scores for students were much lower in level than those found for men and women graduate engineers and the SCII male and female norm groups.

It is interesting to observe that, on the two Engineer Scales, men students scored lower (but still average in level) than both male graduate engineers in this study and the SCII male engineer norm group, while women students scored much lower (well below average level) than did our women engineers and the SCII norm group of women engineers. It is readily apparent that separate norms for men and women are required for the two Engineering Scales in the SCII.

As was found for graduate engineering women in this study, undergraduate women appeared to have a stronger need or orientation for academic work

(Academic Comfort Scale) than did male student and graduate engineers. Women engineering students also expressed more liking for social and enterprising activities (Introversion-Extroversion Scale) than did not only male students but also both male and female graduate engineers and SCII norm group engineers.

Ethnic differences. Four of the six Occupational Theme Scales yielded significant ethnic differences (see Table 25). Mexican American and Foreign National students scored higher than did other ethnic groups on the Realistic Theme Scale (T-scores of 61 and 59, respectively), and these scores were above average when compared to SCII norms. Ethnic group scores were more variable for undergraduates on the Social Theme Scale than on the other theme scales. The small sample sizes of several of the student ethnic groups suggest that at least some of the ethnic differences observed may not be very reliable or valid.

It will be remembered that only one ethnic difference on the Occupational Theme Scales was found for the graduate engineers in this study. Foreign National graduate engineers scored significantly lower (but still average in level compared to SCII norms) than did the other ethnic groups on the Realistic Theme Scale. In general, scores on the SCII Theme Scales tended to be somewhat higher within ethnic group for student engineers than they were for graduate engineers.

On the two specific occupational scales for engineers, Black American students scored significantly lower than did the other ethnic groups. All student ethnic groups scored well below average (T-score range=29-41) on the Male Engineer Scale, and only somewhat higher (T-score range=36-59) on the Female Engineer Scale compared to SCII norms. Thus, the direction of these results is the same as that found for the graduate engineer ethnic groups.

Ethnic differences for undergraduate engineers were found for only one of the two Special Scales on the SCII. On the Introversion-Extroversion (IE) Scale, Asian Pacific students scored higher (T-score=62) than the other ethnic groups. Compared to SCII norms, both Asian Pacific and Hispanic American students scored above average. These results suggest that these two ethnic groups tend to prefer individual activities even more than the other engineering students do. No significant difference was observed among student ethnic groups on the Academic Comfort Scale, but all scores for this scale derived from student ethnic groups were somewhat lower than those found for the graduate engineer ethnic groups.

Ethnic comparisons between undergraduate and graduate engineers would be facilitated if the seven undergraduate ethnic groups were to be reclassified into the same four ethnic categories as was used for graduate engineers. The problem of small sample size for several of the undergraduate ethnic groups would be alleviated, and comparisons between undergraduate and graduate ethnic groups could be clarified. Unfortunately, time and resources were not sufficient to permit these new comparisons to be made at this time.

Current career-choice differences. When engineering students were classified according to their expressed current career choices, significant differences among groups were identified for three of the six Occupational Theme Scales: Realistic, Investigative and Enterprising Themes (see Table 25). Students preferring engineering technology were highest (T-score=63) on the

Realistic Theme Scale and computer science students were lowest (T-score=43). These scores were far above average and below average, respectively, when compared to SCII norms. For the Investigative Theme Scale, biological science students were highest (T-score=62), and far above average compared to SCII norms, and computer science students were lowest (T-score=43), and below average compared to SCII norms. Engineering science students were lowest (T-score=39) on the Enterprising Scale, which was far below average compared to SCII norms, and architectural engineering students were highest (T-score=56), or slightly above average in level compared to SCII norms.

It should be noted that the sample sizes of 15 of the 20 career-choice groups were very small, less than 25 in each group. Consequently, the generalizability of these SCII results is questionable, even though significant differences among the graduate engineers classified by field of engineering were also found on these same three themes. (One-half of the graduate groups also had less than 25 persons in each career field.) The significant career-field differences that are most relevant to this study are those associated with the Realistic and Enterprising Themes, because these themes and the Investigative Theme Scale drew differences across career groups.

The strongest difference among career-choice groups on the SCII Basic Interest Scales was for the Mechanical Activities Scale (Realistic Theme). Technology students scored highest (T-score=65), which was far above average compared to SCII norms, and environmental engineers scored lowest (T-score=43), or below average. Strong differences were identified also for the Science and Medical Science Scales (Investigative Theme). Biomedical engineers and engineering science students scored highest (T-score=60) on the Science Scale, with scores in the above-average range compared to SCII norms, while architectural engineering and computer science students scored lowest (T-score=49), with scores in the average range compared to SCII norms. For the Medical Science Scale (Investigative Theme), both management and biological science students on the average received the highest scores (T-score=60), which were above average compared to SCII norms. Agricultural engineering students had the lowest average score (T-score=42) on the Medical Science Scale, reflecting below average performance compared to SCII norms.

Small but significant differences among career fields were also observed for several other Basic Interest Scales. As expected, agricultural engineering students scored highest (T-score=63) on the Agricultural Scale (Realistic Theme), and computer science students scored lowest (T-score=39), or below average compared to SCII norms. This same pattern of scores was also found for graduate engineers in agricultural engineering and computer science, respectively. Technology students scored highest (T-score=64) on the Adventure Scale (Realistic Theme), which was far above average compared to SCII norms, and computer science students scored lowest (T-score=39), scoring well below average compared to SCII norms.

Although significant career field differences were observed for all five of the Basic Interest Scales classified as belonging to the Enterprising Theme, the strongest difference was found on the Law/Politics Scale. Computer science students seemed to be the least interested (T-score=38) in law and/or political activities, a below-average score, while biological science students appeared to be the most interested (T-score=57) in these areas, an above-average score. It is interesting to note that engineering science students scored lowest on all three of the other two Enterprising Theme Scales: Public Speaking (T-score=38), Merchandising (T-score=39) and Business Management (T-score=38). High scores on these scales were obtained by behavioral science students on the Public Speaking Scale (T-score=55) and by management students on the Merchandising Scale (T-score=55) and the Business Management Scale (T-score=57). These scale scores for students were significantly higher than those obtained by graduate engineers in management, by norm-group engineers and by the people-in-general norm group.

Strong career-field differences were observed for both Female and Male Engineer Scales. Students in environmental engineering scored lowest on both engineering Scales: T-score of 25 for the Female Engineer Scale and of 19 for the Male Engineer Scale. Both scores suggest that these environmental engineering students have extremely low interest in the activities included in both of these engineering scales. Students in engineering science obtained the highest average scores on the two Engineer Scales: a T-score of 55 for the female version and 46 for the male version. These scores were high average and average, respectively, in level compared to the SCII engineer norm group, but they were comparable to the scores of the male engineers in this study. Scores on the two Engineer Scales were as similar in pattern across student career-choice groups as they were for graduate career-field groups. Somewhat higher scores were obtained for the Female Engineer Scale than for the Male Engineer Scale by both student and graduate groups. However, graduate engineers tended to make higher scores on these scales than did undergraduates.

For the two Special Scales, Academic Comfort and Introversion-Extroversion Scales, biological science students scored highest (T-score=56) and architectural engineering students scored lowest (T-score=31) on the former scale, while engineering science students scored highest (T-score=61) and biological science students scored lowest (T-score=44) on the latter scale. Compared to SCII norms, biological science students appeared to have above-average persistence in academic endeavors and in investigative activities (Academic-Comfort Scale) and to have slightly more than average interest in social activities (Extroversion). Architectural engineers indicated little interest (T-score=38) in academic persistence (Academic Comfort Scale), and engineering science students represented themselves as disliking (T-score=61) social and enterprising activities (Introversion-Extroversion Scale).

It is doubtful whether these career-choice field differences should be stressed. As indicated earlier in this section, 15 of the 20 career-choice student groups held less than 25 students in each group, and 7 of the 12 career fields for engineering graduates held less than 30 persons. Consequently, the generalizability of these career-field results, as well as their reliability and validity, can be questioned. It would be important to gather new data from more graduates and students in the career fields that now have small numbers and then to re-analyze the combined data in order to be able to make definitive statements about the interests of engineers and students in the various career fields.

Differences among students relative to levels of career commitment. When students were classified according to levels of certainty regarding careers in engineering, several interesting differences in SCII profiles emerged. These data are presented in Appendix D. Differences among levels of career commitment were found for three of the six Occupational Theme Scales and for 10 of the 23 Basic Interest Scales. Students who were definite (N=133) about their choices of engineering careers scored higher on the average than did other students (N=55) in interests related to the Realistic, Investigative and Conventional Themes.

Committed students also scored higher on the average than did others on Mechanical Activities and Military Activities (Realistic Theme), Mathematics and Science (Investigative Theme), and Sales, Business Management and Law/Politics (Enterprising Theme). However, committed students averaged lower than did other students on Nature (Realistic Theme), Writing and Music/Drama (Artistic Theme). This profile was reversed for students who were either uncertain about or against an engineering career. Moreover, committed students scored higher on the average, and uncertain students scored lower on the average, than did other student on both Male and Female Engineers Scales.

Students who indicated that they "probably" would become engineers (N=175) attained average scores on the SCII scales which were between those attained by committed and uncommitted students. In general, the scores of these "probable" student engineers tended to be more like those of committed students than of uncommitted students. Finally, the interest profile of the typical student who is committed to an engineering career tends to be more like the profile of the typical graduate engineer in this study than does the profile of the typical student who is not definite about a career in engineering.

Validation Studies for the Purdue Interest Questionnaire

As noted earlier in this report, this project provided an opportunity to develop engineering graduate norms for the Purdue Interest Questionnaire. These new norms were prepared using the same scoring keys that were developed to identify various engineering fields. However, the data on engineering graduates also make it possible for students, graduates, counselors and others to compare individual and group interests with engineering graduates employed in various fields. Moreover, we can now also provide functional and educational degree level scales that will facilitate comparisons with engineers engaged in research, development, design, operations and technical management, as well as engineers with BS, MS in engineering, MBA and Ph.D. engineering degrees.

Table 26 summarizes the overall results of the validation studies on the Purdue Interest Questionnaire (PIQ), including (1) the original group of students on which the PIQ was normed (Purdue Engineering Juniors and Seniors majoring in various engineering fields or transferring to non-engineering fields), (2) the 1976 and 1977 Purdue cross-validation groups (those who enrolled in engineering as freshmen and who were majoring in or had graduated in various engineering and non-engineering fields three or four years later, (3) the 1981 national sample of engineering freshmen who planned to major in various engineering fields and (4) the 1981 national engineering graduate sample.

The mean scores in Table 26 provide a synthesis of our study of the PIQ. The top sets of scores are the means on the major engineering scales of those who constituted the major criterion and cross validation groups and contrasts them with general engineering reference groups. For example, the original Purdue chemical engineering criterion group had a mean T-score on the Chemical Engineering (CHE) Scale of 50, whereas the 1976-77 Purdue chemical engineering

TABLE 26

Purdue Interest Questionnaire Means for the Total, Male and Female Student Engineers Who Constituted the Original and Cross Validation Purdue Samples and the National Student and Graduate Samples on the Major Engineering Scales and the Overall Engineering Persister Scale

RELEVANT ENGINEERING SCALES	CRITERION ENGINEERING GROUPS: 1976-77 ORIGINAL CRITERION GROUP	1976-77 CROSS-VALIDATION GROUP			1981 NATIONAL STUDENT GROUP			1981 NATIONAL GRADUATE GROUP			ENGINEERING PERSISTERS IN GENERAL: 1976-77 ORIGINAL CRITERION GROUP	1976-77 CROSS-VALIDATION GROUP			1981 NATIONAL STUDENT GROUP			1981 NATIONAL GRADUATE GROUP		
	TO-TAL	TO-TAL	SEX MA	SEX FE	TO-TAL	SEX MA	SEX FE	TO-TAL	SEX MA	SEX FE	TO-TAL	TO-TAL	SEX MA	SEX FE	TO-TAL	SEX MA	SEX FE	TO-TAL	SEX MA	SEX FE
Chemical	50	43	42	44	44	41	47	48	48	39	37	35	34	39	36	34	39	40	39	42
Civil	50	41	40	45	42	41	44	47	46	49	34	29	29	33	29	28	32	35	34	36
Electrical	50	49	49	49	47	47	44	44	43	44	30	35	34	32	37	38	34	29	29	20
Industrial	50	43	42	44	43	40	44	46	44	46	32	30	30	31	29	28	30	32	31	34
Mechanical	50	46	46	40	45	46	43	45	48	43	37	30	37	32	37	39	33	37	39	34
Engineering Persister	50	52	52	52	51	52	50	50	51	49	50	52	52	52	51	51	50	50	51	49

OVERALL ENGINEERING PERSISTER SCALE

ENGINEERING GROUPS	1976-77 ORIGINAL CRITERION GROUP	1976-77 CROSS VALIDATION GROUP	1981 NATIONAL STUDENT GROUP			1981 NATIONAL GRADUATE GROUP		
	TO-TAL	TO-TAL	TO-TAL	SEX MA	SEX FE	TO	SEX MA	SEX FE
Chemical	52	55	52	54	51	52	53	51
Civil	48	50	50	50	48	48	47	50
Electrical	50	53	52	52	50	50	51	49
Industrial	45	45	45	47	44	45	48	43
Mechanical	53	54	53	53	53	53	54	52
Persister Engineers	50	52	51	52	50	50	51	49

cross-validation group had a mean of 43 (42 for males and 44 for females). The 1981 national student sample of potential chemical engineers had means of 44 (41 and 47, respectively), and the 1981 national sample of graduate chemical engineers had mean scores of 48 (48, and 49, respectively), for the total, male and female groups. In contrast, the original and general engineering sample (non-chemical engineering students) had mean scores on the CHE Scale significantly less than those of any of the chemical engineering groups.

The data for all of the other major engineering scales indicated very similar results. It is also important to note that there are very few sex differences within fields, although there is a tendency for women engineers, including mechanical engineering women, to score lower than male students for all of the groups tested. However, mechanical engineering women did have higher mean scores on the Mechanical Engineering (ME) Scale than did any of the general male or female engineer samples.

Table 26 also presents mean scores on the General Engineering Persistence Scale. These results indicate that all of the specialized engineering groups, as well as the overall engineering groups, have relatively high or similar interests, as measured by the Engineering Persistence Scale. No apparent sex bias was indicated for either the individual engineering specialization or general engineering scales. Additional detailed information on this phase of the study will be incorporated in the next revision of the PIQ Manual.

Purdue Interest Questionnaire: Graduate Engineers

All of the new graduate scales for the PIQ, including the engineering field scales, were computed using standard T-scores (Mean=50; Standard Deviation=10). Table 27 summarizes the mean scale scores of engineering graduates on the Purdue Interest Questionnaire (PIQ) classified by sex, ethnic group and current career field. Engineering Specialty Scale scores greater than 40 indicate that an individual is similar to about 85 percent of the engineers in a given specialty. The higher the score, the greater the degree of similarity. Scores below 26 represent dissimilarity in interests to engineers in that field. Moreover, scores of 40 or higher on the functional and educational level scales indicate that the individual (or group) is similar to the engineers who perform a particular function or have attained a given educational level.

Based upon data from the total group of engineers in this study, the typical graduate engineer looked most similar to engineers in the interdisciplinary engineering specialty area (T-score=48) and least like aeronautical engineers (T-score=33) and industrial engineers (T-score=33). The typical graduate engineer also appears to be similar to engineers in chemical (T-score=42), mechanical (T-score=42) and nuclear (T-score=40) engineering fields (see Table 27).

On the major Function Scales of the PIQ, graduate engineers scored, on the average, highest on the New Developments (T-score=45) and Management (T-score=45) Scales and lowest on the Applications Scale (T-score=42). However, all of these scores indicated similarity of the average graduate engineer to engineers performing these three major functions. On the specific functional scales, engineers as a group scored highest on the Technical Management Scale (T-score=45) and lowest on the Construction Scale (T-score=25). The average, or

TABLE 27

Graduate Engineer Purdue Interest Questionnaire Means for Total, Sex, Ethnicity and Current Main Career Field

SCALE	TO-	SEX		ETHNICITY				CURRENT FIELD OF EMPLOYMENT									
ENGINEERING SPECIALTY	TAL	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	EN	IE	ME	NE	RE
Aeronautical Engr	33	35	31e	35	36	33	38a	49	37	35	31	41	29	21	37	38	32e
Agricultural Engr	39	41	37e	38	42	39	36b	36	49	37	45	34	44	35	43	37	40e
Chemical Engr	42	41	45e	39	38	43	45e	40	38	50	41	40	48	43	39	44	44e
Civil Engr	37	37	38b	33	39	38	32e	31	39	32	50	28	43	36	37	36	38e
Electrical Engr	37	38	37	43	38	37	43e	44	36	39	29	50	31	34	37	39	35e
Industrial Engr	33	32	34e	33	32	33	31	22	25	33	28	27	28	48	32	30	31e
Interdisciplinary Engr	48	48	48	49	49	48	46	47	50	50	48	48	54	44	49	49	49e
Mechanical Engr	42	44	40e	43	44	42	41	43	46	42	39	40	37	40	50	43	40e
Nuclear Engr	40	43	41d	45	44	42	46c	48	43	46	38	46	40	35	44	49	42e
FUNCTION																	
NEW DEVELOPMENTS:	45	45	44	44	44	45	48	54	51	46	45	49	47	34	46	48	44e
Research	34	33	35c	34	32	34	40b	45	39	38	31	39	35	26	34	39	33e
Development	40	40	41a	42	38	40	48e	49	40	45	30	49	37	37	40	44	39e
Design	40	42	38e	41	44	40	37a	42	50	36	51	40	41	28	44	40	39e
APPLICATIONS:	42	43	41b	42	45	42	38b	35	41	39	44	38	39	50	44	38	41e
Operations	41	41	41	41	41	41	40	33	36	42	37	37	38	52	41	38	40e
Production/Maintenance	39	39	39	39	39	39	37	32	36	37	35	36	34	49	41	36	37e
Construction	25	26	23e	23	30	25	15e	16	29	16	43	17	28	22	24	22	26e
MANAGEMENT:	45	45	45	47	46	45	42a	37	40	45	43	42	45	52	43	43	47e
Technical Management	43	43	43	44	44	43	41	36	38	45	41	40	42	52	43	41	44e
Nontechnical Mgmt	31	31	32a	32	32	31	29	23	23	31	28	27	30	43	28	29	32e
Sales/Service	30	31	30	32	32	30	25c	21	27	30	31	28	29	36	30	27	31e
EDUCATIONAL LEVEL																	
Bachelors Degree Only	39	40	38e	37	40	39	35d	36	40	33	43	37	36	42	39	36	38e
Some Grad.Work - Engr	45	46	45	43	44	46	48a	52	49	45	46	48	46	39	47	47	44e
Some Grad.Work - Nonengr	44	44	44	44	45	44	40	36	39	43	42	40	42	53	43	40	45e
Masters - Engineering	44	44	43a	43	45	44	47	51	50	44	49	46	46	34	45	46	42e
Masters - Bus. Admin	43	42	43a	45	44	42	40	33	37	43	41	40	40	53	41	39	43e
Doctorate	39	38	40c	41	38	39	44c	47	41	43	34	44	38	33	39	43	38e
(No. of Cases)	(2025)	(1248)	(777)	(93)	(93)	(1572)	(54)	(58)	(100)	(192)	(316)	(267)	(56)	(205)	(318)	(75)	(101)

typical, graduate engineer also tended to be most similar to engineers having some graduate work (T-score=45) and to those holding a Master's Degree (T-scores of 44 and 43) On the other hand, our typical engineer was least similar to engineers with Bachelor's Degrees only (T-score=39) or with the doctoral degree (T-score=39), but these average scores are still quite similar to engineers who hold these degrees.

Sex differences. When graduate engineers were classified by sex identification, several highly significant differences ($p<.0001$) emerged (see Table 27). Men scored significantly higher than women on the Mechanical (T-scores of 44 and 40, respectively), Agricultural (T-scores of 41 and 37, respectively) and Aeronautical (T-scores of 35 and 31, respectively) scales. On the other hand, women scored significantly higher than men on the Chemical Engineering Scale (T-scores of 45 and 41, respectively). Figure 8 depicts these data.

Major sex differences on the functional areas were found on the Design (New Developments) Scale and the Construction (Applications) Scale. Male engineers scored significantly higher than women on both of these functional scales. Several other significant differences of less magnitude than the above two scales were also observed; notably, women scored higher than men on the Research Scale. Men also scored higher than women on the Bachelor's Degree Only Scale (T-scores of 40 and 38, respectively), and women scored higher than men on the Doctorate Scale (T-scores of 40 and 38, respectively).

Overall, these results suggest that it is probably wise to have separate norms for men and women on the various PIQ scales. However, a new, independent group of graduate engineers should be employed to cross-validate these results before any definitive statement regarding the need for separate sex norms for the PIQ should be made.

Ethnic group differences. A fairly large number of significant differences among ethnic groups was observed for graduate engineers. These data are presented in Table 27. The strongest differences on the Engineering Specialty Scales were observed for Chemical Engineering (CHE), Electrical Engineering (EE) and Civil Engineering (CE) Scales, with less strong differences on the Nuclear Engineering (NE), Agricultural Engineering (AE) and Aeronautical Engineering (AAE) Scales. Foreign National engineers scored highest (T-score=45) on the CHE Scale, and Hispanic Americans scored lowest (T-score=38), compared to the other ethnic groups. On the CE Scale, Hispanic Americans (T-score=39) and White Americans (T-score=38) scored higher than Black American (T-score=33) and Foreign Nationals (T-score=32). However, Black American and Foreign National engineers scored higher on the EE Scale (T-scores of 43, respectively) and the NE Scale (T-scores of 45 and 46, respectively) than did the others. Across all ethnic groups, the highest mean scores were found for the Interdisciplinary Engineering Scale (IES), ME Scale and NE Scale. The lowest mean scores for all ethnic groups were obtained on the Industrial Engineering (IE) Scale.

The strongest differences among ethnic groups on the Function Scales of the PIQ were associated with the Development Scale and the Construction Scale. Foreign National engineers scored highest (T-score=48), and Hispanic American engineers scored lowest (T-score=38) on the Development Scale, compared to the other ethnic groups. On the Construction Scale, Hispanic Americans scored highest (T-score=30), and Foreign Nationals scored lowest (T-score=15). Several

PURDUE INTEREST QUESTIONNAIRE

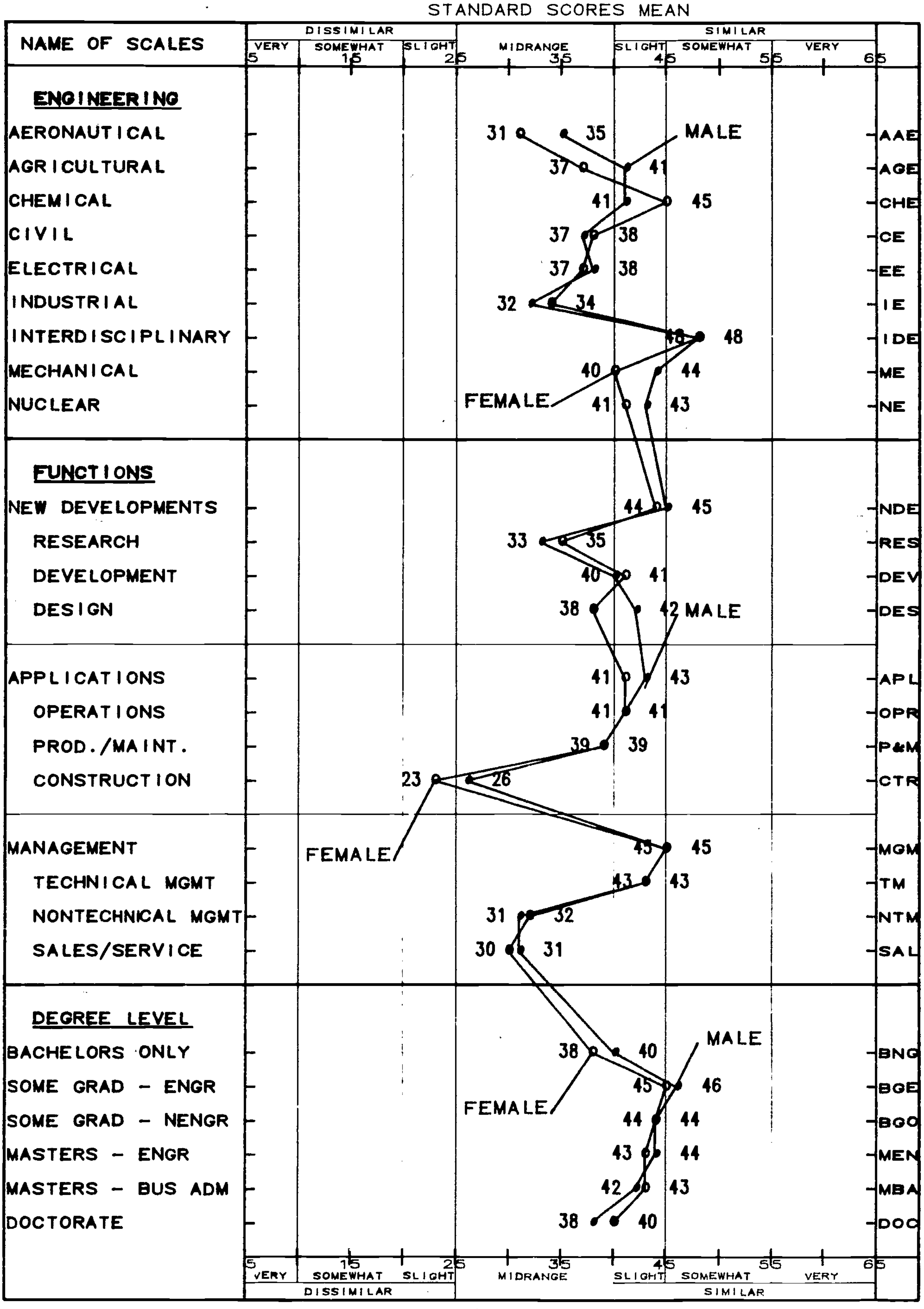

Figure 8 Male/Female Mean Profiles for Graduates on the the Purdue Interest Questionnaire.

other ethnic differences of less magnitude were also observed (see Table 27). The lowest mean scores across all ethnic groups were obtained on the Construction (Applications) Scale and on the Nontechnical Management and Sales/Service Scales. Excluding the major functional scales, the highest mean scores across all ethnic groups were observed for the Technical Management Scale. Scores on the major Function Scales were fairly strong for all ethnic groups (ranging from T-scores of 38 to 48).

On the Educational Level Scales, ethnic differences were observed for only three scales, and only one of these reflected a fairly strong difference ($p<.001$). For the Bachelor's Degree Only Scale, Hispanic American engineers and White American engineers scored highest (T-scores of 40 and 39, respectively), and Foreign Nationals scored lowest (T-score=35).

Field differences. Many PIQ scale differences emerged when the graduate engineers in this study were classified by their current career fields. Differences among fields were highly significant ($p<.0001$) for all scales (see Table 27). Graduate engineers in each particular career field scored highest on the PIQ specialty scale that represents their respective career field. For example, aeronautical engineers scored highest on their Aeronautical Engineering (AAE) Scale; Agricultural engineers scored highest on their Agricultural Engineering (AGE) Scale; etc. However, the PIQ does not include a specialty scale for environmental or resource engineers, but it does contain an Interdisciplinary Engineering (IDE) Scale. Environmental engineers scored highest on the IDE Scale, compared to their scores on the other specialty scales, as did the resource engineers. However, the IDE Scale does not appear to be able to discriminate well among engineers working in the various engineering fields. The mean scores on the IE Scale were relatively strong for all engineering fields.

On the AAE Scale, electrical engineers were most similar, and industrial engineers were least similar, to aeronautical engineers in the field. Chemical engineers, environmental engineers and mechanical engineers scored highest on the AGE Scale, except for agricultural engineers; electrical engineers and industrial engineers scored lower than the other groups on the AGE Scale. The average score obtained by environmental engineers on the CHE Scale (T-score=48) was most similar to that of chemical engineers, while agricultural engineers and mechanical engineers were least similar, as compared to scores for the other fields. Compared to civil engineers, environmental engineers scored highest (T-score=43) and electrical engineers scored lowest (T-score=28) on the CE Scale.

Aeronautical engineers scored highest (T-score=44) and civil engineers scored lowest (T-score=29) on the EE Scale (except for electrical engineers), compared to engineers in other fields. Excluding industrial engineers, chemical engineers scored highest (T-score=33) and aeronautical engineers scored lowest (T-score=22) on the IE Scale. However, scores on the IE Scale were quite low for all of the engineers (except industrial engineers). On the IDE Scale, the average scores for all career fields were similar in level, except for environmental engineers (T-score=54) and industrial engineers (T-score=44). These results suggest that the IDE Scale does not appear to discriminate well among engineers in the various career fields. Additional work needs to be undertaken with this IDE Scale. On the ME Scale, agricultural engineers scored highest

(T-score=46) and environmental engineers scored lowest (T-score=37), compared to engineers in the career fields other than mechanical engineering. Except for nuclear engineers, aeronautical engineers scored highest (T-score=48), and industrial engineers scored lowest (T-score=35), on the NE Scale.

All of the above results suggest that the Engineering Specialty Scales of the PIQ are able to discriminate engineers in each respective field from other engineers. However, the data also suggest that there is considerable similarity of interests among engineers in the various fields. The IE Scale appears to be the most effective scale for discriminating between industrial engineers and all other engineers, and the IDE Scale seems to be the least effective scale for discriminating among the various engineering career-field groups.

PIQ Function Scales and Educational Level Scales also yielded highly significant differences ($p<.0001$) among engineers in the various engineering fields. Among the various career-field groups, aeronautical engineers scored highest and industrial engineers were lowest on the New Developments Function Scale (T-scores of 54 and 34, respectively) and on the specific Research Scale (T-scores of 45 and 26, respectively). Aeronautical engineers also scored highest on the specific Development Scale (T-score=49), while civil engineers scored lowest (T-score=30). On the Design Scale, civil engineers and agricultural engineers scored highest (T-scores of 51 and 50, respectively), and industrial engineers scored lowest (T-score=28), compared to graduates in the other engineering fields.

It is interesting to note that, compared to all engineering career-field groups, aeronautical engineers had the <u>lowest</u> mean scores for all of the Applications Function Scales. Industrial engineers obtained the highest mean scores on these scales, except on the Construction Scale, for which civil engineers had the highest average score. The functional interests of chemical engineers, as well as aeronautical engineers, seem to be least like those of the engineers who were engaged in construction activities. Industrial engineers also obtained the highest average scores on all of the Management Scales, and aeronautical engineers had the lowest scores on these scales, compared with engineers in the other career fields.

Except for the Bachelor's Degree Only Scale, the highest and lowest mean scores on the other Educational Level Scales were obtained either by aeronautical or industrial engineers (see Table 27). Aeronautical engineers were the highest scoring group on three of the other Educational Level Scales (Some graduate work in Engineering, Master's Degree in Engineering and Doctorate), for which industrial engineers were the lowest scoring group, compared to the other groups. On the two nonengineering Educational Level Scales, industrial engineers had the highest scores, and aeronautical engineers had the lowest scorers. Moreover, industrial engineers and civil engineers were the highest scoring groups on the Bachelor's Degree Only Scale, and chemical engineers had the lowest average on this scale.

It is clear that the largest differences among engineers in the various engineering fields with respect to most of the newly developed and normed Function and Educational Level Scales occur between aeronautical and industrial engineers. Aeronautical engineers appear to be interested most in research and development activities, functional areas that may require additional graduate work in engineering. Industrial engineers, on the other hand, seem to be interested primarily in "hands-on" activities and various management functions which may require some graduate work in nonengineering fields (e.g., business administration) or no additional work beyond the Bachelor's Degree.

Counseling potential engineering students. In addition to making comparisons across engineering fields on the various PIQ scales, as was done above, scores obtained from pre-college students should also be compared to those within each engineering field that appears to be promising. Within-sex and within-ethnic group comparisons also can, and should be, made when using the PIQ to assist prospective college students in making career-related decisions. Therefore, scores for the various subgroups within each column on Table 27 can be studied in order to discern the pattern of subscale scores within a given sex, ethnic or career-field group. Within-group differences need to be tested statistically, but these test procedures are beyond the scope of this report. Such tests will be undertaken subsequently.

Purdue Interest Questionnaire: Student Results

Presented in Table 28 are the average scores (T-scores) for the various PIQ scales of the engineering students in this study (N=2217), classified according to sex, ethnicity, current career choice and certainty of career choice. These scores can be compared to the scores derived for PIQ normative groups of freshman engineering and nonengineering students at Purdue University (LeBold, 1976; LeBold, Shell & DeLauretis, 1977; Shell & LeBold, 1978), for which the mean score is 50 and the standard deviation is 10. Comparisons of the 1981 student data to those of the newly derived graduate normative groups on the PIQ Engineering Specialty Scales, and the new Function Scales and Educational Level Scales, are beyond the scope of the present study. However, the freshman data will be rescored and compared to the new national engineer norms as soon as possible.

Overall, the 1981 national student sample scored somewhat lower on the various specialty scales than did the Purdue-based normative groups. The 1981 student group scored lowest on the Management Scale (T-score=27) and highest on the Math/Science Scale (T-score=41). Considering only the Engineering Specialty Scales, the 1981 students scored highest on the Electrical and Mechanical Engineering Scales (T-scores=36) and lowest on the Agricultural and Metallurgical Engineering Scales (T-scores=28). Descriptively, these scores fall within the "mid-range" for each norm group represented by a scale, except for the average score on the Math/Science Scale which would be described as "slightly similar" to the score obtained by that particular norm group. The 1981 student group scored "somewhat similar" to the PIQ norm group on the Engineering Persistence Scale (T-score=50) and "slightly similar" to the norm group on the Engineering Transfer Scale (T-score=42). (These descriptions are presented in the PIQ Interpretive Guide.)

Sex differences. When beginning engineering students were classified according to their sex identification, differences were found for all PIQ scales except for the Metallurgical Engineering Scale. Women (N=765) scored higher than men (N=1452) on the Chemical Engineering Scale (39 vs. 34, respectively), Civil Engineering Scale (31 vs. 28, respectively), Industrial Engineering Scale (30 vs. 28, respectively), Management Scale (29 vs. 26, respectively), ERRATA Sheet for "Report on National Engineering Career Development Study Engineers' Profile for the Eighties"

TABLE 28

Purdue Interest Questionnaire Means and Standard Deviations for Student Engineers Classified by Sex, Ethnicity, Current Career Choice and Certainty of Choice

	TOTAL	SEX		ETHNIC GROUP							CURRENT MAIN CAREER CHOICE																				CERTAINTY CHOICE		
											ENGINEERING																	SCIENCE					
SCALE	UW	MA	FE	BL	MA	HI	AI	AP	WH	FN	AE	AG	AR	BE	CH	CE	CO	EE	ES	EN	IE	ME	NU	RE	OT	TC	MG	BI	CI	PH	UN	PE	DE
Aeronaut Engr	35	37	31	33	35	36	37	34	35	36	46	30	31	36	32	30	36	37	39	31	18	36	38	30	31	36	22	35	32	35	31	35	37
Agric Engr	28	29	26	26	32	29	34	24	27	30	25	37	35	24	25	37	24	26	26	29	26	34	28	30	26	34	19	26	19	26	24	28	29
Chemical Engr	36	34	39	35	33	34	30	37	36	33	34	36	32	40	44	32	34	33	37	43	40	32	36	42	39	31	44	41	39	37	40	36	34
Civil Engr	29	28	31	27	33	29	32	25	29	27	27	31	39	27	29	42	23	23	25	35	33	31	27	35	31	30	31	31	23	27	29	29	29
Electrical Engr	36	38	34	40	36	39	36	40	36	41	39	25	28	38	34	25	46	47	43	25	24	33	41	27	32	36	28	31	39	40	30	36	40
Industrial Engr	29	28	30	30	30	29	27	28	28	30	25	28	27	26	29	30	27	28	24	25	43	30	26	31	32	28	37	26	28	28	28	28	29
Metallurg.Engr	28	28	27	28	30	30	30	27	27	28	26	25	21	29	38	23	24	28	32	21	19	30	37	43	26	30	21	28	17	31	21	27	31
Mechanical Engr	36	38	32	36	40	40	42	33	35	41	37	33	35	31	33	36	33	39	35	25	30	45	39	37	32	42	29	32	24	36	28	35	40
Nuclear Engr	35	37	32	35	36	37	37	37	35	38	38	32	29	37	38	28	38	39	42	31	21	34	45	33	32	36	21	33	29	37	28	35	38
Management	27	26	29	28	26	25	26	28	28	25	25	30	29	26	26	30	26	25	23	31	39	26	22	26	31	25	38	28	34	26	33	27	24
Math/Science	41	40	43	41	38	39	38	43	42	39	42	41	40	44	42	38	43	41	43	45	42	36	40	40	43	38	45	44	49	41	46	41	39
Technology	32	35	27	33	37	36	42	30	31	36	33	35	34	26	23	34	32	37	27	23	29	38	30	28	29	44	30	28	30	30	31	32	34
ENGR PERSIST	50	51	49	50	52	53	52	50	50	53	50	48	48	50	52	50	51	52	52	46	45	53	55	51	48	52	42	49	42	53	44	50	53
ENGR TRANSFER	42	41	43	42	40	40	40	42	42	40	42	43	43	42	40	42	41	41	40	45	46	40	38	41	43	41	48	43	47	40	47	42	40
(No. of Cases)	(2217)	(1452)	(765)	(195)	(130)	(90)	(16)	(48)	(1316)	(83)	(171)	(15)	(56)	(91)	(235)	(190)	(156)	(470)	(23)	(16)	(76)	(288)	(43)	(50)	(57)	(30)	(28)	(44)	(45)	(27)	(272)	(819)	(757)

UW - Unweighted

Sex

MA - Male

FE - Female

Ethnic Group

BL - Black

MA - Mexican American

HI - Other Hispanic

AI - American Indian

AP - Asian Pacific

WH - White

FN - Foreign National

Engineering

AE - Aeronautical Engr.

AG - Agricultural Engr.

AR - Architectural Engr.

BE - Biomedical Engr.

CH - Chemical Engr.

CE - Civil Engr.

CO - Computer

EE - Electrical Engr.

ES - Engineering Sci.

EN - Environmental Engr.

IE - Industrial Engr.

ME - Mechanical Engr.

NU - Nuclear Engr.

RE - Resource Engr.

OT - Other Engr.

Science

TC - Technology

MG - Management

BI - Biological

CI - Computer

PH - Physical

Certainty Choice

UN - Undecided

PE - Possibly Engr.

DE - Definitely Engr.

Math/Science Scale (43 vs. 41, respectively) and the Engineering Transfer Scale (43 vs. 41, respectively). Men scored higher than women on the Aeronautical Engineering Scale (37 vs. 31, respectively), Agricultural Scale (29 vs. 26, respectively), Electrical Engineering Scale (38 vs. 34, respectively), Mechanical Enginering Scale (38 vs. 32, respectively), Nuclear Engineering Scale (37 vs. 32, respectively), Technology Scale (35 vs. 27, respectively) and Engineering Persistence Scale (51 vs. 49, respectively).

These results suggest that separate sex norms based upon students are necessary for the PIQ. Moreover, the national sample of graduate engineers also indicated sex differences for all Engineering Specialty Scales except for the Electrical and Interdisciplinary Scales, the latter being a newly developed scale (based upon the graduate engineering sample).

Ethnic group differences. Strong differences among ethnic groups were found on seven of the PIQ Specialty Scales. However it should be noted that two ethnic groups contained less than 50 students (Asian Pacific and American Indian ethnic groups). Two other groups were comprised of less than 100 students (Hispanic Americans and Foreign Nationals). Consequently, the generalizability of at least some of the observed ethnic differences to new student samples is questionable, and the present data must be interpreted with caution.

On the Agricultural Engineering Scale, the highest average score was obtained by American Indian students (T-score=34), and the lowest score was that of Asian Pacific students (T-score=24). Asian Pacific students scored highest (T-score=37) on the Chemical Engineering Scale, with Mexican Americans and Foreign Nationals scoring lowest on this scale (T-scores of 33). On the Civil Engineering Scale, Mexican Americans scored highest (T-score=33) and Asian Pacific students scored lowest (T-score=25). Foreign Nationals scored highest on the Electrical Engineering Scale (T-score=41), with Mexican American, American Indian and White Americans scoring lowest on this scale (T-scores of 36). On the Mechanical Engineering Scale, American Indians scored highest on the average (T-score=42), and Asian Pacific students scored lowest (T-score=33). On the Math/Science Scale, Asian Pacific students scored highest (T-score=43), with Mexican American and Asian Pacific students scoring lowest (T-scores of 38). Finally, American Indians scored highest on the average on the Technology Scale (T-score=42), and White Americans scored lowest (T-score=31) on this scale.

It will be recalled that the strongest ethnic differences among graduate enginers were found on the Chemical, Civil and Electrical Engineering Scales. Scores for graduate engineer ethnic groups were somewhat higher than those obtained from the student ethnic groups on the Chemical Engineering Scale, and the reverse was true for the Electrical Engineering Scale. Scores on the Engineering Persistence Scale and the Transfer From Engineering Scale were similar across ethnic groups in both student and graduate samples. In both samples, scores across ethnic groups were average in level on the Engineering Persistence Scale and low average on the Engineer Transfer Scale, compared to PIQ student norms (see Table 26).

Across student ethnic groups, the lowest engineering specialty scores were derived for the Management Scale, and the Mathematics/Science Scale drew the highest scores across ethnic groups. All specialty scores for students were below average, or low average, compared to PIQ student norms, as were the scores obtained from graduate-engineer ethnic groups. Moreover, graduate engineers also scored highest and lowest across ethnic groups on the Management Scale and Mathematics/Science Scale, respectively.

Career-choice differences. Highly significant differences among students, classified according to their choices of engineering or science career fields, were observed for all of the PIQ scales. Strong differences across career fields were observed also for the graduate engineers in this study. Students in each career field for which there is a PIQ Specialty Scale scored highest on their respective scale, except for students in management who scored higher on the Mathematics/Science Scale (T-score=45) than on the Management Scale (T-score=38). Students in engineering fields other than the 14 fields represented in Table 28 scored highest on the Mathematics/Science Scale (T-score=43), compared to their scores on the other specialty scales. Students in the three science areas also scored highest on the Mathematics/Science Scale.

It is interesting to look at the career-choice fields that scored highest and lowest on each PIQ Engineering Specialty Scale, other than the specific career-field for which each of the scales is intended. Thus, on the Aeronautical Engineer Scale, engineering science students scored highest (T-score=39) and Industrial Engineering students scored lowest (T-score=18). All of the scores for the various career fields on this scale were substantially lower than that of the aeronautical engineering students (T-score=46). For the Agricultural Engineering Scale, architectural engineering students scored highest (T-score=35) and computer science students scored lowest (T-score=19). The scores for most of the other fields also tended to be low, and even the agricultural engineering students scored rather low (T-score=37) on their own scale. This finding suggests that agricultural engineering students in our national sample are significantly different from the Purdue University norm group of agricultural engineering students.

On the Chemical Engineering Scale, management students scored as high as did chemical engineering students (T-scores=44). Moreover, similar high scores were obtained on this scale from environmental engineering students (T-score=43) and resource engineering students (T-score=42). These results suggest that the Chemical Engineering Scale was not able to differentiate clearly chemical engineering students from several other groups in this study. The lowest score on this scale was derived from technology students (T-score=31), and three other groups had similar low scores for architectural engineering, computer engineering and mechanical engineering students (T-scores=32).

The Civil Engineering Scale discriminated quite well between civil engineering students and all other career-field groups. Scoring second highest were students in architectural engineering (T-score=39) and computer engineering, electrical engineering and computer science students all scored lowest (T-scores=23) compared to other career-choice groups. On the Electrical Engineering Scale, computer engineering students scored second highest (T-score=46), and industrial engineering students scored lowest (T-score=24). This scale did not differentiate well between electrical and computer engineering students, but it did discriminate between these two groups and those of the other career fields.

The Industrial Engineering Scale did differentiate very well between students in industrial engineering and those in all of the other career fields.

Management students scored second highest (T-score=37), and students in environmental science scored lowest (T-score=24). On the Metallurgical Engineering Scale, resource engineering students scored highest (T-score=43), and compute science students scored lowest (T-score=17). No career-field group identified as metallurgical engineering students participated in this study. However, the Metallurgical Engineering Scale did discriminate resource engineering students from all other groups.

Other than mechanical engineering students, technology students scored highest (T-score=42) on the Mechanical Engineering Scale, with computer science and environmental science students scoring lowest (T-scores of 24 and 25, respectively). This scale was fairly strong in differentiating between mechanical engineering students and all other groups. Except for environmental engineering students, who tended to score rather high (T-score=42), the Nuclear Engineering Scale also discriminated quite well between students in nuclear engineering and those in the other career-field groups. On this scale, students in industrial engineering and management (T-scores of 21) held interests that were least like those of nuclear engineering students.

On the Management Scale, industrial engineering students scored slightly higher (T-score=39) than did management students (T-score=38). Both scores were considerably lower than that of the Purdue norm group of management students (T-score=50). However, this scale did differentiate fairly well between these two groups and the other career-fields. The Mathematics/Science Scale was not able to discriminate well among the various career fields. Although computer science students scored highest (T-score=49) on this scale, several other career-field groups also scored quite high (T-scores=40 or higher). Only three groups scored below 40, with management students scoring lowest (T-score=36). These findings may not be surprising, because all career-field groups reported strong interest in mathematics and science on the student survey instrument.

The Technology Scale discriminated well between students in technology and those in the other career fields. Scoring second highest were students in management (T-score=38), and scoring lowest were environmental engineering students (T-score=23). It is interesting to note that, while management students scored fairly high compared to technology students on the Technology Scale, technology students did not score very high on the Management Scale. Overall, the results for the PIQ Engineering Specialty Scale suggest that several PIQ Engineering Specialty Scales were unable to discriminate well between the group for which a given scale was developed and normed and one or more of the other career-field groups.

Scores on the Engineering Persistence Scale were quite strong across all career groups, with scores ranging from 42 to 55. Nuclear engineering students scored highest on this scale, with management and computer science students scoring lowest. These results suggest that most students tended to be interested in continuing with their studies, although students in management and computer science were less interested than others. It is not surprising, therefore, to find that management and computer science students scored highest (T-scores of 48 and 47, respectively), and nuclear engineering students scored lowest (T-score=38), on the Engineering Transfer Scale. In general, scores across career fields on this scale were somewhat lower than were scores on the Engineering Persistence Scale, except for the two high scoring groups. These results make sense, because the more a given group wants to persist in engineering, the less that group wants to transfer out of engineering.

Differences among certainty of career choice levels. When students were reclassified based upon how certain they were about their choices of careers in engineering, significant differences among the three levels (Undecided, Probably Engineering and Definitely Engineering) were observed for 12 of the 14 PIQ scales. No difference among certainty-of-choice levels was observed on the Civil Engineering Scale and the Industrial Engineering Scale. Moreover, all scores on these two scales were very low, with scores of only 28 and 29. All scores on the PIQ scales were fairly low compared to the scores of the Purdue normative samples organized into these same certainty levels. Students who were undecided about careers in engineering scored higher than the other two groups on the Chemical Engineering Scale (T-score=40), the Management Scale (T-score=33), the Mathematics/Science Scale (T-score=46) and the Engineering Transfer Scale (T-score=47). The latter three results are not surprising for these undecided students, but for them to score higher on the Chemical Enginering Scale than did students who were definite about their career-field choices is a finding that needs to be explored further. Students who were definite about their career choices did score higher than others on all of the other scales for which significant differences were found. Moreover, students who indicated that they would "probably" pursue careers in engineering had scores which were between those of the other two groups.

Need for additional analyses. As indicated earlier in this section of the report, comparisons need to be made between the data derived from our national student sample and the new national sample of graduate engineers. Such comparisons are important and necessary for individual and group counseling purposes. These analyses constitute the next step in our program of research designed to validate (and cross-validate) the PIQ for use with future student prospects for careers in engineering.

SUMMARY AND CONCLUSIONS

This research investigation was designed to provide specific information about the factors that have influenced the career decisions of contemporary engineers. Large national samples of professional engineers and beginning engineering students were studied with respect to selected demographic, cognitive, affective and behavioral factors in order to identify those factors that are related to career choice and career development. Two survey instruments, designed to gather relevant information, were administered to participants, together with one or two standardized interest measures: the Strong-Campbell Interest Inventory (SCII) and/or the Purdue Interest Questionnaire (PIQ).

The 1981 Engineering Career Development Study provided an excellent opportunity to examine in depth the career decisions of engineering graduates and engineering students. The study also provided an opportunity to examine the similarities and differences between men and women, between majority and minority engineering students and graduates and among those who specialize in various engineering fields. In addition, the project provided opportunities to examine the usefulness and value of interest inventories in engineering career decision making and to study the extent to which the Strong-Campbell Interest Inventory (SCII) and the Purdue Interest Questionnaire (PIQ) can be used to improve access to students and others considering engineering as a career.

The graduate phase of the study indicated that most engineering graduates are employed in engineering, usually in private industry, in a field similar to and relevant to their college majors. Most graduates are satisfied with their work and are employed in professional engineering or technical management positions; these positions tend to increase in responsibility with experience. In general, few sex or ethnic differences were noted in the employment and professional activities of these graduates, most of whom were members of professional engineering societies. There was some evidence, however, that women with 10 or more years of experience were less likely than their male peers to have managerial responsibilities, and this observation was reflected in the lower salaries reported by experienced women engineers. Graduates tended to have somewhat equally divided views on the need for graduate work in engineering vs. management; however, most graduates had pursued, or were planning to pursue, advanced training beyond the BS degree, with women engineers and Black Americans more inclined toward MBA studies than were others.

Both student and graduate surveys indicated that engineering career decisions and job values were highly related to intrinsic and extrinsic work-related factors. These data also show that male students and male graduates were more influenced by technical activities and hobbies than were women, whereas women engineers were influenced by a wider variety of factors than were men. Moreover, women tended to make their decisions regarding an engineering career somewhat later than did men.

The graduate and student surveys further reveal that engineers have relatively high self-images, especially with regard to their mathematical, science and problem-solving abilities. Men tended to rate their athletic, mechanical and visualization abilities somewhat higher than did women. These findings are reflected in the self-ratings of men for the various instrumental characteristics. In contrast, women in engineering tended to rate their writing, artistic and human relations abilities somewhat higher than did men.

Most engineers viewed themselves and their peers as being quite practical, scientific and somewhat methodical in their occupational orientations. These values were also reflected in their Realistic and Investigative Theme and related Basic Interest Occupational Scale scores on the Strong-Campbell Interest Inventory.

The Purdue Interest Questionnaire also provided insights into the value of the PIQ in making career decisions related to engineering field, function and degree level. The graduate and student data indicated that the PIQ can be used to assist students and graduates in making engineer-related decisions. Graduate and student surveys also indicated that interest inventories, in general, have had very little impact upon engineering career decisions. Unfortunately, most engineering graduates and students had never taken an interest inventory before participating in the present study. Those who had taken an interest inventory previously indicated that the results were quite valuable and did reflect their interests. Hence, it seems plausible to close on the note that interest inventories can be of value in making engineering-related career decisions and could be used to improve access and guidance to prospective engineering students and to enhance career opportunities for engineering graduates.

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APPENDICES

A Marginal Percentages for Total Engineering Graduate Group on the National Engineering Career Development Survey.

B Marginal Percentages for Total Student Group on the Final Pre-Engineering Career Survey.

C Item-Response Percentages by Sex, by Ethnic Group and by Employment Field for Graduate Survey Items.

D Item-Response Percentages by Sex, by Ethnic Group and by Major Field for Final Student Survey Items.

E Highlights of the National Engineering Career Development Survey Sent to All Graduate Engineer Participants.

F* Research Papers Presented to National Professional Organizations and Articles Submitted for Publication.

*Not included in all reports. Available from Educational Resources Information Center (ERIC) or conference Proceedings.

APPENDIX A: Marginal Percentages for Total Engineering Graduate Group on the National Engineering Career Development Survey.

1. Which of the following best describes your employment experiences while an undergraduate? (Check one)

- 10% ☐ 1. None
- 14 ☐ 2. Co-op employment
- 38 ☐ 3. Non Co-op engineering-related employment
- 31 ☐ 4. Non Co-op non-engineering-related employment
- 7 01–9 ☐ 5. Other (Specify)________

(N=2344)

2. Your present employment status: (Check one)

- 1% ☐ 01. Not employed (outside the home) and not seeking work
- 1 ☐ 02. Not employed, seeking engineering or related position
- 0 ☐ 03. Not employed, seeking non-engineering position
- 2 ☐ 04. Employed part-time in engineering position
- 0 ☐ 05. Employed part-time in non-engineering position
- 81 ☐ 06. Employed full-time (35 + hours per week), in engineering position
- 10 ☐ 07. Employed full-time (35 + hours per week), in non-engineering position
- 1 ☐ 08. Self-employed, engineering
- 1 ☐ 09. Self-employed, non-engineering (Specify)________
- 0 ☐ 10. Retired from engineering position
- 0 ☐ 11. Retired from non-engineering position
- 3 ☐ 12. Other (Specify)________

10-11

(2350)

3. How satisfied are you with your choice of occupation?

- 1% ☐ 1. I haven't made a choice yet; I'm still uncertain.
- 6 ☐ 2. I'm not really satisfied; I am reconsidering.
- 22 ☐ 3. I am fairly satisfied, but have some doubts.
- 46 ☐ 4. I think I have made the best choice, given all the circumstances.
- 25 ☐ 5. I am fully satisfied; I prefer this to anything else.

12

(2356)

4. How satisfied are you with your progress in your occupation?

- 10% ☐ 1. Not really satisfied; I think I should be further along.
- 24 ☐ 2. Fairly satisfied with it.
- 45 ☐ 3. I feel I am doing well.
- 18 ☐ 4. I am fully satisfied and very pleased.

13

(2345)

Your Employment

(For Questions 5 through 12 check one box in each column)

The following questions ask you to describe your employment history. Please answer each for your *present position* and your *first job* after BS graduation.

If your *Present Position* is your *First Job*, check here ☐ and record the same responses in the *Present Job* and *First Job* columns.

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5. What type of business do/did you work for?

Manufacturing	Present Job %	First Job
01. Aircraft	4 ☐	5% ☐
02. Chemicals	7 ☐	7 ☐
03. Electrical equipment	2 ☐	2 ☐
04. Electronic equipment	8 ☐	5 ☐
05. Computers	4 ☐	3 ☐
06. Fabricated metal products	2 ☐	3 ☐
07. Machinery (except electrical)	5 ☐	5 ☐
08. Motor vehicles	2 ☐	2 ☐
09. Ordnance	0 ☐	0 ☐
10. Petroleum	4 ☐	4 ☐
11. Primary metal industries	1 ☐	2 ☐
12. Scientific equipment	1 ☐	1 ☐
13. Other manufacturing	6 ☐	8 ☐

Other Kinds of Business	Present Job	First Job
20. Agriculture, forestry, and fisheries	2 ☐	2 ☐
21. Business, personal, and professional services	1 ☐	1 ☐
22. Construction	3 ☐	2 ☐
23. Engineering or architectural services	14 ☐	12 ☐
24. Finance, insurance, or real estate	0 ☐	0 ☐
25. Mining and petroleum extraction	3 ☐	3 ☐
26. Other private, non-profit organizations	0 ☐	0 ☐
27. Professional and technical societies	0 ☐	0 ☐
28. Research institutions	3 ☐	3 ☐
29. Retail and wholesale trade	0 ☐	0 ☐
30. Transportation, communication, or other public utilities	6 ☐	6 ☐
31. Other (Specify)	5 ☐	5 ☐

Continued next column

Government	Present Job	First Job
32. Uniformed military service	1 ☐	3 ☐
33. Federal	7 ☐	6 ☐
34. State	2 ☐	2 ☐
35. Local (city, county, etc.)	1 ☐	1 ☐
36. Regional government	0 ☐	0 ☐
37. Other government	0 ☐	0 ☐
Health Services		
18. Hospital or clinic (including V.A.)	0 ☐	0 ☐
19. Other medical and health services	0 ☐	0 ☐
Educational Institutions		
14. College or university	5 ☐	5 ☐
15. Junior college or technical institute	0 ☐	0 ☐
16. Medical school	0 ☐	0 ☐
17. Other educational institutions	0 ☐	1 ☐
	15-16 (2315)	17-18 (2305)

6. Indicate the principal field in which you have been engaged.

Engineering	Present Job	First Job
11. Aeronautical	3% ☐	3% ☐
12. Agricultural	5 ☐	0 ☐
13. Architectural	0 ☐	0 ☐
14. Bio-Medical	1 ☐	1 ☐
15. Chemical	8 ☐	10 ☐
16. Civil	12 ☐	13 ☐
17. Computer	4 ☐	3 ☐
18. Electrical	8 ☐	8 ☐
19. Engineering Science	1 ☐	1 ☐
20. Environmental, Sanitary	3 ☐	3 ☐
21. Geological/Mineral	1 ☐	1 ☐
22. Industrial	11 ☐	12 ☐
23. Mechanical	13 ☐	15 ☐
24. Mining/Mater./Meta	2 ☐	2 ☐
25. Nuclear	4 ☐	3 ☐
26. Petroleum	2 ☐	2 ☐
27. Other Engineering (Specify:________	0 ☐	6 ☐
Non-Engineering		
28. Technology	1 ☐	1 ☐
29. Business Administration	3 ☐	1 ☐
30. Business, Other	2 ☐	1 ☐
31. Biological Sciences	0 ☐	0 ☐
32. Chemistry	0 ☐	1 ☐
33. Physics	0 ☐	0 ☐
34. Other Physical Sciences	0 ☐	0 ☐
35. Computer Science	1 ☐	1 ☐
36. Mathematics/Statistics	0 ☐	1 ☐
37. Social Sciences	0 ☐	0 ☐
38. Arts and Humanities	0 ☐	0 ☐
39. Education	1 ☐	1 ☐
40. Other (Specify. ________)	3 ☐	3 ☐
	19-20 (2308)	21-22 (2281)

7. Indicate your principal function.

	Present Job	First Job
11. Pre-Professional (including technician, on-the-job training, etc.)	2%	7%
12. Research	8	10
13. Development	11	13
14. Design	20	22
15. Operations	7	8
16. Production & maintenance	6	8
17. Testing & inspection	3	4
18. Construction	4	4
19. Sales & service	3	2
20. Teaching	3	3
21. Technical management	16	5
22. Non-technical management	3	2
23. Consulting	6	4
24. Other (Specify)	7	8
	23-24	25-26
	(2250)	(2207)

8. Indicate your degree of supervisory responsibility.

	Present Job	First Job
1. No supervisory responsibility	41%	61%
2. Supervision of non-technical personnel	10	13
3. Supervision of technical personnel only (except engineering & scientific)	8	8
4. Supervision of technical & non-technical personnel (except engineering & scientific)	10	8
5. Supervision of professional engineering & scientific personnel	17	5
6. Supervision of lower management personnel	3	1
7. Supervision of middle management personnel	2	0.
8. Responsible only to highest administrative offices	5	1
9. Hold highest administrative position	2	0.
	27	28
	(2275)	(2182)

9. Indicate your technical administrative function.

	Present Job	First Job
1. Primarily technical	50%	71%
2. Half technical, half administrative	30	18
3. Primarily administrative, technical background necessary	18	8
4. Primarily administrative, technical background not necessary	2	3
	29	30
	(2192)	(2083)

10. Indicate your level of technical responsibility.

Nature of Work—*Knowledge Required*	Present Job	First Job
1. Simple prescribed procedures—*no previous knowledge*	5%	1%
2. Sequence of prescribed procedures—*limited knowledge of principles*	8	3
3. Specific applications of theory to practice—*general knowledge of principles*	28	13
4. Select and apply standard techniques—*working knowledge of standard methods*	23	19
5. Devises alternative methods of problem-solving using standard methods—*good knowledge of standard guides and techniques*	21	28
6. Complex tasks: improve and extend existing methods—*thorough knowledge of standard guides*	11	25
7. Plans and organizes large projects, national authority—*extensive knowledge of principles and methods*	2	10
8. Pioneering work, international authority—*outstanding knowledge of most advanced techniques*	3	1
	31	32
	(2246)	(2188)

11. Relevance of Your Educational Background to Job:

	Present Job	First Job
1. Must have	38%	36%
2. Very important	24	19
3. Important	23	23
4. Some importance	12	16
5. Little importance	2	4
6. Unnecessary	1	2
	33	34
	(2285)	(2248)

12. General Level of Satisfaction with Work in Position:

	Present Job	First Job
1. Very satisfied	28%	22%
2. Satisfied	51	45
3. Neutral	14	17
4. Dissatisfied	5	12
5. Very dissatisfied	2	4
	35	36
	(2268)	(2214)

13. Present Job

Name of Employer:____________________

Location:____________________ 37-38
City State

Job Title:____________________ 39-52

Gross Annual Professional Income to nearest thousand dollars $__________ 53-54

Check if part-time or graduate student employment ☐ 55

First Job After B.S.—(year began)______ 56-57

Name of Employer:____________________

Location:____________________ 58-59
City State

Job Title:____________________ 60-73

Gross Annual Professional Income to nearest thousand dollars $__________ 74-75

Check if part-time or graduate student employment ☐ 76

14. How many years of professional experience have you had including teaching?

__________Yrs. __________Yrs.
Total Engineering-related
77-78 79-80

15. During the past year, have you engaged in these technical activities? (Please check all that apply)

02–9 ☐ I discussed new engineering developments with my associates. 77%
(1774)
(2066) ☐ I read about new developments in engineering/science. 90
(2076) ☐ I subscribed to engineering or scientific periodicals. 90
(1046) ☐ I read new books about engineering or science. 45
(1033) ☐ I purchased new books on engineering/science. 45
(1208) ☐ I attended local technical meetings on engineering. 52
(383) ☐ I took non graduate-credit courses in engineering or science. 17
(389) ☐ I completed graduate courses in engineering or science. 17
(725) ☐ I attended national technical meetings. 31
(293) ☐ I presented one or more technical papers. 13
(771)
19 ☐ I attended a short course or workshop on management. 33

16. Check one of the following which applies to you.

13% ☐ 1. I am a registered professional engineer (PE).
34 ☐ 2. I am a registered engineer in training (EIT).
53 ☐ 3. I am not a registered engineer.
20
(2036)

17. Indicate the number of national professional, technical and scientific societies in your field of which you are now a member. (Specify number) ____ 21

0	4%	3	14%	6+	1%
1	4%	4	5%		
2	30%	5	2%		

(2253)

18. How many articles have you published? (Specify number) ____ 22-23

0	70%	4-10	6%
1	10	11-25	5
2-3	8	26+	2

(1889)

19. How many books have you published? (Specify number) ____ 24

0	97%
1	2
2+	1

(1750)

20. How many patents do you have?

Number disclosed/applied for ____
Number you have been granted ____ 25, 26

0	89%	0	95%
1	6	1	3
2	2	2	1
3-5	2	3-5	1
6+	1	6+	1
(1776)		(1751)	

Background Information and Education

21. Year of birth: 19____ 27-28

Your sex:
☐ 1. male 60%
☐ 2. female 37
29 (2366)

Your race/ethnic identification:
0. ☐ 1. American Indian
4 ☐ 2. Asian or Pacific Islander
5 ☐ 3. American Black
3 ☐ 4. Mexican-American
0. ☐ 5. Puerto Rican
1 ☐ 6. American Cuban
2 ☐ 7. Other Hispanic
83 ☐ 8. White, Not Hispanic
2 ☐ 9. Other (Specify) ____
30
(2304)

Your Citizenship:
91 ☐ 1. U.S., native-born
6 ☐ 2. U.S., naturalized
4 ☐ 3. Foreign national
(Specify) ____
31
(2312)

Your marital status:
34 ☐ 1. Single
60 ☐ 2. Married now
5 ☐ 3. Separated, divorced
0. ☐ 4. Widowed
32
(2216)

How many children do you have?
1. Total number: ____ 33
2. Living with you: ____ 34

22. From what type of school did you receive your high school and college education?

	High School	College
1. Private-church related	10% ☐	5% ☐
2. Private-non-sectarian	3 ☐	21 ☐
3. Public, state	86 ☐	73 ☐
4. Military	0. ☐	1 ☐
5. Other (Specify)	0. ☐	0. ☐
	35	36
	(2213)	(2210)

23. Which of the following categories best describes your father's and mother's occupation at the time you were in college (BS) and your spouse's current job? If retired, deceased or unemployed, give last occupation. (Please check one box in each column.)

	Father	Mother	Spouse
11. Professional (Engineering)	15% ☐	0.% ☐	12% ☐
12. Professional (Other)	22 ☐	14 ☐	21 ☐
13. Proprietor, Manager, Farm Owner	20 ☐	3 ☐	2 ☐
14. Semi-professional, technical	7 ☐	3 ☐	4 ☐
15. Sales, except sales management	5 ☐	3 ☐	2 ☐
16. Clerical	3 ☐	14 ☐	6 ☐
17. Skilled worker	15 ☐	3 ☐	2 ☐
18. Semi-skilled worker	6 ☐	4 ☐	1 ☐
19. Unskilled, service or farm worker	4 ☐	3 ☐	0. ☐
20. Homemaker	0. ☐	51 ☐	14 ☐
21. Not applicable	3 ☐	2 ☐	37 ☐
	37-38	39-40	41-42
	(2309)	(2313)	(2146)

24. What was your parent's highest level of education attained at the time you entered college, and your spouse's current level of educational attainment?

	Father	Mother	Spouse
1. 8th grade or less	13% ☐	9% ☐	0. ☐
2. Some High School	8 ☐	9 ☐	1 ☐
3. High School graduate	24 ☐	38 ☐	11 ☐
4. Some college	14 ☐	14 ☐	16 ☐
5. Associate degree	4 ☐	6 ☐	10 ☐
6. Bachelor's degree	21 ☐	17 ☐	30 ☐
7. Master's degree	10 ☐	6 ☐	16 ☐
8. Doctor's degree	5 ☐	1 ☐	7 ☐
	43	44	45
	(2304)	(2313)	(1456)

25. From what institution did you receive each degree you have obtained? If you did not graduate, leave year of graduation blank.

Year of Graduation		Last Institution	
1. 19___	Bachelor's	________	46, 48
2. 19___	Master's	________	51, 53
3. 19___	2nd Master's	________	56, 58
4. 19___	Doctorate	________	61, 63

26. Which of the following best describes your current educational level? (Check one box)

11.	Some college but no degree	☐ 1%
12.	Bachelor's degree, no graduate work	☐ 35
13.	Bachelor's degree, some graduate work, with no engineering study	☐ 17
15.	Master's degree in engineering	☐ 25
16.	Master's degree in business administration	☐ 8
17.	Master's degree in other non-engineering field	☐ 3
18.	Master's degree in engineering *and* in another field	☐ 2
19.	Doctorate, engineering	☐ 4
20.	Doctorate, non-engineering	☐ 1
21.	Other (Specify)	☐ 4

66-67
(2309)

27. Further education planned: (Check one)

11.	None, no further education planned	☐ 10%
12.	Some graduate work or continuing engineering education, but no additional degrees	☐ 20
13.	Some graduate work or continuing education in management, but no additional degrees	☐ 13
14.	Master's degree, engineering	☐ 10
15.	Master's degree, business administration	☐ 20
16.	Master's degree, other non-engineering field	☐ 2
17.	Master's degree in engineering *and* in another field	☐ 3
18.	Doctorate, engineering	☐ 8
19.	Doctorate, non-engineering	☐ 2
20.	Other (Specify)	☐ 4

(2292)

68-69

28. If you could choose a particular graduate program to take, which would you choose? (Check one)

1.	A design oriented engineering graduate program	☐ 21%
2.	A research oriented engineering graduate program	☐ 17
3.	A management oriented graduate program	☐ 58
4.	Other (Specify) ________	☐ 4

70
(2248)

29. Major field for each educational degree. (Check one in each column that applies.)

Engineering	B.S. B.A.	First M.S.	Second M.S.	Doct.
11. Aeronautical	☐ 3%	☐ 2%	☐ 2%	☐ 7%
12. Agricultural	☐ 0	☐ 0	☐ 1	☐ 0
13. Architectural	☐ 1	☐ 0	☐ 0	☐ 0
14. Bio-Medical	☐ 0	☐ 0	☐ 2	☐ 1
15. Chemical	☐ 12	☐ 10	☐ 3	☐ 13
16. Civil	☐ 15	☐ 8	☐ 4	☐ 8
17. Computer	☐ 1	☐ 1	☐ 2	☐ 2
18. Electrical	☐ 10	☐ 7	☐ 4	☐ 0
19. Engineering Science	☐ 1	☐ 1	☐ 2	☐ 2
20. Environmental, Sanitary	☐ 1	☐ 3	☐ 2	☐ 2
21. Geological/Mineral	☐ 1	☐ 1	☐ 1	☐ 2
22. Industrial	☐ 12	☐ 8	☐ 8	☐ 10
23. Mechanical	☐ 18	☐ 8	☐ 5	☐ 8
24. Mining/Mater./Metal	☐ 1	☐ 1	☐ 0	☐ 2
25. Nuclear	☐ 1	☐ 3	☐ 2	☐ 2
26. Petroleum	☐ 0	☐ 0	☐ 0	☐ 1
27. Other Engineering	☐ 2	☐ 2	☐ 4	☐ 4
Non-engineering				
28. Technology	☐ 1	☐ 0	☐ 2	☐ 1
29. Business Administration	☐ 1	☐ 18	☐ 37	☐ 2
30. Business, Other	☐ 0	☐ 1	☐ 2	☐ 0
31. Biological Sciences	☐ 1	☐ 0	☐ 1	☐ 0
32. Chemistry	☐ 2	☐ 1	☐ 0	☐ 1
33. Physics	☐ 2	☐ 1	☐ 3	☐ 4
34. Other Physical Sciences	☐ 1	☐ 0	☐ 2	☐ 2
35. Computer Science	☐ 1	☐ 1	☐ 4	☐ 1
36. Mathematics/Statistics	☐ 2	☐ 2	☐ 4	☐ 3
37. Social Sciences	☐ 0	☐ 0	☐ 1	☐ 0
38. Arts and Humanities	☐ 0	☐ 0	☐ 1	☐ 1
39. Education	☐ 0	☐ 1	☐ 0	☐ 2
40. Other (Specify)________	☐ 1	☐ 2	☐ 8	☐ 8
	71-72	73-74	75-76	77-78
	(2288)	(1071)	(128)	(187)

30. Below are some statements about the need for graduate work or continuing education in your present field of employment. For each statement indicate the extent to which you agree or disagree.

	Strongly Agree 1	Agree 2	Disagree 3	Strongly Disagree 4	
1. A bachelor's degree is sufficient preparation; graduate study is not needed.	☐ 16%	☐ 43%	☐ 31%	10% ☐	03-9
2. On-the-job training or "in-house" courses are sufficient to keep "up-to-date."	☐ 6	☐ 41	☐ 46	7 ☐	
3. Non-credit courses are sufficient for keeping "up-to-date."	☐ 3	☐ 52	☐ 40	5 ☐	
4. Graduate work is needed, but in management.	☐ 9	☐ 41	☐ 43	7 ☐	
5. Graduate work is needed in math and science.	☐ 5	☐ 25	☐ 56	14 ☐	
6. Graduate work is needed with emphasis on engineering.	☐ 13	☐ 34	☐ 44	9 ☐	14

(2245)

31. When did you decide on a career in engineering? (Check one in each column.)

	First Considered	Final Decision
1. Before high school	18%	4%
2. During the 1st 2 years of high school (grades 9-10)	18	8
3. During the last 2 years of high school (grades 11-12)	40	43
4. During the 1st year of college	11	18
5. During the 2nd year of college	8	13
6. During the 3rd or 4th year of college	3	7
7. After college	(2291) 15 5	(2245) 16 8

32. Presented below is a list of people, activities, and other factors that may have encouraged you to pursue a career in engineering. Please indicate how important each factor was to you personally.

	Importance of Each Factor: Very % 1	Some % 2	Little % 3	None % 4	
People					
1. Mother (or female guardian)	14	31	28	26 17	(2255)
2. Father (or male guardian)	30	31	18	20	(2284)
3. Other relative	12	18	19	53	(2211)
4. Friends	8	28	28	38	(2207)
5. High School math or science teacher(s)	18	30	22	30	(2233)
6. College teacher(s)	18	28	18	38	(2187)
7. College counselor(s)	8	14	18	58	(2185)
8. Male engineer(s)	12	18	18	51	(2188)
9. Female engineer(s)	2	8	14	78	(2188)
10. High School counselor(s)	7	15	18	62	(2187)
Courses					
11. Career education courses	5	12	17	68 27	(2157)
12. High School math courses	31	35	18	18	(2238)
13. High School science courses	32	38	18	18	(2237)
14. College math courses	21	34	22	24	(2188)
15. College chemistry courses	8	27	28	37	(2183)
16. College physics courses	15	32	25	21	(2184)
17. College science courses	15	35	24	28	(2185)
18. College engineering courses	46	28	8	17	(2207)
Guidance Instruments, Activities					
19. Interest inventory results	5	18	18	57 35	(2162)
20. Aptitude tests	12	33	20	35	(2209)
21. Career or occupational information	20	37	19	23	(2188)
22. Relevant work experience	21	21	17	41	(2193)
22. Hobby Magazine (e.g. Pop. Mechanics)	4	11	18	67	(2187)
24. Technical Publications	5	15	23	57	(2180)
25. Science Fair participation	4	12	18	66	(2183)
26. Outdoor activities	5	14	18	63	(2180)
27. Science Clubs	3	10	17	70	(2183)
28. Junior Achievement	1	3	10	87	(2168)
29. Science Fiction	8	15	18	61	(2182)
30. Liking for problem solving activities	50	38	8	8	(2244)
31. Being curious or creative	46	37	11	7	(2218)
32. Wanting to be of service to others	17	28	26	29	(2198)
33. Flying aircraft	6	6	8	79	(2181)
34. Using a computer	12	20	20	48 50	(2185)
35. Building electrical devices	7	12	15	65	(2184)
36. Mechanical hobby	11	18	17	54	(2185)
37. Construction hobbies	11	19	19	51	(2184)
38. Building model airplanes	6	12	17	65	(2179)
39. Farm experiences	7	8	9	76	(2175)
40. Pre-college summer seminars	4	6	8	82	(2169)
41. Type of work	30	34	13	24	(2203)
42. Challenge	49	35	9	8	(2221)
43. Salary	37	39	15	10	(2224)
44. Creativity	36	38	16	10	(2204)
45. Security	20	36	20	19	(2200)
46. Prestige	24	38	21	17	(2204)
47. Rapid Advancement	18	30	28	24	(2196)
48. Leadership	22	34	24	20	(2195)
49. Independence	34	34	18	14 65	(2189)

50. Main factors influencing your choice of engineering *specialty* (use above numbers if applicable) 66,68,70

33. Have you ever taken an interest inventory in the past as a part or career counseling?

1. Yes	33%
2. No	60
3. Uncertain	7
	72 (2312)

If YES or UNCERTAIN, answer a. through f.

a. Which interest inventory(ies) did you take? (Check as many as apply)

Kuder interest measure (K)	73	21
Purdue Interest Questionnaire (P)		4
Strong Vocational Interest Blank (S) or Strong-Campbell Interest Inventory (S)		16
Uncertain or Other (Specify) ______ (O)	76	61

Answer b. through f. in the appropriate column for each type of inventory you have taken.

b. When did you take the measure(s)?

	% (K)	% (P)	% (S)	% (O)	
Pre-college (including high school	74	33	36	65	77-80 04-
In college	28	38	50	28	9-12
After college	12	38	28	13	13-16
	(27)	(11)	(51)	(78)	

c. What impact did the interest inventory results have for you?

	(K)	(P)	(S)	(O)
1. Very helpful	15	18	11	8
2. Helpful	32	24	36	28
3. Uncertain value	33	30	32	37
4. No value	17	26	20	24
5. Other ______	2	3	2	2
______	17			20
	(204)	(34)	(180)	(522)

d. Did the interest inventory results seem to reflect your interests as you see them?

	(K)	(P)	(S)	(O)
1. No	12	10	8	10
2. Unsure, no	12	7	7	13
3. Unsure, yes	31	48	41	38
4. Yes	46	34	43	40
	(200) 21	(29)	(180) 24	(512)

e. Were the interpretation materials understandable?

	(K)	(P)	(S)	(O)
1. No, not at all	4	4	7	8
2. Yes, partly	48	63	48	60
3. Yes, completely	47	33	44	34
	(192) 25	(27)	(176) 28	(490)

f. Were the interpretation materials helpful?

	(K)	(P)	(S)	(O)
1. No, harmful	3	6	5	4
2. No, useless	16	19	14	24
3. Yes, partly	64	67	67	60
4. Yes, completely	18	8	14	12
	29			32
	(192)	(36)	(185)	(507)

34. Rate yourself on each of the following traits as you really think you are when compared with the average adult who has attended college. We want the most accurate estimate of how you see yourself.

	Highest 10 Percent 1	Above Average 2	Average 3	Below Average 4	Lowest 10 Percent 5	
1. Academic ability	36% ☐	48% ☐	15% ☐	1 ☐	0% ☐	33(2287)
2. Athletic ability	8 ☐	32 ☐	41 ☐	10 ☐	3 ☐	(2285)
3. Artistic ability	4 ☐	23 ☐	38 ☐	30 ☐	5 ☐	(2283)
4. Drive to achieve	31 ☐	50 ☐	17 ☐	2 ☐	0. ☐	(2281)
5. Leadership ability	22 ☐	52 ☐	23 ☐	4 ☐	0. ☐	(2284)
6. Mathematical ability	31 ☐	48 ☐	18 ☐	2 ☐	0. ☐	(228[illegible]
7. Mechanical ability	18 ☐	45 ☐	31 ☐	8 ☐	1 ☐	39(2284)
8. Originality	15 ☐	47 ☐	34 ☐	3 ☐	1 ☐	(2283)
9. Problem solving ability	33 ☐	56 ☐	10 ☐	1 ☐	1 ☐	(2284)
10. Public speaking ability	12 ☐	32 ☐	38 ☐	18 ☐	2 ☐	(2285)
11. Self-confidence (intellectual)	23 ☐	51 ☐	22 ☐	3 ☐	1 ☐	(2285)
12. Self-confidence (social)	14 ☐	34 ☐	40 ☐	12 ☐	1 ☐	(2284)
13. Sensitivity to criticism	7 ☐	30 ☐	54 ☐	8 ☐	1 ☐	45(2285)
14. Understanding others	10 ☐	50 ☐	28 ☐	3 ☐	0 ☐	(2283)
15. Writing ability	18 ☐	43 ☐	32 ☐	7 ☐	1 ☐	(2285)
16. Verbal ability	14 ☐	41 ☐	37 ☐	8 ☐	1 ☐	(2288)
17. Visualization ability	22 ☐	48 ☐	27 ☐	2 ☐	1 ☐	49(2284)

35. Following are a series of 5-point scales which describe a variety of personal characteristics. Please rate yourself on each characteristic, by placing a circle around the appropriate number on the scale.
For example, how artistic are you? On the scale below, very artistic is indicated at the far right and not-at-all artistic is at the far left. If you think you are moderately artistic, your answer might be ④. If you are very unartistic, you should choose ①, and so on.

(2282)	Not at all artistic	1 10% . 2 25% . 3 33% . 4 24% . 5 7%	Very artistic	50
(2287)	Not at all independent	1 0. . . 2 1 . . 3 9 . . 4 41 . . 5 48	Very independent	
(2288)	Not at all emotional	1 1 . . 2 15 . . 3 41 . . 4 34 . . 5 8	Very emotional	
(2284)	Very passive	1 1 . . 2 8 . . 3 30 . . 4 44 . . 5 18	Very active	
(2284)	Not at all able to devote self completely to others	1 2 . . 2 10 . . 3 37 . . 4 48 . . 5 11	Able to devote self completely to others	
(2283)	Very rough	1 0. . . 2 8 . . 3 40 . . 4 43 . . 5 11	Very gentle	55
(2277)	Not at all helpful to others	1 0. . . 2 1 . . 3 18 . . 4 80 . . 5 22	Very helpful to others	
(2285)	Not at all competitive	1 1 . . 2 5 . . 3 22 . . 4 45 . . 5 27	Very competitive	
(2283)	Not at all kind	1 0. . . 2 1 . . 3 21 . . 4 58 . . 5 18	Very kind	
(2281)	Not at all aware of the feelings of others	1 8 . . 2 2 . . 3 20 . . 4 48 . . 5 30	Very aware of the feelings of others	
(2280)	Have difficulty making decisions	1 1 . . 2 8 . . 3 24 . . 4 47 . . 5 21	Can make decisions easily	
(2282)	Give up very easily	1 0. . . 2 2 . . 3 17 . . 4 48 . . 5 35	Never give up easily	
(2282)	Not at all self-confident	1 1 . . 2 8 . . 3 23 . . 4 48 . . 5 22	Very self-confident	
(2285)	Feel very inferior	1 0. . . 2 6 . . 3 48 . . 4 38 . . 5 8	Feel very superior	
(2281)	Not at all understanding of others	1 0. . . 2 2 . . 3 23 . . 4 57 . . 5 18	Very understanding of others	
(2280)	Very cold in relations with others	1 0. . . 2 5 . . 3 38 . . 4 44 . . 5 15	Very warm in relations with others	
(2282)	Goes to pieces under pressure	1 0. . . 2 2 . . 3 20 . . 4 50 . . 5 27	Stands up well under pressure	
(2278)	Not at all tolerant of ambiguity	1 7 . . 2 33 . . 3 35 . 4 20 . . 5 5	Very tolerant of ambiguity	
(2281)	Low verbal ability	1 0. . . 2 7 . . 3 32 . 4 43 . . 5 17	Very high verbal ability	
(2284)	Low math ability	1 0. . . 2 2 . . 3 17 . 4 48 . . 5 32	Very high math ability	
(2281)	Very limited creative abilities	1 0. . . 2 5 . . 3 38 . 4 48 . . 5 18	Very highly creative	
(2283)	Low mechanical ability	1 1 . . 2 8 . . 3 32 . 4 42 . . 5 17	Very high mechanical ability	
(2282)	Low visualization ability	1 1 . . 2 3 . . 3 25 . 4 48 . . 5 23	Very high visualization ability	
(2283)	Low problem-solving ability	1 1 . . 2 0. . . 3 10 . 4 55 . . 5 34	Very high problem-solving ability	73

36. Below are some statements about different aspects of your professional position. Indicate how important each is to you personally, and how characteristic it is of your present job.

	How important to you personally? Very 1	Some 2	Little 3	None 4		How characteristic of your present job? Very 1	Some 2	Little 3	None 4	
74	84%	32%	3%	0.%	1. Opportunity to innovate and propose new ideas	38%	45%	14%	3%	(2221) 38
	81	18	1	0.	2. Opportunity to use my skills and abilities in challenging work	44	42	12	2	(2218)
	70	30	3	1	3. Superiors who are willing to delegate responsibility	44	39	14	3	(2208)
	33	47	17	3	4. Opportunity to make significant contributions to society	14	38	35	13	(2212)
	48	43	10	1	5. A chance to exercise leadership	25	48	23	[illegible]	(2215)
	34	50	14	2	6. Opportunities to help others	20	45	30	[illegible]	(2206)
	48	41	10	2	7. Wide variety of technical work	34	41	20	4	(2218)
05–9	30	42	23	5	8. Opportunity to work with things	24	36	30	10	(2180)
	53	38	[illegible]	2	9. Desirable geographic location	45	31	17	7	(2205)
	54	40	[illegible]	1	10. Opportunity to advance myself economically	27	53	18	4	(2204)
	20	40	32	[illegible]	11. Opportunity to enhance my social status and prestige	13	47	32	[illegible]	(2208)
	72	25	2	1	12. An income which permits me (and my family) to live comfortably	42	47	[illegible]	2	(2210)
14	47	33	15	5	13. Provides an opportunity to move into a management career	36	39	18	[illegible]	(2205) 50
	50	38	[illegible]	3	14. Company realizes that employees often have family responsibilities	30	48	18	5	(2192)
	52	38	[illegible]	1	15. I know exactly what my work responsibilities are	30	48	19	3	(2200)
	20	45	27	8	16. The opportunity to travel	22	38	28	12	(2204)
	45	44	10	1	17. The opportunity to work with people	51	38	[illegible]	1	(2194)
	28	42	25	[illegible]	18. The opportunity to be assigned to different areas of the company	20	32	33	15	(2185)
	74	22	3	1	19. A position where people are interested in working together and not encouraging petty jealousies	27	45	22	[illegible]	(2200)
21	28	45	22	5	20. Freedom from pressure to perform exceptionally well on every assignment	15	49	27	[illegible]	(2188) 57
	37	44	16	3	21. Adequate preparation for top level careers (e.g. by career counseling, job rotation, etc.)	10	33	38	20	(2180)
	61	38	3	0.	22. Participation in important work-related decisions	24	43	25	7	(2201)
	68	28	2	1	23. Company is well-managed and progressive	21	41	28	11	(2197)
	38	41	16	4	24. Flexible working hours	27	30	24	19	(2201)
	48	38	12	2	25. Availability of personal leave (including maternity, and family related leave)	41	40	18	4	(2185)
	52	41	[illegible]	0.	26. The opportunity to keep abreast of the latest developments in my field	28	44	24	5	(2201)
	64	32	3	0.	27. Large degree of freedom to manage own work	44	41	13	2	(2198)
	49	43	7	1	28. Opportunity to work on problems for which there are no ready-made solutions	44	40	13	3	(2185)
30	82	17	1	0.	29. Opportunity to engage in satisfying work	40	48	14	2	(2204) 66
	53	41	6	0.	30. Opportunity to be original and creative	29	45	23	3	(2208)
	52	41	7	0.	31. Opportunity to work with ideas	31	45	21	3	(2203)
	48	41	11	2	32. A sense of job security due to my technical attainments	31	48	17	5	(2198)
	50	34	13	3	33. Freedom from pressure to conform in personal life	33	44	18	5	(2184)
	62	33	5	0.	34. Pleasant people to work with	41	48	10	1	(2199)
	21	60	18	1	35. Freedom to select the projects I work on	9	36	39	18	(2304)
37	33	48	17	3	36. Opportunity to work with colleagues interested in the latest developments in their field	18	41	30	10	73 (2202)

37. Listed below are some topics of current national interest. Please indicate:

(1) How important you believe the issues relating to each topic to be, and

(2) The extent to which you are professionally involved in the area.

	(1) None 1	Minor 2	Major 3	Critical 4		(2) None 1	Minor 2	Some 3	Major 4	(2253)
1. Energy and fuel supplies	0.%	2%	36%	62%	74 (2270)	32	19	23	26	16
2. Health	1	26	59	14	(2262)	68	18	10	4	(2238)
3. Defense	2	19	54	25	(2265)	68	12	7	12	(2238)
4. Environmental protection	1	18	56	25	(2263)	38	24	25	13	(2240)
5. Education	1	14	60	30	(2261)	58	23	14	[illegible]	(2238)
6. Space	3	41	44	12	79 (2232)	83	[illegible]	5	3	(2236)
7. Crime prevention & control	1	13	56	06–9 31	(2259)	90	7	3	1	(2238)
8. Agricultural production	2	25	57	17	(2263)	78	9	5	7	(2243)
9. Welfare and family services	[illegible]	53	33	5	(2259)	92	6	2	0.	(2238)
10. Community development	4	54	38	4	(2253)	70	18	[illegible]	3	(2237)
11. Transportation	2	34	53	12	(2257)	69	15	[illegible]	7	(2242)
12. Communications	4	45	42	8	(2248)	72	13	9	6	(2222)
13. Other (Specify)____	24	9	18 15	48	(258)	88	7	10	15	28 (431)

38. Listed below are some factors that may influence career development. Indicate the extent of their impact on your career since BS graduation.

	Extent of Impact on Your Career				
	Major 1	Moderate 2	Slight 3	None 4	
1. Presence of one or more small children at home.	11%	13%	10%	66% 29	(2252)
2. Other demands on your time (e.g. family needs, social activities, volunteer activities, etc.)	12	35	35	18	(2320)
3. Demands of spouses career (e.g. his/her job transfer, work related entertainment, etc.)	8	15	24	52	(2274)
4. Unsatisfactory work opportunities (e.g. no jobs at your level, poor promotion prospects, "underemployment").	15	18	25	41	(2318)
5. Geographical location of jobs.	22	20	22	26	(2321)
6. Hiring policies against husband and wife working for the same organization.	2	4	7	87	(2276)
7. Lack of adequate help with household care and maintenance.	2	8	18	72	(2302)
8. Little financial incentive for you to work (e.g. low salaries, tax disadvantages, etc.)	5	10	20	64	(2304)
9. Unfavorable attitudes of co-workers toward your career involvement.	4	11	24	62	(2315)
10. Unfavorable attitudes of family members toward your career involvement.	2	5	14	78	(2311)
11. Unfavorable attitudes of friends towards your career involvement.	1	3	11	85	(2312)
12. Travel demands of your job.	4	10	22	64	(2310)
13. Poor personal health.	3	3	8	88 41	(2311)

39. Please indicate the extent to which you agree or disagree with each of the following statements:

	Strongly Agree 1	Agree 2	Disagree 3	Strongly Disagree 4	
1. It is acceptable for women to assume leadership roles in industry as often as men.	56%	35%	7%	2% 42	(2330)
2. Women are competitive enough to be successful in engineering.	55	40	5	0.	(2318)
3. Women possess the self-confidence required of a good engineer.	47	45	7	1	(2312)
4. To be a successful engineer, a woman does not have to sacrifice some of her femininity.	48	37	13	2	(2321)
5. The possibility of pregnancy does not make women less desirable as employees than men.	35	35	28	3	(2317)
6. A full-time employed mother of preschool children can be just as good a mother as the woman who isn't employed	25	31	30	14	(2300)
7. It is more important for a wife to have her career than to help her husband with his career.	19	40	34	7 43	(2178)

40. Since graduation, have there been any periods when you were away from professional employment for six months or more?

%
- 16 ☐ 1. Yes
- 84 ☐ 2. No

49 (2288)

a. IF YES, how many such breaks?

- 78 ☐ 1. One
- 14 ☐ 2. Two
- 8 ☐ 3. Three or more

50 (351)

b. Main reason for most recent break? (Check one).

- 5 ☐ 11. Desire to devote more time to family
- 8 ☐ 12. Pregnancy
- 20 ☐ 13. Return to school or college
- 11 ☐ 14. Moved geographically
- 13 ☐ 15. Lost (or quit) job
- 3 ☐ 16. Getting married
- 8 ☐ 17. Changing professional field
- 3 ☐ 18. Personal ill health
- 12 ☐ 19. Other reasons
- 8 ☐ 20. Military Service

51-52 (400)

c. Length of time of most recent break ________months. 53-54

d. Year of break________________. 55-56

41. How would you compare engineering opportunities for minorities and white Americans?

%
- 10 ☐ 1. Unequal, minorities have better engineering opportunities.
- 25 ☐ 2. Am not sure, probably better for minorities
- 20 ☐ 3. Equal
- 25 ☐ 4. Am not sure, probably better for whites
- 13 ☐ 5. Unequal, white Americans have better engineering opportunities.

57 (2258)

42. Do you think engineering opportunities for men and women are the same?

%
- 12 ☐ 1. No, women receive the most opportunities.
- 34 ☐ 2. Am not sure, probably women have better opportunities.
- 10 ☐ 3. Yes, equal opportunities
- 20 ☐ 4. Am not sure, probably men have better opportunities.
- 18 ☐ 5. No, men receive the most opportunities.

58 (2250)

43. **Several theories of occupational choice propose that people who select different careers are likely to differ in the extent to which they can be described by various groups of characteristics. People often feel that more than one group of characteristics describes them quite well. Please rate how well each group of characteristics listed below describes the typical engineer in your field and yourself.**

The Typical Engineer in Your Field: Similar, Very % 1	Similar, Somewhat % 2	Neutral % 3	Dissimilar, Somewhat % 4	Dissimilar, Very % 5			Yourself: Similar, Very 1	Similar, Somewhat 2	Neutral 3	Dissimilar, Somewhat 4	Dissimilar, Very 5	
59 ☐ 32	54 ☐	10 ☐	3 ☐	0. ☐	(2265)	1. Realistic, Technical, Mechanical, Outdoor	40% ☐	47% ☐	8% ☐	2% ☐	1% ☐ 68	(2270)
37 ☐	48 ☐	11 ☐	2 ☐	1 ☐	(2266)	2. Investigative, Scientific, Inquiring, Analytical	43 ☐	46 ☐	8 ☐	2 ☐	1 ☐	(2280)
2 ☐	15 ☐	38 ☐	32 ☐	12 ☐	(2262)	3. Artistic, Musical, Self-Expressive, Independent	16 ☐	35 ☐	27 ☐	16 ☐	5 ☐	(2275)
4 ☐	20 ☐	37 ☐	31 ☐	8 ☐	(2261)	4. Social, Helping, Guiding, Group-Oriented	13 ☐	36 ☐	31 ☐	15 ☐	4 ☐	(2271)
11 ☐	38 ☐	30 ☐	16 ☐	5 ☐	(2263)	5. Enterprising, Profit-Oriented, Persuasive, Political	12 ☐	34 ☐	28 ☐	18 ☐	8 ☐	(2274)
30 64 ☐	50 ☐	14 ☐	5 ☐	1 ☐	(2258)	6. Conventional, Methodical, Organized, Detailed	24 ☐	48 ☐	18 ☐	10 ☐	3 ☐ 73	(2264)

Please list in the order of their importance, the numbers of the three groups of characteristics which *best* describe:

1. The Typical Engineer in your field

_______ 65 first _______ 66 second _______ 67 third

2. Yourself

_______ 74 first _______ 75 second _______ 76 third

44. **If you have any additional comments, please use the space below.**

1. Interest Inventories (Strong Campbell or PIQ) ____________________

2. Questionnaire ____________________

3. Your present job ____________________

4. Engineering ____________________

5. Education ____________________

6. Your first job ____________________

7. Other ____________________

77-80

RETURN TO: **Engineering Career Development Study**
Purdue University
225 Engineering Administration
West Lafayette, Indiana 47907

THANK YOU FOR YOUR COOPERATION AND TIME

APPENDIX B: Marginal Percentages for Total Student Group on the Final Pre-Engineering Career Survey.

PRE-ENGINEERING

CAREER SURVEY

Student Identification Number

_ _ _ - _ _ - _ _ _ _

DIRECTIONS: This survey has been designed to study your career planning and attitudes. Most questions can be answered simply by marking in the appropriate space. Feel free to record any remarks beside the question itself. All information you provide will be treated as CONFIDENTIAL and will only be used for statistical purposes.

1. When did you consider a COLLEGE EDUCATION, consider an ENGINEERING CAREER, & understand the NATURE OF AN ENGINEERING CAREER?

FC = FIRST CONSIDERED
FD = FINAL DECISION

	COLLEGE EDUCATION FC	COLLEGE EDUCATION FD	ENGINEERING CAREER FC	ENGINEERING CAREER FD	UNDERSTOOD NATURE OF ENGINEERING
Before high school	86%	54%	18%	3%	4%
During the 9th grade	6	15	17	5	5
During the 10th grade	3	7	20	9	11
During the 11th grade	3	12	29	25	22
During the 12th grade	1	10	15	42	27
Just prior to college (after high school)	0	2	2	7	13
Have NOT yet done so		0	0	8	17
	(791)	(759)	(736)	(752)	(773)

2. Below are listed factors that may have influenced you to pursue an ENGINEERING career. Indicate HOW IMPORTANT each one was FOR YOU PERSONALLY:

No = None
Sl = Slight
Mo = Moderate
Gr = Great
Ex = Extreme

	No	Sl	Mo	Gr	Ex
Mother (f.guardian)	39%	23%	26%	9%	4%
Father (m.guardian)	29	15	26	22	10
Other relative	51	18	16	10	5
MALE h.s. math/science teacher(s)	34	20	24	15	6
FEMALE h.s. math/science teacher(s)	57	15	15	9	4
MALE h.s. counselor	63	13	15	7	2
FEMALE h.s. counselor	66	12	12	8	3
MALE practicing engineer(s)	45	12	16	17	10
FEMALE practicing engineer(s)	82	5	6	4	3
MALE engr.student	50	14	18	12	5
FEMALE engr.student	75	10	10	6	3
Career educat. course	61	13	15	8	3
H.s. math course(s)	19	15	27	26	13
H.s. science course(s)	16	15	29	26	14
Interest inventory	49	18	18	11	5
Aptitude test	37	21	26	14	2
Career information	18	16	31	27	8
Pre-college special seminar programs	53	13	15	11	7
Hobby magazine	74	11	9	5	2
Science fair activity	75	12	8	4	2
Science club(s)	81	9	5	3	3
"Junior Achievement"	88	6	4	2	1
Outdoor activities	60	16	14	7	3
Using a computer	41	17	18	14	10
Electrical/mechanical hobby	48	15	16	12	10
Construction hobby	54	14	16	10	7
Farm experiences	83	9	4	2	2
Related work experience	61	12	14	8	6
Thought work itself was interesting	9	10	30	32	19
Liked problem-solving activities	5	11	28	34	21
Had friends with similar interests	26	23	27	16	7
Wanted to be of service to people	21	22	28	19	10
Wanted to contribute to society	16	20	26	24	15
Type of work	8	12	29	33	19
Challenge	4	8	23	38	27
Salary	3	6	18	37	35
Creativity	7	10	27	34	23
Curiosity	6	11	24	34	26
Job security	6	8	25	32	29
Job opportunities	2	5	14	35	45
Prestige/status	14	18	27	23	19
Rapid advancement	11	15	30	26	18
Independence	10	13	28	28	22
Job Flexibility	8	13	24	34	22

(Minimum n = 804)

3. Which below best describes the HIGHEST educational level you (1) DESIRE to achieve & EXPECT to achieve?

	DESIRED LEVEL	EXPECTED LEVEL
No college degree	--%	0%
BACHELOR's degree in two (2) fields including engr.	4	5
Associate degree in engineering technology	0	1
BACHELOR's degree, no graduate work	10	25
BACHELOR's degree and some graduate study in engr.	13	22
BACHELOR's degree & some graduate work with NO engr.study	1	2
MASTER's degree in engr.	27	25
MASTER's degree in a field other than engineering	4	4
MASTER's degree in both engineering and another field	14	7
DOCTORATE, engineering	22	7
DOCTORATE, non-engineering	4	2
Other (specify)______	0	0
	(750)	(748)

4. Have you ever taken an interest inventory?

40% NO
26 UNCERTAIN
35 YES
(788)

▶IF "YES", WHICH one(s) have you taken?

Strong-Campbell Interest Inventory (SC)
Purdue Interest Questionnaire (P)
Kuder interest measure (K)
Self-Directed Search (SD)
Other (specify) (O)

O	SD	K	P	SC
16%	7%	4%	0%	9%

(788)

▶WHAT IMPACT did the inventory results have for you?

	O	SD	K	P	SC
Harmful	2%	4%	--%	--%	3%
No value	26	13	10	--	29
Uncertain value	26	34	50	--	31
Helpful	39	42	27	99	25
Very helpful	8	8	13	--	12
	(121,	53,	30,	1,	68)

▶Did results seem to reflect your interests as you see them?

	O	SD	K	P	SC
NO	12%	11%	10%	33%	18%
Unsure, NO	13	19	7	--	17
Unsure, YES	37	42	37	33	31
YES	38	27	47	33	35
	(125,	52,	30,	3,	72)

▶Were interpretation materials/procedures understandable and helpful?

	O	SD	K	P	SC
NO, harmful	2%	2%	6%	50%	1%
NOT AT ALL/confusing	12	10	6	--	3
YES, partly	54	65	56	--	57
YES, completely	33	22	31	50	39
	(123,	49,	32,	2,	70)

5. Since ENTERING HIGH SCHOOL, how many times have you changed your

	0	1	2	3	4	5+
GENERAL CAREER GOAL (eg, engineering)	37%	28%	18%	12%	3%	2%
	(797)					
SPECIFIC CAREER CHOICE (eg, civil engr.)	40	24	20	9	3	4
	(750)					

6. Indicate the fields in which you would like to be involved in your future work in terms of

	AS MANY AS APPLY	CURRENT MAIN CHOICE (one only)
Aeronautical Engineering	36%	8%
Agricultural Engineering	7	1
Architectural Engineering	19	2
Bio-Medical Engineering	21	5
Chemical Engineering	30	11
Civil Engineering	23	7
Computer Engineering	44	9
Electrical Engineering	47	23
Engineering Science	9	1
Environmental Engineering	13	1
Geological/Mineral Engr.	8	0
Industrial Engineering	13	3
Mechanical Engineering	36	12
Mining/Mater/Metal Engr.	7	2
Nuclear Engineering	23	1
Petroleum Engineering	14	1
OTHER ENGR.______	5	3
Construction Technology	8	1
Electrical/Electronics Tech	19	1
Mechanical Technology	8	--
OTHER TECH.______	0	--
Business/Accounting	19	0
Management	25	1
Law	12	1
Biological Sciences	8	0
Medicine	13	1
Nursing	1	--
Pharmacy	3	--
Chemistry	16	--
Computer Science/Program'ng	37	2
Earth Sciences	5	--
Mathematics/Statistics	25	0
Physics	20	--
Agriculture	5	--
Behavioral Sciences	5	0
Creative Arts	8	0
Other Humanities	5	--
Education	5	0
Forestry	10	--
Social Sciences	4	--
Other (spec.)______	3	0
Undecided/Unknown		5

(Minimum n = 764)(799)

7. Is your college in your (parents') home state? ...29% NO ...70% YES
(804)

8. How did your parents feel in regard to your GOING TO COLLEGE and STUDYING ENGINEERING?

F = Father
M = Mother

	GO TO COLLEGE F	GO TO COLLEGE M	STUDY ENGR. F	STUDY ENGR. M
Didn't want you to do it	1%	1%	1%	1%
Seemed indifferent	1	1	5	7
Showed some interest but thought it unnecessary	1	0	1	2
Maintained there was some need to do it	8	9	5	4
Constantly impressed on you the need to do it	43	44	9	6
Were interested but let me make my own decision	46	46	79	80
	(759,	778,	747,	776)

9. Have you participated in any of the following programs directed toward high sch. students? (If not available, mark NA)

	NA	NO	YES
College recruitment program for students in your field	46%	31%	22%
Summer engineering seminar	40	44	16
Summer sci. or math seminar	38	52	10
High school science fair	34	48	19
Nationwide or regional science or math contests	16	47	37

(Minimum n = 791)

10. Below are statements about different aspects of occupations. Indicate how IMPORTANT TO YOU PERSONALLY each IS in considering or selecting a position within your desired career field (if you have not decided upon a specific field, answer for work in general):

No = None
Sl = Slight
Mo = Moderate
Gr = Great
Ex = Extreme

	IMPORTANCE				
	No	Sl	Mo	Gr	Ex
AN OPPORTUNITY TO	22%	20%	41%	13%	5%
Work indoors	20	20	36	15	8
Work outdoors	6	16	35	30	13
Deal with people	3	13	36	33	14
Deal with ideas, theories, or principles	5	14	33	33	14
Deal with things or machines	0	3	16	45	35
Use my special abilities and aptitudes	1	6	25	40	27
Innovate and propose new ideas	4	13	34	32	17
Work on problems for which there are no ready-made solutions	1	3	18	47	32
Engage in challenging or stimulating work	0	2	13	40	43
Engage in satisfying work	7	18	42	24	9
Develop and test useful hypotheses or generalizations	14	28	36	17	6
Do basic (NOT necessarily practical) scientific research	10	24	34	26	7
Apply principles to develop economically feasible product/process	11	22	40	22	6
Evaluate ideas, theories, or principles	5	16	36	29	13
Develop a working model (of a new instrument or process)	7	18	35	27	12
Set up pilot projects (to develop and test new process/designs)	9	22	37	24	7
Evaluate performance (of PRESENT materials/designs/methods/etc)	9	18	36	28	8
Trouble shoot and/or meet emergencies	9	17	38	27	9
Be assigned to diverse areas of the company	5	16	39	30	10
Engage in a wide variety of technical work	5	14	31	30	21
Make significant contributions to society	1	6	23	40	29
Work with interesting people	7	14	35	26	19
Interact a great deal with other people	9	21	44	22	5
Work with a small group	26	28	29	12	6
Work by myself	5	13	34	29	19
Help people	3	7	26	36	28
Know exactly what my work responsibilities are	2	9	30	37	21
Manage my own work with a large degree of freedom	25	36	31	6	2
Be told what work to do	45	31	18	5	2
Be told how to do my work	3	11	41	35	12
Participate in important work-related decisions	4	15	41	29	10
Plan the best use of equipment and materials					
Perform liaison work with departments and personnel to maintain overall efficiency of process or equipment production	13	22	40	18	6
Simplify production method	10	20	40	23	6
Control expenses	15	22	37	20	7
Exercise leadership	4	12	32	35	16
Move into a management career	13	21	29	23	14
Sell ideas to people	22	24	30	18	7
Work with customer rep's to suggest equipment/process changes	23	27	33	14	4
Conduct negotiations	27	23	33	13	4
Take part in in-service courses	19	25	40	13	4
Prepare for top-level careers (e.g., by continuing education, career counseling, job rotation, etc.)	9	14	31	27	19
Take personal leave (including maternity and family-related)	9	16	32	28	16
Perform duties under flexible working hours	4	12	38	31	14
Travel	6	15	29	27	24
Advance myself economically	1	5	19	40	35
Enhance my social status and prestige	11	16	31	23	19
Live in a desirable geographic location	3	6	25	37	30
Do work which allows for a pleasant home and family life	1	3	14	32	52
OTHER CHARACTERISTICS OF THE JOB ARE					
Presence of many fine detail tasks	9	20	42	22	8
Presence of very few/no fine detail tasks	21	31	36	10	1
Presence of routine operations, calculations, etc	15	27	38	16	4
Little pressure to perform exceptionally well on every assignment	15	24	40	15	6
Employment stability	1	3	21	39	35
Company realizes that employees have family responsibilities	2	6	23	38	32
An income which permits me (and my family) to live comfortably	1	1	11	34	52

(Minimum n = 784)

11. Indicate how CHARACTERISTIC of you each statement below is:

	No	Sl	Mo	Gr	Ex
WHEN I HAVE STUDIED, I HAVE					
Thought about applications of the material	2%	12%	43%	34%	10%
Related facts or concepts from one course to others	1	7	33	44	16
Memorized facts	3	19	37	28	12
NOT finished assignment BECAUSE OF "daydreaming"/putting it off	38	40	16	5	2
					(Minimum n = 776)
DURING HIGH SCH. WHEN I FOUND PROBLEMS HARD TO UNDERSTAND OR TO SOLVE, I..... Asked someone to show me how to look at it or solve it	4%	19%	32%	33%	13%
Spoke to people about them HOPING TO GET SOME NEW INSIGHT	5	16	35	35	9
Kept at them until the problems were solved or understood	3	13	29	37	17
Pushed them out of my mind by doing something else	53	36	9	2	0
					(Minimum n = 793)
IN AN UNPLEASANT SITUATION I					
Generally try to react immediately and figure out best solution	1%	10%	31%	39%	18%
Do NOT worry--things will work out for the best	21	36	30	11	3
I strive to be like I feel others expect me to be	25	30	27	13	4
Compared to most people, I work faster	8	21	46	20	5
I take advantage of opportunities that are presented to me	1	8	38	40	14
I am friendly and easy-going; I have many friends	1	8	33	38	19
I enjoy myself when I am alone, away from other people	5	18	36	28	14

(Minimum n = 791)

12. How certain are your plans concerning engineering as a career?

1% Defin. won't be engr.
2 Prob. won't be engr.
13 Unsure will be engr.
48 Prob. will be engr.
36 Defin. will be engr.

13. Rate YOURSELF below as you think YOU are when compared with PEERS in your OWN age group:

	LOWEST 25%	BELOW AVERAGE	AVERAGE	ABOVE AVERAGE	HIGHEST 25%	HIGHEST 10%	HIGHEST 5%
Math Ability	0%	2%	12%	20%	19%	29%	17%
Science Ability	0	2	14	24	25	23	11
Mechanical Ability	1	4	23	25	21	16	9
Problem-Solving	--	2	16	24	26	22	9
Spatial Visualiz.	1	3	26	26	22	15	9
Athletic Ability	2	7	29	23	17	14	7
Artistic Ability	7	19	32	19	12	7	3
Leadership Ability	1	5	25	23	19	17	11
Public Speaking	4	17	36	19	12	10	4
Writing Ability	1	7	31	26	18	11	5
Personal Relations	1	4	23	24	22	17	9
Reading Ability	0	4	22	26	21	15	11
Management Ability	1	4	25	26	21	16	8

(Minimum n = 745)

14. YOUR SEX: 65% Male 35% Female (806)

15. ETHNIC GROUP?

1% Amer. Indian
17 Black
6 Mexican-Amer.
4 Other Hispan.
0 Middle-East
2 Asian
— Pacific Is.
70 White
0 Other (spec.)

(803)

CITIZENSHIP?

5% Foreign National (specify) ________
6 U.S.-Naturalized
89 U.S.-Native

(946)

16. BIRTHDATE: (Month) ____ 1963 (74%) (806)

17. Which ONE best describes your H.SCHOOL education?

17% General educ.
2 Vocational
81 College prep.

(800)

18. From what ONE type sch. did you receive your HIGH SCH.ed.?

0% Military
8 Church-related
4 Private: Nonsectar.
86 Public
1 Other(spec.)______

(804)

19. How close to your college campus is your parents' home?

23% LESS than 25 mi
23 25 - 100 miles
21 101 - 200 miles
19 201 - 500 miles
14 OVER 500 miles

(802)

20. What is your parents' highest LEVEL OF EDUC. attained?

	FATHER	MOTHER
Some 8th grade or less	4%	3%
Some 10th grade or less	2	2
Some 12th grade or less	4	3
High school graduate	22	32
Some college	14	21
Associate's degree	4	5
Bachelor's degree	22	18
Some graduate school	5	6
Master's degree	14	10
Doctor's degree	9	1
	(790)	(798)

21. What were your parents' LAST occupational LEVELS? (Mark ONE for each)

	FATHER	MOTHER
Professional(supervisory)	34%	13%
Professional(nonsupervisory)	17	18
Proprietor, manager, executive, or LARGE farm owner/operator	16	4
Semi-professional/technical	9	8
SMALL farm owner/operator	1	0
Skilled worker	13	10
Clerical	1	24
Sales (not manager/administr.)	4	5
Semi-skilled worker	5	9
Unskilled worker	1	8
	(775)	(768)

APPENDIX C. Item Response Percentages by Sex, by Ethnic Group, and by Employment Field for the Graduate Survey

This Appendix includes the percentage of respondents that selected each of the alternative responses for each item in the survey; those that did not respond to a given question were not included. To conserve space some of the percentages were based on only one response, e.g. item 32. Some items were open ended, these items are reported as categories, e.g., Item 13 (present income less than $20,000, $21,000 to $23,000, etc.). Values are percentages rounded to nearest whole percent; 0 means zero percent; * means percentage below .5% but not zero. Group counts are enclosed by parentheses. The total number of respondents is 2852, which included pilot and main survey data.

The following is an explanation of the group codes and the number of respondents in each group.

Code	TOTAL	# Cases	Code	SEX	# Cases
WT	Weighted Total	2302	MA	Male	1720
UW	Un-Weighted Total	2732	FE	Female	1080
	ETHNIC GROUP				
BL	Black	128	WH	White	2273
HI	Hispanic	133	FN	Foreign National	79
	FIELD OF CURRENT EMPLOYMENT				
AE	Areonautical Engineer	70	IE	Industrial Engineer	264
AG	Agricülturial Engineer	119	ME	Mechanical Engineer	378
CH	Chemical Engineer	294	NE	Nuclear Engineer	90
CE	Civil Engineer	454	OE	Other Engineer	275
EE	Electrical Engineer	346	BA	Business Administration	126
GM	Geo-Mining Engineer	84	OT	Other Technical	190

Statistical Significance Based on Chi-Square Analysis of Frequency

a : significance of less than .05 b : significance of less than .01
c : significance of less than .001 d : significance of less than .0001
e : significance of less than .0000

	TOTAL		SEX		ETHNIC GROUP				FIELD OF CURRENT EMPLOYMENT											
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
1. Which of the following best describes your employment experiences while an undergraduate?																				
1. None	12	9	10	7b	5	14	8	29e	10	5	12	8	10	7	10	7	10	9	6	14d
2. Co-op employment	13	13	13	15	19	12	13	17	17	12	13	12	15	12	16	14	13	14	14	11
3. Non Co-op engineering	37	39	37	43	45	39	39	20	37	50	40	47	44	39	30	40	34	35	34	25
4. Non Co-op non-engr	32	32	33	29	23	27	33	23	27	27	30	26	26	33	37	33	36	33	40	35
5. Other	6	7	7	7	9	8	7	11	9	6	6	6	5	8	7	6	7	9	7	15
2. Your present employment status:																				
01. Not employed/not seeking	*	1	*	1c	0	0	1	0e	0	0	*	0	0	0	0	*	0	*	0	1e
02. Not employed/seeking engr	*	1	1	1	3	2	1	6	0	2	*	1	1	1	0	0	0	2	0	0
03. Not employed/seek non-engr	0	*	*	*	1	0	*	*	0	0	0	0	0	0	0	0	0	*	0	1
04. Employed part-time in engr	1	2	1	2	1	0	1	9	0	8	*	1	1	4	1	1	3	3	0	1
05. Employed p-t in non-engr	*	*	*	*	1	0	*	0	0	1	0	0	0	0	*	0	0	*	1	1
06. Employed f-t 35+ hrs engr	80	81	80	82	69	79	81	79	86	81	95	90	88	76	89	94	91	83	14	30
07. Employed f-t 35+ hrs non	12	10	10	10	22	9	10	3	3	1	1	2	5	17	7	1	3	5	74	52
08. Self-employed, engineer	2	2	2	1	0	2	2	1	1	0	1	3	1	1	1	2	1	1	1	1
09. Self-employed, non-engr	1	1	2	1	1	3	1	0	0	3	0	1	1	0	*	0	0	1	6	7
10. Retired from engineering	0	1	1	*	0	0	1	0	7	0	1	1	*	0	0	0	0	1	0	1
11. Retired from non-engr	0	*	*	*	0	0	*	0	0	0	0	0	0	0	0	0	0	0	0	1
12. Other	3	3	3	3	3	5	3	3	3	5	2	2	3	1	1	1	1	3	5	6
3. How satisfied are you with your choice of occupation?	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
1. Still uncertain	1	1	1	2b	1	2	1	4	0	2	1	*	1	2	0	1	0	4	3	2d
2. Not satisfied; reconsidering	5	5	4	7	10	5	5	8	4	7	4	3	3	4	6	6	7	6	10	11
3. Satisfied, some doubts	20	21	20	24	22	26	21	25	26	25	21	25	23	18	19	20	22	24	10	19
4. Made best choice	48	47	48	45	44	44	48	46	41	47	48	46	46	45	51	52	52	42	47	42
5. Fully satisfied	25	25	26	23	23	24	26	18	29	20	27	26	28	31	24	21	20	25	30	26
4. How satisfied are you with your progress in your occupation?																				
1. Not satisfied	14	15	13	18e	28	15	14	19b	13	15	15	11	16	15	16	14	15	17	18	16a
2. Fairly satisfied	23	24	22	28	22	23	24	29	23	19	27	26	24	23	28	27	25	18	13	24
3. Feel I'm doing well	46	45	46	41	38	49	45	38	46	48	43	46	42	46	42	49	50	47	41	41
4. Fully satisfied	18	16	18	13	12	13	17	14	17	18	17	18	18	15	14	10	10	17	28	20

	TOTAL		SEX		ETHNIC GROUP				FIELD OF CURRENT EMPLOYMENT											
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
5. What type of business do you work for? (Present job)																				
Manufacturing																				
01. Aircraft	3	4	4	3e	2	4	4	0e	51	0	0	1	4	2	3	6	0	4	1	1e
02. Chemicals	4	6	7	5	4	1	7	18	0	1	34	1	2	1	4	5	0	3	11	4
03. Electrical equipment	3	2	2	2	3	3	2	1	0	0	0	0	7	0	3	2	4	3	2	2
04. Electronic equipment	6	5	4	6	7	9	5	3	3	1	0	0	20	0	9	4	0	7	2	2
05. Computers	4	3	3	4	9	8	3	3	1	1	*	*	12	0	5	2	0	2	3	6
06. Fabricated metal products	2	2	2	2	0	1	3	1	0	2	1	1	*	0	8	5	0	1	5	2
07. Machinery (except elec.)	4	4	5	3	2	2	5	3	0	22	1	0	2	0	3	15	0	3	3	3
08. Motor vehicles	1	2	1	3	6	0	1	0	0	0	0	1	1	1	6	4	0	2	0	1
09. Ordnance	0	*	*	*	1	0	*	0	1	0	0	0	0	0	*	1	0	1	0	0
10. Petroleum	3	4	4	4	2	5	4	4	0	0	21	2	1	1	1	5	0	2	4	3
11. Primary metal industries	2	2	1	2	1	0	2	0	0	0	1	1	1	8	3	1	0	1	2	2
12. Scientific equipment	0	1	*	1	2	1	1	0	0	0	*	0	1	0	0	1	2	1	1	2
13. Other manufacturing	8	9	8	10	10	2	9	12	1	4	8	1	4	2	26	13	3	10	15	5
Other Kinds of Business																				
20. Agri., forest., & fisheries	1	1	2	1	0	1	1	1	0	17	*	1	0	0	1	0	0	0	2	4
21. Bus., Pers., & Prof. ser.	2	1	1	1	0	2	1	1	0	1	0	1	1	2	2	0	0	2	6	3
22. Construction	3	3	4	3	1	6	3	3	3	2	1	12	1	0	*	2	6	2	6	3
23. Engr. or Arch. services	16	16	16	16	6	12	17	12	7	2	14	42	11	13	3	14	43	17	2	5
24. Finance, Ins., or real est.	0	*	*	1	1	0	*	0	0	0	0	0	0	0	1	0	0	*	5	1
25. Mining and petrol. extract.	4	3	3	2	1	2	3	4	0	0	4	2	*	44	1	*	0	1	2	2
26. Other priv., non-prof. org.	2	*	*	*	0	0	*	0	1	0	*	0	*	1	0	*	0	*	0	1
27. Prof. & Tech. societies	0	*	*	0	0	0	*	0	0	0	0	0	0	0	0	0	0	0	1	0
28. Research Institutions	4	3	3	3	5	5	3	7	0	2	4	1	2	4	*	5	13	5	0	5
29. Retail & Wholesale trade	1	*	*	*	0	0	*	0	0	1	0	*	0	0	1	0	0	1	2	0
30. Trans., comm., & util.	7	7	6	7	10	6	7	5	0	1	*	7	14	1	4	5	9	9	15	10
31. Other	4	5	5	6	8	8	5	7	6	4	3	3	5	3	3	4	8	9	5	11
Government																				
32. Uniformed military	1	1	1	1	2	2	1	0	3	0	1	*	1	0	1	1	0	2	0	3
33. Federal	7	7	6	8	6	14	6	0	17	12	1	11	6	10	4	4	10	7	2	5
34. State	1	2	2	2	0	3	2	0	0	2	*	6	0	3	*	0	0	0	0	3
35. Local (city, county, etc)	1	1	1	1	6	2	1	0	0	0	1	2	0	0	*	*	0	1	0	4
36. Regional government	0	*	*	*	0	0	*	0	0	0	0	0	0	0	0	0	0	1	0	0
37. Other government	0	*	*	*	0	0	*	0	1	0	0	*	0	0	0	*	0	*	0	0
Health Services																				
18. Hospital or clinic	0	*	*	1	1	0	*	0	0	0	0	0	0	0	2	0	0	*	1	2
19. Other medical/health ser.	1	*	*	*	0	0	*	0	0	0	0	0	0	0	1	*	0	1	2	0
Educational Institutions																				
14. College or university	5	5	6	4	2	2	5	16	3	29	3	3	4	2	6	3	2	6	5	7
15. Junior coll. or tech. inst.	0	*	*	*	1	0	*	1	0	0	0	*	0	0	0	0	0	0	0	2
16. Medical school	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17. Other educational inst.	0	*	*	*	2	0	*	0	0	0	*	0	0	0	0	0	0	0	0	1

5. What type of business do you work for? (First Job)	TOTAL		SEX		ETHNIC GROUP				FIELD OF CURRENT EMPLOYMENT											
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
Manufacturing																				
01. Aircraft	5	5	6	3e	6	8	5	0e	40	1	1	1	7	6	4	7	1	5	2	3e
02. Chemicals	5	7	8	7	3	2	8	13	2	2	33	3	2	6	5	5	1	3	14	5
03. Electrical equipment	4	3	3	2	5	3	2	0	2	0	0	0	9	1	3	1	3	5	2	3
04. Electronic equipment	6	4	4	5	8	5	4	5	2	0	1	*	15	0	7	4	1	8	2	2
05. Computers	3	2	2	4	3	7	2	1	2	1	*	0	9	0	3	1	1	1	2	6
06. Fabricated metal products	3	2	3	2	0	1	3	4	2	2	1	1	1	0	8	4	1	2	7	2
07. Machinery (except elec.)	4	5	5	3	1	2	5	4	2	24	1	*	2	1	4	11	0	4	2	4
08. Motor vehicles	2	2	2	3	10	0	2	1	3	0	*	1	1	1	8	5	1	2	2	2
09. Ordnance	0	*	*	*	1	1	*	0	0	0	0	*	*	0	*	1	0	1	0	0
10. Petroleum	4	4	4	3	3	5	4	5	2	1	17	2	1	1	1	5	1	4	4	2
11. Primary metal industries	2	2	2	2	1	2	2	0	0	0	2	1	2	5	6	2	0	2	5	0
12. Scientific equipment	0	1	*	1	1	1	1	0	0	0	0	0	2	0	*	1	3	1	2	1
13. Other manufacturing	8	8	7	9	13	5	8	7	3	3	7	2	5	6	23	11	4	7	14	7
Other Kinds of Business																				
20. Agri., forest., & fisheries	1	1	2	1	0	2	2	3	0	17	*	1	0	0	1	1	1	*	0	2
21. Bus., Pers., & Prof. ser.	1	1	*	1	1	2	1	0	0	1	*	1	1	1	0	0	0	*	3	2
22. Construction	3	3	4	2	1	5	3	1	2	3	1	11	1	1	*	*	4	3	2	1
23. Engr. or Arch. services	13	13	13	14	8	11	14	13	6	1	10	35	10	8	2	11	25	13	5	6
24. Finance, Ins., or real est.	0	*	*	*	0	0	*	1	0	0	*	0	*	0	*	0	0	*	1	2
25. Mining and petrol. extract.	2	2	3	2	1	2	2	3	2	0	4	1	*	36	1	0	0	1	2	3
26. Other priv., non-prof. org.	0	*	*	*	0	0	*	0	0	0	*	0	0	0	0	*	0	*	2	1
27. Prof. & Tech. societies	1	*	*	*	0	0	*	0	0	0	0	0	0	0	*	0	0	*	0	1
28. Research Institutions	3	3	3	4	3	3	3	4	0	1	5	1	4	3	1	4	10	5	2	5
29. Retail & Wholesale trade	0	*	*	*	0	0	*	0	2	0	0	0	*	0	1	0	0	*	1	0
30. Trans., comm., & util.	7	7	7	7	11	8	7	4	0	3	1	7	11	2	3	6	8	9	11	10
31. Other	3	4	4	5	5	8	4	5	3	3	3	3	4	3	4	5	7	6	2	8
Government																				
32. Uniformed military	6	3	5	1	2	4	4	0	7	3	4	3	1	1	3	4	4	4	3	3
33. Federal	7	6	6	7	7	9	6	1	18	8	*	9	7	8	3	4	14	6	5	6
34. State	1	2	1	2	0	5	2	1	0	0	1	8	0	3	*	1	1	*	0	1
35. Local (city, county, etc)	1	1	1	1	4	1	1	0	0	0	1	3	1	0	1	1	0	*	0	3
36. Regional government	0	*	*	0	0	0	*	0	0	0	0	*	0	0	0	0	0	*	0	0
37. Other government	0	*	*	*	0	0	*	1	0	0	0	1	0	0	0	0	0	0	0	0
Health Services																				
18. Hospital or clinic	0	*	*	1	1	0	*	0	0	0	1	0	0	0	2	0	0	1	1	1
19. Other medical/health ser.	0	*	*	*	0	0	*	0	0	0	0	*	0	0	*	*	0	*	0	1
Educational Institutions																				
14. College or university	4	5	5	5	2	0	5	17	4	26	4	3	4	5	3	4	4	4	4	8
15. Junior coll. or tech. inst.	0	*	*	*	0	0	*	1	0	0	0	0	0	0	0	0	1	1	0	1
16. Medical school	0	*	*	0	1	0	*	0	0	0	0	0	*	0	0	*	0	0	0	0
17. Other educational inst.	0	1	1	1	2	0	1	1	2	2	*	*	2	1	*	1	1	*	1	3

6. Indicate the principal field in which you have been engaged. (Present Job)

	TOTAL WT	TOTAL UW	SEX MA	SEX FE	ETHNIC GROUP BL	HI	WH	FN	FIELD OF CURRENT EMPLOYMENT AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
Engineering																				
11. Aeronautical	2	3	3	2e	2	3	2	0e	100	0	0	0	0	0	0	0	0	0	0	0e
12. Agricultural	4	5	6	2	1	1	5	13	0	100	0	0	0	0	0	0	0	0	0	0
13. Architectural	0	*	*	0	1	0	*	0	0	0	0	0	0	0	0	0	0	2	0	0
14. Bio-Medical	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	8	0	0
15. Chemical	6	10	12	6	2	2	10	22	0	0	87	0	0	0	0	0	0	0	0	0
16. Civil	13	14	14	14	8	17	15	7	0	0	0	83	0	0	0	0	0	0	0	0
17. Computer	4	3	3	5	8	5	3	3	0	0	0	0	27	0	0	0	0	0	0	0
18. Electrical	18	9	9	10	25	17	8	7	0	0	0	0	73	0	0	0	0	0	0	0
19. Engineering Science	1	1	1	*	1	2	1	0	0	0	0	0	0	0	0	0	0	10	0	0
20. Environmental, Sanitary	2	3	2	4	1	5	3	1	0	0	0	17	0	0	0	0	0	0	0	0
21. Geological/Mineral	1	1	1	1	0	0	2	1	0	0	0	0	0	36	0	0	0	0	0	0
22. Industrial	7	10	7	14	4	6	10	9	0	0	0	0	0	0	100	0	0	0	0	0
23. Mechanical	13	14	14	15	14	15	14	9	0	0	0	0	0	0	0	100	0	0	0	0
24. Mining/Mater./Metal	3	2	3	1	2	1	2	3	0	0	0	0	0	64	0	0	0	0	0	0
25. Nuclear	3	3	3	4	0	0	4	3	0	0	0	0	0	0	0	0	100	0	0	0
26. Petroleum	1	2	2	1	2	2	1	7	0	0	13	0	0	0	0	0	0	0	0	0
27. Other Engineering	7	8	8	9	7	13	8	5	0	0	0	0	0	0	0	0	0	80	0	0
Non-Engineering																				
28. Technology	1	1	1	1	2	1	*	1	0	0	0	0	0	0	0	0	0	0	0	7
29. Business Adminstration	4	3	3	2	3	1	3	1	0	0	0	0	0	0	0	0	0	0	66	0
30. Business, Other	2	2	2	2	2	1	2	0	0	0	0	0	0	0	0	0	0	0	34	0
31. Biological Sciences	0	*	0	*	0	0	*	0	0	0	0	0	0	0	0	0	0	0	0	2
32. Chemistry	*	*	*	0	0	0	*	0	0	0	0	0	0	0	0	0	0	0	0	4
33. Physics	*	*	*	*	0	1	*	0	0	0	0	0	0	0	0	0	0	0	0	4
34. Other Physical Sciences	*	*	*	*	0	0	*	0	0	0	0	0	0	0	0	0	0	0	0	3
35. Computer Science	2	1	1	2	1	2	1	5	0	0	0	0	0	0	0	0	0	0	0	18
36. Mathematics/Statistics	0	*	*	1	0	0	*	0	0	0	0	0	0	0	0	0	0	0	0	4
37. Social Sciences	0	*	0	*	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
38. Arts and Humanities	0	*	*	0	1	0	0		0	0	0	0	0	0	0	0	0	0	0	1
39. Education	1	1	1	*	4	0	*	3	0	0	0	0	0	0	0	0	0	0	0	7
40. Other	5	4	4	3	7	7	3	0	0	0	0	0	0	0	0	0	0	0	0	50

6. Indicate the principal field in which you have been engaged. (First Job)

	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
Engineering																				
11. Aeronautical	2	3	4	2e	4	5	3	0e	70	1	0	1	2	2	1	1	3	4	2	1e
12. Agricultural	4	5	7	2	1	2	5	11	0	86	*	2	0	1	*	1	1	2	3	2
13. Architectural	*	*	*	*	1	0	*	1	0	0	0	1	0	0	0	0	1	2	0	0
14. Bio-Medical	1	1	1	1	1	0	1	1	0	0	0	*	1	0	0	1	0	5	0	1
15. Chemical	7	11	13	7	3	2	11	20	2	3	71	2	3	5	2	1	2	4	17	5
16. Civil	15	15	15	15	13	19	15	4	5	3	*	73	1	2	2	3	1	4	7	3
17. Computer	4	3	2	4	6	7	2	3	0	0	*	0	19	0	2	*	1	1	2	1
18. Electrical	19	9	9	10	24	13	9	4	5	0	*	*	59	2	3	1	1	5	5	3
19. Engineering Science	1	1	1	1	0	2	1	4	0	0	1	0	1	0	0	1	4	6	2	1
20. Environmental, Sanitary	1	3	2	4	1	2	3	5	0	0	2	11	1	2	*	*	0	1	0	2
21. Geological/Mineral	1	1	1	1	0	0	1	3	0	0	0	*	0	27	0	0	0	0	0	0
22. Industrial	7	10	8	14	7	6	11	7	0	1	1	1	2	0	73	3	0	6	25	5
23. Mechanical	15	15	15	16	16	11	16	11	8	3	2	1	3	2	3	81	13	6	11	9
24. Mining/Mater./Metal	2	2	2	1	2	1	2	1	0	0	*	*	0	37	0	*	0	2	2	1
25. Nuclear	3	3	2	3	1	0	3	1	0	0	1	*	*	1	0	2	63	2	1	1
26. Petroleum	2	2	2	1	3	4	1	5	2	0	10	1	*	6	0	*	1	0	1	0
27. Other Engineering	5	6	6	7	5	11	6	4	2	2	2	1	2	0	2	2	3	44	2	3
Non-Engineering																				
28. Technology	*	1	1	1	3	1	1	0	0	0	*	0	0	0	*	0	0	*	1	6
29. Business Adminstration	1	1	1	1	0	1	1	0	0	0	1	1	1	1	2	1	0	*	4	2
30. Business, Other	1	1	1	1	1	2	1	1	2	0	1	0	1	2	1	0	0	*	10	1
31. Biological Sciences	*	*	*	1	1	0	*	0	0	0	0	*	0	0	*	0	0	0	0	2
32. Chemistry	1	1	1	1	1	2	1	0	0	0	3	*	0	2	1	*	0	1	2	3
33. Physics	1	1	1	*	0	1	1	0	2	0	*	0	1	0	0	0	0	1	1	4
34. Other Physical Sciences	*	*	*	*	0	0	*	0	2	0	*	*	0	0	0	*	1	0	0	2
35. Computer Science	1	1	1	2	1	2	1	5	0	0	*	0	0	0	2	*	0	*	2	11
36. Mathematics/Statistics	*	1	*	2	0	0	1	0	2	1	0	0	2	0	1	*	1	0	1	3
37. Social Sciences	0	*	*	*	1	0	*	0	0	0	0	0	0	0	1	0	0	*	1	1
38. Arts and Humanities	0	*	*	*	1	0	*	0	0	0	0	0	0	0	0	0	0	0	0	1
39. Education	1	1	1	1	2	1	1	7	3	1	*	*	2	1	0	*	1	*	1	6
40. Other	5	4	4	3	5	8	4	0	0	2	2	3	2	5	5	1	1	4	2	23

	TOTAL		SEX		ETHNIC GROUP				FIELD OF CURRENT EMPLOYMENT											
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
7. Indicate your principal function. (Present Job)																				
11. Pre-Professional	1	2	1	3e	0	7	2	0e	0	1	*	3	1	2	2	*	3	2	0	3e
12. Research	8	9	9	8	5	2	9	22	15	29	14	5	7	19	3	9	6	10	3	7
13. Development	9	11	10	13	10	7	11	14	16	4	19	3	22	11	5	13	14	12	3	7
14. Design	18	20	21	20	27	20	20	18	16	36	22	33	24	9	1	34	18	14	2	3
15. Operations	6	7	6	8	3	7	7	4	6	3	10	3	4	7	22	2	6	5	9	5
16. Production & maintenance	6	7	6	7	8	6	7	5	4	5	8	1	4	3	17	10	2	6	3	4
17. Testing & inspection	2	3	2	3	3	10	2	1	0	4	1	3	4	2	1	4	5	5	1	3
18. Construction	5	4	4	3	1	9	4	3	0	1	1	14	1	0	0	4	6	2	0	1
19. Sales & service	4	3	4	2	3	5	3	0	0	2	1	*	4	4	*	2	1	4	8	10
20. Teaching	3	3	3	2	6	1	3	8	3	4	2	2	3	2	5	2	3	3	3	7
21. Technical management	21	16	18	11	15	12	16	13	31	5	13	11	1	22	26	12	16	18	19	16
22. Non-technical management	5	3	4	3	8	4	3	0	1	0	1	2	2	0	2	1	2	2	33	9
23. Consulting	8	7	8	8	1	3	8	9	3	2	3	15	4	12	10	3	14	8	5	7
24. Other	6	7	6	9	10	5	7	4	4	6	6	4	5	6	6	6	5	11	12	19
7. Indicate your principal function. (First Job)																				
11. Pre-Professional	6	7	6	7b	4	11	6	6e	5	5	3	10	3	19	8	5	9	7	3	7e
12. Research	10	11	12	9	8	4	11	21	21	27	17	6	8	17	2	8	9	13	10	13
13. Development	12	13	12	13	11	8	13	13	18	5	22	3	23	11	7	14	16	12	11	12
14. Design	26	23	24	22	30	18	23	21	27	41	21	34	29	2	4	35	22	16	11	13
15. Operations	7	8	8	9	3	9	9	4	8	2	11	3	5	9	29	3	9	9	14	3
16. Production & maintenance	8	9	9	9	11	13	9	6	5	6	9	2	6	9	21	11	3	9	15	9
17. Testing & inspection	4	5	5	5	5	11	5	0	2	3	2	5	5	5	2	7	3	7	2	6
18. Construction	5	4	5	3	0	6	4	3	0	2	*	14	1	1	1	3	9	4	3	2
19. Sales & service	3	2	3	2	3	4	3	0	3	1	*	1	7	2	1	1	2	2	7	6
20. Teaching	3	3	3	4	4	2	3	14	5	6	3	1	4	4	2	2	3	2	2	8
21. Technical management	6	5	5	5	8	4	5	7	6	1	3	5	3	9	6	3	8	5	7	5
22. Non-technical management	2	2	2	2	5	2	2	0	2	0	2	2	1	1	3	1	0	3	5	4
23. Consulting	2	4	3	5	3	1	4	3	0	1	2	9	2	1	5	2	1	4	6	1
24. Other	5	6	5	8	5	7	6	4	2	0	5	6	4	8	9	5	5	9	6	11
8. Indicate your degree of supervisory responsibility. (Present Job)	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
1. None	30	40	32	54e	44	44	39	43	41	41	40	34	45	23	45	45	47	39	23	40e
2. Superv non-tech pers	7	10	9	13	7	8	11	12	4	16	12	10	7	13	9	11	6	6	19	13
3. Superv tech pers	10	10	10	9	15	9	9	13	6	13	10	10	11	9	5	14	6	12	3	5
4. Superv tech & non-tech pers	12	11	12	8	8	10	11	11	4	16	7	13	9	17	11	9	14	11	7	13
5. Superv prof pers	23	18	22	11	13	12	18	13	28	8	24	19	21	20	18	17	24	20	7	9
6. Superv lower mgmt	4	3	3	2	4	4	3	3	6	2	1	2	2	2	4	2	0	3	10	6
7. Superv middle mgmt	5	3	4	1	3	4	3	0	6	1	2	2	2	1	2	*	1	3	11	3
8. Respon only to highest offices	6	5	7	2	6	5	5	4	3	3	2	7	2	13	6	1	3	5	13	8
9. Hold highest admin position	3	2	3	*	0	3	2	1	3	2	1	4	1	2	1	1	0	2	7	2
8. Indicate your degree of supervisory responsibility. (First Job)																				
1. None	56	61	56	69e	62	54	62	55b	73	47	55	53	68	48	73	63	69	60	68	67e
2. Superv non-tech pers	13	13	14	12	8	12	14	14	3	24	20	15	10	19	12	11	13	11	13	9
3. Superv tech pers	10	9	10	8	10	11	9	12	8	9	9	10	9	16	6	12	6	13	9	4
4. Superv tech & non-tech pers	9	8	10	5	9	11	8	8	3	11	8	10	6	11	5	7	7	10	5	10
5. Superv prof pers	8	6	7	4	8	5	5	6	11	2	8	8	6	5	3	6	4	4	3	3
6. Superv lower mgmt	1	1	1	1	3	0	1	3	3	3	*	2	*	0	*	1	1	1	1	2
7. Superv middle mgmt	*	*	*	*	0	2	*	0	0	0	0	1	0	1	0	0	1	1	0	1
8. Respon only to highest offices	2	1	1	1	2	6	1	3	0	3	*	2	1	1	1	*	0	*	1	3
9. Hold highest admin position	*	*	*	0	0	0	*	0	0	0	0	1	0	0	0	*	0	0	0	1
9. Indicate your technical administrative function. (Present Job)																				
1. Primarily technical	43	50	47	56e	48	42	49	71e	52	64	67	52	59	38	33	62	51	41	4	36e
2. Half tech, half admin	34	29	31	27	26	31	29	18	31	25	22	28	26	38	43	29	34	36	21	26
3. Primarily admin (technical)	22	19	21	15	17	24	19	10	16	10	12	20	13	24	21	9	14	23	58	29
4. Primarily admin (non-technical)	2	2	2	3	9	3	2	1	0	1	0	1	2	0	3	0	1	*	17	10
9. Indicate your technical administrative function. (First Job)																				
1. Primarily technical	74	72	74	69b	67	71	72	80a	82	73	83	70	74	71	69	75	70	65	71	67e
2. Half tech, half admin	18	18	17	19	19	22	18	15	10	20	12	19	18	17	18	19	20	25	15	16
3. Primarily admin (technical)	6	8	6	10	8	15	7	3	2	6	6	10	6	10	7	6	11	10	8	12
4. Primarily admin (non-technical)	3	3	3	3	6	3	3	2	7	1	1	2	3	2	6	1	0	1	6	5

	TOTAL		SEX		ETHNIC GROUP				FIELD OF CURRENT EMPLOYMENT											
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
10. Indicate your level of technical responsibility.(Present Job)																				
1. Simple prescribed procedures	1	1	1	2e	5	2	1	0c	3	1	*	1	1	0	*	1	0	2	4	5e
2. Sequence of prescribed procedures	2	3	3	3	1	6	3	7	1	3	0	3	2	1	4	2	3	3	6	6
3. Specific applications of theory	11	12	11	14	13	16	12	13	7	15	12	12	14	11	7	16	15	11	13	12
4. Select & apply standard procedures	14	18	16	22	19	24	18	12	20	27	14	25	15	8	13	21	23	17	9	16
5. Devise alternative procedures	23	25	23	29	26	22	25	29	16	32	28	29	23	35	25	27	16	24	17	20
6. Complex tasks: improve procedures	29	26	27	24	23	22	26	29	31	20	33	18	29	26	36	24	30	22	29	27
7. Plans & organizes large projects	18	11	15	6	8	7	12	7	14	1	11	11	14	13	12	8	12	16	21	10
8. Pioneering work	3	3	4	1	5	1	3	3	8	1	3	2	2	6	3	2	1	6	2	5
10. Indicate your level of technical responsibility.(First Job)																				
1. Simple prescribed procedures	5	5	5	5c	6	3	5	5	2	3	4	6	6	9	5	3	4	5	3	8e
2. Sequence of prescribed procedures	9	9	10	8	8	12	9	6	8	8	7	9	8	9	12	10	11	9	10	14
3. Specific applications of theory	30	28	29	26	19	29	28	26	37	30	29	26	26	35	28	27	28	30	30	25
4. Select & apply standard procedures	19	22	20	25	23	26	22	15	22	20	16	31	18	20	22	25	29	21	20	15
5. Devise alternative procedures	21	21	20	24	23	15	22	20	19	25	21	21	21	14	23	21	17	22	23	24
6. Complex tasks: improve procedures	12	11	12	10	16	12	11	20	11	13	18	5	18	12	9	10	12	10	9	9
7. Plans & organizes large projects	4	3	3	1	4	2	2	6	2	0	5	3	2	2	2	2	0	2	3	4
8. Pioneering work	1	1	1	1	1	1	1	2	2	1	1	0	2	0	*	1	0	0	1	2
11. Relevance of your educational background to your present job.																				
1. Must have	36	39	39	39e	35	35	39	42b	44	39	49	53	38	43	28	41	36	36	16	24e
2. Very important	27	23	25	19	23	24	23	18	22	27	23	21	27	25	24	20	26	22	27	17
3. Important	22	23	23	24	19	27	23	31	23	24	20	18	21	19	31	26	25	21	29	25
4. Some importance	11	11	10	13	16	9	11	7	9	7	8	8	10	13	10	10	11	16	23	23
5. Little importance	2	2	2	4	1	3	2	1	3	2	*	*	2	0	5	3	1	4	2	6
6. Unnecessary	1	1	1	2	6	2	1	1	0	2	0	*	2	0	1	1	0	1	3	5
11. Relevance of your educational background to your first job.																				
1. Must have	37	37	38	37	33	37	38	41	36	31	45	44	37	36	24	37	40	36	42	35e
2. Very important	19	18	19	18	22	18	18	20	22	29	16	20	19	25	15	14	17	16	24	15
3. Important	24	23	24	22	23	20	23	25	29	26	21	22	24	16	28	25	18	25	15	22
4. Some importance	14	16	14	18	18	20	15	9	7	12	14	11	13	11	23	19	23	15	15	18
5. Little importance	5	4	4	4	2	2	4	4	3	0	2	2	6	5	6	4	0	6	2	6
6. Unnecessary	2	2	2	2	2	3	2	1	3	2	2	1	1	7	3	1	1	2	2	5
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
12. General level of satisfaction with work in postion.(Present Job)																				
1. Very satisfied	31	30	33	26e	20	28	31	17e	29	24	28	32	33	39	29	23	22	33	48	30b
2. Satisfied	53	50	51	49	46	52	50	63	52	55	56	48	49	44	48	57	62	46	35	48
3. Neutral	12	14	12	15	20	15	13	13	12	17	12	15	12	14	15	13	13	14	14	13
4. Dissatisfied	4	5	4	7	7	2	5	6	4	3	4	5	6	1	6	6	3	5	3	5
5. Very dissatisfied	1	1	1	2	7	3	1	1	3	1	1	1	1	1	2	1	0	2	1	4
12. General level of satisfaction with work in postion.(First Job)																				
1. Very satisfied	24	23	24	20e	14	29	23	24	32	17	24	23	25	21	20	18	18	23	34	21a
2. Satisfied	46	45	47	42	47	34	45	50	42	53	48	44	46	38	40	46	51	44	39	47
3. Neutral	17	16	15	18	22	21	16	14	15	16	12	20	15	19	20	16	17	18	13	14
4. Dissatisfied	10	12	11	14	12	11	12	7	8	10	13	10	11	18	16	16	10	8	13	11
5. Very dissatisfied	3	4	3	6	4	4	4	4	3	3	4	3	3	5	4	4	3	6	2	7
13. Location of Present Job.																				
1. North Central	20	24	24	22	46	2	24	26e	17	51	18	21	20	8	33	29	6	18	22	30e
2. North East	17	21	20	22	8	7	22	29	11	10	27	18	20	17	21	21	26	24	29	19
3. South	29	30	30	29	31	46	29	23	29	20	41	30	27	35	30	25	20	31	32	29
4. West	25	26	25	28	16	45	25	22	43	27	14	31	33	40	16	25	48	27	17	23
13. Income of Present Job.																				
1. 2000 to 20000 (lower decile)	16	11	10	12e	10	15	10	18b	3	33	4	20	6	8	8	5	7	10	7	18e
2. 21000 to 23000 (ld-lower quartile)	7	12	9	17	11	21	12	8	6	21	3	21	14	13	12	12	7	10	5	6
3. 24000 to 27000 (lq-median)	17	27	21	37	29	26	27	17	22	23	18	24	30	29	29	41	30	27	14	19
4. 28000 to 33000 (m-upper quartile)	26	26	27	25	33	24	25	36	22	16	43	17	27	20	31	25	30	24	24	27
5. 34000 to 42000 (uq-upper decile)	23	15	19	7	12	9	15	14	25	4	21	10	16	8	15	11	19	14	26	19
6. 43000 to 99000 (upper decile)	11	10	15	2	6	6	11	7	23	4	11	8	7	21	7	6	6	15	24	11

	TOTAL		SEX		ETHNIC GROUP				FIELD OF CURRENT EMPLOYMENT											
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
13. First Year After B.S. (Year Began)																				
1. 1980-81 (1 to 2)	11	13	10	18e	10	33	13	14e	4	17	12	27	18	2	2	15	6	13	2	9e
2. 1977-79 (3 to 5)	19	37	28	49	33	37	37	30	31	48	36	44	32	32	36	41	33	37	15	29
3. 1972-76 (6 to 10)	30	27	32	21	49	22	26	40	14	33	32	15	30	19	27	28	34	26	41	36
4. 1902-71 (11 or more)	40	23	30	12	9	8	25	16	51	1	20	14	20	47	35	16	25	24	41	27
13. Location of First Job.																				
1. North Central	20	27	27	26	55	6	27	25e	20	48	22	22	26	10	35	32	9	24	31	33e
2. North East	18	22	23	22	12	9	24	28	17	6	27	16	21	19	23	22	36	29	25	26
3. South	24	28	28	28	25	43	28	30	32	24	37	32	25	29	28	26	23	24	28	22
4. West	18	23	22	24	9	41	22	18	31	22	14	30	28	42	15	20	33	23	17	20
13. Income of First Job.																				
1. 0 to 4000 (lower decile)	20	28	29	28e	31	28	28	40b	42	33	29	32	29	30	23	28	23	34	16	27e
2. 5000 to 9000 (ld-lower quartile)	21	13	16	9	5	10	14	16	17	13	11	11	12	24	19	8	17	13	21	18
3. 10000 to 14000 (lq-median)	30	20	23	15	30	19	20	12	18	28	16	17	21	23	22	20	21	19	29	28
4. 15000 to 19000 (m-upper quartile)	14	20	17	26	21	22	21	15	16	16	19	24	17	14	23	22	24	19	20	18
5. 20000 to 23000 (uq-upper decile)	7	10	8	13	10	15	10	9	3	8	13	9	14	4	9	14	10	8	7	4
6. 24000 to 99000 (upper decile)	8	8	7	9	3	5	8	9	4	3	12	6	7	4	3	9	6	7	8	5
14. Total Years of Professional Experience.																				
1. 0 to 2 years	36	42	37	51e	31	43	43	32e	24	44	39	63	43	23	25	44	28	39	22	40e
2. 3 to 5 years	13	23	20	27	25	28	22	37	20	33	29	18	18	23	24	27	22	21	18	20
3. 6 to 10 years	22	18	21	14	34	22	17	17	10	20	18	11	24	15	22	16	29	20	29	18
4. 11 to 20 years	27	11	13	7	8	5	11	11	13	2	9	5	9	28	16	8	18	2	23	13
5. 21 to 60 years	2	7	10	2	2	2	8	4	34	1	5	3	5	11	13	5	4	10	9	9
14. Years of Engineering Experience.																				
1. 0 to 2 years	39	45	40	54e	46	46	45	37e	23	45	40	62	47	31	23	46	28	41	34	60e
2. 3 to 5 years	15	24	21	29	23	28	24	34	25	35	33	20	17	23	30	28	25	22	26	14
3. 6 to 11 years	26	18	22	12	28	23	17	18	9	18	17	11	24	19	23	17	33	21	25	16
4. 12 to 71 years	20	13	18	5	4	3	14	11	43	2	10	7	12	27	24	9	14	16	15	10
15. Percent responding "YES" to Engaging in these Technical Activities During the Past Year.	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
1. Discuss new engr developments	69	76	78	72b	62	70	78	62e	82	85	82	74	80	86	73	77	77	79	63	46e
2. Read about new engr developments	79	88	89	87	84	85	89	88	86	91	89	88	90	94	83	89	84	87	82	76d
3. Subscribe to engr periodicals	76	88	87	90a	66	74	91	84e	89	90	91	83	86	94	90	88	91	87	86	75d
4. Read new books on engr or sci	43	45	49	38e	45	56	44	55	56	51	50	47	54	58	31	40	46	42	33	37e
5. Purchased new books on engr/sci	42	44	47	38e	45	44	43	66c	41	48	46	54	55	62	26	45	36	39	33	33e
6. Attended local technical meetings	44	52	52	52	36	33	53	54c	44	58	55	53	51	67	58	50	52	47	45	36e
7. Took non-grad credit engr course	14	17	17	18	18	26	17	24	21	14	21	18	25	21	13	17	15	13	5	15d
8. Completed grad courses in engr	13	16	15	19b	22	15	15	33d	20	32	9	16	23	12	12	20	10	15	10	11e
9. Attended national tech meeting	32	31	33	27c	19	18	32	37c	33	33	37	19	29	53	28	27	41	38	29	31e
10. Presented one or more tech papers	14	12	15	8e	5	7	13	18a	17	18	16	7	11	23	8	10	23	17	7	15e
11. Attended short course on mgmt	28	31	30	33	36	33	32	23	27	18	28	24	26	39	44	29	37	34	53	31e
16. Which applies to the respondent?																				
1. Registered Professional Engineer	25	14	20	5e	5	10	15	19e	9	11	12	23	12	17	9	17	17	12	18	9e
2. Registered Engineer in Training	25	34	30	40	16	29	37	15	12	62	33	60	21	13	13	45	20	35	24	22
3. Not a Registered Engineer	49	52	50	55	79	61	48	66	79	27	55	17	67	70	78	38	63	53	58	69
17. Number of National Societies that you are a member of.																				
1. 0	5	4	4	5a	19	12	3	5e	2	0	2	3	10	1	2	4	0	6	6	11e
2. 1	42	43	45	39	33	48	43	36	49	56	50	44	36	35	42	45	46	38	38	32
3. 2	28	30	29	31	29	23	30	31	27	31	32	30	32	30	34	28	28	27	28	28
4. 3	15	15	14	17	13	10	15	17	17	5	9	14	15	19	14	15	18	16	19	19
5. 4 or more	10	9	9	9	6	7	9	12	6	8	8	10	7	15	8	8	8	13	9	11
18. Number of Articles Published.																				
1. 0	63	69	63	79e	79	82	67	49b	48	60	57	76	73	59	81	76	63	62	69	63e
2. 1	10	11	11	10	11	7	11	12	10	11	16	9	8	12	9	10	6	13	6	13
3. 2	5	4	5	3	0	3	4	11	0	11	9	5	3	0	2	2	7	5	8	2
4. 3	4	4	5	3	3	1	4	11	6	11	4	2	4	8	2	3	6	4	5	3
5. 4 to 9	9	6	8	3	5	1	5	12	14	2	8	5	6	4	3	4	9	8	4	9
6. 10 or more	9	7	9	3	3	6	7	6	23	6	5	3	6	17	4	6	9	9	7	11

	TOTAL		SEX		ETHNIC GROUP				FIELD OF CURRENT EMPLOYMENT											
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
19. Number of Books Published.																				
1. 0	97	97	96	98	100	99	96	98	92	99	98	98	96	94	98	99	97	96	98	92
2. 1	1	2	2	1	0	0	2	2	4	0	1	1	2	4	2	0	3	2	2	5
3. 2	1	1	1	*	0	0	1	0	2	0	0	1	1	0	0	1	0	1	0	1
4. 3 or more	1	1	1	*	0	1	1	0	2	1	1	1	1	1	*	0	0	1	0	2
20. Number of Patents Applied for.																				
1. 0	84	88	84	95e	88	94	88	90	83	82	81	97	87	82	96	84	88	84	87	93e
2. 1	6	6	7	4	9	0	6	9	11	11	10	2	5	8	3	8	9	6	6	2
3. 2 or more	10	6	9	1	3	6	6	1	6	7	9	2	7	10	1	8	3	10	7	5
20. Number of Patents Granted.																				
1. 0	91	94	91	98	95	95	93	97	94	93	91	98	91	88	98	92	98	90	95	94
2. 1	4	3	5	1	3	2	4	3	2	2	5	1	6	7	2	4	2	4	5	2
3. 2 or more	5	3	4	1	2	3	3	0	4	5	4	1	4	4	0	4	0	6	0	5
21. Year of Birth (Age of Respondent)																				
1. 1901 to 1934 (46 or older)	3	10	14	3e	6	2	11	1e	31	1	8	11	9	11	12	6	12	14	11	13e
2. 1935 to 1945 (36 to 45)	30	14	17	9	9	6	14	16	16	2	10	10	12	25	19	11	18	17	25	23
3. 1946 to 1950 (31 to 35)	29	17	20	12	27	28	16	28	18	6	16	15	22	21	18	18	24	13	20	20
4. 1951 to 1955 (26 to 30)	24	33	32	33	34	31	33	43	19	59	48	26	28	31	30	32	31	32	32	30
5. 1956 to 1960 (20 to 25)	14	26	16	43	24	33	27	13	16	33	17	39	30	13	22	33	17	23	12	14
21. Sex.																				
1. Male	97	63	100	0e	74	83	60	87e	74	87	77	62	58	76	47	61	54	63	69	61e
2. Female	3	37	0	100	26	17	40	13	26	13	23	38	42	24	53	39	46	37	31	39
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
21. Race or Ethnic identification.																				
1. American Indian	*	*	*	*	0	0	0	0e	2	0	1	1	*	1	0	1	0	*	0	0e
2. Asian or Pacific Islander	8	4	5	3	0	0	0	49	4	4	8	3	5	2	5	3	7	4	1	4
3. American Black	7	5	6	3	100	0	0	4	4	1	2	3	12	2	2	5	0	4	5	10
4. Mexican American	5	2	3	1	0	49	0	1	0	0	1	3	4	0	2	3	0	4	0	4
5. Puerto Rican	*	*	*	*	0	6	0	0	0	0	*	1	1	0	0	*	0	*	0	1
6. American Cuban	2	1	2	*	0	23	0	3	4	1	0	1	2	0	1	1	0	2	1	2
7. Other Hispanic	2	2	2	1	0	22	0	16	2	1	3	2	2	1	1	2	0	2	1	1
8. White, Not Hispanic	75	84	80	90	0	0	100	19	79	91	83	87	74	91	88	84	91	83	92	77
9. Other	1	1	2	1	0	0	0	9	4	2	1	1	*	2	2	2	2	1	0	2
21. Citizenship.																				
1. U.S. Native-born	85	91	88	95e	98	67	98	0e	91	91	86	95	90	94	91	92	91	90	96	88e
2. U.S. Natualized	9	5	7	3	2	33	2	0	9	1	5	3	8	3	6	6	7	8	3	7
3. Foreign National	6	4	5	1	0	0	0	100	0	8	9	2	2	3	3	2	2	2	1	5
21. Marital Status.																				
1. Single	23	33	26	43e	41	40	32	35b	28	39	32	38	35	24	28	33	32	32	29	30
2. Married now	72	62	70	49	48	57	63	63	68	60	65	59	59	69	65	61	60	65	66	60
3. Seperated, Divorced	5	5	4	7	11	2	5	3	5	1	3	4	6	7	7	6	8	4	5	10
4. Widowed	0	*	*	*	0	1	*	0	0	0	*	0	*	0	*	*	0	0	0	0
21. Total Number of Children.																				
1. 0	32	52	39	76e	42	44	53	51c	30	60	57	57	51	37	49	56	47	52	44	45b
2. 1	20	15	18	11	32	18	14	22	19	21	13	13	14	16	18	17	11	14	16	18
3. 2	34	19	26	7	15	22	19	24	30	13	19	16	23	29	19	17	24	16	27	22
4. 3 or more	14	14	18	6	11	16	14	4	21	6	12	14	12	18	14	10	18	18	13	15
21. Number of Children Living with You.																				
1. 0	35	56	45	77e	48	48	58	50b	47	60	61	60	56	44	54	58	55	56	53	52
2. 1	20	17	20	12	33	17	17	22	16	21	16	15	16	19	17	19	17	17	15	20
3. 2	33	18	24	7	16	20	18	24	16	13	17	15	19	31	21	17	20	16	24	20
4. 3 or more	12	8	10	4	4	15	8	4	2	6	6	10	8	6	9	6	9	11	8	9
22. Type of High School Attended.																				
1. Private-church related	9	11	11	11	7	11	10	34e	10	4	16	12	8	6	13	10	11	12	9	11
2. Private-non-sectarian	4	3	3	3	1	3	2	17	2	2	5	3	4	4	3	2	6	4	1	4
3. Public, state	87	86	86	86	92	86	87	49	89	95	79	85	88	91	84	88	83	83	90	86
4. Military	*	*	*	*	0	0	*	0	0	0	0	0	*	0	1	*	0	*	0	0
5. Other	0	*	*	*	0	0	*	0	0	0	*	1	*	0	0	0	0	*	0	0

	TOTAL		SEX		ETHNIC GROUP				FIELD OF CURRENT EMPLOYMENT											
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
22. Type of College Attended.																				
1. Private-church related	3	5	4	6d	3	1	6	9d	8	2	6	5	5	4	4	6	4	6	6	5c
2. Private-non-sectarian	19	21	20	24	27	4	22	19	32	4	31	17	25	13	23	18	20	25	21	23
3. Public, state	76	72	74	69	70	94	72	73	58	94	61	78	69	82	72	75	75	67	71	70
4. Military	1	1	1	0	0	1	1	0	2	0	2	*	1	1	1	*	1	1	2	2
5. Other	*	*	*	*	1	0	*	0	0	0	0	0	*	0	1	0	0	*	1	0
23. Father's Occupation.																				
11. Professional (Engineering)	11	16	12	23e	2	7	17	12e	18	3	21	15	16	12	16	19	24	14	11	14e
12. Professional (Other)	18	21	18	27	14	15	21	32	18	20	22	22	22	22	21	18	23	21	28	21
13. Proprietor, Manager, Farm Owner	22	21	24	15	10	17	21	28	16	48	21	20	17	24	15	20	12	21	21	25
14. Semi-professional, technical	7	7	7	8	1	9	7	5	6	3	6	9	8	5	8	6	9	7	2	7
15. Sales, except sales management	5	5	5	6	3	4	5	4	3	4	5	7	5	8	3	6	4	4	4	4
16. Clerical	3	3	4	2	3	3	3	8	6	3	3	2	3	2	4	4	5	2	2	3
17. Skilled worker	19	16	18	12	24	14	16	3	19	11	14	14	18	18	15	17	16	19	22	14
18. Semi-skilled worker	8	7	8	4	24	14	5	5	5	5	3	7	7	7	12	5	4	9	6	5
19. Unskilled, service or farm worker	6	5	5	4	22	17	3	4	9	3	4	4	5	2	6	6	4	4	6	7
20. Homemaker	*	*	*	*	0	0	*	0	0	1	*	0	0	0	1	0	0	0	0	0
23. Mother's Occupation.																				
11. Professional (Engineering)	*	*	0	1e	0	0	*	0e	0	0	*	1	0	0	0	0	0	*	1	0
12. Professional (Other)	11	14	12	19	22	9	14	14	15	18	17	12	16	18	13	13	17	15	9	14
13. Proprietor, Manager, Farm Owner	3	3	3	4	3	3	3	7	3	4	2	4	2	2	2	4	1	5	1	4
14. Semi-professional, technical	2	3	3	4	7	1	3	3	0	3	1	3	1	5	4	5	1	2	5	3
15. Sales, except sales management	2	3	2	4	0	3	3	1	4	1	3	3	3	5	3	3	1	3	3	1
16. Clerical	14	14	13	16	10	8	15	1	10	9	11	18	15	17	13	15	18	11	14	14
17. Skilled worker	4	3	3	2	6	2	2	4	3	2	3	3	4	6	2	2	2	2	3	2
18. Semi-skilled worker	6	4	4	2	9	5	3	4	2	4	2	4	4	3	6	2	5	5	4	4
19. Unskilled, service or farm worker	4	4	4	3	14	7	3	1	4	2	3	3	3	6	3	5	2	4	3	3
20. Homemaker	53	53	56	46	30	62	53	60	59	56	57	49	53	39	55	52	52	52	56	54
23. Spouse's Occupation.	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
11. Professional (Engineering)	2	17	2	51e	10	12	18	13a	16	5	12	15	19	11	19	24	24	18	10	13c
12. Professional (Other)	26	33	34	28	47	25	33	32	33	42	39	25	32	27	36	27	38	37	32	37
13. Proprietor, Manager, Farm Owner	1	3	2	5	2	3	3	0	0	2	1	6	1	0	2	3	2	3	4	4
14. Semi-professional, technical	4	7	7	6	12	4	7	2	7	5	4	11	10	2	9	6	4	4	4	7
15. Sales, except sales management	2	3	3	3	2	1	3	4	2	2	2	4	1	2	9	6	4	6	5	1
16. Clerical	10	10	14	*	12	15	9	15	7	8	9	12	5	19	8	10	6	12	10	13
17. Skilled worker	2	3	3	4	5	3	3	6	0	3	2	1	5	8	2	4	2	2	5	1
18. Semi-skilled worker	2	2	2	1	5	1	1	2	2	3	1	*	2	5	3	1	0	2	1	2
19. Unskilled, service or farm worker	1	1	1	1	0	1	1	0	0	0	1	1	1	0	1	*	0	0	1	0
20. Homemaker	28	24	34	*	7	34	24	25	33	32	31	25	24	27	19	22	24	16	28	23
24. Father's Educational Level.																				
1. 8th grade or less	17	14	17	7e	23	28	12	21e	26	15	8	14	15	9	17	11	11	17	11	13
2. Some High School	10	9	10	6	21	9	8	14	7	6	8	10	8	12	9	6	8	12	12	10
3. High School Graduate	28	24	26	21	23	21	25	15	29	32	24	21	25	27	24	27	23	22	26	23
4. Some College	14	15	15	15	13	17	15	6	19	14	15	15	14	19	14	15	14	14	8	15
5. Associate Degree	3	3	3	3	2	4	3	4	3	5	4	3	4	3	4	3	5	2	3	3
6. Bachelor's Degree	17	21	18	27	9	12	22	28	9	15	25	21	20	18	18	24	23	20	25	24
7. Master's Degree	7	9	7	13	6	5	10	5	6	9	11	11	9	7	10	9	11	9	8	7
8. Doctor's Degree	4	5	4	8	4	4	5	7	1	4	6	6	6	5	5	5	6	4	7	4
24. Mother's Educational Level.																				
1. 8th grade or less	14	9	12	4e	9	34	7	33e	17	8	9	9	8	8	11	9	7	12	7	10
2. Some High School	10	9	11	6	16	13	8	22	12	5	6	7	10	12	11	7	8	12	10	11
3. High School Graduate	41	38	40	35	27	28	40	25	41	40	38	40	37	40	38	41	40	35	24	33
4. Some College	13	15	13	18	21	10	15	6	12	14	15	15	15	11	13	15	13	15	21	19
5. Associate Degree	4	6	5	7	6	4	6	1	4	9	5	5	5	3	6	7	3	5	5	6
6. Bachelor's Degree	14	17	15	20	6	7	19	10	13	15	21	18	17	18	15	15	28	14	18	15
7. Master's Degree	3	5	4	8	13	3	5	3	1	9	6	4	7	5	5	4	1	6	5	6
8. Doctor's Degree	1	1	1	2	1	1	1	0	0	2	1	1	1	2	1	1	0	1	1	1
24. Spouse's Educational Level.																				
1. 8th grade or less	0	*	*	0e	0	0	0	0a	0	0	0	0	1	0	0	0	0	0	0	0b
2. Some High School	2	1	2	1	1	1	1	6	0	1	0	1	2	3	1	1	0	3	1	2
3. High School Graduate	14	12	16	3	10	15	12	8	19	9	8	11	12	22	17	13	16	11	3	9
4. Some College	21	18	21	9	20	25	17	12	15	19	13	21	21	17	17	18	9	14	24	17
5. Associate Degree	11	8	10	3	12	14	7	8	10	11	6	9	10	11	7	7	5	8	8	5
6. Bachelor's Degree	37	39	37	44	29	27	40	39	29	46	47	42	31	32	37	46	32	35	35	39
7. Master's Degree	13	16	13	23	25	10	16	18	19	13	20	11	18	9	14	11	20	21	17	20
8. Doctor's Degree	3	6	2	17	3	8	7	8	8	1	6	5	5	6	6	4	18	8	7	8

	TOTAL		SEX		ETHNIC GROUP				FIELD OF CURRENT EMPLOYMENT											
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
25. Year of Bachelor's Degree.																				
1. 1980-1981	9	8	6	12e	6	22	8	9e	3	10	3	15	13	4	2	9	5	8	2	6e
2. 1979-1977	17	35	27	50	35	37	36	20	29	50	28	42	32	33	32	44	26	33	16	28
3. 1976-1972	31	28	31	23	46	26	26	44	15	38	42	19	28	19	26	27	32	27	40	28
4. 1971-1907	43	29	37	16	12	15	31	27	53	3	28	24	27	44	40	20	37	32	42	38
25. Institution of Bachelor's Degree																				
1. Very low SAT V+M 400-854	1	1	1	1c	17	0	*	0e	5	1	2	1	3	0	1	2	0	1	0	0e
2. Low SAT V+M 855-925	10	6	6	5	3	61	3	8	2	0	3	8	10	1	4	8	3	7	1	6
3. Medium low SAT V+M 926-997	13	13	14	12	1	8	15	12	11	18	15	15	10	19	13	13	17	10	18	10
4. Medium SAT V+M 998-1074	26	24	25	22	4	24	25	23	30	38	22	23	20	35	21	23	19	23	24	28
5 Medium hi SAT V+M 1075-1153	28	29	29	30	24	1	32	19	25	39	25	32	27	33	34	30	23	28	31	30
6. High SAT V+M 1154-1235	14	15	16	14	45	5	14	27	16	1	20	13	15	6	18	15	22	18	14	17
7. Very high SAT V+M 1236-HI	8	12	9	16	6	2	13	12	12	3	15	10	16	6	11	11	16	14	12	10
(Austin, 1971: Levels of Institutional Selectivity, p. 24)																				
25. Year of First Master's Degree.																				
1. 1980-1981	5	15	13	21e	31	35	15	13c	9	35	12	20	18	10	11	22	7	10	13	9e
2. 1979-1977	11	36	35	40	29	26	36	49	16	46	57	37	30	21	20	28	39	38	31	31
3. 1976-1972	15	25	24	26	40	26	24	26	19	8	21	22	28	41	40	29	32	12	34	21
4. 1971-1907	69	24	28	14	0	13	26	12	56	11	11	21	24	28	29	21	23	40	23	39
25. Instituiton of First Masters.																				
1. Medium SAT V+M 400-1153	73	65	67	63	33	68	66	75d	53	95	64	69	56	72	74	76	56	54	64	64e
2. High SAT V+M 1154-HI	27	35	33	37	67	32	34	25	47	5	36	31	44	28	26	25	44	46	36	36
25. Year of Second Master's Degree.																				
1. 1980-1981	1	20	22	15	0	0	21	44	0	50	33	22	31	0	14	13	13	0	36	0a
2. 1979-1977	1	28	23	41	100	0	27	11	0	0	17	33	19	0	29	25	38	10	55	71
3. 1976-1972	2	22	25	15	0	0	20	33	50	0	17	22	0	67	29	38	50	40	0	14
4. 1971-1907	96	30	30	30	0	100	33	11	50	50	33	22	50	33	29	25	0	50	9	14
25. Instituiton of Second Masters.																				
1. Medium SAT V+M 400-1153	66	58	58	59	25	100	57	60	25	0	71	50	60	0	50	75	83	56	30	75
2. High SAT V+M 1154-HI	34	42	42	41	75	0	43	40	75	0	29	50	40	100	50	25	17	44	70	25
25. Year of Doctorate Degree.	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
1. 1980-1981	1	15	16	10b	100	0	12	50d	0	63	32	8	9	0	7	0	13	8	14	25d
2. 1979-1977	1	13	9	32	0	0	13	10	14	13	8	8	13	40	33	30	0	4	29	0
3. 1976-1972	4	22	22	23	0	33	20	40	0	0	12	17	30	0	20	40	63	4	43	38
4. 1971-1907	94	50	53	36	0	67	55	0	86	25	48	67	48	60	40	30	25	83	14	38
25. Instituiton of Doctorate.																				
1. Medium SAT V+M 400-1153	68	58	56	67	0	100	55	91	38	90	61	58	47	60	73	58	57	39	25	67
2. High SAT V+M 1154-HI	32	42	45	33	100	0	45	9	62	10	39	42	53	40	27	42	43	61	75	33
26. Describe Current Education Level.																				
11. No degree	*	1	1	*	1	0	1	0e	0	0	0	0	1	1	*	1	0	1	0	1e
12. Bachelor's, no grad work	32	35	33	39	36	56	35	9	22	43	13	44	38	42	34	45	28	36	19	26
13. Bachelor's, some non-engr grad wor	16	16	14	18	27	22	15	8	23	11	5	14	15	19	22	17	20	17	19	26
14. Bachelor's, some engr grad work	4	5	4	6	3	1	5	3	1	6	3	6	7	2	2	6	3	4	1	7
15. Master's in engr	26	25	27	21	16	13	25	54	30	28	56	27	21	15	19	19	31	22	17	14
16. Master's in business admin	6	5	6	4	1	2	6	4	0	1	9	1	3	2	10	3	4	5	29	5
17. Master's in other non-engr	2	3	3	3	5	0	3	3	1	0	3	1	2	13	3	1	0	3	4	12
18. Master's in engr and another field	3	2	2	2	2	0	2	3	1	0	3	1	3	0	1	2	6	2	4	2
19. Doctorate, engr	8	5	6	2	0	1	4	14	10	7	7	3	5	2	6	3	6	8	1	3
20. Doctorate, non-engr	2	1	1	1	2	0	1	0	1	0	1	0	1	3	1	0	1	1	5	5
21. Other	2	3	3	5	7	6	3	4	9	5	1	4	4	0	3	5	1	2	3	3
27. Further Education Planned.																				
11. None	23	19	24	10e	4	14	20	19e	37	18	23	13	12	17	23	14	21	20	29	28e
12. Some grad work in engr	20	20	21	18	14	15	21	14	15	20	26	21	23	31	18	18	19	20	9	13
13. Some grad work in non-engr	14	12	13	10	16	13	12	9	10	10	13	9	8	13	15	11	14	11	25	14
14. Master's in engr	9	12	10	15	11	20	12	6	12	14	6	22	14	7	6	16	3	12	3	7
15. Master's in management	18	20	17	26	30	23	20	17	7	14	17	16	23	18	28	24	21	20	23	14
16. Master's in non-engr	1	2	1	3	0	2	2	3	3	2	2	1	1	2	2	2	7	1	0	4
17. Master's in engr and another field	2	4	2	6	3	5	4	1	6	1	3	5	4	2	2	4	6	3	0	5
18. Doctorate in engr	6	7	7	6	8	2	6	19	6	16	6	7	9	3	4	7	6	6	3	2
19. Doctorate in non-engr	2	2	2	2	3	0	2	4	2	2	2	1	2	1	1	1	2	3	4	6
20. Other	4	4	4	4	9	6	3	8	3	3	3	3	4	5	1	4	1	6	3	7

	TOTAL		SEX		ETHNIC GROUP				FIELD OF CURRENT EMPLOYMENT											
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
28. Choose a Particular Graduate Program.																				
1. Design oriented engr program	20	21	22	19a	21	29	20	20a	26	35	21	32	26	17	9	22	14	20	6	12e
2. Research oriented engr program	13	17	17	17	13	11	17	29	26	32	25	15	16	21	7	20	17	18	2	14
3. Management oriented program	62	55	56	56	59	57	56	46	44	30	49	48	53	54	78	53	61	55	91	61
4. Other	5	6	5	7	7	2	6	5	5	4	5	5	5	8	6	6	8	6	2	13
29. Indicate the Major Field of Bachelor's Degree.																				
Engineering																				
11. Aeronautical	2	2	3	1e	6	2	2	0e	40	1	1	0	1	0	0	3	2	2	3	2e
12. Agricultural	6	8	10	4	0	2	9	10	0	84	*	6	1	2	1	8	1	6	7	7
13. Architectural	1	1	1	1	1	0	1	1	2	0	0	2	*	0	0	0	0	2	0	1
14. Bio-Medical	*	*	*	[illegible]	1	0	1	0	0	0	*	1	1	0	0	0	0	2	1	0
15. Chemical	9	13	16	8	[illegible]	6	14	27	2	2	77	6	3	5	3	2	4	8	19	10
16. Civil	16	17	16	18	12	26	17	5	9	3	2	74	2	7	1	3	6	15	8	6
17. Computer	1	1	1	1	6	0	1	0	0	0	0	0	4	1	0	0	1	1	2	1
18. Electrical	26	11	11	11	31	28	9	10	10	0	*	0	67	2	2	1	2	11	5	9
19. Engineering Science	1	1	1	*	[illegible]	0	1	0	0	0	1	1	1	0	1	0	4	*	2	0
20. Environmental, Sanitary	1	1	1	1	1	2	1	0	0	2	0	4	0	0	*	0	0	1	0	0
21. Geological/Mineral	1	1	1	1	0	0	1	1	0	0	0	1	0	28	0	0	0	0	3	1
22. Industrial	6	10	7	15	5	9	11	5	0	2	*	1	3	1	65	1	0	10	23	10
23. Mechanical	20	19	18	20	19	19	18	20	24	2	5	1	4	5	7	76	22	24	15	17
24. Mining/Mater./Metal	1	1	2	*	1	0	1	3	0	0	0	0	0	27	*	0	0	1	1	1
25. Nuclear	1	1	1	2	0	0	1	0	0	0	0	0	1	1	0	1	29	*	0	0
26. Petroleum	0	*	*	0	0	0	*	0	0	0	0	0	0	0	0	0	1	0	0	0
27. Other Engineering	2	2	2	1	0	[illegible]	2	0	2	2	1	1	2	1	2	2	3	5	1	1
Non-Engineering																				
28. Technology	1	1	1	*	1	2	1	1	0	0	0	0	1	1	1	1	0	2	2	4
29. Business Adminstration	*	1	1	1	3	0	1	0	2	0	*	0	0	0	4	0	0	*	2	1
30. Business, Other	0	*	*	1	0	0	*	0	2	0	0	0	0	0	1	*	0	0	2	0
31. Biological Sciences	*	1	1	1	3	0	1	0	0	1	*	2	0	1	*	0	0	1	1	3
32. Chemistry	1	2	2	2	0	0	2	5	2	0	9	1	*	6	*	*	6	2	1	4
33. Physics	1	2	2	2	1	0	2	4	3	0	1	*	3	2	1	1	10	3	0	4
34. Other Physical Sciences	*	1	1	1	0	0	1	0	2	0	1	1	0	2	0	0	1	1	0	3
35. Computer Science	*	1	*	1	0	1	1	3	0	0	0	0	1	0	1	0	0	*	0	6
36. Mathematics/Statistics	1	2	1	4	2	0	3	0	4	1	0	1	5	1	5	1	6	*	3	7
37. Social Sciences	*	*	0	1	1	0	*	0	0	0	*	0	*	0	3	*	0	0	0	1
38. Arts and Humanities	*	*	*	*	0	1	*	0	0	0	*	0	*	1	*	0	0	0	1	1
39. Education	*	*	*	1	1	0	*	1	0	1	0	0	1	0	*	0	0	*	0	2
40. Other	1	1	1	1	2	0	1	3	0	1	0	1	0	5	1	0	1	2	1	1
29. Indicate the Major Field of First Master's Degree.	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
Engineering																				
11. Aeronautical	1	2	2	2e	2	6	2	0e	44	0	0	0	1	3	0	3	0	2	0	0e
12. Agricultural	4	5	6	2	0	3	5	18	0	84	0	4	0	0	0	6	0	2	1	1
13. Architectural	1	*	1	*	2	0	*	2	0	0	0	1	0	0	0	0	0	2	0	0
14. Bio-Medical	*	*	*	1	2	0	*	0	0	0	0	0	1	0	0	0	0	2	0	1
15. Chemical	11	18	22	12	0	9	18	32	0	2	79	7	4	3	0	2	2	9	9	5
16. Civil	10	9	9	10	10	9	10	3	8	4	*	49	2	0	2	2	0	8	5	1
17. Computer	1	1	1	2	4	3	1	0	0	0	0	0	8	0	0	0	0	2	0	0
18. Electrical	18	8	7	8	25	18	6	11	3	2	0	0	47	0	1	2	2	12	5	5
19. Engineering Science	*	1	1	2	0	0	1	0	8	0	*	0	0	3	0	2	0	3	0	0
20. Environmental, Sanitary	4	3	4	2	2	3	3	2	0	0	*	17	0	6	0	2	0	2	0	0
21. Geological/Mineral	1	2	1	2	0	0	2	0	0	0	0	2	0	31	0	0	0	2	1	1
22. Industrial	7	7	5	11	6	6	7	10	0	0	0	0	2	0	50	2	2	5	11	10
23. Mechanical	11	9	9	9	8	12	9	8	25	2	1	0	2	6	1	49	4	9	3	8
24. Mining/Mater./Metal	1	1	2	1	2	0	1	0	0	0	0	1	0	28	0	1	0	2	0	1
25. Nuclear	4	3	3	3	2	0	3	0	0	0	0	0	0	0	0	3	63	2	1	0
26. Petroleum	*	*	*	0	0	3	0	0	0	0	*	0	0	0	0	0	0	0	0	0
27. Other Engineering	4	4	4	3	2	0	3	0	0	0	1	8	6	0	3	7	0	7	0	2
Non-Engineering																				
28. Technology	*	*	*	*	0	0	*	0	0	0	0	1	0	0	0	0	0	0	0	2
29. Business Adminstration	14	15	15	16	13	27	16	3	3	4	12	6	12	6	28	13	11	15	52	14
30. Business, Other	1	1	1	1	0	0	1	2	0	0	1	1	1	0	3	2	0	1	3	2
31. Biological Sciences	*	*	*	1	2	0	*	0	0	0	0	1	0	0	1	0	0	1	0	2
32. Chemistry	1	1	1	1	0	0	1	0	3	0	3	1	0	3	0	1	0	1	1	1
33. Physics	1	2	2	1	0	0	2	3	0	0	*	0	3	0	0	0	9	3	0	8
34. Other Physical Sciences	*	1	1	1	0	0	1	2	0	0	0	1	0	3	0	1	0	0	0	5
35. Computer Science	1	1	1	3	0	0	1	3	0	0	0	0	4	0	1	0	0	0	1	8
36. Mathematics/Statistics	1	2	1	4	2	0	2	0	3	0	*	0	4	0	5	0	2	2	3	6
37. Social Sciences	*	1	*	1	2	0	1	0	0	0	0	1	0	0	1	1	0	1	1	1
38. Arts and Humanities	*	*	*	*	2	0	*	0	0	0	0	0	1	0	1	1	0	0	0	1
39. Education	1	1	1	2	4	0	1	2	0	2	0	0	1	8	1	0	2	2	1	4
40. Other	2	2	2	2	6	0	2	2	3	0	1	2	1	3	3	1	2	3	1	8

	TOTAL		SEX		ETHNIC GROUP				FIELD OF CURRENT EMPLOYMENT											
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
29. Indicate the Major Field of Second Master's Degree.																				
Engineering																				
11. Aeronautical	1	3	4	0a	0	0	4	0	50	0	0	0	0	0	0	0	0	12	0	0e
12. Agricultural	*	1	1	0	0	0	0	10	0	33	0	0	0	0	0	0	0	0	0	0
14. Bio-Medical	0	1	0	5	0	0	2	0	0	0	0	0	8	0	0	0	0	0	0	0
15. Chemical	2	4	3	7	0	0	4	0	0	0	23	0	0	0	0	0	14	6	0	0
16. Civil	3	4	5	2	0	0	4	10	0	0	0	36	0	0	0	0	0	6	0	0
17. Computer	*	2	1	5	0	0	3	0	0	0	0	0	8	0	7	0	0	0	0	0
18. Electrical	10	4	5	2	11	0	3	10	0	0	6	0	19	0	0	0	0	0	0	0
19. Engineering Science	*	1	1	2	0	0	2	0	0	33	0	0	4	0	0	0	0	0	0	0
20. Environmental, Sanitary	2	2	3	0	0	0	1	0	0	0	0	7	7	0	0	0	0	0	0	0
21. Geological/Mineral	1	1	1	0	0	0	2	0	0	0	0	7	0	0	0	0	0	0	0	0
22. Industrial	8	6	8	2	0	0	6	10	0	0	6	0	4	0	29	0	0	0	7	14
23. Mechanical	4	5	6	2	11	0	6	0	0	0	0	7	0	0	0	29	0	12	0	0
25. Nuclear	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	29	0	0	0
26. Petroleum	0	1	1	0	0	0	1	0	0	0	6	0	0	0	0	0	0	0	0	0
27. Other Engineering	8	4	5	2	0	0	5	10	25	0	0	0	0	0	7	12	0	12	0	0
Non-Engineering																				
28. Technology	0	1	2	0	0	17	1	0	0	0	0	0	0	0	0	0	0	6	7	0
29. Business Adminstration	42	36	37	35	56	50	33	50	25	33	53	29	8	50	36	47	14	35	64	43
30. Business, Other	3	2	2	2	0	17	2	0	0	0	0	7	0	0	14	0	0	0	0	0
31. Biological Sciences	0	1	0	2	0	0	1	0	0	0	0	7	0	0	0	0	0	0	0	0
33. Physics	1	3	3	2	0	0	4	0	0	0	0	0	4	0	0	0	29	0	0	7
34. Other Physical Sciences	1	1	1	2	11	0	1	0	0	0	0	0	4	50	0	0	0	0	0	0
35. Computer Science	3	5	5	7	0	17	6	0	0	0	0	0	23	0	0	0	0	0	0	14
36. Mathematics/Statistics	4	3	1	9	0	0	5	0	0	0	0	0	4	0	7	6	0	0	7	7
37. Social Sciences	0	1	0	2	0	0	1	0	0	0	0	0	0	0	0	0	0	6	0	0
38. Arts and Humanities	0	1	1	0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
39. Education	0	1	0	2	0	0	1	0	0	0	0	0	4	0	0	0	0	0	0	0
40. Other	6	5	6	5	0	0	6	0	0	0	6	0	4	0	0	6	14	6	14	7

29. Indicate the Major Field of Doctorate Degree.	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
Engineering																				
11. Aeronautical	3	7	7	6a	17	17	4	0e	73	0	0	7	0	0	0	20	0	4	0	0e
12. Agricultural	6	8	10	0	0	0	7	27	0	77	0	0	0	0	0	0	0	4	14	0
14. Bio-Medical	0	1	0	3	0	0	1	0	0	0	0	0	0	0	0	0	0	4	0	0
15. Chemical	4	13	15	6	0	0	14	13	0	0	89	14	0	0	0	0	13	4	0	0
16. Civil	5	7	7	6	0	0	7	13	9	0	0	57	6	0	0	0	0	4	0	0
17. Computer	4	2	1	6	0	0	2	0	0	0	0	0	11	0	0	0	0	0	14	0
18. Electrical	21	7	9	3	33	17	5	13	0	0	0	0	56	0	0	0	0	8	0	6
19. Engineering Science	1	2	2	3	0	0	2	13	0	8	0	0	0	0	0	10	13	4	0	0
20. Environmental, Sanitary	3	2	2	6	0	0	3	0	0	0	0	14	0	14	5	0	0	0	14	0
21. Geological/Mineral	2	2	2	0	0	0	2	0	0	0	0	0	0	29	0	0	0	0	14	0
22. Industrial	4	10	5	25	0	0	13	0	0	0	6	0	0	0	79	0	0	0	0	0
23. Mechanical	9	6	6	6	0	0	6	7	9	0	6	0	0	0	0	60	0	8	0	0
24. Mining/Mater./Metal	1	2	3	0	0	0	2	7	0	0	0	0	0	14	0	10	0	4	0	6
25. Nuclear	5	2	2	3	0	0	2	0	0	0	0	0	0	0	0	0	50	0	0	0
26. Petroleum	*	1	1	0	0	17	0	0	0	0	0	0	0	0	5	0	0	0	0	0
27. Other Engineering	3	4	5	0	0	0	6	0	0	0	0	7	6	0	0	0	0	21	0	0
Non-Engineering																				
28. Technology	0	1	1	0	0	17	0	0	0	0	0	0	0	0	0	0	0	4	0	0
29. Business Adminstration	5	2	2	3	0	0	2	0	0	0	0	0	0	0	0	0	0	4	14	12
32. Chemistry	1	1	1	0	0	0	1	0	0	0	0	0	0	14	0	0	0	0	0	0
33. Physics	1	4	2	11	0	0	5	0	0	0	0	0	6	0	0	0	25	0	0	18
34. Other Physical Sciences	1	2	2	3	0	0	2	0	0	0	0	0	29	0	0	0	0	4	0	6
35. Computer Science	2	1	2	0	0	0	2	0	0	0	0	0	0	0	5	0	0	0	0	6
36. Mathematics/Statistics	1	2	2	3	0	17	2	0	0	0	0	0	11	0	5	0	0	4	0	6
38. Arts and Humanities	0	1	1	0	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
39. Education	*	2	2	3	0	0	2	7	0	15	0	0	0	0	0	0	0	0	0	6
40. Other	16	9	9	8	33	17	9	0	9	0	0	0	6	0	0	0	0	17	43	29

30. Percent who "strongly agree" or "agree" regarding the need for graduate work or continuing education in employment.	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
1. Graduate study is not needed	57	59	59	59	60	61	59	42a	57	56	61	61	58	55	62	68	48	57	53	52
2. "On Job" training is sufficient	46	47	47	46	57	55	46	32b	48	41	47	42	48	48	41	50	43	50	54	51
3. Non-credit courses are sufficient	55	56	56	56	51	46	57	59	56	55	57	56	52	65	56	59	49	53	63	51
4. Mgmt graduate work is needed	53	50	49	51	49	60	50	47	34	40	34	46	51	51	65	50	52	48	72	51e
5. Math & sci graduate work is needed	29	31	32	30	30	30	30	47a	47	41	26	27	36	41	22	25	43	34	19	36e
6. Engr graduate work is needed	45	47	48	46	41	47	46	74e	55	64	45	59	57	48	36	44	55	46	23	26e

	TOTAL		SEX		ETHNIC GROUP				FIELD OF CURRENT EMPLOYMENT											
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
31. When first considered on a career in Engineering.																				
1. Before High school	24	18	22	11e	32	18	17	20b	39	11	18	12	22	17	14	20	21	22	20	17e
2. During grades 9 or 10	23	19	23	12	14	24	18	18	14	22	24	18	17	12	14	22	13	14	20	24
3. During grades 11 or 12	36	39	38	41	33	42	40	36	26	25	41	43	33	33	45	43	33	41	37	31
4. During first year of college	10	11	10	14	15	13	11	9	8	11	6	15	14	13	11	9	13	12	6	12
5. During second year of college	3	5	3	9	3	2	6	5	3	6	4	7	5	13	7	5	7	3	4	5
6. During third of fourth year of coll	2	3	2	5	1	1	4	8	6	3	5	2	3	11	3	1	7	2	5	3
7. After college	2	5	2	8	2	1	5	4	5	2	3	4	7	2	6	1	6	7	6	8
31. When final decision on a career in Engineering.																				
1. Before high school	5	4	5	2c	•	5	3	9e	14	3	4	3	6	1	4	5	7	4	5	1e
2. During grades 9 or 10	10	6	8	3	14	9	6	4	5	3	8	3	8	4	6	7	2	8	5	8
3. During grades 11 or 12	47	43	48	34	44	46	43	42	41	49	46	40	41	28	39	51	37	43	48	42
4. During first year of college	18	19	18	21	10	28	19	20	11	21	15	24	18	20	17	18	21	16	20	21
5. During second year of college	9	12	10	17	11	9	13	7	11	13	11	17	9	14	15	12	11	13	12	8
6. During third of fourth year of coll	5	7	5	10	5	3	7	10	5	8	6	7	10	16	9	4	6	5	4	6
7. After college	6	9	6	12	2	0	9	9	13	4	10	6	8	17	10	3	17	10	8	15
32. Percent indicating factors as "Very" or "Some" importance in pursuing an engineering career.	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
People																				
1. Mother (or female guardian)	42	44	41	49d	52	46	44	38	39	47	43	47	44	44	42	44	55	42	50	38
2. Father (or male guardian)	61	61	60	61	50	59	62	58	60	56	62	61	59	55	59	65	62	60	64	55
3. Other relative	28	27	27	27	30	38	25	41c	24	30	29	33	29	30	23	26	20	25	27	28
4. Friends	35	36	37	34	41	35	35	49	31	34	32	39	32	37	36	38	43	38	42	27
5. High-school math or science teach	49	48	49	47	53	48	48	57	55	53	55	44	45	54	44	51	48	41	54	53a
6. College teacher(s)	41	44	41	50e	44	44	44	49	40	55	42	47	39	47	42	45	48	39	48	45
7. College counselor(s)	22	22	21	26b	34	31	21	26c	14	33	14	25	21	17	28	25	18	21	22	22c
8. Male engineer(s)	32	32	32	32	26	37	31	43	23	29	29	38	32	30	31	31	38	30	27	24a
9. Female engineer(s)	5	8	4	15e	11	10	8	6	7	7	5	8	11	12	8	9	8	10	9	6
10. High-school counselor(s)	26	22	24	18b	37	19	22	6	22	27	19	23	22	26	20	24	19	20	20	20
Courses																				
11. Career education courses	19	17	19	14b	30	25	16	17d	12	20	12	20	15	10	21	17	21	20	11	18a
12. High-school math courses	67	67	66	68	79	71	66	69a	75	68	70	62	65	62	70	69	67	66	63	64
13. High-school science courses	70	69	71	66a	80	69	69	69	75	68	79	63	67	72	66	73	72	67	66	69a
14. College math courses	53	55	53	59b	66	66	53	62b	63	49	52	53	60	56	58	54	66	53	49	53
15. College chemistry courses	33	35	37	33	51	41	34	45c	26	23	64	35	31	46	27	30	42	32	39	34e
16. College physics courses	49	48	49	46	61	62	46	54d	57	48	49	45	49	54	39	54	66	46	45	43c
17. College science courses	51	50	52	47a	60	63	49	60c	48	54	53	50	52	69	41	51	63	50	43	49b
18. College engineering courses	73	75	74	76	80	79	74	79	69	76	74	82	76	74	73	77	78	74	68	58c
Guidance Instruments, Activities																				
19. Interest inventory results	26	24	25	23	25	16	25	21	16	33	16	22	21	25	33	26	25	24	24	23b
20. Aptitude tests	45	45	45	45	47	39	46	40	37	49	38	43	40	43	55	48	41	44	51	46a
21. Career or occupational information	57	57	57	58	66	67	56	57a	49	63	56	59	51	61	65	57	50	59	52	61a
22. Relevant work experience	47	42	46	36e	44	36	42	35	43	51	34	36	43	51	38	41	41	43	41	44
23. Hobby magazines(eg Pop. Mechanics)	23	15	22	4e	27	17	14	23c	31	19	14	8	20	8	10	20	9	19	8	17e
24. Technical publications	24	21	25	14e	28	27	18	43e	33	22	22	16	23	24	13	19	27	28	17	21c
25. Science fair participation	20	16	18	12c	30	12	14	32e	16	18	20	9	19	18	16	15	13	15	17	18a
26. Outdoor activities	18	19	21	17a	19	22	19	22	11	41	12	32	10	49	13	15	12	19	9	13e
27. Science clubs	13	12	13	11	25	10	11	23e	8	11	18	7	13	21	11	11	19	12	10	16b
28. Junior Achievement	6	4	5	3	11	7	3	17e	2	4	3	3	5	5	7	3	2	4	3	4
29. Science fiction	26	23	24	20a	39	33	21	30e	29	15	22	16	33	33	17	23	26	24	14	29e
30. Liking for problem solving	82	85	84	88b	85	82	86	83	83	87	84	81	87	89	86	87	91	84	87	85
31. Being curious or creative	82	83	83	82	88	82	82	84	79	88	83	78	86	80	85	83	90	81	80	82
32. Wanting to be of service to others	44	45	44	46	47	49	43	59	24	65	41	53	40	43	44	39	49	44	47	45e
33. Flying aircraft	14	12	14	8e	20	17	10	15c	27	6	6	8	15	10	8	17	13	12	10	16e
34. Using a computer	31	32	28	39e	42	42	31	39b	27	35	26	28	48	18	33	29	37	32	30	35e
35. Building electrical devices	32	20	26	12e	48	28	18	32e	16	24	12	7	54	12	13	17	18	22	19	22e
36. Mechanical hobby	40	29	40	12e	40	36	28	43c	40	50	20	16	28	33	20	49	24	31	29	31e
37. Construction hobbies	40	31	40	16e	40	39	30	32a	37	41	23	35	30	33	20	37	27	32	28	31d
38. Building model airplanes	27	18	26	5e	31	26	16	30e	42	9	13	12	21	16	14	23	20	22	17	24e
39. Farm Experiences	18	15	20	8e	11	18	15	11	3	82	6	13	10	15	10	15	9	10	15	19e
40. Pre-college seminars	8	10	8	12c	20	12	9	8c	8	14	10	8	9	3	6	12	6	13	10	11
41. Type of work	60	64	63	65	53	58	65	58a	59	73	65	67	57	62	62	63	68	70	66	57a
42. Challenge	82	83	81	89e	83	87	84	90	81	85	80	84	84	86	84	86	91	85	78	78
43. Salary	76	75	74	77	82	72	75	73	62	71	77	77	74	79	74	77	82	72	80	69
44. Creativity	74	74	73	76	75	74	74	86	79	80	74	70	77	70	73	73	79	76	70	72
45. Security	58	61	59	64b	64	64	61	68	48	59	65	62	61	54	67	64	62	58	59	52
46. Prestige	64	62	62	63	58	72	61	73a	44	57	62	64	60	54	68	63	62	59	69	59a
47. Rapid advancement	45	48	45	53c	53	61	46	62c	44	56	52	63	54	47	62	51	49	58	65	52b
48. Leadership	54	56	54	60b	57	69	55	70b	44	56	52	63	54	47	62	51	49	58	65	52b
49. Independence	65	68	62	78e	70	73	68	73	57	67	61	73	67	75	72	66	68	71	69	63

	TOTAL		SEX		ETHNIC GROUP				FIELD OF CURRENT EMPLOYMENT											
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
33. Have you ever taken an interest inventory as part of career counseling?																				
1. Yes	27	33	28	40e	23	16	36	3e	30	28	30	31	31	26	40	33	33	34	43	32c
2. No	65	60	64	54	68	79	57	96	64	55	66	60	65	66	52	60	53	61	54	61
3. Uncertain	8	7	8	6	10	5	7	1	6	17	5	9	4	8	9	7	14	6	3	7
33. If yes or uncertain, which interest inventory taken.																				
1. Kuder interest measure	20	21	17	26c	8	0	22	0a	23	6	21	17	25	13	31	25	10	20	26	22a
2. Purdue Interest Questionaire	3	3	3	4	5	0	3	0	0	0	2	4	1	3	5	6	3	1	7	2
3. Strong-Campbell Interest Inventory	14	18	16	20	20	40	18	33	9	19	17	18	19	17	19	16	18	13	30	23
4. Other	59	58	59	58	52	56	58	67	64	70	56	59	53	63	57	57	68	62	48	66
33. When was the interest inventory taken?																				
1. Pre-college Kuder interest measure	67	70	67	71	0	0	70	0b	86	67	68	70	62	50	79	82	50	67	43	57
2. Pre-college PIQ	10	18	18	19	0	0	21	0	0	0	100	33	0	0	0	13	0	0	0	100
3. Pre-college SCII	37	34	36	33	25	29	37	0	33	60	38	39	29	20	38	43	13	25	13	40
4. Pre-college other	61	62	66	58	56	50	63	100	71	70	73	69	47	68	51	76	64	53	55	54b
5. In college Kuder interest measure	16	24	18	28	100	0	23	0b	43	0	16	19	31	50	32	12	25	22	21	36
6. In college PIQ	14	29	24	35	0	0	30	0	0	0	0	17	100	100	43	38	100	100	0	0
7. In college SCII	46	46	44	48	50	29	47	0	33	40	47	50	48	80	50	24	75	50	31	60
8. In college other	24	26	23	30	17	40	25	0	21	16	15	34	30	16	35	16	29	20	38	30a
9. After college Kuder interest	9	10	10	10	0	0	10	0	0	33	16	4	8	0	3	15	25	11	36	0a
10. After college PIQ	23	30	19	41	50	0	28	0	0	0	0	33	100	0	29	29	0	0	50	0
11. After college SCII	27	27	28	26	25	29	25	100	33	10	33	7	10	20	29	43	38	17	50	27
12. After college other	11	12	13	10	26	15	11	0	7	0	13	6	15	5	19	11	4	14	21	16
33. Percent responding "Very helpful" or "Helpful" to impact.	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
1. Kuder Interest measure	41	48	43	52	33	0	53	0	50	67	93	58	70	0	46	30	75	56	39	46b
2. Purdue Interest Questionnaire	54	54	36	69	100	0	46	0	100	0	50	75	0	0	60	40	100	0	50	0
3. Strong-Campbell Interest Inventory	59	49	55	43	43	33	50	100	33	30	57	62	73	60	43	50	38	27	31	67
4. Other	40	62	61	63	58	41	63	100	92	70	64	58	64	71	57	63	76	41	57	68
33. Percent responding "Yes" or "Unsure,Yes" to reflection of interests.																				
1. Kuder Interest measure	83	78	77	79	67	0	78	0	100	67	56	83	74	100	81	83	75	72	77	73
2. Purdue Interest Questionaire	64	86	73	100	100	0	85	0	100	0	100	100	0	100	75	100	100	50	100	100
3. Strong-Campbell Interest Inventory	85	86	92	79a	100	71	86	100	33	100	87	85	69	100	96	84	100	92	93	74
4. Other	80	77	81	71a	68	56	78	50	75	90	62	76	77	69	87	79	72	77	79	76
33. Percent responding "Yes,partly" or "Yes,completely" to interpetation materials being understandable.																				
1. Kuder interest measure	94	96	95	96	50	0	96	0b	100	100	100	96	87	100	100	100	100	83	91	90
2. Purdue Interest Questionaire	100	100	100	100	0	0	100	0	100	0	100	100	0	100	100	100	100	100	100	100
3. Strong-Campbell Interest Inventory	96	93	98	89a	86	100	93	100	100	100	93	93	88	100	100	100	100	91	92	80
4. Other	91	93	94	92	88	88	94	100	100	94	88	97	96	94	97	95	83	90	91	95
33. Percent responding "Yes,partly" or "Yes,completely" to interpetation materials being helpful.																				
1. Kuder interest measure	85	81	82	80	100	0	81	0	100	67	60	75	74	100	91	87	67	82	82	70
2. Purdue Interest Questionaire	99	96	100	91	0	0	95	0	100	0	100	67	0	100	100	100	100	100	100	100
3. Strong-Campbell Interest Inventory	88	84	92	75b	71	86	84	100	100	100	85	82	56	80	96	90	86	91	79	80
4. Other	75	73	78	67b	71	75	74	50	70	72	71	75	72	63	84	71	54	81	71	76
34. Percent rating themselves as "Above Average" or "Highest 10%" when compared with the average adult attending college.																				
1. Academic ability	82	84	82	87c	74	70	86	90e	87	81	94	83	83	77	81	84	85	85	85	85b
2. Athletic ability	47	41	47	32e	50	51	40	32b	34	43	44	45	43	52	44	37	37	41	38	33
3. Artistic ability	24	28	26	32c	35	29	27	24	27	23	23	33	31	28	22	29	32	32	24	30
4. Drive to achieve	81	80	80	81	90	80	79	89b	75	70	86	78	82	78	78	74	82	87	90	79d
5. Leadership ability	77	73	75	71a	79	71	73	72	78	60	77	71	72	72	76	69	75	79	89	70d
6. Mathematical ability	81	81	78	85e	76	75	81	88	84	76	90	79	83	60	83	80	85	79	88	71e
7. Mechanical ability	70	64	70	54e	61	55	65	53a	80	72	60	57	62	63	47	80	71	72	60	59e
8. Originality	67	63	67	58e	64	58	63	65	78	61	70	56	67	78	57	59	62	61	77	65e
9. Problem solving ability	91	89	89	90	82	87	90	91a	89	87	94	89	91	81	91	85	83	89	95	84b
10. Public speaking ability	46	45	46	44	48	34	47	29c	48	40	45	39	48	46	45	40	42	46	66	49c
11. Self-confidence(intellectual)	78	75	78	70e	82	74	74	84	81	68	83	71	73	72	76	64	79	80	88	78e
12. Self-confidence(social)	48	47	47	49	69	60	45	52e	50	32	44	50	51	47	50	42	45	51	58	47b
13. Sensititity to criticism	38	37	35	40a	30	41	36	45	37	42	31	36	37	37	33	39	47	38	43	37
14. Understanding of others	67	68	66	71b	80	76	66	72b	70	59	69	65	68	69	70	65	71	71	77	67
15. Writing ability	58	62	59	67c	58	49	63	55b	67	44	68	54	61	70	60	59	69	62	79	65e
16. Verbal ability	53	56	55	56	57	46	57	46a	59	45	64	50	57	61	54	50	61	57	70	59c
17. Visualization ability	75	71	74	66e	72	72	71	71	75	64	75	68	69	73	68	70	74	76	72	71

	TOTAL		SEX		ETHNIC GROUP				FIELD OF CURRENT EMPLOYMENT											
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
35. Percent rating themselves as "Very" (5) or "Moderately" (4) on the following personal characteristics.																				
1. Very artistic	26	26	23	32e	33	25	26	38a	25	25	23	31	29	31	20	30	28	25	25	26
2. Very independent	89	80	78	82	83	86	79	80	81	78	75	79	80	82	80	81	88	79	81	77
3. Very emotional	36	37	32	44e	25	33	37	45a	25	31	41	44	37	35	35	36	30	36	31	36a
4. Very active	61	54	53	56	60	62	53	63a	55	51	53	53	55	57	53	51	48	55	62	58
5. Able to devote self to others	50	45	47	42a	44	49	44	51	47	52	44	50	41	37	46	44	36	50	48	34a
6. Very gentle	50	48	48	50	45	41	49	58	54	47	48	53	50	39	48	47	53	49	40	46
7. Very helpful to others	82	77	78	76	89	78	77	88a	76	81	81	76	80	69	78	76	78	79	79	72
8. Very competitive	76	61	62	60	62	69	60	70	57	49	68	60	60	62	67	58	70	65	68	54a
9. Very kind	80	73	74	71	83	73	73	84	64	78	70	76	77	71	73	66	79	71	76	73
10. Very aware of the feelings of other	76	68	67	72a	74	64	68	75	56	73	65	73	73	60	72	66	68	68	74	60a
11. Can make decisions easy	73	60	64	53e	69	71	58	67b	67	58	59	56	55	66	67	58	62	69	63	57
12. Never give up easily	82	70	73	66b	76	76	70	71	82	68	74	69	68	69	72	68	75	69	71	67
13. Very self confident	77	63	69	55e	70	68	62	79a	57	57	70	63	57	65	60	62	61	65	82	65a
14. Feel very superior	50	42	46	34e	52	45	41	50a	44	39	45	40	39	41	43	37	45	44	51	48
15. Very understanding of others	72	69	68	71	78	73	69	85a	69	65	71	76	69	67	70	68	66	64	78	65
16. Very warm in relations with others	55	52	49	57c	63	57	51	65a	52	55	39	55	54	47	58	56	46	58	42	47c
17. Stands up well under pressure	82	70	74	63e	81	78	68	75a	59	76	72	68	68	76	69	65	62	74	73	72
18. Very tolerant of ambiguity	27	21	23	17c	32	30	19	34e	21	18	26	15	25	24	23	22	19	21	27	12b
19. Very high verbal ability	58	52	51	53	59	50	52	37a	49	39	55	46	53	63	51	49	61	57	59	57a
20. Very high math ability	81	72	70	75a	76	65	72	78	78	72	83	73	75	53	72	74	76	66	77	59d
21. Very highly creative	69	59	62	54c	62	64	58	68	70	58	63	52	64	69	54	58	55	55	62	60
22. Very high mechanical ability	66	51	57	43e	57	50	52	39	57	61	47	41	48	59	39	70	57	61	44	51e
23. Very high visualization ability	77	63	68	55e	66	67	63	55	71	64	63	59	64	74	59	65	63	68	61	62
24. Very high problem solving ability	89	83	84	80a	76	79	84	82	88	84	88	83	82	73	84	81	86	81	90	72a

36. Percent indicating various statements as "Very" important to them personally	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
1. Opportunity to innovate	67	64	67	58e	75	64	62	76b	72	64	70	55	62	70	72	62	52	63	74	64d
2. Opportunity to use my skills	77	80	78	85d	88	83	80	85	84	72	84	78	83	78	84	79	82	79	86	80
3. Delegate responsibility	65	66	65	69a	67	71	66	66	65	54	69	69	63	60	73	63	53	65	84	72e
4. Significnt contributions to society	33	33	35	31a	47	50	30	54e	29	43	35	38	32	33	21	31	36	33	32	35c
5. Excercise leardership	49	45	47	43a	59	52	44	47b	39	36	48	47	38	46	51	41	48	47	63	45c
6. Opportuntities to help others	34	34	35	33	49	47	32	50e	21	45	32	41	31	27	35	31	25	34	33	37b
7. Wide variety of technical work	46	48	47	48	51	49	47	57	50	46	56	44	53	61	39	54	53	49	28	38e
8. Opportuntity to work with things	33	30	33	26b	39	39	29	30a	35	38	27	25	39	37	18	43	21	34	20	26e
9. Desirable geographical location	53	52	51	53	57	61	52	44	53	50	52	58	49	51	51	53	49	58	54	48
10. Opportunity to advance economically	58	53	55	49b	63	63	51	57b	41	34	54	55	50	55	58	52	54	52	65	53c
11. Opportunity to enhance social statu	25	20	22	17	33	25	18	38e	12	15	20	21	18	15	20	19	24	20	37	21b
12. An income to live comfortably	75	71	72	67b	87	76	69	74d	66	59	71	71	70	78	76	66	67	73	77	71a
13. Opportunity to move into mgmt	48	46	46	46	50	54	45	50	29	27	47	46	39	45	66	39	44	47	71	45e
14. Company realizes family responsibil	52	49	50	49	56	58	48	49	48	48	49	53	49	55	52	54	47	46	40	43
15. Know exactly my work responsibiliti	53	51	52	50	64	71	48	72e	50	50	47	55	53	55	50	52	44	50	43	57
16. Opportunity to travel	18	20	18	22a	32	19	18	31c	11	23	19	22	18	30	18	15	17	24	18	21a
17. Opportunity to work with people	40	44	41	51e	51	53	44	45	31	37	46	44	44	47	55	43	35	43	51	42b
18. Assigned to different areas in the	23	25	21	31e	44	31	23	24e	21	13	31	20	23	21	36	26	21	23	30	24e
19. People working together, no petty j	70	73	69	79e	82	85	72	77c	61	73	68	78	75	77	69	78	62	74	68	71b
20. Freedom from pressure to excell	27	28	27	29	33	46	25	42e	23	27	25	30	30	37	25	30	24	28	19	27
21. Preparation for top level careers	35	36	33	41e	56	45	33	45e	26	23	34	35	37	39	43	35	31	34	49	38b
22. Participation in work-related decis	64	61	61	60	66	63	60	63	60	49	61	60	61	69	62	60	47	62	72	61a
23. Co. is well-managed and progressive	65	66	66	67	77	75	65	73b	57	64	64	67	66	63	72	70	54	67	70	64
24. Flexible work hours	42	38	34	44e	54	41	36	47c	37	35	30	46	44	37	33	35	46	43	23	43e
25. Availability of personal leave	50	47	42	57e	62	56	46	54c	45	50	44	54	52	45	43	47	49	48	27	46c
26. Opportunity to keep abreast	50	52	54	50	68	61	49	72e	49	63	49	52	58	66	48	52	44	53	36	55c
27. Freedom to manage own work	62	61	61	62	68	64	60	70	63	59	57	56	63	61	70	58	63	62	68	70a
28. Problems with no ready made solutio	52	49	53	44d	52	48	49	65a	66	48	54	44	50	51	52	47	35	51	51	52a
29. Engage in satisfying work	80	82	81	85a	85	81	83	78	89	74	79	85	80	80	83	85	81	81	88	86
30. Be original and creative	54	53	56	48c	58	61	51	74d	61	48	57	47	56	59	54	56	39	53	50	54
31. Work with ideas	52	52	54	49a	60	62	50	69c	61	47	59	45	56	58	56	51	39	52	50	51b
32. Job security due to technical attai	45	46	47	45	60	48	44	58c	51	46	49	51	53	44	43	45	35	46	32	42b
33. Freedom from pressure to conform	46	50	47	54c	57	54	48	54	44	46	52	52	51	55	46	50	51	50	31	52a
34. Pleasant people to work with	56	62	60	65b	61	69	61	74	60	68	62	72	61	70	53	62	55	64	43	59e
35. Freedom to select projects	20	22	21	23	25	26	20	42e	26	21	22	18	24	27	20	20	17	24	17	25
36. Colleagues interested in latest dev	32	33	33	33	43	42	31	47d	33	43	30	33	42	48	26	30	28	35	24	36d

	TOTAL WT	TOTAL UW	SEX MA	SEX FE	ETHNIC GROUP BL	HI	WH	FN	FIELD OF CURRENT EMPLOYMENT AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
36. Percent indicating various statements as "Very" characteristic of your present job.																				
1. Opportunity to innovate	43	38	42	32e	37	34	39	39	33	43	42	26	39	47	48	34	21	45	54	39e
2. Opportunity to use my skills	46	43	45	40a	41	45	43	44	39	44	44	40	47	54	41	40	33	47	58	47b
3. Delegate responsibility	43	43	43	44	46	42	44	27a	41	40	46	42	44	42	43	41	36	46	51	50
4. Signifient contributions to society	15	14	15	11b	14	20	13	13	12	21	13	14	12	15	7	12	18	17	14	17a
5. Excercise leardership	31	25	29	18e	35	31	24	13b	25	22	20	23	23	21	27	18	16	31	53	32e
6. Opportuntities to help others	23	20	21	16b	34	19	19	20c	14	32	18	17	19	14	22	15	11	22	19	27c
7. Wide variety of technical work	36	34	36	30b	29	35	34	30	38	35	38	32	40	44	25	34	29	41	18	31e
8. Opportuntity to work with things	25	24	26	22a	27	29	24	20	31	34	24	17	35	22	14	34	12	27	19	20e
9. Desirable geographical location	46	45	44	47	40	53	46	32a	43	38	39	48	46	43	43	51	48	47	50	43
10. Opportunity to advance economically	28	27	26	27	27	30	27	16	28	16	29	24	30	20	27	25	20	27	43	30c
11. Opportunity to enhance social statu	17	13	14	12	22	17	12	17b	7	11	13	12	13	8	13	12	7	15	27	16b
12. An income to live comfortably	41	41	39	45a	43	41	42	25a	45	30	48	34	41	42	42	44	29	45	57	45e
13. Opportunity to move into mgmt	40	35	36	34	41	43	35	18b	33	21	31	30	36	33	41	28	29	45	66	38e
14. Company realizes family responsibil	29	29	30	27	26	43	28	19c	25	31	24	33	31	41	28	29	21	27	33	27
15. Know exactly my work responsibiliti	34	30	32	27b	46	44	27	41e	32	30	27	29	30	26	28	31	20	32	38	41
16. Opportunity to travel	24	21	23	18b	29	26	21	14	15	21	21	23	20	30	16	15	17	29	32	22c
17. Opportunity to work with people	51	50	50	51	55	58	51	29c	47	44	50	46	49	50	58	48	40	55	71	51c
18. Assigned to different areas in the	21	19	18	22a	35	34	18	16e	18	10	24	16	22	7	23	21	12	18	29	17c
19. People working together, no petty j	29	27	28	24	27	34	26	23	25	31	27	30	28	26	19	27	21	26	35	29
20. Freedom from pressure to excell	14	15	14	16	12	17	14	21	7	18	14	18	15	20	14	15	9	7	18	13a
21. Preparation for top level careers	10	10	10	11	16	19	10	3c	12	10	8	8	9	8	9	13	7	11	23	12b
22. Participation in work-related decis	31	25	28	18e	23	26	25	17	20	20	21	23	23	29	24	23	13	28	43	31e
23. Co. is well-managed and progressive	24	21	23	16d	27	25	20	18	18	21	19	19	23	23	20	18	14	23	37	21b
24. Flexible work hours	27	26	26	26	28	31	26	24	16	33	18	29	31	37	24	20	24	31	24	31c
25. Availability of personal leave	39	40	41	39	39	53	39	37a	45	44	37	41	43	46	37	38	31	45	33	46
26. Opportunity to keep abreast	30	28	31	23d	29	33	27	36	25	41	32	27	32	32	20	23	15	33	28	30d
27. Freedom to manage own work	43	42	43	40	46	40	42	32	31	45	38	37	45	45	47	36	29	46	49	54d
28. Problems with no ready made solutio	46	44	46	40a	40	38	44	43	38	47	47	36	47	42	47	39	28	48	52	49b
29. Engage in satisfying work	40	37	39	33b	35	38	37	37	34	35	37	32	41	40	37	33	20	41	49	45b
30. Be original and creative	31	29	32	25b	29	33	29	31	30	29	32	28	34	35	31	26	13	33	41	34e
31. Work with ideas	32	31	34	27b	29	35	31	30	25	33	35	23	35	29	36	27	19	35	39	38c
32. Job security due to technical attai	29	31	31	32	32	38	31	30	31	24	37	29	27	28	28	28	34	32	36	35
33. Freedom from pressure to conform	31	33	32	34	27	36	33	29	36	26	27	34	33	41	26	34	30	39	28	39a
34. Pleasant people to work with	38	41	41	41	34	38	42	35	35	45	38	50	42	38	34	40	36	42	34	41a
35. Freedom to select projects	11	9	10	8	9	9	9	7	10	10	5	7	11	14	11	7	4	9	11	15a
36. Colleagues interested in latest dev	18	19	19	18	21	17	19	20	25	33	14	16	27	24	11	14	14	23	16	20e

	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
37. Percent indicating curent national problems to be of a "Major" or "Critical" nature.																				
1. Energy and fuel supplies	98	98	98	98	97	99	98	96	97	99	99	98	99	100	98	97	99	98	98	98
2. Health	71	73	72	75	85	75	72	85c	67	75	74	77	76	71	78	70	68	70	64	74
3. Defense	81	79	81	76a	79	81	80	59c	95	69	76	78	79	88	81	81	75	77	86	78b
4. Environmental protection	77	81	78	84c	86	85	80	86	73	82	85	88	80	80	77	78	77	79	74	84b
5. Education	82	85	85	86	93	92	84	85c	82	89	80	87	84	92	86	87	87	86	80	84
6. Space	54	55	56	54	58	65	55	45	73	56	45	50	64	66	52	56	55	63	45	56e
7. Crime prevention and control	84	86	86	87	88	91	86	86	86	84	85	88	88	93	90	86	85	81	81	86
8. Agricultural production	74	74	76	71b	78	80	74	69	65	97	75	77	70	84	70	74	65	75	69	70e
9. Welfare and family services	34	38	36	43c	77	47	35	48e	36	41	35	39	44	33	43	36	33	38	30	39
10. Community development	40	42	42	43	73	57	39	49e	29	45	41	53	44	37	43	37	26	42	34	42e
11. Transprotation	64	65	64	66	73	71	64	67	62	56	62	70	68	68	61	63	57	73	60	66a
12. Communications	49	51	50	53	64	63	49	61d	46	46	40	54	58	51	52	48	43	59	51	53b
13. Other	67	66	67	65	76	47	66	71	78	59	68	53	83	93	65	60	70	60	87	58
37. Percent indicting "Minor","Some", or "Major" professional involvement in the current national problems																				
1. Energy and fuel supplies	68	68	73	59e	49	54	69	77e	53	78	87	65	63	92	56	72	99	64	69	52e
2. Health	34	32	34	29a	29	34	33	31	15	32	36	39	25	27	34	27	35	35	37	29c
3. Defense	38	32	35	28c	36	43	32	14c	92	11	22	28	45	33	28	32	43	39	27	26e
4. Environmental protection	63	62	67	54e	52	61	63	60	32	69	84	81	43	92	46	58	79	59	59	40e
5. Education	46	42	46	36e	51	42	41	59b	41	62	37	39	42	48	44	34	41	48	46	43c
6. Space	19	17	19	15b	22	25	16	8b	75	5	7	7	27	18	15	16	14	26	18	17e
7. Crime prevention and control	15	11	13	7e	23	25	9	10e	10	6	7	9	17	5	5	6	8	13	19	17e
8. Agricultural production	24	22	27	15e	10	18	23	31b	12	95	19	23	17	23	15	19	7	15	22	17e
9. Welfare and family services	11	8	10	6d	20	15	7	10e	7	13	5	8	9	2	8	4	4	11	19	11e
10. Community development	32	30	32	26b	48	35	29	19d	25	36	19	49	24	22	27	20	21	32	41	35e
11. Transprotation	35	31	34	26d	32	28	31	25	48	18	23	48	26	30	28	26	20	33	35	27e
12. Communications	30	28	28	28	46	33	26	23e	28	13	14	22	50	16	34	14	16	33	40	43e
13. Other	32	32	36	28	48	21	31	31	23	48	39	33	35	48	25	22	26	30	50	33

	TOTAL		SEX		ETHNIC GROUP				FIELD OF CURRENT EMPLOYMENT											
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
38. Percent indication "Major" or "Moderate" impact of factors in career development.																				
1. Presence of small children	30	24	28	16e	28	26	23	26	33	20	21	20	25	36	26	20	31	24	21	25a
2. Other demands of your time	49	47	47	45	53	49	46	39	51	52	38	48	48	46	49	49	49	49	33	41a
3. Demands of spouse's career	22	24	21	29e	24	26	24	26	23	24	26	22	23	28	29	20	31	25	22	21
4. Unsatisfactory work opportunities	38	34	35	33	49	37	32	42c	29	27	34	30	30	30	42	31	35	34	41	38a
5. Geographical location of jobs	54	51	51	51	48	57	51	45	49	47	54	54	51	52	47	52	58	52	46	49
6. Hiring policy against spouses	5	6	4	8e	6	6	5	7	11	2	4	6	6	11	6	6	10	4	5	3
7. Lack of adequate household help	9	10	7	16e	13	9	10	12	11	5	8	10	10	8	10	12	20	10	7	12
8. Little financial incentives to work	20	15	18	11e	21	19	13	34e	15	17	15	18	14	13	14	17	28	14	15	11
9. Unfavorable attitudes of co-workers	15	14	13	16a	20	16	13	31e	14	20	18	11	14	15	13	13	17	12	15	14
10. Unfavorable attitudes of family	8	7	8	6	13	7	6	16c	6	9	7	5	8	6	9	7	13	8	3	10
11. Unfavorable attitudes of freinds	4	4	4	3	7	4	3	8b	5	7	3	2	4	4	3	4	9	3	2	4
12. Travel demands of your job	17	15	17	12c	16	11	14	21	17	14	17	13	12	25	14	11	17	13	17	15
13. Poor personal health	5	6	6	6	9	7	5	18e	9	9	7	4	8	6	6	4	9	5	3	4
39. Percent who "Strongly Agree or "Agree" with statements regarding women.																				
1. Assume leadership roles like men	91	91	88	95e	90	89	92	79c	92	83	90	90	92	91	92	90	92	92	92	97a
2. Competitive enough to be successful	91	95	92	99e	96	92	95	90	94	95	92	95	95	94	98	93	97	92	92	97
3. Possess the self confidence require	88	92	89	98e	94	89	93	82b	96	90	89	93	92	89	95	90	89	91	92	99a
4. Does not need to sacrifice feminini	81	85	80	93e	85	80	86	73a	88	78	79	88	89	82	88	83	86	85	82	88a
5. Pregnancy does not hinder employmen	60	70	61	85e	77	66	70	65	76	66	65	74	70	61	71	69	81	72	63	72a
6. Full-time employed mothers	43	56	41	80e	67	46	56	44b	49	45	51	56	58	54	63	54	63	57	54	61a
7. Women's career over men's career	44	59	53	70e	60	57	59	56	56	56	64	58	65	57	56	56	62	60	63	58
40. Since graduation, have there been any periods when you were away from professional employment?																				
1. Yes	15	16	14	19b	19	11	16	18	17	14	15	13	14	24	21	8	19	13	21	25e
2. No	85	84	86	81	81	89	84	82	83	86	85	87	86	76	79	92	81	87	79	75
40. If YES, how many breaks?																				
1. One	76	80	79	81	59	92	80	79	82	94	84	83	61	80	86	92	63	81	78	78
2. Two	17	14	14	14	23	0	15	14	9	6	11	13	28	20	8	8	31	7	17	15
3. Three or more	7	6	8	5	18	8	6	7	9	0	5	4	11	0	6	0	6	13	4	8
40. Main reason for most recent break.	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
11. Desire to devote more time to famil	3	5	1	10e	0	0	6	0	0	0	0	2	3	5	12	10	5	6	0	2
12. Pregnancy	1	7	0	16	3	6	8	0	0	0	11	8	14	0	4	3	21	9	8	5
13. Return to school or college	30	29	32	24	52	35	27	29	36	44	49	21	38	19	20	33	16	14	44	34
14. Moved geographically	14	11	8	14	7	6	10	12	0	6	0	9	11	24	13	13	16	14	8	14
15. Lost (or quit) job	14	14	18	9	23	18	13	6	29	11	3	9	16	14	21	7	11	17	16	14
16. Getting married	3	3	1	6	0	0	4	6	0	6	0	6	0	0	4	3	5	6	4	2
17. Changing professional field	8	6	8	4	7	18	6	0	0	11	3	0	6	10	5	10	0	6	12	14
18. Personal ill health	2	3	3	4	0	0	3	6	7	0	3	8	3	0	2	0	0	6	0	2
19. Other reasons	10	12	12	11	10	6	11	35	21	17	19	19	5	10	9	13	11	14	8	5
20. Military service	15	10	18	0	0	12	12	6	7	6	14	19	5	19	11	7	16	9	0	9
40. Length of most recent break.																				
1. 1-2 months	7	11	8	14	13	13	10	8	7	11	5	15	12	9	15	22	6	6	11	2a
2. 3-6 months	27	23	23	22	19	20	23	23	53	17	8	30	24	18	22	13	33	28	11	21
3. 7-12 months	23	26	26	26	36	20	23	39	7	33	31	23	37	32	23	22	6	31	30	21
4. 1-2 years	26	24	28	20	19	20	25	23	13	22	28	19	24	36	28	25	39	19	41	26
5. 2-3 years	7	6	7	5	10	13	5	8	13	11	8	2	2	0	3	9	0	8	0	12
6. 3 or more years	11	10	9	12	3	13	12	0	7	6	21	11	0	5	18	9	17	8	7	17
40. Year of break.																				
1. 1900-1960	87	87	88	83e	77	89	87	85c	80	86	90	90	91	77	80	92	82	89	81	81e
2. 1961-1971	3	2	2	2	0	1	2	2	4	0	3	2	1	8	6	1	4	1	2	2
3. 1972-1976	4	3	3	3	4	3	3	6	6	1	2	2	2	8	5	2	6	1	6	7
4. 1977-1981	6	8	6	12	19	8	8	6	10	13	5	7	6	8	8	5	8	8	12	10
41. How would you campare engineering. opportunities for minorities and white Americans?																				
1. Minorities have better opport	16	17	19	13b	3	7	19	3e	13	17	22	16	14	14	13	20	19	19	16	11a
2. Not sure, minorities probably have	22	24	23	27	8	13	27	9	14	28	22	26	25	26	30	24	23	23	19	24
3. Equal	22	21	21	20	10	38	20	17	30	14	22	25	21	15	18	20	19	22	22	18
4. Not sure, whites probably have	23	25	23	27	25	23	25	36	29	28	19	25	24	31	25	20	29	23	28	34
5. Whites have better opportunities	17	14	14	13	55	19	9	35	14	13	15	8	17	15	14	16	11	13	15	14

	TOTAL		SEX		ETHNIC GROUP				FIELD OF CURRENT EMPLOYMENT											
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
42. Do you think engineering opportunities for men and women are the same?																				
1. No, women have more opportuntities	13	12	15	7e	7	8	13	5e	11	22	16	11	13	7	9	15	13	9	11	8c
2. Not sure, women probably have more	26	24	25	21	13	24	24	12	13	33	27	24	21	20	22	27	22	25	21	18
3. Equal	15	17	15	20	5	17	18	17	16	11	14	18	19	12	20	16	22	16	16	17
4. Not sure, men probably have better	29	29	29	28	30	32	29	42	44	22	28	31	26	47	29	23	28	28	35	31
5. No, men have more opportuntities	18	19	15	25	46	19	17	24	17	12	15	16	21	14	21	19	16	23	17	26
43. "Very Similar" and "Somewhat Similar" Charactersitics of the typical engineer in your field.																				
1. Realistic, technical, mechanical	85	87	86	88	81	84	87	88	87	97	86	92	86	82	86	86	84	80	91	80e
2. Investigative, scientific	84	85	85	86	85	84	85	84	90	89	84	83	88	82	87	82	86	83	84	87
3. Artistic, musical, independent	19	16	18	14a	28	26	15	17e	19	16	13	14	21	15	16	15	18	17	15	17
4. Social, helping, guiding	27	24	25	22	31	31	22	45e	19	34	19	24	22	27	31	23	17	26	23	25b
5. Enterprising, profit-oriented	44	48	47	49	53	58	47	49	41	48	57	49	42	56	59	39	41	46	55	40e
6. Conventional, methodical	79	81	81	81	82	76	81	66b	81	86	81	86	77	82	84	74	80	79	85	77b
43. Percentage listing of three occupational groups which best describe the "Typical Engineer in Your Field."	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
Realistic, Technical, Outdoor																				
First choice	39	38	41	33d	33	40	38	40	42	55	36	44	33	36	26	47	39	34	29	31e
Second choice	26	25	24	26	26	21	25	21	23	21	26	23	30	22	19	24	20	31	23	28
Third choice	16	17	15	21	19	20	17	17	23	13	14	13	19	19	29	15	21	18	23	16
None of the above	19	20	20	20	21	19	20	21	12	11	24	21	18	23	26	15	19	17	26	25
Investigative, Scientific, Analytical																				
First choice	32	32	31	33	27	36	31	37	35	24	30	23	40	27	40	28	33	32	33	37e
Second choice	34	34	36	32	28	37	35	30	29	47	35	33	34	33	31	39	35	35	33	32
Third choice	15	16	15	17	21	10	16	21	23	14	15	21	13	18	16	16	19	13	21	9
None of the above	19	18	18	19	23	17	18	11	12	16	20	24	14	22	13	16	14	20	13	22
Artistic, Self-expressive, Independent																				
First choice	1	1	1	0.	4	3	0	0d	0	0	1	1	1	1	0	2	0	1	0	1b
Second choice	2	2	2	2	2	3	2	4	2	3	3	1	3	1	1	2	1	2	3	1
Third choice	6	5	5	5	6	9	5	3	5	4	3	3	10	11	1	6	10	5	4	7
None of the above	91	92	92	93	88	86	93	93	94	94	93	95	87	86	98	90	89	92	93	92
Social, Helping, Guiding																				
First choice	1	1	1	1	2	2	1	0e	2	5	2	2	0	0	2	0	1	2	1	1a
Second choice	4	4	4	3	7	4	3	7	3	2	3	4	2	1	8	3	3	3	3	5
Third choice	7	7	6	7	8	10	6	21	5	9	7	6	6	6	8	7	2	7	4	10
None of the above	88	89	89	89	83	84	90	71	90	84	88	88	92	93	83	90	93	88	92	84
Enterprising, Persuasive, Political																				
First choice	5	6	5	7	11	4	5	10a	3	4	10	5	4	11	5	4	3	6	6	9c
Second choice	10	11	10	12	14	17	11	11	14	10	11	11	10	19	16	9	10	10	13	4
Third choice	12	13	13	14	9	14	13	16	12	14	14	12	14	10	18	9	14	14	16	10
None of the above	74	70	72	67	66	64	71	63	71	73	64	71	72	60	60	78	72	70	65	77
Conventional, Methodical, Detailed																				
First choice	22	23	21	26b	22	15	24	13b	19	12	21	26	23	25	27	19	24	26	31	22e
Second choice	24	24	23	25	22	16	24	24	29	17	21	28	22	19	25	23	30	19	25	28
Third choice	25	26	27	23	30	34	25	21	26	45	27	24	21	36	25	26	28	28	21	23
None of the above	29	28	29	26	25	36	27	41	26	27	32	22	35	21	23	33	18	28	24	26
43. "Very Similar" and "Somewhat Similar" Charactersitics of Yourself.																				
1. Realistic, technical, mechanical	89	88	90	85d	88	87	88	82	86	95	86	91	89	92	81	94	87	86	80	81e
2. Investigative, scientific	90	89	90	87a	90	85	89	94	94	90	92	92	91	93	93	86	90	91	84	87d
3. Artistic, musical, independent	42	50	44	61e	67	59	49	45c	50	49	47	47	55	53	46	48	56	56	47	54
4. Social, helping, guiding	46	49	47	54c	64	52	48	65c	44	47	50	48	54	33	51	50	46	47	49	51
5. Enterprising, profit-oriented	50	46	50	39e	57	50	45	39a	36	37	45	45	45	50	55	41	46	48	70	41e
6. Conventional, methodical	72	70	72	66c	63	71	70	67	74	74	66	73	67	61	73	67	69	71	69	68

	TOTAL		SEX		ETHNIC GROUP				FIELD OF CURRENT EMPLOYMENT											
	WT	UW	MA	FE	BL	HI	WH	FN	AE	AG	CH	CE	EE	GM	IE	ME	NE	OE	BA	OT
43. Percentage listing of three occupational groups which best describes "Yourself."																				
Realistic, Technical, Outdoor																				
First choice	43	38	43	30e	27	42	39	26a	37	58	37	42	33	44	23	51	38	34	31	33e
Second choice	23	23	23	23	20	21	23	26	22	24	23	27	27	20	21	21	20	24	15	18
Third choice	13	13	15	14	24	17	14	16	15	7	13	10	16	19	21	13	16	18	9	18
None of the above	20	25	21	32	30	20	25	32	26	10	27	21	23	17	35	16	27	24	45	32
Investigative, Scientific, Analytical																				
First choice	28	31	30	32a	37	20	30	46b	45	24	37	21	37	31	35	25	34	34	28	30e
Second choice	34	32	34	28	30	32	32	35	31	38	32	31	29	41	25	37	26	35	26	34
Third choice	15	15	14	16	13	20	15	6	17	24	11	16	13	15	19	13	19	13	18	12
None of the above	23	23	22	25	20	28	23	13	8	14	20	32	21	13	21	24	21	18	28	24
Artistic, Self-expressive, Independent																				
First choice	3	5	4	7e	8	5	5	3	5	2	3	5	6	3	5	5	6	8	6	4
Second choice	6	9	7	13	13	9	9	7	14	6	10	7	10	8	9	7	12	11	6	12
Third choice	10	14	11	18	19	15	13	16	9	15	11	15	17	20	10	13	17	17	11	12
None of the above	81	72	79	62	60	72	73	74	72	78	76	74	68	69	77	74	66	65	77	72
Social, Helping, Guiding																				
First choice	3	5	2	9e	13	5	5	6c	3	6	6	6	6	1	9	3	6	4	9	7
Second choice	9	10	9	12	18	14	9	13	8	13	8	8	10	5	15	11	8	7	10	10
Third choice	9	11	10	13	9	16	10	17	15	8	14	11	11	5	10	10	11	9	12	10
None of the above	79	74	78	67	61	66	75	64	74	73	73	75	73	88	67	77	76	80	69	73
Enterprising, Persuasive, Political																				
First choice	9	7	7	5e	7	11	6	4	2	1	6	6	7	12	10	4	8	7	15	7e
Second choice	11	9	11	6	9	10	9	9	8	7	11	8	7	9	10	8	12	10	27	7
Third choice	12	10	12	8	10	10	10	15	9	12	11	12	9	12	12	8	13	8	17	8
None of the above	68	74	70	80	75	69	74	73	82	81	73	75	78	67	67	80	67	75	42	78
Conventional, Methodical, Detailed																				
First choice	15	14	12	18d	9	16	15	15	9	9	12	21	12	9	18	12	9	13	11	19d
Second choice	16	17	17	17	10	15	17	9	19	13	16	18	18	13	19	16	22	13	17	18
Third choice	22	20	22	16	21	21	19	28	29	32	20	15	16	29	24	21	20	19	21	20
None of the above	47	49	49	49	61	48	49	49	43	46	52	47	55	48	38	51	49	55	51	44

APPENDIX D. Item-Response Percentages by Sex, Ethnic, and Current Main Career Choice Groups for Final Student "Pre-Engineering Career Survey."

(Values are percents rounded to nearest whole percent, 0 means zero percent, 0. means percentage below .5% but not zero. Group counts are enclosed in parentheses.)

	TOTALS		SEX		ETHNIC GROUP				CURRENT MAIN CAREER CHOICE								
	WT	UW	M	F	Bl	Hi	Ma	FN	AAE	ARE	BE	CHE	CE	COE	EE	IE	ME
1. When did you first consider a college education	(820)	(842)	(556)	(286)	(136)	(86)	(595)	(25)	(69)	(17)	(38)	(87)	(60)	(74)	(196)	(19)	(99)
Before high school	88	86	83	93c	86	80	87	84	81	71	95	89	83	89	85	74	85b
During the 9th grade	6	6	7	4	4	7	6	12	9	6	--	5	8	5	8	5	6
During the 10th grade	3	3	5	1	4	7	3	0	4	0	0	5	5	4	1	5	6
During the 11th grade	3	3	4	2	4	6	3	0	6	12	3	2	2	1	4	11	2
During the 12th grade	0.	1	0.	1	1	0	1	0	0	0	0	0	2	0	0	5	1
Just prior to college	1	1	1	0	1	0	1	4	0	12	3	0	0	0	1	0	0
When did you finally decide on a college education	(804)	(807)	(534)	(273)	(120)	(83)	(581)	(23)	(67)	(16)	(32)	(83)	(60)	(70)	(183)	(22)	(98)
Before high school	55	54	49	64c	47	49	56	61a	58	44	75	58	53	56	50	46	48a
During the 9th grade	14	15	15	14	17	23	13	4	12	6	19	19	20	14	17	14	12
During the 10th grade	7	7	9	4	10	6	6	4	5	0	0	2	2	6	9	5	15
During the 11th grade	12	12	14	7	12	8	12	9	9	19	6	7	12	7	14	14	14
During the 12th grade	8	10	10	8	11	12	9	4	13	19	0	12	7	11	9	14	10
Just prior to college	4	3	3	3	2	1	3	17	1	12	0	1	7	6	2	9	0
Have not yet done so	0.	0.	0.	0	0	0	0.	0	1	0	0	0	0	0	0	0	0
When did you first consider an engineering career	(790)	(779)	(512)	(268)	(109)	(79)	(569)	(23)	(66)	(14)	(32)	(83)	(54)	(71)	(174)	(21)	(94)
Before high school	19	18	21	12b	18	16	18	30a	26	7	19	18	13	17	18	10	27
During the 9th grade	19	17	17	15	18	15	17	9	18	7	12	19	31	13	20	9	13
During the 10th grade	19	20	22	18	20	27	19	17	23	7	9	22	28	25	21	14	25
During the 11th grade	27	28	25	34	31	29	28	13	18	43	41	26	17	27	29	43	27
During the 12th grade	15	15	13	18	11	10	16	17	14	29	13	15	7	17	10	19	7
Just prior to college	2	2	2	3	0	2	2	13	1	7	6	0	4	1	2	5	0
When did you finally decide on an engineering career	(782)	(799)	(532)	(267)	(122)	(83)	(574)	(20)	(65)	(17)	(34)	(81)	(59)	(70)	(188)	(21)	(96)
Before high school	3	3	3	2b	2	4	3	5b	5	0	6	3	0	1	2	5	6d
During the 9th grade	4	5	6	2	8	1	5	5	15	0	3	5	3	3	3	10	8
During the 10th grade	8	10	11	7	16	13	7	20	11	0	3	9	22	7	10	5	13
During the 11th grade	26	25	26	24	24	26	26	25	32	18	27	26	22	21	33	5	27
During the 12th grade	42	42	40	46	43	46	41	30	31	41	44	37	41	51	42	52	43
Just prior to college	10	8	6	10	7	6	8	15	2	24	12	7	9	10	7	14	1
Have not yet done so	7	8	7	8	1	4	10	0	5	18	6	14	3	6	3	9	2
When did you understand the nature of an engineering career	(818)	(823)	(544)	(279)	(130)	(84)	(584)	(25)	(66)	(16)	(35)	(82)	(60)	(74)	(192)	(21)	(98)
Before high school	7	5	6	2c	5	4	4	12	9	0	6	1	7	7	6	0	3a
During the 9th grade	4	5	6	3	6	6	4	4	8	0	6	6	2	3	5	5	6
During the 10th grade	11	11	12	10	15	14	10	16	14	0	11	10	15	14	13	5	17
During the 11th grade	24	22	23	19	23	26	22	8	27	12	26	18	23	23	27	24	20
During the 12th grade	27	27	26	29	28	25	27	28	21	37	20	38	18	34	31	38	20
Just prior to college	12	13	12	15	15	12	13	16	4	37	9	10	20	4	9	19	19
Have not yet done so	16	18	15	23	6	13	21	16	17	12	23	17	15	16	10	9	13

WT - Weighted
UW - Unweighted
M - Male
F - Female

Bl - Black
Hi - Hispanic
Ma - Caucasian
FN - Foriegn

AAE - Aeronautical Engineering
ARE - Architectural Engineering
BE - Biomedical Engineering
CHE - Chemical Engineering
CE - Civil Engineering

COE - Computer Engineering
EE - Electrical Engineering
IE - Industrial Engineering
ME - Mechanical Engineering

	TOTALS		SEX		ETHNIC GROUP				CURRENT MAIN CAREER CHOICE								
	WT	UW	M	F	Bl	Hi	Ma	FN	AAE	ARE	BE	CHE	CE	COE	EE	IE	ME
2. Which factors below moderately to extremely influenced you to pursue an engineering career:	(846)	(859)	(566)	(293)	(138)	(89)	(603)	(29)	(69)	(17)	(38)	(87)	(63)	(76)	(199)	(22)	(102)
Mother (f. guardian)................	37	38	36	44a	38	46	37	38	35	41	39	41	41	34	39	45	41
Father (m. guardian)................	57	57	58	55	41	56	61	55c	44	53	61	67	59	55	55	64	68
Other relative......................	31	32	33	30	34	40	30	31	32	18	26	30	37	26	35	41	41
MALE H.S. math/science teacher(s).....	45	46	44	49	50	58	43	59b	45	47	45	61	40	42	47	32	53
FEMALE H.S. math/science teacher(s)...	25	28	24	35c	36	48	23	31e	17	41	21	38	30	29	31	27	27
MALE H.S. counselor..................	21	24	24	25	36	22	22	28b	32	23	16	25	22	26	27	32	22
FEMALE H.S. counselor................	18	22	20	26	30	33	19	21c	17	18	24	21	24	22	26	36	19
MALE practicing engineer(s)...........	41	44	44	43	44	56	42	41	39	24	45	48	47	33	47	68	49
FEMALE practicing engineer(s).........	11	13	9	22e	23	20	9	21e	10	18	24	15	10	11	12	23	14
MALE engineering student..............	34	37	36	37	45	51	32	45c	32	24	32	40	32	28	43	73	40b
FEMALE engineering student............	18	19	15	27d	28	32	15	28e	15	29	24	23	19	13	20	32	19
Career education course..............	23	27	26	28	41	37	21	34e	22	47	37	29	35	28	33	27	17a
H.S. math course(s)	66	66	64	71a	67	70	65	83	65	76	55	79	60	64	70	54	63
H.S. science course(s)...............	70	69	69	69	67	69	69	72	67	65	63	94	54	66	74	59	67e
Interest inventory...................	35	33	34	32	35	41	31	52a	32	35	29	33	30	33	34	41	39
Aptitude test........................	45	42	44	38	42	59	40	52b	42	41	37	45	41	41	45	46	50
Career information...................	67	67	66	68	77	66	64	66a	62	71	71	70	60	72	66	73	73
Pre-college special seminar programs..	29	34	28	45e	52	55	26	38e	22	53	50	40	32	37	39	46	34
Hobby magazine.......................	16	16	18	11b	19	24	13	24a	23	12	13	9	14	10	22	18	22
Science fair activity................	15	14	15	12	18	19	11	31c	16	18	18	9	14	12	17	14	17
Science club(s)......................	11	11	11	11	17	25	8	14e	17	6	13	17	3	8	13	4	16
"Junior Achievement".................	5	7	6	8	13	13	3	24e	6	0	11	3	6	5	10	14	8
Outdoor activities...................	22	25	26	22	19	42	23	41d	29	23	21	17	40	13	22	18	37c
Using a computer.....................	47	42	45	37a	46	54	39	55a	41	29	34	38	25	82	55	27	25e
Electrical/mechanical hobby..........	43	37	48	17e	44	45	34	52b	26	29	18	21	29	41	62	18	58e
Construction hobby...................	33	32	40	18e	34	45	29	55c	32	53	16	21	51	13	43	27	49e
Farm experiences.....................	6	9	9	8	4	12	9	17	7	23	8	2	14	8	7	18	15b
Related work experience..............	26	28	29	25	27	46	25	31c	16	53	29	28	35	21	36	27	29a
Thought work itself was interesting...	82	81	81	82	85	91	79	93b	74	77	82	78	89	80	86	82	85
Liked problem-solving activities......	83	83	80	89c	87	91	81	79	80	94	90	89	86	82	83	96	80
Had friends with similar interests....	49	51	55	44b	51	62	49	62	43	65	50	57	44	50	56	54	51
Wanted to be of service to people.....	50	58	55	64b	66	74	53	55c	42	76	66	55	68	47	57	59	60a
Wanted to contribute to society.......	61	65	63	68	74	81	60	72d	59	77	74	70	75	57	63	55	69
Type of work.........................	81	81	81	82	83	88	79	83	84	88	79	87	89	78	79	86	86
Challenge............................	87	88	85	94d	96	94	86	83c	81	94	87	93	94	88	89	91	90
Salary...............................	90	90	90	92	94	90	90	76a	88	94	89	95	90	87	90	91	94
Creativity...........................	83	85	84	86	94	89	81	97c	88	100	89	82	82	85	86	86	89
Curiosity............................	83	84	82	88a	90	91	82	76b	83	94	90	87	81	83	82	91	85
Job security.........................	82	85	83	88a	91	88	84	55e	75	88	84	92	84	80	83	95	87
Job opportunities....................	91	93	92	95	96	93	93	83	85	88	89	99	95	91	94	95	97a
Prestige/status......................	64	68	66	73a	74	80	66	66a	65	65	71	74	71	62	65	73	73
Rapid advancement....................	74	75	73	77	83	87	71	76c	68	71	76	82	78	76	72	86	84
Independence.........................	76	78	75	83b	85	89	74	79b	70	71	82	82	87	72	78	86	84
Job flexibility......................	78	80	78	85b	84	90	77	86b	75	82	89	84	86	68	81	82	83
3. What is your desired educational level	(800)	(796)	(526)	(270)	(115)	(88)	(569)	(24)	(68)	(15)	(32)	(82)	(56)	(71)	(182)	(21)	(97)
No college degree....................	0	0	0	0a	0	0	0	0	0	0	0	0	0	0	0	0	0
BACHELOR's degree in two fields including engineering...............	4	4	3	6	4	4	4	4	1	13	3	5	5	3	2	5	6
ASSOCIATE degree in engineering technology........................	0.	0.	1	0	0	1	0.	0	2	0	0	0	0	0	1	0	0
BACHELOR's degree, no graduate work...	9	10	11	7	5	7	12	4	12	20	6	6	7	1	10	19	15
BACHELOR's degree & some graduate study in engineering................	14	12	12	13	10	9	14	0	9	7	9	15	20	11	10	24	8
BACHELOR's degree & some graduate work with NO engineering study......	1	1	1	1	1	1	1	0	1	0	0	1	2	0	1	5	1
MASTER's degree in engineering........	26	27	27	28	35	23	26	33	31	20	22	27	27	37	32	24	29
MASTER's degree in a field other than engineering....................	5	4	4	6	3	2	5	0	0	0	6	6	5	3	2	0	5
MASTER's degree in both engineering & another field....................	14	14	13	16	15	17	13	17	7	13	16	13	9	13	16	5	16
DOCTORATE, engineering...............	22	22	25	18	24	26	21	29	35	20	22	20	25	30	25	14	17
DOCTORATE, non-engineering...........	4	4	4	6	3	8	4	12	2	7	16	7	0	3	1	5	3
Other................................	1	0.	1	0	0	1	0.	0	0	0	0	0	0	0	1	0	0

	TOTALS		SEX		ETHNIC GROUP				CURRENT MAIN CAREER CHOICE								
	WT	UW	M	F	Bl	Hi	Ma	FN	AAE	ARE	BE	CHE	CE	COE	EE	IE	ME
(3 continued)																	
What is your expected educational level	(787)	(798)	(525)	(273)	(119)	(82)	(572)	(25)	(68)	(15)	(33)	(80)	(57)	(69)	(183)	(22)	(96)
No college degree	1	0.	0.	0	0	0	0.	0a	0	0	3	0	0	0	1	0	0
BACHELOR's degree in two fields including engineering	4	5	5	5	4	7	5	4	7	13	3	2	7	4	4	4	6
ASSOCIATE degree in engineering technology	1	1	1	1	0	2	1	0	2	0	0	0	4	0	1	0	1
BACHELOR's degree, no graduate work	23	24	26	22	11	15	29	8	29	20	15	26	17	20	16	41	27
BACHELOR's degree & some graduate study in engineering	24	22	23	21	28	19	21	16	13	33	15	26	25	20	31	18	23
BACHELOR's degree & some graduate work with NO engineering study	2	3	3	3	4	1	2	4	0	0	3	0	3	4	2	0	0
MASTER's degree in engineering	24	25	25	26	29	35	22	40	34	13	33	22	32	33	26	23	26
MASTER's degree in a field other than engineering	4	4	3	6	4	4	4	4	0	7	6	2	5	7	2	9	4
MASTER's degree in both engineering & another field	6	7	7	7	11	5	6	4	4	7	12	9	5	3	7	4	7
DOCTORATE, engineering	7	7	7	8	6	8	7	12	10	7	9	7	2	7	9	0	3
DOCTORATE, non-engineering	2	2	2	3	2	2	2	8	0	0	0	4	0	0	1	0	2
Other	0.	0.	0.	0	0	0	0.	0	0	0	0	0	0	0	1	0	0
4. Have you taken an interest inventory	(827)	(842)	(556)	(286)	(134)	(89)	(592)	(27)	(68)	(17)	(37)	(85)	(62)	(74)	(195)	(21)	(99)
No	38	41	39	44a	48	39	39	44	50	24	35	39	40	38	46	48	32a
Uncertain	26	27	28	20	24	19	27	18	21	47	16	19	37	28	23	19	34
Yes	36	33	33	36	28	42	34	37	29	29	49	42	23	34	31	33	33
Which one(s)	(827)	(280)	(556)	(286)	(134)	(89)	(592)	(27)	(68)	(17)	(37)	(85)	(62)	(74)	(195)	(21)	(99)
Other	17	15	17	12	12	21	15	18	18	12	11	20	15	20	13	14	15
"Self-Directed Search"	6	6	6	9	6	11	6	7	6	6	11	7	3	4	6	5	12
Kuder interest measure	6	4	4	5	2	4	4	7	4	0	8	1	3	4	5	0	3
"Purdue Interest Questionnaire"	0.	0.	0.	0	0	0	0.	0	0	0	0	0	0	0	1	0	0
"Strong-Campbell Interest Inventory"	8	8	8	10	8	5	10	4	6	6	22	13	2	5	8	10	3b
What was impact of other interest inventory	(139)	(128)	(94)	(34)	(15)	(17)	(91)	(5)	(12)	(2)	(4)	(17)	(9)	(15)	(23)	(3)	(15)
Harmful	1	2	2	0	7	6	0	0	0	0	0	0	0	7	0	0	7
No value	23	27	30	18	27	35	25	20	33	0	25	29	22	7	35	33	33
Uncertain value	30	25	27	21	7	6	32	20	0	50	0	29	0	40	22	67	27
Helpful	40	39	34	53	47	47	35	60	50	50	75	41	78	27	39	0	27
Very helpful	7	8	7	9	13	6	8	0	17	0	0	0	0	20	4	0	7
What was impact of "Self-Directed Search"	(50)	(57)	(32)	(25)	(8)	(11)	(36)	(2)	(4)	(1)	(4)	(6)	(2)	(3)	(13)	(1)	(12)
Harmful	2	4	6	0	12	9	0	0	0	0	0	0	0	0	8	0	8
No value	13	14	16	12	12	0	19	0	0	100	0	33	0	0	8	0	17
Uncertain value	44	33	28	40	12	27	39	50	75	0	0	33	50	33	31	100	25
Helpful	37	40	41	40	62	45	36	0	0	0	100	17	50	33	46	0	42
Very helpful	4	9	9	8	0	18	6	50	25	0	0	17	0	33	8	0	8
What was impact of Kuder interest measure	(53)	(33)	(21)	(12)	(3)	(4)	(24)	(2)	(3)	(0)	(3)	(1)	(2)	(3)	(9)	(0)	(3)
Harmful	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No value	9	12	10	17	0	25	12	0	0	0	0	100	0	0	22	0	0
Uncertain value	68	49	57	33	67	25	50	50	33	0	67	0	50	33	56	0	33
Helpful	16	27	19	42	33	25	25	50	33	0	33	0	50	33	22	0	33
Very helpful	7	12	14	8	0	25	12	0	33	0	0	0	0	33	0	0	33
What was impact of "Purdue Interest Questionnaire"	(0)	(1)	(1)	(0)	(0)	(0)	(1)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(1)	(0)	(0)
Harmful	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
No value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Uncertain value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Helpful	0	100	100	0	0	0	100	0	0	0	0	0	0	0	100	0	0
Very helpful	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
What was impact of "Strong-Campbell Interest Inventory"	(67)	(71)	(43)	(28)	(11)	(4)	(55)	(1)	(4)	(1)	(7)	(11)	(1)	(4)	(15)	(2)	(3)
Harmful	2	3	2	4	0	25	2	0	0	0	0	0	0	25	0	0	33
No value	34	32	28	39	45	0	31	100	25	0	29	36	0	25	27	50	33
Uncertain value	33	30	35	21	18	25	33	0	50	100	43	45	0	25	20	0	0
Helpful	26	24	23	25	27	25	24	0	0	0	29	18	100	25	40	50	0
Very helpful	5	11	12	11	9	25	11	0	25	0	0	0	0	0	13	0	33
Did results of other interest inventory reflect interests	(143)	(131)	(94)	(37)	(16)	(18)	(93)	(4)	(12)	(2)	(4)	(17)	(9)	(15)	(23)	(3)	(16)
NO	8	12	11	14	0	28	11	0	17	0	0	24	0	7	4	33	19
Unsure, NO	12	13	14	11	19	17	11	25	8	0	0	6	11	13	9	33	19
Unsure, YES	44	37	35	43	19	22	43	50	25	50	50	59	67	33	39	33	31
YES	36	38	40	32	62	33	35	25	50	50	50	12	22	47	48	0	31
Did results of "Self-Directed Search" reflect interests	(52)	(56)	(30)	(26)	(7)	(9)	(38)	(2)	(5)	(1)	(4)	(6)	(3)	(3)	(11)	(1)	(11)
NO	8	11	10	11	43	0	8	0	20	0	25	17	0	0	18	0	9
Unsure, NO	22	18	23	11	14	11	21	0	20	100	0	0	67	0	18	0	18
Unsure, YES	30	45	40	50	29	56	45	50	40	0	50	67	33	67	27	100	45
YES	40	27	27	27	14	33	26	50	20	0	25	17	0	33	36	0	27

	TOTALS		SEX		ETHNIC GROUP				CURRENT MAIN CAREER CHOICE								
	WT	UW	M	F	Bl	Hi	Ma	FN	AAE	ARE	BE	CHE	CE	COE	EE	IE	ME
(4 continued)																	
Did results of Kuder interest measure reflect interests	(53)	(33)	(21)	(12)	(3)	(4)	(24)	(2)	(3)	(0)	(3)	(1)	(2)	(3)	(9)	(0)	(3)
NO	7	9	14	0	33	0	8	0	0	0	0	0	50	0	22	0	0
Unsure, NO	4	6	9	0	0	25	4	0	0	0	0	0	0	0	11	0	0
Unsure, YES	51	36	38	33	33	50	33	50	0	0	33	100	0	33	33	0	33
YES	39	49	38	67	33	25	54	50	100	0	67	0	50	67	33	0	67
Did results of "Purdue Interest Questionnaire" reflect interests	(2)	(3)	(3)	(0)	(0)	(1)	(2)	(0)	(1)	(0)	(0)	(0)	(0)	(0)	(2)	(0)	(0)
NO	56	33	33	0	0	0	50	0	100	0	0	0	0	0	0	0	0
Unsure, NO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Unsure, YES	22	33	33	0	0	0	50	0	0	0	0	0	0	0	50	0	0
YES	22	33	33	0	0	100	0	0	0	0	0	0	0	0	50	0	0
Did results of "Strong-Campbell Interest Inventory" reflect interests	(71)	(75)	(45)	(30)	(11)	(5)	(58)	(1)	(5)	(1)	(8)	(11)	(2)	(4)	(16)	(2)	(3)
NO	17	17	13	23	36	0	15	0	20	0	12	36	50	25	12	0	33
Unsure, NO	20	17	18	17	0	40	17	100	20	100	37	18	0	25	6	0	0
Unsure, YES	29	31	33	27	27	0	34	0	20	0	12	36	0	25	19	100	0
YES	33	35	36	33	36	60	33	0	40	0	37	9	50	25	62	0	67
Were other interest inventory interpretation materials/procedures understandable and helpful	(140)	(130)	(95)	(35)	(15)	(18)	(92)	(5)	(12)	(2)	(4)	(17)	(9)	(15)	(23)	(3)	(15)
NO, harmful	1	2	1	3	0	6	1	0	0	0	0	0	0	0	0	0	7
NOT AT ALL/confusing	10	12	14	9	0	17	13	20	17	0	0	29	11	7	9	0	7
YES, partly	59	55	53	60	60	28	59	60	33	100	75	53	67	47	52	67	67
YES, completely	30	32	33	29	40	50	27	20	50	0	25	18	22	47	39	33	20
Were "Self-Directed Search" interpretation materials/procedures understandable and helpful	(48)	(53)	(28)	(25)	(7)	(10)	(34)	(2)	(4)	(1)	(4)	(4)	(2)	(3)	(12)	(1)	(11)
NO, harmful	2	2	0	4	0	0	3	0	0	0	0	0	0	0	0	0	0
NOT AT ALL/confusing	9	9	7	12	14	0	12	0	0	100	0	0	0	0	8	0	9
YES, partly	64	68	71	64	71	80	62	100	75	0	75	50	100	67	75	100	64
YES, completely	25	21	21	20	14	20	23	0	25	0	25	50	0	33	17	0	27
Were Kuder interest measure interpretation materials/procedures understandable and helpful	(56)	(35)	(21)	(14)	(3)	(4)	(26)	(2)	(3)	(0)	(3)	(1)	(3)	(3)	(9)	(0)	(3)
NO, harmful	5	6	0	14	0	0	8	0	0	0	0	0	33	0	0	0	0
NOT AT ALL/confusing	5	9	9	7	33	25	4	0	0	0	0	0	0	0	22	0	0
YES, partly	64	54	57	50	33	50	58	50	33	0	67	0	33	67	56	0	33
YES, completely	26	31	33	29	33	25	31	50	67	0	33	100	33	33	22	0	67
Were "Purdue Interest Questionnaire" interpretation materials/procedures understandable and helpful	(2)	(2)	(1)	(1)	(0)	(0)	(2)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(1)	(0)	(0)
NO, harmful	73	50	0	100	0	0	50	0	0	0	0	0	0	0	0	0	0
NOT AT ALL/confusing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YES, partly	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
YES, completely	27	50	100	0	0	0	50	0	0	0	0	0	0	0	100	0	0
Were "Strong-Campbell Interest Inventory interpretation materials/procedures understandable and helpful	(68)	(73)	(44)	(29)	(11)	(5)	(56)	(1)	(4)	(1)	(8)	(11)	(1)	(4)	(16)	(2)	(3)
NO, harmful	1	1	0	3	0	0	2	0b	0	0	0	9	0	0	0	0	0
NOT AT ALL/confusing	16	4	4	3	0	0	4	100	0	0	12	0	0	25	0	0	0
YES, partly	55	56	52	62	54	40	59	0	50	0	37	54	0	50	62	100	67
YES, completely	28	38	43	31	45	60	36	0	50	100	50	36	100	25	37	0	33
5. How many times has general career goal changed since entering high school	(839)	(850)	(558)	(292)	(134)	(90)	(598)	(28)	(67)	(17)	(38)	(87)	(62)	(76)	(194)	(22)	(100)
Not at all	42	37	42	28b	34	36	38	46	48	24	24	38	40	36	41	18	46
Once	24	27	26	30	28	33	26	21	24	53	32	30	29	29	28	32	25
Twice	19	18	17	20	19	16	19	18	22	6	16	15	8	8	7	23	11
Three times	12	12	10	15	10	9	12	14	6	12	16	15	8	8	7	23	11
Four times	2	3	2	4	4	6	2	0	0	0	10	3	3	5	2	0	1
Five or more times	2	3	2	2	4	1	2	0	0	6	3	0	2	4	3	0	2
How many times has specific career choice changed since entering high school	(774)	(794)	(519)	(275)	(114)	(83)	(573)	(24)	(65)	(16)	(37)	(84)	(57)	(72)	(179)	(21)	(92)
Not at all	39	41	41	40	41	41	40	50	45	44	30	45	47	31	43	48	46
Once	25	24	23	25	24	25	24	17	29	12	24	23	17	40	23	14	21
Twice	19	19	19	18	20	17	19	0	15	31	19	18	16	13	21	24	21
Three times	10	9	9	9	4	2	3	8	6	12	13	8	9	7	9	14	6
Four times	3	3	3	4	3	2	3	8	1	0	8	4	9	4	2	0	3
Five or more times	5	4	4	4	3	4	4	8	3	0	5	2	2	6	2	0	3

	TOTALS WT	TOTALS UW	SEX M	SEX F	ETHNIC GROUP Bl	ETHNIC GROUP Hi	ETHNIC GROUP Ma	ETHNIC GROUP FN	CURRENT MAIN CAREER CHOICE AAE	ARE	BE	CHE	CE	COE	EE	IE	ME
6. What are your career alternative interests	(804)	(816)	(534)	(282)	(127)	(83)	(578)	(28)	(68)	(15)	(37)	(84)	(57)	(73)	(190)	(20)	(97)
Aeronautical Engineering	39	36	44	21e	24	31	39	36b	100	33	27	24	19	35	35	15	48e
Agricultural Engineering	6	7	7	9	1	11	9	0b	3	27	16	2	10	1	3	15	11e
Architectural Engineering	16	19	20	17	12	21	20	21	21	100	8	7	49	8	15	10	28e
Bio-Medical Engineering	19	21	17	27c	20	18	22	4	18	7	97	33	3	9	17	15	9e
Chemical Engineering	30	30	28	33	17	29	33	21b	19	27	35	100	14	15	18	20	18e
Civil Engineering	19	23	26	18b	16	32	24	29a	19	47	11	6	98	5	15	10	26e
Computer Engineering	46	45	47	42	53	46	43	61a	44	33	32	35	30	99	62	10	28e
Electrical Engineering	49	49	55	36e	55	45	47	68	34	47	41	20	12	66	98	20	34e
Engineering Science	10	10	9	11	10	13	9	21	12	7	14	8	4	8	11	10	4
Environmental Engineering	12	13	11	19c	6	13	15	7a	12	20	14	23	25	3	7	25	6a
Geological/Mineral Engineering	9	8	9	6	1	7	10	0b	4	27	11	13	9	3	4	5	4b
Industrial Engineering	11	13	14	12	9	16	14	18	7	33	8	7	9	3	12	100	21e
Mechanical Engineering	36	36	43	25e	34	43	36	25	38	53	22	13	25	18	33	5	98e
Mining/Materials/Metall. Engineering	8	7	8	5	2	11	7	4	3	13	11	13	5	1	2	5	5b
Nuclear Engineering	23	24	25	22	15	27	25	43b	25	0	19	26	14	23	27	15	21
Petroleum Engineering	17	15	17	12a	12	26	14	25b	12	13	19	37	14	8	14	20	13d
Other Engineering	5	5	5	5	3	6	5	4	1	7	5	1	5	3	2	0	3
Construction Technology	8	9	10	6a	6	12	9	14	7	27	3	5	40	1	5	5	11e
Electrical/Electronics Technology	20	19	24	11e	29	24	16	36c	9	7	11	4	5	27	48	5	9e
Mechanical Technology	7	9	11	3d	9	14	7	14	12	20	8	4	2	0	7	5	31e
Other Technology	0.	1	1	0	0	1	0.	0	0	0	0	1	0	1	0	0	1
Business/Accounting	17	18	16	22a	14	12	20	18	7	20	8	13	21	15	21	35	18a
Management	22	24	22	28	25	20	25	25	10	33	24	19	25	26	24	80	28e
Law	10	12	10	16b	9	14	13	11	10	13	16	14	16	9	14	5	10
Biological Sciences	10	8	6	12b	5	8	9	4	9	7	41	16	7	3	3	10	1e
Medicine	12	13	11	18b	13	17	13	14	10	0	73	15	5	7	8	5	5e
Nursing	0.	1	0	1a	2	1	0.	0	0	0	3	0	0	3	0	0	0
Pharmacy	2	3	1	7e	2	1	4	0	0	7	5	7	5	1	2	0	1
Chemistry	14	15	15	17	9	23	16	7a	16	13	19	49	5	9	10	5	11e
Computer Science/Programming	38	38	37	38	50	37	35	39b	35	20	30	35	25	64	53	15	21e
Earth Sciences	7	5	6	5	2	7	6	0	6	27	3	7	7	1	4	5	3b
Mathematics/Statistics	23	25	22	30b	23	27	25	29	27	27	19	20	25	31	26	30	17
Physics	24	20	23	14b	14	26	21	18	34	20	8	19	18	18	24	5	22a
Agriculture	4	5	5	5	1	6	6	4	2	27	3	2	14	3	3	10	5d
Behavioral Sciences	3	5	3	10e	6	7	5	0	1	7	8	7	7	4	4	15	2
Creative Arts	10	8	6	12b	3	13	8	4a	3	27	5	8	12	12	3	10	5b
Other Humanities	4	5	3	10e	5	6	5	4	3	0	11	2	5	3	1	10	4
Education	4	5	4	6	4	11	4	4	3	13	8	5	5	4	4	10	3
Forestry	9	10	10	8	2	11	12	0c	12	13	8	14	21	3	6	5	8b
Social Sciences	3	4	3	7b	4	7	4	11	3	7	3	5	7	4	2	20	2b
Other	5	3	2	5a	1	2	4	4	0	7	3	5	2	1	3	10	1
What is your current main career choice	(841)	(855)	(566)	(289)	(136)	(90)	(601)	(28)									
Aeronautical Engineering	9	8	9	5e	2	7	10	11									
Agricultural Engineering	1	1	1	1	0	0	1	0									
Architectural Engineering	2	2	2	2	1	3	2	0									
Bio-Medical Engineering	3	4	2	9	6	6	4	0									
Chemical Engineering	12	10	7	16	5	10	12	4									
Civil Engineering	7	7	9	5	4	13	7	18									
Computer Engineering	11	9	8	10	13	6	8	7									
Electrical Engineering	24	23	28	15	40	23	19	32									
Engineering Science	1	1	1	1	0	0	1	0									
Environmental Engineering	1	1	1	2	0	0	1	0									
Geological/Mineral Engineering	0.	0.	0.	0	0	0	0.	0									
Industrial Engineering	1	3	1	5	1	4	2	4									
Mechanical Engineering	12	12	15	6	17	13	11	11									
Mining/Materials/Metall. Engineering	2	2	2	1	1	4	2	0									
Nuclear Engineering	1	1	1	2	0	1	2	4									
Petroleum Engineering	1	0.	0.	1	1	0	1	0									
Other Engineering	2	2	2	3	2	1	3	0									
Construction Technology	0.	1	1	3	0	0	1	0									
Electrical/Electronics Technology	1	1	1	1	1	1	1	4									
Mechanical Technology	0	0	0	0	0	0	0	0									
Other Technology	0	0	0	0	0	0	0	0									
Business/Accounting	0.	0.	0	0	0	0	0.	0									
Management	0.	1	0.	1	0	1	1	0									
Law	1	0.	0.	1	1	1	0.	0									
Biological Sciences	0.	0.	0.	0	0	0	0.	0									
Medicine	1	1	1	2	2	1	1	0									
Nursing	0	0	0	0	0	0	0	0									
Pharmacy	0	0	0	0	0	0	0	0									
Chemistry	0	0	0	0	0	0	0	0									
Computer Science/Programming	18	2	1	3	3	1	2	0									
Earth Sciences	0	0	0	0	0	0	0	0									

	TOTALS		SEX		ETHNIC GROUP				CURRENT MAIN CAREER CHOICE								
(6 continued)	WT	UW	M	F	Bl	Hi	Ma	FN	AAE	ARE	BE	CHE	CE	COE	EE	IE	ME
Mathematics/Statistics	1	0.	0	0	0	0	0.	0									
Physics	0	0	0	0	0	0	0	0									
Agriculture	0	0	0	0	0	0	0	0									
Behavioral Sciences	0.	0.	0.	0	0	0	0.	0									
Creative Arts	0.	0.	0.	0	0	0	0.	0									
Other Humanities	0	0	0	0	0	0	0	0									
Education	0.	0.	0.	0	0	0	0.	0									
Forestry	0	0	0	0	0	0	0	0									
Social Sciences	0	0	0	0	0	0	0	0									
Other	0.	0.	0.	0	0	0	0.	0									
Undecided/Unknown	4	5	4	6	0	2	6	7									
7. Is college in your (parents') home state	(842)	(859)	(566)	(293)	(137)	(90)	(604)	(28)	(69)	(17)	(38)	(87)	(62)	(76)	(198)	(22)	(102)
YES	72	69	70	68	42	70	77	46e	65	77	61	63	74	66	70	73	70
8. How did your father feel about you going to college	(818)	(811)	(541)	(270)	(120)	(82)	(582)	(27)	(69)	(17)	(35)	(83)	(60)	(71)	(180)	(21)	(100)
Didn't want you to do it	1	1	1	2	2	1	1	0	1	6	0	1	2	0	0	0	0
Seemed indifferent	1	1	2	1	2	1	1	0	1	0	3	0	0	3	1	0	1
Showed some interest but thought it unnecessary	0.	1	1	1	2	1	0.	0	0	6	0	0	0	0	1	0	2
Maintained there was some need to do it	11	8	9	7	4	2	10	11	10	0	6	6	8	11	7	5	10
Constantly impressed on you the need to do it	43	42	42	42	38	51	42	37	39	29	43	45	38	46	41	33	45
Were interested but let me make my own decision	45	47	46	48	52	43	46	52	48	59	49	48	52	39	52	62	42
How did your mother feel about you going to college	(829)	(832)	(547)	(285)	(129)	(86)	(588)	(29)	(69)	(16)	(37)	(85)	(60)	(73)	(189)	(22)	(101)
Didn't want you to do it	1	1	1	1	1	1	1	0	1	13	3	0	2	0	0	0	0d
Seemed indifferent	0.	1	1	1	1	1	1	0	0	0	0	1	0	4	0	0	0
Showed some interest but thought it unnecessary	0.	0.	0	0.	1	0	0	0	0	0	0	0	0	0	0	0	0
Maintained there was some need to do it	10	8	9	6	4	5	10	10	12	0	5	7	10	14	6	5	11
Constantly impressed on you the need to do it	43	43	43	44	44	46	43	31	36	37	40	48	45	42	40	36	48
Were interested but let me make my own decision	45	47	46	47	50	47	45	59	51	50	51	43	43	40	54	59	41
How did your father feel about you studying engineering	(815)	(799)	(532)	(267)	(112)	(81)	(578)	(28)	(69)	(17)	(33)	(84)	(55)	(71)	(180)	(21)	(95)
Didn't want you to do it	1	1	1	1	1	1	1	4	1	6	3	2	2	1	0	0	1
Seemed indifferent	5	5	5	3	6	4	5	0	9	6	6	4	4	4	3	0	4
Showed some interest but thought it unnecessary	1	1	1	1	3	3	1	0	1	0	0	0	0	1	2	0	1
Maintained there was some need to do it	6	5	6	3	3	5	5	7	3	6	3	5	6	3	6	10	3
Constantly impressed on you the need to do it	7	9	8	10	14	16	7	18	3	12	6	5	13	13	9	10	15
Were interested but let me make my own decision	79	79	78	80	73	72	81	71	83	71	82	85	76	78	80	81	86
How did your mother feel about you studying engineering	(831)	(828)	(545)	(283)	(124)	(87)	(588)	(29)	(69)	(16)	(35)	(86)	(60)	(73)	(191)	(21)	(96)
Didn't want you to do it	1	1	1	1	1	1	1	0	1	6	0	2	2	1	1	0	0
Seemed indifferent	7	7	8	5	6	9	6	3	12	6	11	6	5	4	4	0	5
Showed some interest but thought it unnecessary	1	2	2	2	1	3	1	0	0	0	0	1	2	1	2	0	1
Maintained there was some need to do it	6	4	5	3	6	3	4	3	1	6	0	3	3	5	4	9	6
Constantly impressed on you the need to do it	6	7	7	6	10	10	5	21	3	19	3	8	8	8	6	5	12
Were interested but let me make my own decision	79	80	78	84	77	72	82	72	83	63	86	79	80	80	84	86	76
9. Did you participate in college recruitment program for students in your field	(831)	(847)	(556)	(291)	(137)	(89)	(593)	(28)	(68)	(17)	(38)	(84)	(58)	(74)	(197)	(22)	(101)
Not available	50	47	47	47	39	38	49	75e	47	47	42	48	57	38	48	59	48
No	30	31	33	27	20	30	34	14	29	35	29	31	26	35	27	23	29
Yes	20	22	20	26	41	31	16	11	23	18	29	21	17	27	24	18	23
Did you participate in summer engineering seminar	(831)	(847)	(556)	(291)	(137)	(89)	(593)	(28)	(68)	(17)	(38)	(84)	(58)	(74)	(197)	(22)	(101)
Not available	46	41	42	39c	31	27	44	75e	35	35	29	35	45	34	46	41	50a
No	44	43	46	39	38	30	47	21	52	35	40	46	45	46	34	41	42
Yes	11	16	13	22	31	43	9	4	13	29	32	19	10	20	21	18	9

(9 continued)	TOTALS WT	TOTALS UW	SEX M	SEX F	ETHNIC GROUP Bl	ETHNIC GROUP Hi	ETHNIC GROUP Ma	ETHNIC GROUP FN	CURRENT MAIN CAREER CHOICE AAE	ARE	BE	CHE	CE	COE	EE	IE	ME
Did you participate in summer science or math seminar	(831)	(846)	(555)	(291)	(137)	(88)	(593)	(28)	(68)	(17)	(38)	(84)	(58)	(73)	(197)	(22)	(101)
Not available	43	39	39	38	34	35	39	71e	38	35	37	33	47	29	41	41	52
No	49	51	52	49	48	49	54	21	53	59	42	56	45	62	47	59	41
Yes	8	10	8	12	18	16	7	7	9	6	21	11	9	10	12	0	12
Did you participate in high school science fair	(830)	(845)	(554)	(291)	(137)	(88)	(592)	(28)	(68)	(17)	(38)	(84)	(57)	(73)	(197)	(22)	(101)
Not available	41	34	34	34	29	26	36	54a	28	24	29	42	49	25	29	41	43a
No	44	48	48	46	46	54	47	32	54	65	45	39	42	56	50	54	35
Yes	16	19	18	20	25	19	17	14	18	12	26	19	9	19	20	5	23
Did you participate in nationwide or regional science or math contests	(831)	(847)	(556)	(291)	(137)	(89)	(593)	(28)	(68)	(17)	(38)	(84)	(58)	(74)	(197)	(22)	(101)
Not available	15	17	18	16	20	22	15	39d	10	6	16	13	28	14	20	18	20b
No	46	47	46	48	56	47	45	36	43	65	47	33	53	57	46	50	51
Yes	39	36	36	36	23	30	40	25	47	29	37	54	19	30	34	32	29
10. Which of the following work characteristics are of great or extreme importance to you AN OPPORTUNITY TO	(826)	(826)	(544)	(282)	(133)	(89)	(576)	(28)	(68)	(17)	(37)	(85)	(60)	(76)	(194)	(21)	(99)
Work indoors	14	18	17	20	26	38	12	35e	6	18	19	17	21	25	25	32	15a
Work outdoors	26	24	26	20	12	31	25	45d	33	47	14	21	52	11	22	9	22e
Deal with people	36	44	37	58e	56	57	39	55d	38	53	68	48	57	36	33	64	47d
Deal with ideas, theories, or principals	51	48	48	48	58	54	45	59b	49	47	49	51	43	51	52	29	52
Deal with things or machines	43	48	52	42b	64	62	42	59e	45	35	32	37	39	58	62	33	67e
Use my special abilities and aptitudes	81	81	78	85b	85	88	78	86	78	76	78	88	75	83	84	76	80
Innovate and propose new ideas	70	67	69	65	77	74	63	83c	67	71	68	70	61	72	71	52	72
Work on problems for which there are no ready-made solutions	53	50	52	47	58	63	45	76e	57	41	54	47	48	54	55	24	53
Engage in challenging or stimulating work	80	78	75	83b	77	86	78	69	77	82	84	83	72	84	80	81	75
Engage in satisfying work	83	84	81	90c	85	82	83	90	81	94	86	86	79	83	80	95	88
Develop and test useful hypotheses or generalizations	32	34	31	37	43	41	30	45b	38	24	27	39	18	36	38	24	40
Do basic (NOT necessarily practical) scientific research	22	23	22	25	30	34	19	38c	20	18	31	31	8	18	28	19	19a
Apply principles to develop economically feasible product/process	29	33	31	38a	42	38	30	31a	28	24	38	36	31	31	32	52	37
Evaluate ideas, theories, or principles	25	28	27	32	35	38	25	34b	32	12	24	36	25	20	30	24	33
Develop a working model (of a new instrument or process)	39	43	43	41	51	60	38	34d	52	24	49	40	34	37	48	29	56b
Set up pilot projects (to develop and test new process/design)	39	40	40	39	45	49	38	35	61	23	38	36	36	40	41	33	41a
Evaluate performance (of PRESENT materials/designs/methods/etc)	27	32	31	35	36	43	30	31a	36	35	30	29	38	32	31	48	35
Trouble shoot and/or meet emergencies	35	36	34	39	40	41	35	28	46	53	32	36	31	32	39	19	36
Be assigned to diverse areas of the company	31	36	30	49e	45	44	33	38a	25	29	39	38	36	31	39	52	36
Engage in a wide variety of technical work	35	41	40	42	51	48	37	48b	36	65	40	39	36	38	55	33	43b
Make significant contributions to society	43	51	46	60d	67	59	46	55d	52	41	59	56	52	49	48	48	51
Work with interesting people	65	71	65	81e	75	77	68	83	62	71	76	73	77	67	69	91	69
Interact a great deal with other people	37	45	38	59e	56	57	40	62d	38	65	54	34	50	45	42	75	48b
Work with a small group	25	27	26	27	29	30	25	28	23	18	22	33	29	21	32	15	28
Work by myself	17	18	17	18	20	22	16	31	16	23	24	23	18	11	20	14	17
Help people	41	49	45	56b	60	63	43	59e	48	59	68	45	48	37	47	52	44
Know exactly what my work responsibilities are	61	65	62	70a	73	74	61	79b	59	88	68	65	64	60	67	76	71
Manage my own work with a large degree of freedom	58	59	58	60	61	73	55	76c	62	59	49	57	53	63	57	57	62
Be told what work to do	8	9	8	10	11	12	7	10	6	12	8	7	13	7	9	9	9
Be told how to do my work	5	7	6	9	11	8	6	17a	4	12	5	11	8	5	6	0	9
Participate in important work-related decisions	42	47	42	54c	54	54	44	48	43	53	35	43	47	47	49	71	43
Plan the best use of equipment and materials	33	41	39	44	50	44	37	54b	43	53	34	39	44	39	43	81	49a
Perform liaison work with departments and personnel to maintain overall efficiency of process or equipment production	17	25	20	35e	32	33	22	36b	17	35	30	26	20	31	26	67	25b
Simplify production method	25	29	28	33	33	34	27	45	29	29	19	27	28	32	31	71	34b
Control expenses	19	26	23	32b	37	28	23	17b	13	41	22	24	34	20	23	71	33e
Exercise leadership	45	51	49	55	63	64	46	45c	48	59	57	53	56	46	51	76	48
Move into a management career	30	37	34	43a	47	38	35	35	16	41	46	37	38	39	33	91	39e

	TOTALS		SEX		ETHNIC GROUP				CURRENT MAIN CAREER CHOICE								
	WT	UW	M	F	Bl	Hi	Ma	FN	AAE	ARE	BE	CHE	CE	COE	EE	IE	ME
(10 continued)																	
Sell ideas to people..................	23	25	24	28	32	32	22	34a	17	35	19	29	21	23	28	38	28
Work with customer rep's to suggest equipment/process changes...........	16	18	15	24c	20	24	17	21	10	29	11	18	20	17	17	52	21b
Conduct negotiations..................	11	17	14	22b	22	28	13	24c	15	18	22	24	20	13	15	19	21
Take part in in-service courses.......	16	18	16	21	20	22	16	21	17	23	17	19	21	16	24	14	11
Prepare for top-level career (e.g., by continuing education, career counsel-ing, job rotation, etc.)............	40	47	42	57d	56	57	43	55b	43	47	46	50	44	49	49	48	39
Take personal leave (including mater-nity and family-related)............	41	43	37	54e	46	49	42	32	35	47	57	49	41	37	38	43	46
Perform duties under flexible working hours..............................	43	46	42	53b	51	47	44	48	42	65	54	49	49	43	46	57	36
Travel................................	48	52	45	64e	56	60	49	65a	58	71	54	58	56	55	48	52	42
Advance myself economically...........	74	75	73	77	77	78	74	69	75	76	70	74	77	78	78	95	71
Enhance my social status and prestige.	37	43	41	46	50	52	40	52a	43	59	46	39	45	51	42	52	43
Live in desirable geographic location.	66	67	66	69	64	75	66	65	65	65	81	66	63	71	66	86	66
Do work which allows for a pleasant home and family life................	80	82	83	80	83	81	82	76	80	88	89	80	79	80	84	86	81
OTHER CHARACTERISTICS OF THE JOB ARE	(816)	(829)	(545)	(284)	(132)	(89)	(580)	(28)	(68)	(17)	(37)	(85)	(59)	(73)	(193)	(21)	(98)
Presence of many fine detail tasks....	29	30	30	29	29	45	27	46c	38	59	24	23	48	23	31	33	32b
Presence of very few/no fine detail tasks..............................	12	11	10	13	11	10	12	11	13	6	13	14	10	5	11	14	8
Presence of routine operations, calculations, etc...................	16	20	17	25b	22	31	17	32b	19	12	25	25	25	15	21	38	14
Little pressure to perform exception-ally well on every assignment.......	18	22	20	26	32	35	17	36e	25	29	13	21	15	20	25	33	24
Employment stability..................	71	74	71	81b	77	76	73	75	66	88	73	72	75	66	79	95	76
Company realizes that employees have family responsibilities.............	67	69	70	69	70	69	70	57	54	76	59	78	63	63	73	71	77a
An income which permits me (and my family) to live comfortably.........	85	87	86	87	92	88	85	86	82	82	92	88	83	85	91	95	88
11. Which statements are greatly or extremely characteristic of you																	
WHEN I HAVE STUDIED, I HAVE																	
Thought about applications of the	(813)	(820)	(538)	(282)	(128)	(87)	(577)	(28)	(68)	(17)	(37)	(85)	(60)	(72)	(191)	(20)	(96)
material............................	43	44	43	46	50	56	40	55b	43	59	40	43	43	43	49	45	46
Related facts or concepts from one course to others....................	57	60	55	68d	61	66	58	69	57	65	59	67	60	65	63	50	47
Memorized facts.......................	34	40	37	45a	48	41	39	24a	38	47	41	43	39	40	44	41	40
NOT finished assignment BECAUSE OF "daydreaming"/putting it off........	9	7	6	9	8	8	6	7	10	6	8	6	3	7	5	10	4
DURING HIGH SCHOOL WHEN I FOUND PROBLEMS HARD TO UNDERSTAND OR TO SOLVE, I																	
Asked someone to show me how to look	(828)	(839)	(551)	(288)	(132)	(90)	(588)	(29)	(68)	(17)	(37)	(86)	(62)	(73)	(195)	(21)	(100)
at it or solve it..................	39	45	41	53b	51	49	43	39	43	65	49	40	45	42	50	68	40
Spoke to people about them HOPING TO GET SOME NEW INSIGHT..................	39	44	39	53d	47	43	43	36	37	59	51	52	39	36	45	55	46
Kept at them until the problems were solved or understood................	54	54	52	58	65	56	51	57a	59	53	57	58	58	51	55	55	49
Pushed them out of my mind by doing something else.....................	6	3	4	0b	0	3	3	14c	6	0	0	3	6	1	3	0	2
IN AN UNPLEASANT SITUATION I																	
Generally try to react immediately	(832)	(836)	(551)	(285)	(133)	(88)	(586)	(29)	(68)	(17)	(36)	(85)	(62)	(74)	(195)	(22)	(97)
and figure out best solution........	56	57	55	61	60	66	55	71	63	59	68	62	61	56	55	82	48
Do NOT worry - things will work out for the best........................	15	13	15	10a	12	10	15	7	18	13	11	12	19	10	16	0	11
I strive to be like I feel others expect me to be.............................	17	17	19	14a	10	21	18	21	19	29	16	22	26	9	14	14	18
Compared to most people, I work faster...............................	24	26	25	28	24	29	26	35	21	53	27	28	29	33	29	27	20
I take advantage of opportunities that are presented to me......................	48	54	51	60b	59	65	51	66a	49	53	67	58	53	64	51	55	54
I am friendly and easy-going; I have many friends..............................	50	57	57	59	63	66	55	55	46	65	70	55	68	53	59	82	61a
I enjoy myself when I am alone, away from other people.........................	37	42	36	52e	40	48	42	35	41	47	40	46	35	39	42	36	37
12. How certain are your plans concerning engineering as a career	(839)	(845)	(556)	(289)	(136)	(89)	(591)	(29)	(69)	(17)	(37)	(85)	(62)	(76)	(196)	(22)	(99)
Definitely won't be engineer..........	0.	1	0.	1b	1	1	0.	0e	0	0	0	0	0	1	0	0	1
Probably won't be engineer............	1	2	1	2	1	0	2	0	1	0	0	1	2	0	1	5	0
Unsure will be engineer...............	11	13	10	19	6	6	16	7	9	18	16	13	8	12	6	9	9
Probably will be engineer.............	55	49	51	45	38	38	53	48	44	59	60	57	45	49	49	59	50
Definitely will be engineer...........	32	36	37	33	53	55	29	45	46	24	24	29	45	38	45	27	40

	TOTALS		SEX		ETHNIC GROUP				CURRENT MAIN CAREER CHOICE								
	WT	UW	M	F	Bl	Hi	Ma	FN	AAE	ARE	BE	CHE	CE	COE	EE	IE	ME
13. Which of the following do you rate yourself above average in when compared with same-age peers	(774)	(786)	(517)	(269)	(123)	(85)	(553)	(25)	(67)	(17)	(34)	(81)	(53)	(71)	(183)	(20)	(93)
Math ability	88	86	86	85	76	86	87	100c	91	88	84	91	82	85	88	86	84
Science ability	88	84	85	82	72	87	86	86c	88	82	86	95	73	79	87	82	76b
Mechanical ability	76	71	78	59e	62	73	74	69a	81	77	78	70	65	66	77	48	87c
Problem-solving ability	85	83	83	81	74	80	84	93b	84	81	81	87	75	88	84	77	86
Spatial visualization ability	74	71	73	67	61	74	72	80a	84	77	74	72	68	68	74	70	72
Athletic ability	63	62	67	50e	66	60	61	59	64	59	51	67	77	57	62	54	62
Artistic ability	40	42	40	46	49	45	40	43	42	82	38	30	53	46	40	32	45b
Leadership ability	65	69	67	72	77	71	67	55a	73	71	69	70	63	71	68	91	66
Public speaking ability	44	44	44	45	56	43	42	45a	39	24	38	45	44	50	48	59	38
Writing ability	60	59	56	66b	61	57	60	45	59	65	68	64	47	65	54	55	57
Personal relations ability	69	72	70	76	75	78	72	52a	74	82	76	70	68	71	72	91	73
Reading ability	72	73	69	80c	75	76	73	45b	71	59	81	76	69	80	69	73	70
Management ability	70	70	69	73	70	74	70	75	63	59	62	69	68	76	76	91	70
14. Your sex:	(848)	(863)			(139)	(90)	(605)	(29)	(69)	(17)	(38)	(87)	(63)	(76)	(200)	(22)	(103)
Female	19	34			40	31	34	21	22	35	66	52	22	40	21	64	18e
15. Your ethnic group:	(848)	(853)	(569)	(294)					(69)	(17)	(38)	(87)	(63)	(76)	(200)	(22)	(103)
Black	6	16	15	19					4	6	21	8	10	24	27	9	22c
Hispanic	4	10	11	10					9	18	13	10	19	7	11	18	12
Majority (White, Asian, Pac. Isl.)	85	70	70	70					83	77	66	81	64	67	58	68	63
Foreign national	5	3	4	2					4	0	0	1	8	3	5	5	3
Your Citizenship:	(836)	(835)	(550)	(285)	(133)	(86)	(587)	(29)	(69)	(17)	(36)	(87)	(61)	(72)	(193)	(21)	(99)
U.S. native	91	91	90	93	93	86	96	0e	90	88	92	97	90	92	89	91	87
U.S. naturalized	4	6	6	5	7	14	4	0	6	12	8	2	2	6	7	5	10
Foreign national:	5	4	4	2	0	0	0	100	4	0	0	1	8	3	5	5	3
	(49)	(48)	(35)	(13)	(0)	(12)	(9)	(27)	(5)	(0)	(2)	(2)	(5)	(4)	(15)	(2)	(5)
Canada	0	0	0	0	0	0	0	0b	0	0	0	0	0	0	0	0	0
Europe/Other English speaking	3	6	6	8	0	0	11	7	0	0	50	0	40	0	0	0	0
Latin America/S. America/Carribean	61	50	57	31	0	100	0	44	40	0	0	50	20	75	60	50	80
Asia	33	40	31	61	0	0	89	41	40	0	50	50	40	25	33	50	20
Middle East	1	2	3	0	0	0	0	4	20	0	0	0	0	0	0	0	0
Africa	2	2	3	0	0	0	0	4	0	0	0	0	0	0	7	0	0
16. Year of birth	(848)	(863)	(569)	(294)	(139)	(90)	(605)	(29)	(69)	(17)	(38)	(87)	(63)	(76)	(200)	(22)	(103)
1962	22	23	25	21	19	21	24	38e	13	29	21	22	27	21	26	18	23
1963	75	73	71	75	70	76	74	48	83	65	74	74	71	74	70	77	72
1964	3	4	4	4	12	3	2	14	4	6	5	5	2	5	4	5	5
17. Describe your high school education	(834)	(846)	(557)	(289)	(137)	(89)	(591)	(29)	(68)	(17)	(37)	(87)	(62)	(75)	(198)	(22)	(100)
General education	20	18	19	16	25	16	16	31b	13	6	16	12	19	21	16	23	20
Vocational education	3	2	3	1	3	1	2	10	3	0	3	0	5	3	5	5	0
College preparatory	77	80	78	83	72	83	82	59	84	94	81	89	76	76	79	73	80
18. From what type of high school did you receive your education	(839)	(850)	(558)	(292)	(137)	(90)	(594)	(29)	(69)	(17)	(37)	(87)	(62)	(76)	(198)	(22)	(100)
Military	0.	0.	0.	0	0	1	0.	0c	0	0	0	0	0	0	0	5	0e
Church-related	6	8	8	8	11	19	6	7	9	6	11	7	13	8	7	0	12
Private: Nonsectarian	5	5	5	4	7	4	4	17	7	6	3	8	7	5	4	0	6
Public	88	86	85	87	81	74	89	76	84	77	84	85	81	87	88	96	82
Other	0.	1	0.	1	1	1	1	0	0	12	3	0	0	0	1	0	0
19. How close to your college campus is your parent's home	(837)	(848)	(556)	(292)	(137)	(89)	(593)	(29)	(67)	(17)	(37)	(87)	(62)	(76)	(198)	(22)	(101)
Less than 25 miles	27	24	21	28b	26	36	21	35e	12	35	24	18	42	18	28	27	19b
25-100 miles	21	23	26	16	15	16	26	21	27	24	19	26	18	15	24	14	26
101-200 miles	22	21	21	19	14	5	26	7	33	18	14	20	15	20	19	18	19
201-500 miles	17	19	18	19	25	20	17	10	9	6	16	18	13	33	21	18	23
Over 500 miles	14	14	13	17	21	24	11	28	19	18	27	17	13	15	9	23	14
20. What is your father's highest educational level	(829)	(835)	(550)	(285)	(129)	(87)	(591)	(28)	(69)	(17)	(35)	(85)	(61)	(75)	(194)	(22)	(99)
Some 8th grade or less	3	4	4	5	7	16	2	7e	4	18	6	5	8	3	4	9	4
Some 10th grade or less	2	2	2	2	2	2	2	7	1	0	9	1	2	1	5	0	1
Some 12th grade or less	4	4	5	4	6	13	3	4	3	6	6	2	7	7	6	0	2
High school graduate	19	22	23	20	29	17	21	25	23	29	17	12	16	21	25	9	28
Some college	15	14	14	14	16	15	14	11	15	18	14	15	20	13	13	32	14
Associate's degree	5	4	5	2	2	7	3	7	7	6	0	2	2	5	6	0	4
Bachelor's degree	26	22	23	20	15	10	25	18	25	12	29	27	23	24	18	9	22
Some graduate school	5	4	4	4	5	2	5	0	4	0	6	5	7	5	3	5	3
Master's degree	13	14	11	18	12	9	15	14	10	12	6	21	10	15	12	27	13
Doctor's degree	9	9	8	11	6	8	10	7	7	0	9	9	7	5	9	9	8

	TOTALS		SEX		ETHNIC GROUP				CURRENT MAIN CAREER CHOICE								
(20 continued)	WT	UW	M	F	Bl	Hi	Ma	FN	AAE	ARE	BE	CHE	CE	COE	EE	IE	ME
What is your mother's highest educational level	(837)	(844)	(554)	(290)	(137)	(88)	(590)	(29)	(69)	(17)	(37)	(87)	(60)	(75)	(198)	(22)	(100)
Some 8th grade or less................	2	3	4	2	2	15	1	14e	1	12	3	1	10	4	2	0	5
Some 10th grade or less...............	3	3	3	2	4	6	2	7	1	0	3	3	3	0	4	5	3
Some 12th grade or less...............	3	3	3	3	7	2	2	7	3	0	5	2	2	7	4	5	2
High school graduate..................	31	32	34	28	30	30	33	24	32	41	22	26	38	25	33	27	34
Some college..........................	20	20	19	21	18	18	21	7	26	24	22	21	15	20	22	23	17
Associate's degree....................	5	5	5	6	4	3	6	3	6	0	8	7	3	5	5	5	3
Bachelor's degree.....................	19	17	16	19	14	14	19	21	10	12	22	20	18	19	16	18	20
Some graduate school..................	9	6	6	4	9	6	5	7	12	0	3	5	7	7	6	5	8
Master's degree.......................	8	10	9	11	12	7	10	10	7	12	14	14	3	11	8	14	7
Doctor's degree.......................	0.	1	0.	2	2	0	1	0	1	0	0	1	0	3	0	0	1
21. What was your father's last occupational level	(820)	(819)	(543)	(276)	(123)	(85)	(584)	(27)	(68)	(17)	(34)	(85)	(61)	(74)	(188)	(21)	(96)
Professional/managerial...............	66	66	64	70	53	46	72	67e	66	53	74	71	64	68	65	62	64
Semi-professional/technical...........	11	10	9	11	11	17	9	4	6	6	12	8	7	11	10	5	9
Skilled...............................	18	18	21	14	26	26	15	22	21	29	15	18	25	14	18	33	19
Semi-skilled..........................	4	5	5	4	8	7	3	4	6	6	0	2	5	4	6	0	7
Unskilled.............................	2	1	1	1	2	5	1	4	1	6	0	1	0	4	1	0	1
What was your mother's last occupational level	(805)	(807)	(532)	(275)	(132)	(82)	(568)	(25)	(65)	(17)	(36)	(83)	(58)	(71)	(189)	(19)	(94)
Professional/managerial...............	35	35	33	41	45	33	34	32d	32	35	47	35	38	34	39	32	27a
Semi-professional/technical...........	10	9	8	9	6	6	10	8	6	6	3	19	5	11	7	5	6
Skilled...............................	41	38	39	36	26	34	43	20	45	18	36	36	31	38	35	37	48
Semi-skilled..........................	8	9	10	8	14	12	7	20	9	23	11	7	9	7	9	21	10
Unskilled.............................	6	8	9	6	9	15	6	20	8	18	3	2	17	10	10	5	10

Highlights of the National Engineering Career Development Study[1]

W. K. LeBold, K. W. Linden, C. M. Jagacinski, & K. D. Shell

Purdue University

The National Engineering Career Development Study was a comprehensive study of today's engineering students and engineering graduates. Primary goals of the study were: (1) to gather information about the kinds of jobs currently held by engineers in different fields and factors influencing the career choice and career development of engineers, (2) to develop up-to-date normative data on the interests of men and women in the major fields of engineering, and [illegible] currently used interest inventories for [illegible] on the engineering scales. Surveys and [illegible] sent to members of nine major engineering [illegible] graduates of eight major universities [illegible]. Eighty percent of the engineers received the *Purdue Interest [illegible]* (PIQ), and twenty percent received the *Strong [illegible] Inventory* (SCII). Over 50% of the 5,142 [illegible] completed surveys and interest [illegible].

[illegible] Characteristics

[illegible] of the survey and interest [illegible] were men. The vast majority [illegible] were Black, 4% were Asian or [illegible] of Spanish or Mexican descent, and 2% [illegible]. A larger proportion of men than [illegible] married (79% vs. 49%) and [illegible] children (61% vs. 24%). This [illegible] that women in the sample [illegible] the sample. The median [illegible] while the median [illegible] who were married, [illegible] compared to only 2% [illegible] middle and upper- [illegible] fathers holding professional [illegible] had fathers [illegible] of the men.

[illegible] Activities

[illegible] provide information [illegible] respondents and [illegible]. The breakdown of [illegible] job. In general, [illegible] manufacturing firms, except [illegible] and nuclear engineers. [illegible] of aeronautical and [illegible] working in each [illegible] degree in the same field [illegible] of the aeronautical engineering [illegible].

The most frequently reported job functions for the respondents as a total group were technical management, development, and design. However, there was considerable variation across fields in terms of the most common job functions (Table 1).

Engineers in our sample had engaged in a variety of professional activities (Table 2). The majority of engineers in all fields had read and discussed new developments in engineering during the past year, with a small proportion presenting technical papers. Agricultural, civil, and mechanical engineers were more likely to be registered than engineers in other fields.

Differences in the supervisory and technical responsibility for men and women are shown in Figures 2 and 3. Figure 2 illustrates the percentage of respondents supervising professional or managerial personnel. Figure 3 illustrates reported work complexity. Although men and women reported generally comparable levels of technical responsibility, men tended to report higher levels of supervisory responsibility than did women.

Figure 4 presents the median salary for men and women engineers. Salaries are comparable for the first 5 years of experience. After 5 years of experience, women report slightly lower salaries than men with much larger differences after 10 years of experience. This difference should be interpreted with the knowledge that 85% of the women in the sample received their BS

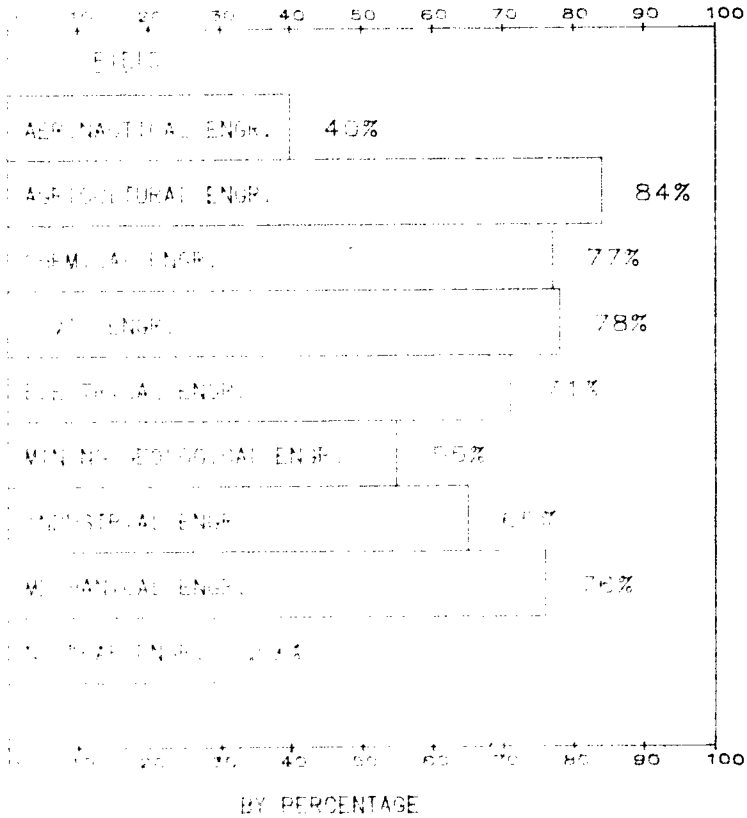


Figure 1 Percentage of Engineers Working in Each Major Field Who Received Their BS Degree in the Same Field.

[1] [illegible] grant No. [illegible]-19613 from the [illegible] program of the National Science Foundation [illegible]. Grantees undertaking such projects under [illegible] encouraged to express their judgement in professional and [illegible] of view or opinions do not, therefore, necessarily [illegible] National Science Foundation or Purdue University procedures or

degree since 1972. Median salaries for women with 10 or more years of experience are therefore based on a small number of cases. However, these results are consistent with previous findings.

Job Satisfaction

The majority of engineers in the sample were satisfied with their choice of engineering as a career and the progress they had made in their career (Table 3). However, fewer women than men were satisfied with their career progress. This sex difference was also found for the respondent's general level of satisfaction with their work.

In Table 4, 36 job factors have been rank-ordered according to the percentage of respondents rating each as "Very Important". The table also lists the rank of each factor based on the percentage indicating each as "Very Characteristic" of their current position and the percentage and rank differences. Although field and sex differences are not shown, women did feel that certain factors including the opportunity to work with people, preparation for top level careers, flexible working hours and the availability of personal leave were more important than did men. Women rated their jobs lower than did men in terms of the opportunity to innovate, to exercise leadership, and to participate in work related decisions.

The column of rank differences illustrates discrepancies in the relative ordering of factors in terms of importance to the individual and the extent to which the factors are characteristic of the job. Several factors were very important to the respondents but less characteristic of their jobs. These factors included "a position where people are interested in working together and not encouraging petty jealousies," "company is well-managed and progressive," and "participation in important work-related decisions." It is clear from Table 4 that the majority of factors were more important to the respondents than characteristic of their job as might be expected.

Education

Table 5 depicts present and planned levels of education as well as attitudes towards post-baccalaureate education. Sixty-four percent of the respondents had already begun or completed post-baccalaureate work. Furthermore, 81% of the respondents expected to continue their education. A large percentage of the respondents (20%) planned to get a masters degree in business administration and 56% indicated they would prefer a management-oriented graduate program. In answering the questions regarding their attitudes toward the need for further education, it is contradictory that while

TABLE 1: Characteristics of Present Job of Respondents

TYPE OF EMPLOYER		SEX					FIELD					
Manufacturing	*TO*	*M*	*F*	*AE*	*AG*	*CH*	*CE*	*EE*	*GM*	*IE*	*ME*	*NE*
Aircraft	4%	4%	3%	51%	0%	0%	1%	4%	2%	3%	6%	0%
Chemicals/Petroleum/Ordnance	10	11	9	1	1	55	3	3	2	5	11	0
Electrical/Electronic equip	10	9	12	4	2	0	0	39	0	17	8	4
Fabricated/Primary metals	4	3	4	0	2	2	2	1	8	11	6	0
Machinery (except elec.)	4	5	3	0	22	1	0	2	0	3	15	0
Other manufacturing	12	9	14	1	4	8	2	6	3	32	18	5
Other Kinds of Business												
Agri., forest., & fisheries	1	2	1	0	17	0.	1	0	0	1	0	0
Construction	3	4	3	3	2	1	12	1	0	0.	2	6
Engr. or Arch. services	16	16	16	7	2	14	42	11	13	3	14	43
Mining and petrol. extract.	3	3	2	0	0	4	2	0.	44	1	0.	0
Trans., comm., & util.	7	6	7	0	1	0.	7	14	1	4	5	9
Other Private Business	9	9	11	7	8	7	5	8	10	7	9	21
Government & Health Services	12	10	13	21	14	3	19	7	13	8	5	10
Educational Institutions	5	6	4	3	29	3	3	4	2	6	3	2
PRINCIPAL FUNCTION												
Pre-Professional	2%	1%	3%	0%	1%	0%	3%	1%	2%	2%	0%	3%
Research	9	9	8	15	29	14	5	7	19	3	9	6
Development	11	10	13	16	4	19	3	22	11	5	13	14
Design	20	21	20	16	36	22	33	24	9	1	34	18
Operations	7	6	8	6	3	10	3	4	7	22	2	6
Production & maintenance	7	6	7	4	5	8	1	4	3	17	10	2
Testing & inspection	3	2	3	0	4	1	3	4	2	1	4	5
Construction	4	4	3	0	1	1	14	1	0	0	4	6
Sales & service	3	4	2	0	2	1	0.	4	4	0.	2	1
Teaching	3	3	2	3	4	2	2	3	2	5	2	3
Technical management	16	18	11	31	5	13	11	16	22	26	12	16
Non-technical management	3	4	3	1	0	1	2	2	0	2	1	2
Consulting	7	8	8	3	2	3	15	4	12	10	3	14
Other	7	6	9	4	6	6	4	5	6	6	6	5

=Total AE=Aeronautical CE=Civil IE=Industrial
Male AG=Agricultural EE=Electrical ME=Mechanical
F=Female CH=Chemical GM=Geological/Mining NE=Nuclear

TABL

Percentage engaging in each acti
during the past year
Discuss new engr developmen
Read about new engr develop
Subscribe to engr periodicals
Read new books on engr or
Purchased new books on eng
Attended local technical meetin
Took non-grad credit engr co
Completed grad courses in e
Attended national tech meeti
Presented one or more tech pap
Attended short course on mg

Professional Registration St
Registered Professional Engine
Registered Engineer in Train
Not a Registered Engineer

TO=Total AE=Aeronautical
M=Male AG=Agricultu
F=Female CH=Chemical

TABLE 3: Sati

How satisfied are you with
choice of occupation?
Still uncertain
Not satisfied; reconsidering
Satisfied, some doubts
Made best choice
Fully satisfied

How satisfied are you with
progress in your occupation?
Not satisfied
Fairly satisfied
Feel I'm doing well
Fully satisfied

General level of satisfactio
with work in present job.
Very satisfied
Satisfied
Neutral
Dissatisfied
Very dissatisfied

TO=Total AE=Aerona
M=Male AG=Agricul
F=Female CH=Chemical

the majority (59%) did not view graduate education as necessary, 64% have pursued graduate education.

Career Development

Most of the engineers sampled considered engineering as a career while in high school and finally decided on an engineering career between their junior year in high school and first year of college (Table 6). Women tended to make the decision later than did men. There was some variation in decision times across fields with geological/mining engineers making a career decision later than engineers in other fields and aeronautical engineers considering engineering earlier than those in other fields.

Factors influencing the decision to pursue a career in engineering are shown in Table 7. The most influential factors tend to be characteristic of the type of work associated with engineering (chal-

fessional Activities of Survey Respondents

	SEX					FIELD					
TO	M	F	AE	AG	CH	CE	EE	GM	IE	ME	NE
76%	78%	72%	82%	85%	82%	74%	80%	86%	73%	77%	77%
88	89	87	86	91	89	88	90	94	83	89	84
88	87	90	89	90	91	83	86	94	90	88	91
45	49	38	56	51	50	47	54	58	31	40	46
44	47	38	41	48	46	54	55	62	26	45	36
52	52	52	44	58	55	53	51	67	58	50	52
17	17	18	21	14	21	18	25	21	13	17	15
16	15	19	20	32	9	16	23	12	12	20	10
31	33	27	33	33	37	19	29	53	28	27	41
12	15	8	17	18	16	7	11	23	8	10	23
31	30	33	27	18	28	24	26	39	44	29	37
14%	20%	5%	9%	11%	12%	23%	12%	17%	9%	17%	17%
34	30	40	12	62	33	60	21	13	13	45	20
52	50	55	79	27	55	17	67	70	78	38	63

CE=Civil IE=Industrial
EE=Electrical ME=Mechanical
M=Geological/Mining NE=Nuclear

tion With Career Choice, Career Progress And Work

	SEX					FIELD					
TO	M	F	AE	AG	CH	CE	EE	GM	IE	ME	NE
1%	1%	2%	0%	2%	1%	0%	1%	2%	0%	1%	0%
5	4	7	4	7	4	3	3	4	6	6	7
1	20	24	26	25	21	25	23	18	19	20	22
7	48	45	41	47	48	46	46	45	51	52	52
25	26	23	29	20	27	26	28	31	24	21	20
5%	13%	18%	13%	15%	15%	11%	16%	15%	16%	14%	15%
4	22	28	23	19	27	26	24	23	28	27	25
5	46	41	46	48	43	46	42	46	42	49	50
16	18	13	17	18	17	18	18	15	14	10	10
30%	33%	26%	29%	24%	28%	32%	33%	39%	29%	23%	22%
0	51	49	52	55	56	48	49	44	48	57	62
4	12	15	12	17	12	15	12	14	15	13	13
5	4	7	4	3	4	5	6	1	6	6	3
1	1	2	3	1	1	1	1	1	2	1	0

rical IE=Industrial
ME=Mechanical
ogical/Mining NE=Nuclear

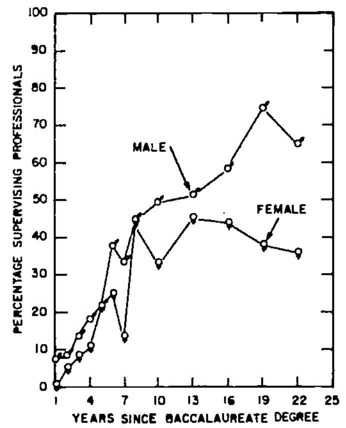


Figure 2 Percentage of Men and Women Engineers Supervising Professional or Managerial Personnel by Years Since BS Degree.

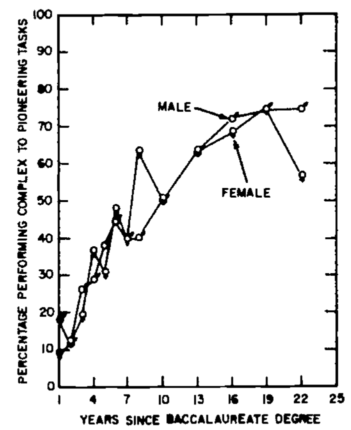


Figure 3 Percentage of Men and Women Engineers Reporting High Technical Responsibility (viz., Complex to Pioneering Work) by Years Since BS Degree.

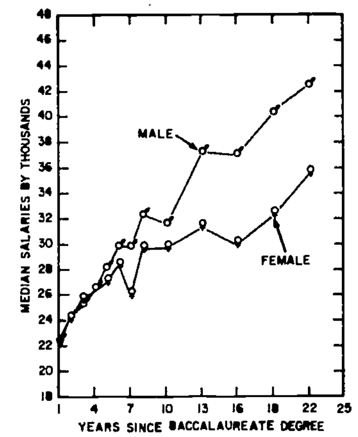


Figure 4 Median Salaries in Thousands of Dollars for Men and Women Engineers by Years Since BS Degree.

TABLE 4: Rank Order of Various Job Factors in Terms of Importance and Degree to Which They Characterize Present Jobs

JOB FACTORS	PERCENTAGE RATING Very Important	Very Characteristic	Rank Importance	Rank Characteristic	Rank Difference	Percent Difference
Engage in satisfying work	82%	37%	1	15	-10	45
Opportunity to use my skills	80	43	2	5	-3	37
People working together, no petty jealousies	73	27	3	21	-18	46
An income to live comfortably	71	41	4	7	-3	30
Company is well-managed and progressive	66	21	5	28	-23	45
Delegate responsibility	66	43	6	4	2	23
Opportunity to innovate	64	38	7	10	-3	26
Pleasant people to work with	62	41	8	8	0	21
Freedom to manage own work	61	42	9	6	3	19
Participation in work-related decisions	61	25	10	25	-15	36
Opportunity to advance economically	53	27	11	22	-11	26
Desirable geographical location	52	45	12	2	10	7
Work with ideas	52	31	13	16	-3	21
Opportunity to keep abreast	52	28	14	20	-6	24
Know exactly my work responsibilities	51	30	16	17	-1	21
Freedom from pressure to conform	50	33	17	14	3	17
Problems with no ready made solutions	49	44	18	3	15	5
Company realizes family responsibilities	49	29	19	19	0	20
Wide variety of technical work	48	34	20	13	7	14
Availability of personal leave	47	40	21	9	12	7
Job security due to technical attainments	46	31	22	15	7	15
Opportunity to move into management	46	35	23	12	11	11
Exercise leadership	45	25	24	24	0	20
Opportunity to work with people	44	50	25	1	24	-6
Flexible work hours	38	26	26	23	3	12
Preparation for top level careers	36	10	27	35	-8	26
Opportunities to help others	34	20	28	29	-1	14
Colleagues interested in latest developments	33	19	29	31	-2	14
Significant contributions to society	33	14	30	33	-3	19
Opportunity to work with things	30	24	31	26	5	6
Freedom from pressure to excel	28	15	32	32	0	13
Assigned to different areas in the company	25	19	33	30	3	6
Freedom to select projects	22	9	34	36	-2	13
Opportunity to enhance social status	20	13	35	34	1	7
Opportunity to travel	20	21	36	27	9	-1

TABLE 5: Current and Planned Education of Survey Respondents and Attitudes Toward Graduate Work

		SEX					FIELD					
Current Educational level	TO	M	F	AE	AG	CH	CE	EE	GM	IE	ME	NE
No degree	1%	1%	0.%	0%	0%	0%	0%	1%	1%	0.%	1%	0%
BS, no grad work	35	33	39	22	43	13	44	38	42	34	45	28
BS, some non-engr grad work	16	14	18	23	11	5	14	15	19	22	17	20
BS, some engr grad work	5	4	6	1	6	3	6	7	2	2	6	3
MS, engr	25	27	21	30	28	56	27	21	15	19	19	31
MBA (business administration)	5	6	4	0	1	9	1	3	2	10	3	4
MS/MA other non-engr field	3	3	3	1	0	3	1	2	13	3	1	0
MS engr and another field	2	2	2	1	0	3	1	3	0	1	2	6
PhD engr	5	6	2	10	7	7	3	5	2	6	3	6
PhD non-engr	1	1	1	1	0	1	0	1	3	1	0	1
Other	3	3	5	9	5	1	4	4	0	3	5	1
Planned Educational Level												
None	19%	24%	10%	37%	18%	23%	13%	12%	17%	23%	14%	21%
Some grad work in engr	20	21	18	15	20	26	21	23	31	18	18	19
Some grad work in non-engr	12	13	10	10	10	13	9	8	13	15	11	14
MS in engr	12	10	15	12	14	6	22	14	7	6	16	3
MBA (business administration)	20	17	26	7	14	17	16	23	18	28	24	21
MS/MA non-engr field	2	1	3	3	2	2	1	1	2	2	2	7
MS engr and another field	4	2	6	6	1	3	5	4	2	2	4	6
PhD in engr	7	7	6	6	16	6	7	9	3	4	7	6
PhD in non-engr	2	2	2	2	2	2	1	2	1	1	1	2
Other	4	4	4	3	3	3	3	4	5	1	4	1
Preferred Graduate Program												
Design oriented engr program	21%	22%	19%	26%	35%	21%	32%	26%	17%	9%	22%	14%
Research oriented engr program	17	17	17	26	32	25	15	16	21	7	20	17
Management oriented program	56	56	56	44	30	49	48	53	54	78	53	61
Other	6	5	7	5	4	5	5	5	8	6	6	8
Percent who "strongly agree" or "agree" regarding the need for graduate work or continuing education in employment.												
Grad study is not needed	59%	59%	59%	57%	56%	61%	61%	58%	55%	62%	68%	49%
"On Job" training is sufficient	47	47	46	48	41	47	42	48	48	41	50	43
Non-credit courses are sufficient	56	56	56	56	55	57	56	52	65	56	59	46
Mgmt grad work is needed	50	49	51	34	40	34	46	51	51	65	50	52
Math & Sci grad work is needed	31	32	30	47	41	26	27	36	41	22	25	43
Engr grad work is needed	47	48	46	55	64	45	50	57	48	36	44	55

TO=Total AE=Aeronautical CE=Civil IE=Industrial
M=Male AG=Agricultural EE=Electrical ME=Mechanical
F=Female CH=Chemical GM=Geological/Mining NE=Nuclear

TABLE 6: Time of First Consideration and Final Decision of an Engineering Career

		SEX					FIELD					
First Consideration	TO	M	F	AE	AG	CH	CE	EE	GM	IE	ME	NE
Before High school	18%	22%	11%	30%	11%	18%	12%	22%	17%	14%	20%	21%
During grades 9 or 10	19	23	12	14	22	24	18	17	12	14	22	13
During grades 11 or 12	39	38	41	26	25	41	43	33	33	45	43	38
During 1st year of college	11	10	14	8	11	6	15	14	13	11	9	13
During 2nd year of college	5	3	9	3	6	4	7	5	13	7	5	7
During 3rd or 4th year of college	3	2	5	6	3	5	2	3	11	3	1	7
After college	5	2	8	5	2	3	4	7	2	6	1	6
Final Decision												
Before High school	4%	5%	2%	14%	3%	4%	3%	6%	1%	4%	5%	7%
During grades 9 or 10	6	8	3	5	3	8	3	8	4	6	7	2
During grades 11 or 12	43	48	34	41	49	46	40	41	28	39	51	37
During 1st year of college	19	18	21	11	21	15	24	18	20	17	18	21
During 2nd year of college	12	10	17	11	13	11	17	9	14	15	12	11
During 3rd or 4th year of college	7	5	10	5	8	6	7	10	16	9	4	6
After college	9	6	12	13	4	10	6	8	17	10	3	17

TO=Total AE=Aeronautical CE=Civil IE=Industrial
M=Male AG=Agricultural EE=Electrical ME=Mechanical
F=Female CH=Chemical GM=Geological/Mining NE=Nuclear

TABLE 7: Percentage of Respondents Rating the Following Factors as of "Very" or "Some" Importance in Influencing Their Decision to Study Engineering

FACTORS	TO	SEX M	SEX F	FIELD AE	AG	CH	CE	EE	GM	IE	ME	NE
Work Related												
Like problem solving	85	84	88	83	87	84	81	87	89	86	87	91
Challenge	83	81	89	81	85	80	84	84	86	84	86	91
Being curious or creative	83	83	82	79	88	83	78	86	80	85	83	90
Salary	75	74	77	62	71	77	77	74	79	74	77	82
Creativity	74	73	76	79	80	74	70	77	70	73	73	79
Independence	68	62	78	57	67	61	73	67	75	72	66	68
Type of work	64	63	65	59	73	65	67	57	62	62	63	68
Prestige	62	62	63	44	57	62	64	60	54	68	63	62
Security	61	59	64	48	59	65	62	61	54	67	64	62
Leadership	56	54	60	44	56	52	63	54	47	62	51	49
Relevant work experience	42	46	36	43	51	34	36	43	51	38	41	41
Rapid advancement	48	45	53	44	56	52	63	54	47	62	51	49
Wanting to be of service	45	44	46	24	65	41	53	40	43	44	39	49
School Related												
College engineering courses	75	74	76	69	76	7[illegible]	82	76	74	73	77	78
H.S. science courses	69	71	66	75	68	79	63	67	72	66	73	72
H.S. math courses	67	66	68	75	68	70	62	65	62	70	69	67
Career or occupational info	57	57	58	49	63	56	59	51	61	65	57	50
College math courses	55	53	59	63	49	52	53	60	56	58	54	66
College science courses	50	52	47	48	54	53	50	52	69	41	51	63
College physics courses	48	49	46	57	48	49	45	49	54	39	54	66
Aptitude tests	45	45	45	37	49	38	43	40	43	55	48	41
College chemistry courses	35	37	33	26	23	64	35	31	46	27	30	42
Interest inventory results	24	25	23	16	33	16	22	21	25	33	26	25
Career education courses	17	19	14	12	20	12	20	15	10	21	17	21
Pre-college summer seminars	10	8	12	8	14	10	8	9	3	6	12	6
People Related												
Father/male guardian	61	60	61	60	56	62	61	59	55	59	65	62
H.S. math or sci. teacher(s)	48	49	47	55	53	55	44	45	54	44	51	48
College teacher(s)	44	41	50	40	55	42	47	39	47	42	45	48
Mother/female guardian	44	41	49	39	47	43	47	44	44	42	44	55
Friends	36	37	34	31	34	32	39	32	37	36	38	43
Male engineer(s)	32	32	32	23	29	29	38	32	30	31	31	38
Other relative	27	27	27	24	30	29	33	29	30	23	26	20
H.S. counselor(s)	22	24	18	22	27	19	23	22	26	20	24	19
College counselor(s)	22	21	26	14	33	14	25	21	17	28	25	18
Female engineer(s)	8	4	15	7	7	5	8	11	12	8	9	8
Activity Hobby Related												
Using a computer	32	28	39	27	35	26	28	48	18	33	29	37
Construction hobbies	31	40	16	37	41	23	35	30	33	20	37	27
Mechanical hobby	29	40	12	40	50	20	16	28	33	20	49	24
Science Fiction	23	24	20	29	15	22	16	33	33	17	23	26
Technical publications	21	25	14	33	22	22	16	23	24	13	19	27
Building electrical devices	20	26	12	16	24	12	7	54	12	13	17	18
Outdoor activities	19	21	17	11	41	12	32	10	49	13	15	12
Building model airplanes	18	26	5	42	9	13	12	21	16	14	23	20
Science Fair participation	16	18	12	16	18	20	9	19	18	16	15	13
Farm Experiences	15	20	8	3	82	6	13	10	15	10	15	9
Hobby Magazine	15	22	4	31	19	14	8	20	8	10	20	9
Flying aircraft	12	14	8	27	6	6	8	15	10	8	17	13
Science Clubs	12	13	11	8	11	18	7	13	21	11	11	19
Junior Achievement	4	5	3	2	4	3	3	5	5	7	3	2

TO=Total AE=Aeronautical CE=Civil IE=Industrial
M=Male AG=Agricultural EE=Electrical ME=Mechanical
F=Female CH=Chemical GM=Geological/Mining NE=Nuclear

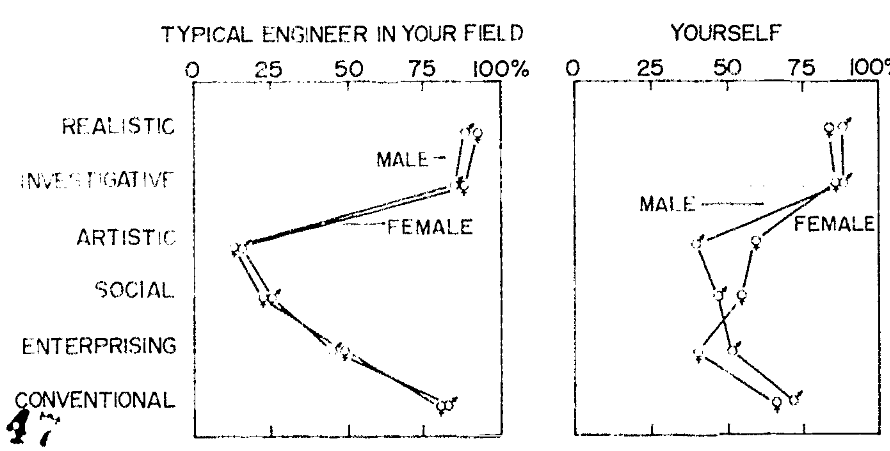


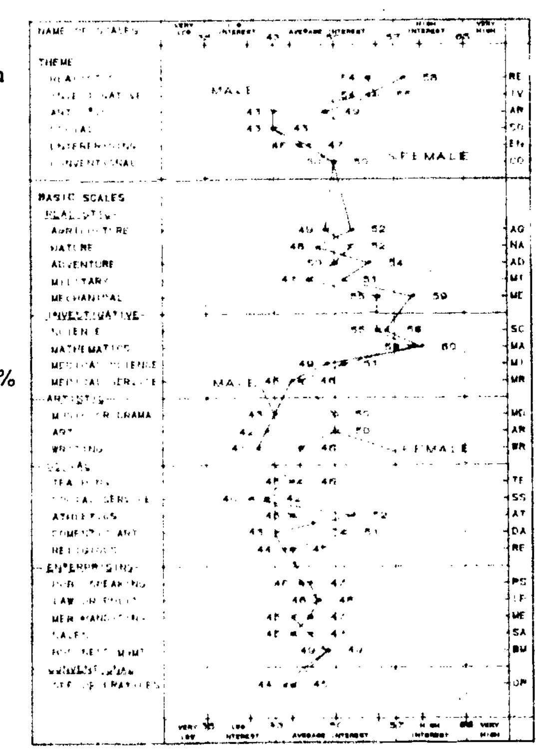
Figure 5 Percentage of Men and Women Engineers Who Rated Various Occupational Themes as "Very Similar" or "Similar" to the Typical Engineer in Their Field and to Themselves.

TABLE 8: Means for Total, Sex, and Current Main Career Field and Standard Deviations for the Total Group of Engineering Graduates for the Purdue Interest Questionnaire

SCALE	TO	SEX M	SEX F	CURRENT MAIN CAREER FIELD AE	AG	CH	CE	EE	EN	IE	ME	NE	RE	STANDARD DEV.
ENGINEERING SPECIALTY														
Aeronautical Engr	33	35	31	49	37	35	31	41	29	21	37	38	32	15.1
Agricultural Engr	39	41	37	36	49	37	45	34	44	35	43	37	40	11.4
Chemical Engr	42	41	45	40	38	50	41	40	48	43	39	44	44	10.6
Civil Engr	37	37	38	31	39	32	50	28	43	36	37	36	38	11.5
Electrical Engr	37	38	37	44	36	39	29	50	31	34	37	39	35	11.8
Industrial Engr	33	32	34	22	25	33	28	27	28	48	32	30	31	14.2
Interdisciplinary Engr	48	48	48	47	50	50	48	48	54	44	49	49	49	10.5
Mechanical Engr	42	44	40	43	46	42	39	40	37	40	50	43	40	11.5
Nuclear Engr	40	43	41	48	43	46	38	46	40	35	44	49	42	12.2
FUNCTION														
NEW DEVELOPMENTS:	45	45	44	54	51	46	45	49	47	34	46	48	44	11.6
Research	34	33	35	45	39	38	31	39	35	26	34	39	33	14.7
Development	40	40	41	49	40	45	30	49	37	37	40	44	39	12.4
Design	40	42	38	42	50	36	51	40	41	28	44	40	39	12.7
APPLICATIONS:	42	43	41	35	41	39	44	38	39	50	44	38	41	11.5
Operations	41	41	41	33	36	42	37	37	38	52	41	38	40	10.6
Production/Maintenance	39	39	39	32	36	37	35	36	34	49	41	36	37	10.5
Construction	25	26	23	16	29	16	43	17	28	22	24	22	26	15.7
MANAGEMENT:	45	45	45	37	40	45	43	42	45	52	43	43	47	11.1
Technical Management	43	43	43	36	38	45	41	40	42	52	43	41	44	11.5
Nontechnical Mgmt	31	31	32	23	23	31	28	27	30	43	28	29	32	13.9
Sales/Service	30	31	30	21	27	30	31	28	29	36	30	27	31	12.1
EDUCATIONAL LEVEL														
Bachelors Degree Only	39	40	38	36	40	33	43	37	36	42	39	36	38	10.4
Some Grad.Work - Engr	45	46	45	52	49	45	46	48	46	39	47	47	44	10.3
Some Grad.Work - Nonengr	44	44	44	36	39	43	42	40	42	53	43	40	45	11.2
Masters - Engineering	44	44	43	51	50	44	49	46	46	34	45	46	42	11.2
Masters - Bus. Admin	43	42	43	33	37	43	41	40	40	53	41	39	43	12.3
Doctorate	39	38	40	47	41	43	34	44	38	33	39	43	38	12.6
SAMPLE SIZE	2025	1248	777	58	100	192	316	267	56	205	318	75	101	

TOT - Total
M - Male
F - Female
AE - Aeronautical Engineering
AG - Agricultural Engineering
CH - Chemical Engineering
CE - Civil Engineering
EE - Electrical Engineering
EN - Environmental Engineering
IE - Industrial Engineering
ME - Mechanical Engineering
NE - Nuclear Engineering
RE - Resource (Mining, Geological Petroleum) Engineering

Figure 6 *Strong-Campbell Interest Inventory* Mean Profiles for Men and Women Engineers for Occupational Themes and Basic Interest Scales.



lenge or liking for problem solving). Men were more influenced by hobby activities than were women, while women were somewhat more influenced by certain job characteristics than were men (e.g. independence, challenge).

Interest Measures

The Strong Campbell Interest Inventory (SCII) includes scales to measure six occupational themes: realistic, investigative, artistic, social, enterprising and conventional. Survey respondents were asked to rate how well each of the occupational themes described themselves and the typical engineer in their field. The percentage of men and women engineers rating each theme as "very" or "somewhat similar" to the typical engineer in their field and to themselves is illustrated in Figure 5. Both men and women agreed that the typical engineer is realistic, investigative, and conventional. In addition, they rated themselves as most similar to these same three themes. Those engineers who actually took the SCII likewise scored highest on the realistic, investigative, and conventional themes (see Figure 6). Survey respondents rated themselves higher on the artistic and social themes than they rated the typical engineer in their field, and women rated themselves as more similar to the artistic theme than did men. Among those who took the SCII, women scored higher than did men on the artistic theme. Thus, engineer's self-reports of their occupational orientations were very consistent with their scores on the occupational themes on the *Strong-Campbell Interest Inventory*.

Figure 6 illustrates the typical interest pattern of the men and women engineers who took the SCII. Among basic interest scales, engineers scored high on the mechanical activities, science and mathematics scales, but low on the social service, religious activities, office practices, teaching, and medical service scales. The men demonstrated low scores on the basic interest scales under the artistic theme while women's scores were average on these scales.

Table 8 illustrates the mean scale scores from the *Purdue Interest Questionnaire* (PIQ) broken down by sex and current job field. Engineering specialty scale scores greater than 40 indicate the individual is similar to engineers in that specialty. The higher the score, the greater the degree of similarity. Scores below 25 represent dissimilarity to engineers in that field. Likewise, high scores on the functional and educational level scales indicate the individual (or group) is similar to engineers who perform that function or have attained that educational level.

As the table illustrates, engineers scored highest on the scale corresponding to their field. There is significant variation across fields on the functional scales. For the educational level scales, most fields scored highest on graduate work or masters degree in engineering, the exceptions being industrial engineers who scored highest on the non-engineering graduate work or masters in business administration scales.

Examination of score differences between men and women revealed that sex bias occurred only with the Mechanical Engineering Scale of the PIQ where men scored significantly higher than women ($p < .005$). Within-field score differences were also examined across ethnic groups in a particular field and no significant difference was found.

In summary, the survey results depict engineers as working primarily in manufacturing and private business and being quite satisfied with their jobs. Their selection of an engineering career was heavily influenced by the nature of engineering work; engineers also rated the characteristics of their work as being very important to their job satisfaction. The analysis of the interest inventories indicated that most scales do not demonstrate sex or ethnic bias and are consistent with current employment. The *Purdue Interest Questionnaire* appears to be a promising instrument for counseling engineering students, especially when used in conjunction with a general interest inventory such as the *Strong-Campbell Interest Inventory*.

APPENDIX F

F-1 Factors Influencing the Career Development of Recent Engineers

F-2 Abstract-Utility of Cognitive and Noncognitive Factors in Predicting Academic Status and Curricular Specialization of Beginning Engineering Students

F-3 Androgyny and Job Performance in a Male-Dominated Field

F-4 Engineering Profiles for the Eighties: Electrical and Mechanical Engineers

F-5 Utility of SAT Scores in Predicting Engineering and University Retention

F-6 The New Engineer: Black and White, Male and Female

F-7 Interest Profiles of Professional Engineers

F-8 Engineering Careers: Women in a Male-Dominated Field

RWI

FACTORS INFLUENCING THE CAREER DEVELOPMENT OF RECENT ENGINEERS

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Summary

Preliminary results from a national survey of professional engineers were used to examine the factors affecting the career decisions of men and women engineers who had completed their bachelor's degree since 1975. Few differences between men and women were found in the survey results. Women decided to go into engineering at a later time than did men and were less influenced by hobbies in making this decision.

Both men and women were primarily influenced by work-related factors such as challenge, liking for problem-solving and opportunity to be creative in their decision to become an engineer. Other major influences included high school math and science courses and college engineering courses.

There were few differences in the employment patterns and professional activities of men and women who recently graduated in engineering. Men were a little more likely to be satisfied with their career development, more satisfied with their initial jobs and to have more supervisory responsibilities in their current (1981) jobs. Women on the other hand were more likely to belong to more than one professional society and to have taken short courses in management.

Factors that were most important to engineers in their jobs included satisfying work and an opportunity to use their skills and abilities in challenging work. Aside from these intrinsic work-related factors, engineers were concerned with having a pleasant social environment to work in.

A significant finding in this study was the overwhelming number of engineers interested in pursuing graduate education. The vast majority of the respondents had already started graduate work or indicated plans to do so. This is contrary to the widely held view that few graduates continue their education. However, a significant proportion of our respondents planned to pursue graduate work in management and on a part-time basis.

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Introduction

During the past ten years, there has been a dramatic increase in the proportion of women students enrolled in engineering programs. As of 1980, women represented 14.5% of the freshman engineering students compared to less than three percent in 1970.[1] Numerous factors have been identified as contributing to this dramatic increase including (1) changes in the job market, (2) recruitment of women engineers by industry, and (3) a change in the societal attitude toward women's roles.[2] As engineering becomes a more open field for women, the characteristics of the women who enroll in engineering programs may change.

In this paper, we will examine and compare factors contributing to the career decisions and career satisfaction of men and women engineers who have completed their Bachelor's degree within the past seven years. Chi Square analyses of frequencies were used to test for sex differences. Differences that were statistically significant at the .05 level or less are noted.

Description of the Sample

The data presented below are derived from the preliminary results of the National Engineering Career Development Survey conducted at Purdue University under a grant from the National Science Foundation. This survey was mailed to a national sample of men and women members of several major engineering societies who agreed to participate in the study. A subsample of the respondents who received their Bachelor's degree in 1975 or later was selected for this analysis. Within this subsample, men and women were matched by year of graduation and society membership. The sample discussed in this paper consisted of 262 pairs of matched men and women engineers. The percentage of respondents that graduated in each of the past seven years included 10% (1975), 11% (1976), 16% (1977), 22% (1978), 26% (1979), 14% (1980), and 1% (1981). In addition, the percentage of respondents from each of the participating engineering societies were 3% (ANS), 10% (AIChE), 30%(ASCE), 9% (IEEE), 26% (ASME), 7% (AIIE), 4% (ASME of AIME), and 11% (ASAE). Eighty-seven percent of these engineers were employed full-time in engineering positions. The rest of the respondents were either employed part-time or in non-engineering positions. Table 1 illustrates the major characteristics of the

TABLE 1

Job Characteristics for First Job After BS and Present Position.

	First Job After BS		Present Job	
Type of Employer	M	F	M	F
Manufacturing	36%	43%	39%	45%
Other Business	46	40	45	41
Government	12	11	12	10
Health/Education	6	5	4	4
(No. of Cases)	(257)	(255)	(258)	(252)
Principal Field	M	F	M	F
Civil	26	23	24	24
Mechanical	21	21	29	19
Other Engineering	15	14	20	18
Chemical/Petroleum	10	12	9	8
Agricultural	8	4	7	4
Electrical/Computer	8	7	8	10
Industrial	7	6	7	5
Non-Engineering	4	7	6	5
Environmental	1	6	0	7
(No. of Cases)	(255)	(252)	(259)	(251)
Function	M	F	M	F
Design	29	26	32	27
Research & Develop.	17	22	18	22
Pre-Profes./Other	16	18	12	11
Operatn., Produc.	14	11	13	13
Test., Construc.	13	11	10	10
Management	4	4	7	9
Sales	3	2	2	2
Consulting	3	6	5	6
(No. of Cases)	(252)	(251)	(257)	(249)

respondent's first job after receiving the B.S. degree and the current (1981) job. There were no statistically significant differences between men and women in terms of these job characteristics. Most of the respondents were employed by manufacturing firms or some other type of business. The largest proportion of the respondents were involved either in design or in research and development as their primary function.

Of the respondents 93% were white (non-Hispanic) and about half of them were married. However, a significantly larger proportion of women (90%) than of men (76%) reported having no children. The women were somewhat more likely to have fathers with professional positions than were the men (50% vs 38%). However, men and women were equally like to have fathers who were engineers (18% men, 22% women) and mothers who were working during the respondent's college years (53% men, 54% women). In addition, 27% of the women were married to professional engineers while only three percent of the men had married professional engineers. Among those who were married, 86% of the women reported that their spouse had a Bachelor's degree or a more advanced degree compared to 46% of the spouses of men. This difference is probably a function of several factors including societal attitudes, age when married and the relative proportion of men and women enrolled in college engineering programs. Finally, the majority of the respondents had attended public high schools (85%) and public colleges or universities (71%).

Career Decision

Table 2 presents responses to a question

TABLE 2

Time of Engineering Career Decision.

	First Considered		Final Decision	
Time	M	F	M	F
Before High School	23%	9%	6%	2%
Grades 9-10	22	11	8	2
Grades 11-12	39	46	48	33
During 1st year of college	8	15	18	26
During 2nd year of college	4	8	11	19
During 3rd or 4th year of college	1	7	5	10
After college	2	6	4	9
(No. of Cases)	(251) ***	(255)	(255) ***	(250)

*** $p < .001$

concerning when the respondents decided to study engineering. The majority of both the men and the women first considered engineering as a career during the last two years of high school. However, a larger proportion of men (45%) than women (20%) had considered engineering before their last two years of high school. In general, the women's initial and final decisions to become an engineer occur later than the men's decisions ($p < .001$).

Aside from the timing of their career decision, there were also differences among the men and women in terms of how strongly various factors influenced their decision to study engineering. Table 3 presents the percent of men and women who rated various factors as of "very" or "some" importance in their career decision. In general, the most influential factors are related to the characteristics of the jobs held by engineers. These factors include challenge, liking for problem solving activities, being curious or creative, and salary. All of these factors except salary relate to intrinsic satisfaction derived from engaging in engineering work. Aside from work-related factors, respondents rated high school math and science courses and college engineering courses as very influential. The most influential people included father, mother, and high school and college teachers.

There were some significant differences between men and women in their perceptions of how

TABLE 3
Percentage of Men and Women Respondents Rating the Following Factors as Very or Somewhat Important in Influencing Their Decision to Study Engineering.

	Total	Male	Female
People			
Father/male guardian	64	66	62
Mother/female guardian	49	49	49
H.S. math or sci. teacher(s)	47	49	44
College teacher(s)	44	40	49*
Male engineer(s)	33	34	31
Friends	33	34	33
Other relative	31	32	30
H.S. counselor(s)	23	27	19
College counselor(s)	22	20	23
Female engineer(s)	11	7	15**
Courses			
College engineering	79	77	81
H.S. science	66	67	64
H.S. math	66	62	69
College math	54	51	58
College science	47	47	47
College physics	45	46	44
College chemistry	33	33	32
Career education	17	18	15
Guidance and Testing			
Career or occupation infor.	57	60	54
Aptitude tests	43	43	43
Interest inventory results	25	26	24
Hobbies and Activities			
Like problem solving	86	85	88
Being curious or creative	81	82	81
Wanting to be of service	47	47	47
Relevant work experience	39	46	33**
Using a computer	35	31	40*
Construction hobbies	30	42	18***
Mechanical hobby	26	41	11***
Outdoor activities	24	25	23
Science Fiction	22	24	19
Science Fair participation	17	23	11***
Technical Publications	16	22	10***
Building electrical devices	16	23	8***
Farm experiences	15	17	13
Building model airplanes	14	24	4***
Science Clubs	12	14	11
Hobby Magazine	12	21	2***
Pre-college summer seminars	11	8	13
Flying aircraft	11	15	6**
Junior Achievement	4	3	4
Work			
Challenge	87	83	90
Salary	79	78	80
Creativity	72	70	74
Independence	70	61	78***
Type of work	66	65	66
Security	63	60	66
Prestige	61	58	65
Leadership	56	49	64***
Rapid Advancement	51	46	55

* $p < .05$
** $p < .01$
*** $p < .001$

strongly the various factors influenced their career decision. Although very few respondents were influenced by female engineer(s), women were more likely to report this as an important factor than were men. Women also rated the importance of leadership and independence more highly than did men. Although less than half of the respondents viewed hobbies and hobby magazines as important, men were more likely to rate them as important than were women.

Respondents were also asked to indicate which of the factors was most influential in their choice of engineering specialty. The most frequently cited factors for both men and women included challenge, liking for problem-solving, and college engineering courses. Finally, it should be noted that the majority (71%) of both men and women respondents were satisfied with their choice of occupation.

Education

Of particular interest were the educational aspirations of the respondents and their attitudes toward further education. Table 4 presents

TABLE 4
Current and Planned Educational Level of Survey Respondents.

Educational Level	M	F
Current		
BS, no graduate work	47%	47%
BS, some graduate work	19	21
MS, engineering	26	26
MBA	4	3
MS,other non-engr. field	1	0
Ph.D.	1	1
Other	3	2
(No. of Cases)	(257)	(259)
Planned	M	F
No further education	12	8
Some Eng.grad work-no degrees	21	18
Some Mgt.grad work-no degrees	12	10
MS Engineering	15	19
MBA	20	25
MS other non-engineering	[illegible]	
MS engineering & non-engr.		4
Ph.D. engineering	[illegible]	5
Ph.D. non-engineering		3
Other	[illegible]	3
Content Summary-Graduate Work		
Engineering graduate work	46	42
Engr. & non-engr. grad work	2	4
Non-engineering graduate work	36	42
Degree-Content Summary		
MS or Ph.D. engineering	25	24
MS engineering & non-engr.	2	4
Ms or PhD non-engr.	24	32
(No. of Cases)	(257)	(258)

information about the current and planned education of our respondents. There were no significant differences among the men and women in terms of their current and planned educational level. About half of the respondents had already engaged in graduate work beyond the Bachelor's degree. In addition, 26% of the respondents had already completed a Master's degree. Only 12% of the men and eight percent of the women did not plan any further education. Of those who did not plan any further education approximately half had not already engaged in some graduate work. Thus, only about five percent of the engineers surveyed had not participated in further education and did not plan to. Forty-six percent of the men and 42% of the women plan to do graduate work in engineering while 32% of the men and 35% of the women were planning graduate work in management. In general, both men and women respondents seem to personally feel a need for graduate work since 95% of them had already started or planned to pursue graduate courses and over half of them expected to get advanced degrees. However, when asked about their opinion of graduate education, 63% of the respondents agreed that a Bachelor's degree is sufficient preparation for an engineer and that no graduate work is needed. About half of the respondents agreed that graduate work is needed in management or engineering. Hence, there appears to be a minor discrepancy between the respondents' personal educational plans and their opinion of the need for graduate education. It may be that some of the respondents feel an engineer can adequately perform his or her work with a Bachelor's degree, but that additional education is needed for career advancement. This latter hypothesis is supported by the large number of engineers seeking training in management. When asked to state a preference among graduate programs oriented toward design, research, or management, the management-oriented program received the most endorsements (48%), compared to design (27%) and research (20%).

Job Satisfaction

In this section we will explore similarities and differences between men and women engineers in terms of how satisfied they are with their jobs and the job characteristics which are important to them personally. We will also examine the respondents assessment of various factors which may interfere with career development.

Table 5 illustrates the responses of the men and women engineers in our sample to questions concerning job satisfaction and the nature of their jobs. Clearly the majority of respondents are satisfied with their present job. However, a larger proportion of the women than the men were not satisfied with their first job. This may be partially a function of the perceived relevance of their educational background. Job satisfaction was significantly related to perceived relevance of educational background for both the first job after B.S. and the present job. Those who were satisfied with their job were more likely to perceive their educational background as relevant to their job than were those who were not satisfied with their job. This relationship between job satisfaction and relevance of educational background was stronger for the first job after B.S. graduation than for the present job. In general, the respondents indicated that their first job was primarily technical in nature with little supervisory responsibility. Present jobs are characterized as somewhat more administrative with higher levels of technical and supervisory responsibility. The men in our sample reported significantly more supervisory responsibility for their present job than did the women. In addition, a larger proportion of men (70%) than women (56%) reported being very satisfied with their progress in their occupation ($p < .02$).

Given these differences in supervisory responsibility and career progress, how do men and women compare in terms of professional

TABLE 5
Job Satisfaction, Relevance of Education, Technical Supervisory Responsibility and Salary on First and Present (1981) Job.

	1st Job After BS		Present Job	
Satisfaction with Work	M	F	M	F
Satisfied	70%	56%	80%	74%
Neutral or Dissatisfied	30	44	20	26
(No. of Cases)	(249)	(247) **	(255)	(245)
Relevance of Education	M	F	M	F
Must have/very important	55	58	62	60
Important	28	20	25	23
Some Importance	10	17	10	12
Little or No Importance	7	6	2	5
(No. of Cases)	(254)	(254) *	(257)	(250)
Supervisory Responsibility	M	F	M	F
None	56	63	43	56
Supervision of Non-Professionals	36	32	39	35
Superv. of Prod.& Mgt.	8	5	18	9
(No. of Cases)	(252)	(253)	(259)	(250) **
Technical-Admin. Function	M	F	M	F
Technical	71	71	61	62
Technical-Administrative	22	27	27	27
Administrative (tech.)	6	6	11	9
Admin. (non-tech.)	1	2	1	2
(No. of Cases)	(242)	(240)	(251)	(241)
Technical Responsibility	M	F	M	F
Simple-Limited	12	15	5	6
General-Standard	78	74	74	73
Complex-Pioneering	10	11	21	21
(No. of Cases)	(252)	(251)	(257)	(248)

	First Job		Present Job	
Annual Salary	Male	Female	Male	Female
Upper Quartile	$21,300	20,900	28,200	27,600
Median	17,900	18,200	25,300	25,000
Lower Quartile	14,900	15,800	22,800	22,800
(No. of Cases)	(174)	(177)	(240)	(231)

* $p < .05$
** $p < .01$

activities? Women were significantly ($p < .01$) more likely to belong to two or more national societies than were the men (52% vs 40%). When asked to indicate whether or not they had engaged in a number of different technical activities during the past year, men and women engineers responded similarly. The vast majority of our respondents (90%) read about engineering or science and many discussed engineering developments with their associates (76%). Only about 20% reported taking an engineering or science course during the past year. However, more women (32%) than men (24%) had attended a short course or workshop on management ($p < .05$). Only 22% had attended a national technical meeting while even fewer had presented one or more technical papers (7%). The small number of respondents reporting this type of activity may reflect the fact that the majority are recent graduates. Finally, 58% of the engineers in our sample were registered engineers in training.

What types of factors do engineers feel are important in a job? Table 6 presents a rank ordering of a number of job factors based on the percent of recent graduates who rated each factor as "very" important to them personally. It also includes the rank based on the percentage who indicated each factor was very characteristic of their present position. Only total group percentages are reported in this table since there were very few sex differences. The only significant differences between men and women involved the importance ratings of flexible working hours and the availability of personal leave. Women rated these factors as more important than did the men which is consistent with our findings in a previous survey.[3] The most important factor was the "opportunity to engage in satisfying work" followed by the "opportunity to use my skills and abilities in challenging work." These two factors involve intrinsic rewards derived from engaging in the work. It is interesting to note that the factors which influenced the engineer's decision to study engineering were also intrinsic. Engineers also expressed some concern about their social work environment. This is reflected in the high ranking of factors such as "pleasant people to work with" (ranked 6th), and "a position where people are interested in working together and not encouraging petty jealousies" (ranked 3rd). Although salary was viewed as fairly important (ranked 5th), social status and prestige was rated last.

TABLE 6
Rank Order of Various Job Factors in Terms of Importance and Degree to Which They Characterize Present Jobs.

	Imptnce Rank	%	Charac Rank	%	Rank Dif.
Engage in satisfying work	1	84	11	32	-10
Opportunity to use skills	2	80	7	38	-5
Interest in working together	3	76	19	26	-16
Co. well-managed/progressive	4	71	26	19	-22
Comfortable income	5	69	3	44	2
Pleasant co-workers	6	69	4	42	2
Superiors delegate respon.	7	67	6	40	1
Participate in decisions	8	61	25	20	-17
Propose new ideas	9	59	12	32	-3
Freedom to manage own work	10	58	8	38	2
Advance economically	11	56	17	27	-6
Freedom in personal life	12	56	14	31	-2
Desirable geographic location	13	52	2	46	11
Co. realizes home responsibility	14	51	16	30	-2
Personal leave available	15	51	5	42	10
Know responsibilities exactly	16	50	18	26	-2
Be original and creative	17	40	24	22	-7
Up-to-date on new develop.	18	48	20	26	-2
Job security	19	48	15	30	4
Work with ideas	20	47	21	25	-1
Variety of technical work	21	47	13	31	8
Problems with no easy solutions	22	45	9	38	13
Work with people	23	44	1	46	22
Exercise leadership	24	43	29	17	-5
Move into a management career	25	43	10	34	15
Opportunity to help others	26	36	31	15	-5
Prepare/top level careers	27	36	35	10	-8
Flexible working hours	28	35	23	24	5
Make significant contributions	29	34	34	12	-5
Co-workers interested/new devel.	30	33	30	16	0
Work with things	31	31	22	25	9
Freedom from pressure	32	26	32	14	0
Assigned to different areas	33	23	28	18	5
Travel opportunities	34	21	27	19	7
Select own work projects	35	19	36	6	-1
Enhance status/prestige	36	19	33	12	3

There is a positive relationship between the rank ordering based on importance ratings and the rank order based on characteristic ratings. The Spearman Rank Order Correlation between the two rankings is .64 which is significant at the .01 level. A comparable degree of relationship has been found between importance and characteristics ratings in an earlier survey of Purdue engineering graduates.[4]

Although there is a high degree of correspondence between the importance and characteristic rank orderings, differences between the ranks of each individual item can give us some insight into how discrepant the engineer's jobs are from their ideal jobs. Negative rank differences represent factors which are more important to the engineers than they are characteristic of their jobs. Positive discrepancies represent factors that are more characteristic of the jobs than important. As Table 6 illustrates, the greatest discrepancies occurred for the "opportunity to work with people" and "company is well-managed and progressive." Working with people was very characteristic of the engineers' jobs, but of less importance relatively to them. On the other hand, the engineers tend to place working in a "well-managed and progressive company" and "participating in work-related decisions" as important, but they do not rate these factors as likely to be characteristic of their jobs. In general, the high correspondence between the importance and characteristic ratings may reflect the generally high level of job satisfaction in the sample.

Aside from characteristics of the job or work setting, there are a number of situational factors which can affect the individual's career development. Table 7 presents a rank ordering of various situational factors which were rated as

TABLE 7

Rank Order Table of the Percentage of Male and Female Engineers Rating Various Factors as Having a Major/Moderate Influence on Their Career Development.

Factor	T	M	F
Geographical location	53	48	58*
Other demands on time	47	48	46
Unsatisfactory work opportunities	29	25	29
Demands of spouse's career	22	17	28**
Little financial incentive to work	15	19	12
Unfavorable co-worker attitude	14	12	16
Travel demands of your job	13	14	12
Lack of adequate household help	11	6	15**
Small children at home	11	14	9
Anti-nepotism policy	8	6	11
Unfavorable family attitudes	7	8	6
Poor personal health	5	5	4
Unfavorable attitudes of friends	3	3	3

* $p < .05$
** $p < .01$

having a "major" or "moderate" influence on career development. The most highly rated factor was the geographical location of jobs which was somewhat more of a problem for women than men. Given that many of the women were married to professional people, this may reflect the problem of a dual-career couple. The only other major career influence was other demands on the individual's time which affected about half of the men and women in the sample. Women were more likely than men to cite demands of spouse's career and lack of household help as a problem. However, these factors were highly rated by only a small proportion of the sample. In general, the factors presented did not have a large impact on our respondents. The engineers in our sample were not greatly affected by negative attitudes of friends, family, or coworkers, and most of them did not have children.

Finally, our respondents were asked to indicate the extent to which they agreed with a number of statements concerning the role of women in the work force. Table 8 presents the percentage of men and women agreeing with these statements. In general, both men and women have favorable attitudes toward working women. However, a greater proportion of women than men agree with the statements. The largest discrepancy in the opinions of the men and women concerned working mothers. While 77% of the women felt a mother of preschool children could work full time and still fulfill her maternal duties, only 41% of the men supported this statement. This type of discrepancy could lead to some difficulties for women engineers who choose to resume full time employment shortly after having a child. However, the fact that more than half of the male respondents agreed with all of the other statements reflects a fairly positive attitude toward women in the work force.

TABLE 8

Percentage of Men and Women Engineers Agreeing with Statements Concerning the Role of Women in the Work Force.

	Total	Male	Female
1. Women can assume industry leadership roles	91	90	93
2. Women can be successful engineering competitors	96	92	100***
3. Women are good self-confident engineers	92	87	98***
4. Women engineers do not have to sacrifice femininity	83	74	92***
5. Pregnancy does not make women less effective engineers	73	64	82***
6. Full-time employed mother as good as mother not employed	59	41	77***
7. Wife's career more important than helping husband in his career	64	56	73***

*** $p < .001$

Conclusion

In conclusion, there were few differences between men and women recent engineering graduates in terms of their job characteristics or career influences. Women tended to decide to go into engineering at a later time than did men and were slightly less satisfied with their first jobs. Men and women were equally satisfied with their present jobs and had similar technical responsibilities, although men had more supervisory responsibility and were more satisfied with their progress in their career.

Both men and women engineers were attracted to engineering as a career because of intrinsic work-related factors such as challenge, problem-solving activities and opportunities to be creative. A similar group of intrinsic work-related factors was rated as very important to the engineers in their jobs. Aside from factors related to the type of work, men and women were influenced by high school math and science course and college engineering courses in their decision to study engineering.

The overwhelming majority of the respondents had already begun taking graduate courses or indicated plans to do so. About a third of the respondents planned to pursue graduate work in management compared to about half who planned engineering graduate work. Since most of the respondents were employed full-time, it is quite probable that they will pursue their graduate work on a part-time basis.

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A B S T R A C T*

Shell, Kevin Duane. Ph.D., Purdue University, August 1982. Utility of Cognitive and Noncognitive Factors in Predicting Academic Status and Curricular Specialization of Beginning Engineering Students. Major Professor: J. F. Feldhusen.

The primary purpose of the present study was the examination of the utility of pre- or early-college cognitive and noncognitive factors in predicting later academic status and curricular specialization of students who had begun college as engineering students. Also of major concern were effects of different sample representations or of nonnormally distributed measures upon differentiation results. Cognitive data included SAT scores, high school rank, and average grades in math, science, and English. Noncognitive data included the students' sex, socioeconomic status (SES) measures, and interest scores from the Strong-Campbell Interest Inventory (SCII) and the Purdue Interest Questionnaire (PIQ).

During their first semester in fall 1976, 419 beginning engineering students took the two inventories. They were followed up eight semesters later and classified according to both academic status and specialization field. From this original sample was selected a subsample of 317 students who proportionally (by field) represented the 1975 beginning student population as of eight semesters later.

The majority of the 63 factors were statistically distributed nonnormally and were thus normalized. Each factor was examined as normalized and nonnormalized data as well as with the original sample and the modified sample. Single-factor ANOVA was performed on each factor under each of the four conditions, and several discriminant analyses were performed on various sets of the factors.

x

Results indicated that cognitive and noncognitive factors were approximately equally useful in predicting academic status, but certain of the noncognitive factors were much more useful than the cognitive factors in predicting specialization. Of special importance, although specialization is a subgrouping of academic status, many factors which differentiated specializations did not differentiate academic status groups. In addition, SATs were no more useful in differentiating groups than other cognitive factors or even some noncognitive factors. Finally, with differences in group representation or with nonnormally distributed factors, the utility of only a few factors varied appreciably. However, under such conditions the set of factors selected for multi-factor prediction tended to be somewhat different while giving comparable reclassification results.

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Androgyny and Job Performance in a Male-Dominated Field

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ABSTRACT

The relationships between androgyny and self-report measures of job performance, satisfaction, self-concept of abilities, and attitudes towards women in the engineering work force were examined for a sample of male and female engineers. The androgynous and masculine sex-typed groups reported significantly higher levels of job performance, job satisfaction and self-concept of abilities than did the feminine sex-typed and undifferentiated groups regardless of sex. The androgynous group was not significantly different from the masculine sex-typed group on any of the measures of job performance or self-concept of abilities. For the measure of attitudes towards women in the engineering work force, females tended to be more favorable than were males regardless of their sex-typed grouping. Analysis of self-report measures did not support the hypothesis that androgynous persons perform better in a male-dominated field than do masculine sex-typed persons. It appears that the presence of instrumental traits is related to higher levels of self-reported job performance and satisfaction in engineering.

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Androgyny and Job Performance in a Male-Dominated Field*

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Recent research in the area of masculine and feminine personality characteristics has led to conflicting results concerning the adaptive value of androgyny. Bem and her colleagues (Bem 1975; Bem & Lenney, 1976; Bem, Martyna & Watson, 1976) have argued that androgyny facilitates adjustment in terms of behavioral flexibility. Androgynous individuals can more easily adapt to cross-sex typed activities in the laboratory setting than sex-typed individuals. In addition, androgynous individuals have been found to have higher levels of self-esteem (Spence, Helmreich, & Stapp, 1975). Majors, Carnevale, and Deaux (1981) have also reported that androgynous individuals are better liked and are perceived to be better adjusted than sex-typed individuals. Heilbrun (1981) has found that androgynous college women are more satisfied with their performance and are rated as more competent than their sex-typed female peers. However, this relationship was not found for male college students. These results would lead one to hypothesize that in a male-dominated field such as engineering, androgynous individuals should evidence greater satisfaction and higher levels of performance than sex-typed individuals at least where women are concerned. However, other research suggests that the instrumental characteristics endorsed by individuals classified as masculine sex-typed or androgynous may be more predictive of performance in a male-dominated field (see Spence and Helmreich, 1979; Lubinski, Tellegen & Butcher, 1981; Motowidlo, 1982).

The present research was conducted to investigate the relationship between sex-typing and self-reported job satisfaction and performance in the male-dominated field of engineering. In particular, we were interested in determining whether or not androgyny would lead to greater levels of satisfaction and performance for males as well as females, or if simply the presence of instrumental traits would be associated with greater levels of satisfaction and performance.

Method

Subjects

Subjects in this study represent a subsample of the respondents to a national survey of career patterns in engineering. Subjects in the national survey were selected from nine different engineering societies. The subsample of 346 men and 346 women used in this study were matched by year of B.S. graduation and society membership. In addition, the subsample was limited to respondents who received their B.S. degree since 1975.

* This research was supported by grant No. SED79-19613 from the Research in Science Education (RISE) program of the National Science Foundation. Grantees undertaking such projects under NSF sponsorship are encouraged to express their judgement in professional and technical matters. Points of view or opinions do not, therefore, necessarily represent official National Science Foundation procedures or policy.

Procedure

Respondents completed the instrumental and expressive scales of the Personal Attributes Questionnaire (Spence & Helmreich, 1978) as well as an extensive survey and interest inventory. Instrumental and expressive scores were formed by summing the designated item responses for respondents with complete data. Table 1 contains the means and medians for the instrumental and expressive scales. Men scored significantly higher than did women ($t(707)=2.40$, $p<.02$) on the instrumental scale but the difference between the groups was not significant on the expressive scale. Consistent with the results of Spence and Helmreich (1978), there was a low positive correlation between the instrumental and expressive scales ($r=.055$, $p>.05$).

INSERT TABLE 1 ABOUT HERE

Total group medians were used to divide the group into four sex-typed groups according to the following scheme:

Classification	Instrumental	Expressive
Androgynous	Above Median	Above Median
Masculine Typed	Above Median	Below Median
Feminine Typed	Below Median	Above Median
Undifferentiated	Below Median	Below Median

Table 2 presents the percentage of men and women engineers classified into these four sex-typed groups. There is a significant difference between the percentage of men and women classified into each group ($x^2(3)=8.38$, $p<.05$). Women engineers were more likely to be classified as feminine sex-typed than were men (30% vs. 22%), but there was little difference between the percentage of women and men classified as masculine sex-typed (24% vs. 22%).

INSERT TABLE 2 ABOUT HERE

For comparison purposes, the engineers were also classified into the four sex-typed groups using the medians reported by Spence and Helmreich (1978) for a college sample. Table 2 displays the percentage of engineers and college students classified in this manner. The college median on the instrumental scale (21) was lower than the engineers' median while the college median on the expressive scale (23) was higher than the engineers' median. Using the college medians, the engineers are more likely to be classified as masculine sex-typed as compared to the classification using their own medians. Using college medians, women engineers were less likely to be classified as feminine sex-typed and undifferentiated and were more likely to be classified as masculine typed and androgynous than were the college women. The male engineers tended to be classified similar to Spence and Helmreich's (1978) male college students.

The engineers' responses to various items on the survey dealing with job performance, job satisfaction, self-concept of abilities and attitudes towards women in the engineering work force were analyzed using a procedure recommended by Taylor and Hall (in press). Taylor and Hall suggest the use of factorial analysis of variance to test the main effects of the instrumental and expressive scales as well as the interaction between the two scales. Taylor and Hall explain that the presence of a main effect for both the instrumental and expressive scales would suggest that androgyny (the presence of both instrumental and expressive traits) is associated with higher scores on the dependent measure (assuming the significant main effects reflect a positive relationship with the dependent variable). If only one scale is consistently found to be related to the dependent variable, the concept of androgyny may not be relevant to the measures being examined. In accordance with this recommendation, our analyses involved 2 X 2 X 2 analyses of variance and covariance using the following three factors: Instrumental scale (above and below the engineers' median), Expressive scale (above and below the engineers' median), and Sex (male and female).

Results

Job Performance

Several items on the survey were designed to assess the individuals job performance. The items included level of supervisory responsibility, level of technical responsibility, and annual salary. Supervisory responsibility was recorded on a nine-point scale ranging from no supervisory responsibility to holding the highest administrative post and technical responsibility was recorded on an eight-point scale ranging from simple procedures requiring no previous knowledge to pioneering work requiring outstanding knowledge of advanced techniques. In addition, respondents were presented with a list of 17 professional activities and were asked to check those they had engaged in during the past year. The list included items such as completing a graduate course in engineering or science, reading a new book about engineering or science or presenting a paper at a professional meeting.

Since there were significant differences among the groups in terms of the average number of years of professional experience in engineering, analysis of covariance was used. A 2 X 2 X 2 analysis of covariance was performed on each dependent variable. Table 3 contains the adjusted group means for men and women classified into the four sex-typed groups.

INSERT TABLE 3 ABOUT HERE

A significant main effect for the instrumental scale was found in the analysis of supervisory responsibility ($F[1,622]=9.69$, $p<.002$, $w^2=.01$), technical responsibility ($F[1,619]=15.43$, $p<.001$, $w^2=.02$), annual salary

($F[1,578]=5.87$, $p<.02$, $w^2=.01$), and professional activities ($F[1,636]=13.75$, $p<.001$, $w^2=.02$). For each dependent variable, the adjusted group means for the androgynous and masculine typed group were significantly higher than were the adjusted group means for the feminine typed and undifferentiated groups. The only significant effect for the expressive scale occurred when salary was examined ($F[1,578]=6.62$, $p<.01$, $w^2=.01$) with those high on the expressive scale (androgynous and feminine typed groups) reporting significantly lower salaries than did those low on the expressive scale (masculine typed and undifferentiated groups). Finally, men tended to reported higher levels of supervisory responsibility than did women ($F[1,622]=16.27$, $p<.001$, $w^2=.02$).

A significant three-way interaction was found for the professional activities variable ($F[1,636]=4.50$, $p<.04$, $w^2=.01$). Among men, the androgynous and masculine typed groups had higher means than did the feminine typed and undifferentiated groups. However, only the comparisons between the feminine typed group and the masculine typed and androgynous groups were significant ($p<.05$). Among the women, the undifferentiated group had the lowest mean which was significantly different from the masculine typed group which had the highest mean. The means for the feminine typed and androgynous groups fell inbetween these extremes and were not significantly different from either extreme. No other significant main effects or interaction effects were found on the job performance variables.

The results indicated that the instrumental scale is consistently related to the self-report measures of job performance examined, while the expressive scale is not. However, it is important to note that the magnitude of the observed effects is quite small.

Job Satisfaction

Job satisfaction was examined in two different ways. First of all, respondents made a global rating of their general level of satisfaction with their present job. This rating was made on a five-point scale ranging from "very dissatisfied" to "very satisfied". An analysis of covariance was performed on these ratings and the adjusted group means are displayed in Table 3. Years of professional engineering experience was used as a covariate since there is some evidence to suggest that people are generally less satisfied in their first few years of employment. The results indicated a significant effect for the instrumental scale ($F[1,617]=8.13$, $p<.005$, $w^2=.01$). The androgynous and masculine typed groups reported higher levels of satisfaction than did the feminine typed and undifferentiated groups. No other significant effects were found for general job satisfaction ratings.

Satisfaction was also examined using a procedure developed by LeBold and Woods (1970). Respondents were given a list of 36 statements describing positive aspects of a job. They rated each item in terms of how important it was to them personally and how characteristic it was of their present job. A factor analysis of the importance ratings was conducted using a randomly selected sample of respondents from the entire group of engineers who completed the survey. A principal axis factor analysis was conducted with squared multiple Rs in the diagonals followed by a varimax rotation. This analysis suggested three major factors. The first factor involved 13 items dealing primarily with intrinsic aspects of the job (e.g., "opportunity to use my skills and abilities in challenging work," "opportunity to be original and creative"). The second factor consisted of 12 items concerning career advancement opportunities (e.g. "a chance to exercise leadership", "adequate prepartion for top level careers"). Finally, the third factor involved 11 items which focussed on the working conditions (e.g. "pleasant people to work with", "flexible working hours"). Scale scores were formed by averaging the respondents ratings of each of the items on a given scale. Only respondents who completed all of the items on a given scale were included in the analysis. This procedure resulted in six scale scores, three for importance ratings and three for characteristic ratings. Cronbach's alpha was computed for each of the scales. The alpha values ranged from .75 to .89. According to LeBold and Wood (1970), importance ratings reflect how much the individual values given job factors. We have typically found that importance ratings of the items in this list are quite high (LeBold & Wood, 1970; Jagacinski & LeBold, 1981). On the other hand, characteristic ratings are more reflective of satisfaction with the job.

2 X 2 X 2 analyses of variance were conducted on the importance and characteristic ratings. Table 4 displays the group means for the importance and characteristic ratings of each factor. All ratings were made on a four-point scale and it is clear that the importance ratings are higher than the characteristic ratings. The analysis of variance of the importance ratings resulted in a significant main effect for the instrumental scale on the intrinsic factors ($F[1,659]=30.88$, $p<.001$, $w^2=.04$) and career advancement opportunities ($F[1,663]=54.81$, $p<.001$, $w^2=.07$). A significant main effect for the expressive scale was found for all three factors: intrinsic factors ($F[1,659]=21.88$, $p\leq.001$, $w^2=.03$), career advancement opportunities ($F[1,663]=13.03$, $p<.001$, $w^2=.02$), and pleasant working conditions ($F[1,651]=40.81$, $p<.001$, $w^2=.06$). There were no significant effects for sex or any interaction effects. The presence of main effects for both the instrumental and the expressive scales for the intrinsic job factors and career advancement opportunities implies that the androgynous engineers value these factors more than the other sex-typed groups do. In fact, the androgynous group does have the highest group mean on these two variables followed by the masculine typed, feminine typed and undifferentiated groups in that order. The androgynous group rated intrinsic job factors and career advancement opportunities as significantly more important than did the masculine typed group. On the other hand, pleasant working conditions are valued more highly by individuals who rated themselves highly on the expressive scale regardless of their score on the instrumental scale.

INSERT TABLE 4 ABOUT HERE

Table 4 also contains the respondents' mean ratings of how characteristic each factor is of their present job. LeBold and Wood (1970) have found these ratings to be highly related to other measures of job satisfaction. The analysis of intrinsic job factors resulted in significant main effects for the instrumental scale ($F[1,644]=12.65$, $p<.001$, $w^2=.02$) and for sex ($F[1,644]=6.10$, $p<.02$, $w^2=.01$). Men in our sample found their jobs to be characterized by intrinsic job factors to a greater extent than did women. Androgynous and masculine typed engineers also had higher ratings than did feminine typed and undifferentiated engineers.

A more complex relationship was found for the career advancement opportunities. Significant main effects were found for the instrumental scale ($F[1,642]=16.71$, $p<.001$, $w^2=.02$), the expressive scale ($F[1,642]=4.78$, $p<.03$, $w^2=.01$) and sex ($F[1,642]=5.29$, $p<.03$, $w^2=.01$). However, a significant interaction between the expressive scale and sex was also found ($F[1,642]=6.75$, $p<.01$, $w^2=.01$). For men, there was no appreciable difference between the ratings of those high and low on the expressive scale. However, for women those high on the expressive scale found their job characterized by career advancement opportunities to a greater extent than did those low on the expressive scale. The main effect for the instrumental scale was characterized by those high on the instrumental scale (androgynous, masculine typed) reporting higher ratings than those low on the scale (feminine typed, undifferentiated).

Finally, the analysis of pleasant working conditions revealed only a significant main effect for the expressive scale ($F[1,622]=7.80$, $p<.005$, $w^2=.01$) with those high on the scale rating their jobs as more characterized by pleasant working conditions than did those low on the scale.

Although many significant effects were found for the importance and characteristic ratings, only a small proportion of the variance was accounted for in each case. In terms of the characteristic ratings, the androgynous group was not significantly different from the masculine typed group.

Self-Concept of Abilities

Survey respondents were asked to rate themselves on various abilities relative to the average adult who has attended college. These ratings were made on a five-point scale ranging from "lowest 10 percent" to "highest 10 percent". Most of the engineering respondents rated themselves as above average on most of the items. Several scales were formed by averaging responses to related items: verbal abilities (e.g. writing ability, public speaking ability), academic skills (e.g. problem solving ability, mathematical ability), self-confidence (intellectual self-confidence, leadership ability) and mechanical/visual skills. Cronbach's alpha for these scales ranged from .73 to .82. One might anticipate that items of this type should be related to self-esteem and hence should result in the highest ratings by androgynous persons.

Table 5 presents the group means on each of the variables. For each of the self-concept scales, a significant main effect for the instrumental scale was found: verbal abilities ($F[1,689]=68.15$, $p<.001$, $w^2=.08$) academic skills ($F[1,685]=78.18$, $p<.001$, $w^2=.10$), self-confidence ($F[1,686]=292.84$, $p<.001$, $w^2=.29$), and mechanical/visual skills ($F[1,687]=55.52$, $p<.001$, $w^2=.07$). In each case, the androgynous and masculine typed groups rated themselves higher than did the feminine typed and undifferentiated groups. In addition, men rated themselves higher than women did in terms of academic skills ($F[1,685]=5.48$, $p<.02$, $w^2=.01$) and mechanical/visual skills ($F[1,687]=36.42$, $p<.001$, $w^2=.05$). For verbal abilities, women rated themselves higher than did men ($F[1,689]=6.35$, $p<.02$, $w^2=.01$) and there were two significant interactions for this variable. An interaction between the instrumental and expressive scales ($F[1,689]=16.38$, $p<.001$, $w^2=.02$) revealed that among those low on the instrumental scale there was a significant difference in the ratings of those high and low on the expressive scale with the high expressives rating themselves higher. Respondents who were high on the instrumental scale rated their verbal abilities high regardless of their score on the expressive scale. A similar interaction pattern was found between the expressive scale and sex ($F[1,689]=4.99$, $p<.03$, $w^2=.01$). Men who were high on the expressive scale rated their verbal abilities higher than men low on the expressive scale, while women rated their verbal abilities highly regardless of their score on the expressive scale.

INSERT TABLE 5 ABOUT HERE

Several complex interactions for the self-confidence scale were also found. There was a significant main effect for the expressive scale on self confidence ratings ($F[1,688]=4.38$, $p<.04$, $w^2=.01$), with those high on the scale (feminine typed and androgynous groups) expressing greater self-confidence. However, the interpretation of this main effect must be qualified due to the presence of several interactions. There was a significant interaction between the expressive and instrumental scales ($F[1,688]=7.12$, $p<.008$, $w^2=.01$) and a significant three-way interaction ($F[1,688]=6.75$, $p<.01$, $w^2=.01$). Analysis of the differences among the interaction patterns revealed that women low on the instrumental scale rated their self-confidence higher when they were high on the expressive scale as compared to being low on the expressive scale. Differences between the self-confidence ratings of those high and low on the expressive scale for all other sex by instrumental scale groupings were not significantly different.

As in the previous analyses, the instrumental scale had a much stronger influence on these self-report ratings than did the expressive scale. Differences between the ratings of androgynous and masculine typed engineers (men and women combined) were not statistically significant. In addition, an examination of the pattern of means within sex shows that among women engineers the mean for the masculine typed group is higher than the mean for the androgynous group on three of the four measures examined. This pattern is contrary to the pattern reported by Spence and Helmreich (1978) when group means on the Texas Social Behavior Inventory were examined. Spence and Helmreich reported that the androgynous group had a higher mean score than the masculine typed group. The discrepancy may be partially a function of the fact that the items used in this study deal primarily with performance abilities (e.g. math, leadership, public speaking) and not with abilities to interact effectively with others.

Attitudes Towards Women

Survey respondents were given a series of statements concerning attitudes towards women in the engineering work force. Respondents indicated their extent of agreement with the statements on a four-point scale. Some example items were: "Women are competitive enough to be successful in engineering", "The possibility of pregnancy does not make women less desirable as employees than men." Responses to the seven attitude items were averaged for each respondent and analysis of variance was conducted on these derived scores. The only significant effect was for sex ($F[1,609]=222.55$, $p<.001$, $w^2=.27$) with a significant proportion of the variance accounted for. Women expressed more favorable attitudes than did men regardless of their sex-type classification. Table 6 illustrates the group mean ratings.

INSERT TABLE 6 ABOUT HERE

Spence and Helmreich (1978) report generally low correlations between the instrumental and expressive scales and their own attitude towards women scale. However, when they compared the attitudes of the four sex-typed groups within sex, they found more favorable attitudes among masculine typed females and feminine typed males than the other groups. This pattern was not found in the present study.

Discussion

Table 7 summarizes the significant main effects observed in all the analyses conducted. The results of this study support the hypothesis that self-reported job performance, job satisfaction, and self-concept of abilities are significantly related to the instrumental scale of the Personal Attributes Questionnaire (PAQ). Relationships between these measures and the expressive scale were much weaker and often qualified by interaction effects. There was little evidence to support the hypothesis that androgynous men or women would report greater performance and satisfaction than their masculine typed colleagues. Instead, both the androgynous and masculine typed groups consistently reported greater satisfaction, performance, and self-concept of abilities scores, than the feminine-typed and undifferentiated groups. This result is consistent with recently reported findings concerning behavior in work settings (Motowidlo, 1982).

INSERT TABLE 7 ABOUT HERE

A possible limitation of this study concerns the exclusive use of self report data. The relationships found for the job performance variables, need to be examined with more objective measures. It is also important to note that the magnitude of the effects for the instrumental scale on job performance and job satisfaction measures were quite small. Future research should be directed towards examining other personality and situational variables which may explain differences in job performance and satisfaction among men and women in male-dominated professions.

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TABLE 1

Group Means and Medians for the Scales from the Personal Attributes Questionnaire

	Instrumental	Expressive
Males		
Mean	23.34	22.13
Median	23.43	22.01
N	354	351
Females		
Mean	22.61	22.45
Median	22.74	22.24
N	355	355
Total		
Mean	22.98	22.29
Median	23.02	22.11
N	709	706

TABLE 2

Percentage of Males and Females Classified into Each Sex-Typed Group

Classification by means of:

Classification Group	Engr. Medians Engineers Males	Engr. Medians Engineers Females	College Medians* Engineers Males	College Medians* Engineers Females	College Medians* Students Males	College Medians* Students Females
Androgynous	35	28	35	33	32	27
Masculine Typed	22	24	40	37	34	14
Feminine Typed	22	30	8	14	8	32
Undifferentiated	21	18	17	16	25	28
(No. of Cases)	(346)	(353)	(346)	(353)	(715)	(715)

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*Spence and Helmreich (1978)

TABLE 3

Adjusted Group Means for Self-Report Measures of Job Performance and General Job Satisfaction

Group	Level of Supervisory Responsibility		Level of Technical Responsibility	
	Males	Females	Males	Females
Androgynous	2.88	2.39	4.59	4.69
Masculine Type	2.91	2.10	4.79	4.79
Feminine Type	2.40	1.88	4.57	4.13
Undifferentiated	2.35	1.78	4.35	4.17
	Annual Salary in Thousands		Number of Professional Activities Engaged In	
	Males	Females	Males	Females
Androgynous	26.0	24.8	7.03	6.57
Masculine Type	27.6	25.8	7.16	7.21
Feminine Type	24.0	24.1	6.00	6.47
Undifferentiated	25.8	24.6	6.57	6.00
	Job Satisfaction			
	Males	Females		
Androgynous	4.03	4.05		
Masculine Typed	4.06	3.96		
Feminine Typed	3.91	3.84		
Undifferentiated	3.99	3.48		

TABLE 4

Factors Related to Job Satisfaction

	Mean Ratings of Personal Importance		Mean Ratings of How Characteristic of Present Job:	
	Intrinsic Job Factors			
	Male	Female	Male	Female
Androgynous	3.51	3.56	2.98	2.97
Masculine Typed	3.38	3.37	3.05	2.86
Feminine Typed	3.38	3.34	2.90	2.82
Undifferentiated	3.26	3.27	2.85	2.65
	Career Advancement Opportunities			
	Male	Female	Male	Female
Androgynous	3.38	3.44	2.95	2.99
Masculine Typed	3.32	3.34	3.02	2.84
Feminine Typed	3.23	3.20	2.88	2.82
Undifferentiated	3.05	3.10	2.82	2.57
	Pleasant Working Conditions			
	Male	Female	Male	Female
Androgynous	3.40	3.52	3.04	3.07
Masculine Typed	3.24	3.24	3.03	2.95
Feminine Typed	3.44	3.45	3.08	2.98
Undifferentiated	3.27	3.33	2.94	2.83

TABLE 5

Group Means for Self-Concept of Abilities

Group	Verbal Abilities		Academic Skills	
	Males	Females	Males	Females
Androgynous	3.70	3.64	4.11	4.02
Masculine Typed	3.62	3.90	4.07	4.06
Feminine Typed	3.41	3.51	3.83	3.76
Undifferentiated	3.09	3.24	3.80	3.65
	Self-Confidence		Mechanical/Visual Skills	
	Males	Females	Males	Females
Androgynous	4.18	4.01	4.04	3.82
Masculine Typed	4.04	4.18	4.09	3.80
Feminine Typed	3.51	3.59	3.69	3.44
Undifferentiated	3.36	3.38	3.81	3.42

TABLE 6

Group Means
Attitude Towards Women in the
Engineering Work Force

Group	Males	Females
Androgynous	2.86	3.50
Masculine Typed	2.98	3.47
Feminine Typed	2.87	3.55
Undifferentiated	2.96	3.52

TABLE 7

Summary of Significant Main Effects
from Analyses of Variance and Covariance

Dependent Variable	Instrumental (I)	Expressive (E)	Sex (S)
Job Performance			
Supervisory Responsibility	++		+++
Technical Responsibility	+++		
Professional Activities	+++		
Salary	+	-	
Job Factors-Importance			
Intrinsic Factors	+++	+++	
Career Advancement	+++	+++	
Working Conditions		+++	
Job Factors-Characteristic			
Intrinsic Factors	+++		+
Career Advancement	++	+*	+*
Working Conditions		++	
Job Satisfaction	++		
Self-Concept of Abilities			
Verbal Abilities	+++		-
Academic Skills	+++		+
Self Confidence	+++	+**	
Mechanical/Visual Skills	+++		+++
Attitude Towards Women			---

p<.05 + or -
p<.01 ++ or --
p<.001 +++ or ---

+ High>low or Male>female
- Low>high or Female>male

*Significant ExS Interaction: Effect of expressive scale holds for females only.

**Significant IxE and IxExS Interactions: Effect for expressive scale holds only for females low on instrumental scale.

ENGINEERING PROFILES FOR THE EIGHTIES: ELECTRICAL AND MECHANICAL ENGINEERS

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Summary

Comparisons among men and women members of IEEE and ASME were made in terms of their responses to the 1981 National Engineering Career Development Survey. The sample was limited to men and women who had received their bachelor's degree since 1975. In general, few significant differences were found. Those differences found were more likely to be a function of sex than society membership.

Consistent with the results of previous surveys, men in this sample tended to decide on a career in engineering earlier than did the women. However, both men and women were highly influenced by the nature of engineering work in their decision to study engineering.

Although more than half of the engineers in the sample felt that a bachelor's degree was sufficient preparation for a career in engineering, 89% of the respondents planned to continue their education. About one-half of these respondents planned to continue their studies in engineering, the rest expecting to continue in a nonengineering field such as management. A larger percentage of women than men had already begun graduate work.

Most of the respondents were working for some type of manufacturing firm and described their jobs as primarily technical. Men were somewhat more likely to report higher levels of supervisory responsibility than were women. Members of ASME were more likely to be involved in the areas of energy and fuel supplies and environmental protection while members of IEEE were more likely to be involved in communications and crime prevention and control.

The engineers in this sample took part in a variety of professional activities such as attending technical meetings and reading about new developments in their field. Members of ASME were more likely to be registered professional engineers or engineers-in-training than were members of IEEE.

The vast majority of respondents were satisfied with their jobs and their choice of engineering as a career. In terms of the importance of various job characteristics, engineers in this sample felt it was most important to have a job which provides an opportunity to apply one's skills in challenging work and to engage in satisfying work. A larger percentage of women than men rated the availability of personal leave and flexible working hours as very important in a job.

Fifty percent of the respondents felt that engineering opportunities were better for minorities than whites (although the reverse was true for minorities). Women tended to feel there were better engineering opportunities for men than women while men were more likely to endorse the opposite viewpoint. However, men did express generally favorable attitudes towards women in the engineering work force.

Finally, respondents described the typical engineer in their field and themselves as being realistic, investigative and conventional. The members of IEEE rated themselves as somewhat more investigative than did the members of ASME. In addition, our respondents were more likely to rate themselves as artistic and social than the typical engineer in their field.

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Introduction

During the past few years, there has been a dramatic increase in the popularity of engineering as an undergraduate college major. Increases in the engineering enrollments of U.S. colleges have also involved an increase in the number of women and minorities studying engineering. The relative increase in the proportion of women studying engineering has been much more dramatic than the relative increase in the proportion of under-represented minorities. Given these changes in the engineering pool, it will be useful to take a closer look at recent engineering graduates. In this paper we will specifically examine similarities and differences between men and women who recently became members of the Institute of Electrical and Electronics Engineers and the American Society of Mechanical Engineers. Several different areas will be examined includ-

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ing 1) Career Decisions: When do students typically decide on a career in engineering? What factors influence this decision?, 2) Education: What is the current and planned level of education of today's engineers? How do engineers rate the usefulness of their education for their jobs? What are their opinions concerning the need for further education?, 3) Job Status and Professional Activities: What types of jobs do these engineers hold? To what extent do engineers participate in professional activities?, 4) Job Satisfaction: How satisfied are these engineers with their jobs? What factors do they perceive to be important in a job?, and 5) Self Assessments: What do these engineers view as their major strengths? How do they describe themselves and the typical engineer in their field?

Method

Data Base

The data for this paper are derived entirely from the 1981 National Engineering Career Development Survey conducted at Purdue University under a research grant from the National Science Foundation. This survey was mailed to a national sample of men and women members of several major engineering societies including the Institute of Electrical and Electronics Engineers (IEEE) and the American Society of Mechanical Engineers (ASME). Surveys and interest inventories were sent to 580 members of IEEE and 567 members of ASME with return rates of 43% and 57%, respectively. We will limit the present discussion to the career surveys completed by respondents from these two societies who received their bachelor's degree in 1975 or later. Hence our focus will be on recent engineering graduates. In order to control for years of experience, the men and women selected from each society were matched by year of BS degree. This procedure decreased the sample size considerably. The current sample consists of 33 men and 33 women members of IEEE and 83 men and 82 women members of ASME. As will be pointed out later, members of these societies do not necessarily have a bachelor's degree in electrical or mechanical engineering, although the vast majority do. Although generalizations derived from these data are limited to recent graduates who join these major societies, independent analyses made by current field of employment or college major in electrical or mechanical engineering resulted in almost identical results.

Statistical Analysis

In this paper, chi square analyses of frequencies were used to test for differences among the four groups (IEEE men, IEEE women, ASME men, ASME women). Primary attention will be focused on differences that are statistically significant at the .05 level or less.

Results

Description of the Sample

There were few significant differences between men and women, or between IEEE and ASME members, in terms of their demographic characteristics. The sample consists primarily of white respondents (93%) with four percent Asian-Pacific Islanders two percent Blacks and two percent Hispanics. Fifty percent of the respondents were married, but only 26% indicated that they had children. Men were more likely to indicate that they had children than were women (34% vs. 18%). Of those who were married, 64% of the women were married to engineers versus only 4% of the men. In addition, the spouses of women engineers were more likely to have post-baccalaureate degrees than were the spouses of men (38% vs. 0%). Ninety percent of the respondents were employed full-time in engineering, the rest being employed part-time, doing graduate work or working in nonengineering-related careers. The median number of years of professional experience in engineering was three. The median number of years of engineering experience for men in IEEE was slightly higher (3.8), while the median for women (2.6) in IEEE was slightly lower. However, this difference was not statistically significant.

Career Decisions

Time of Decisions. When did IEEE and ASME members typically decide to go into engineering? Table 1 presents information concerning when respondents first considered going into engineering and when they made their final decision. There is a significant sex difference for the timing of both decisions. As can be seen, men initially considered and finally decided on a career in engineering earlier than did women.

TABLE 1
Time of Engineering Career Decision

		IEEE		ASME	
First Considered [c]	T	M	F	M	F
Before or during grade 10	43%	45%	19%	65%	30%
11-12th Grade	34	30	44	25	41
During or after college	23	24	37	10	30
(No. of cases)	(229)	(33)	(32)	(83)	(81)
Final Decision [c]					
Before or during grade 10	13	21	3	17	9
11-12th grade	40	45	15	57	31
During/after college	47	33	82	26	60
(No. of cases)	(225)	(33)	(33)	(81)	(78)

c=$p<.001$.

Factors Influencing Career Decision. Table 2 presents a list of factors which could influence an individual to pursue a career in engineering and the percentage of respondents from each group who rated each factor as important in their own decision to study engineering. The most highly rated factors (e.g., liking for problem solving, challenge) are related to the types of problems engineers confront in their jobs. Generally, work-related factors were most

TABLE 2
Percentage of Respondents Rating the Following Factors as of "Very" or "Some" Importance in Influencing Their Decision to Study Engineering

		IEEE		ASME	
	T	M	F	M	F
Work					
Like problem solving	87	88	88	84	94
Challenge	86	85	85	83	90
Being curious or creative	81	91	85	81	75
Salary	79	79	76	83	76
Creativity	71	85	73	63	72
Independence	66[a]	67	73	54	76
Security	63	58	67	61	65
Prestige	59	55	76	58	56
Type of work	59	59	67	58	58
Leadership	49	52	52	37	58
Rapid advancement	48	39	52	48	51
Relevant work experience	38	49	27	40	37
Wanting to be of service	36[a]	52	30	25	43
School Related					
College engineering courses	76	69	81	70	84
H.S. math courses	67[a]	49	59	68	78
H.S. science courses	64[a]	61	45	74	64
College math courses	56	50	72	49	59
College science courses	47	52	53	47	43
College physics courses	47	50	38	48	49
College chemistry courses	24	19	29	29	20
Career education courses	13	12	13	20	8
Career or occupational info.	54	56	58	55	51
Aptitude tests	48	60	49	46	46
Interest inventory results	25	34	30	27	18
Pre-college summer seminars	11	0	15	11	13
People					
Father/male guardian	62[a]	46	49	76	60
H.S. math or sci. teacher(s)	49	55	50	49	46
Mother/female guardian	45	46	30	55	40
College teacher(s)	41	33	55	35	44
Friends	34	24	46	39	30
Male engineer(s)	31	21	49	30	29
Other relative	28	42	24	30	22
H.S. counselor(s)	21	36	9	21	19
College counselor(s)	20	18	22	21	20
Female engineer(s)	9[b]	6	22	1	14
Activities, Hobbies					
Mechanical hobby	40[c]	42	12	70	18
Using a computer	38[c]	49	73	21	38
Construction hobbies	33[c]	44	21	50	17
Building electrical devices	29[c]	82	39	28	3
Science Fiction	26	42	33	22	20
Building model airplanes	19[b]	19	15	33	5
Hobby Magazine	19[c]	42	0	34	1
Science Fair participation	18[b]	30	21	24	6
Technical publications	15[c]	30	9	22	4
Flying aircraft	15	12	12	22	10
Outdoor activities	14	6	9	22	12
Science Clubs	11	18	9	15	5
Farm Experiences	10[a]	3	9	17	5
Junior Achievement	3	6	3	1	3

a=$p<.05$, b=$p<.01$, c=$p<.001$

influential, followed by engineering, math and science courses. ASME members were more likely to be influenced by high school math and science courses than were IEEE members. In general, there are few differences among men and women members of IEEE and ASME in their ratings of the importance of these factors. As can be seen in Table 2, most of the significant differences occur in reference to activities and hobbies. As a group, the set of activities and hobbies were rated fairly low in importance, although men were more likely to rate them as important than were women. However, women members of IEEE were more likely to be influenced by use of a computer than were any of the other groups of respondents.

Education

Educational Level. As mentioned earlier, not all respondents from IEEE or ASME received their bachelor's degree in electrical or mechanical engineering. As can be seen in Table 3, although over 90% of the respondents from ASME received their bachelor's degree in mechanical engineering, only 77% of the men and 48% of the women respondents from IEEE received a bachelor's degree in electrical engineering. An additional 10% of the men and 10% of the women respondents from IEEE received their degree in computer

TABLE 3
Educational Background, Plans and Opinions Regarding Graduate Work

		IEEE		ASME	
	T	M	F	M	F
Field of BS [c]					
Electrical Engineering	17%	77%	48%	0%	0%
Mechanical Engineering	69	3	0	96	91
Other Engineering	8	17	24	1	6
Nonengineering	6	3	28	2	2
(No. of cases)	(223)	(30)	(29)	(82)	(82)
Current Educational Level [b]					
BS Degree Only	52	55	41	63	44
Some Engr. Graduate Work	19	14	37	18	15
Some Nonengr. Graduate Work	29	31	22	19	41
(No. of cases)	(226)	(29)	(32)	(83)	(82)
Planned Educational Level					
None	11	10	10	16	9
Advanced Study-Engineering	45	33	48	46	46
Advanced Study-Nonengineering	44	57	42	39	45
(No. of cases)	(226)	(30)	(31)	83)	(82)
Preferred Graduate Program					
Design-Oriented	25	25	26	32	17
Research-Oriented	17	6	26	14	21
Management-Oriented	52	63	45	52	53
Other	6	6	3	3	10
(No. of cases)	(225)	(32)	(31)	(81)	(81)
Opinions on Graduate Work					
BS Enough	65	75	58	67	64
In-House Courses Enough	50	47	49	49	52
Non-Credit Courses Enough	56	71	61	56	48
Need Grad Work-Management	48	59	45	45	49
Need Grad Work-Math/Science	25	25	34	19	29
Need Grad Work-Engineering	47	39	56	45	48

b=$p<.01$, c=$p<.001$

engineering, a highly related field. Twenty-eight percent of the women respondents from IEEE received their bachelor's degree in a nonengineering field (e.g., computer science 7%, math/stat 10%). However, a large proportion of women in IEEE have pursued graduate study in engineering as is evident in Table 3. In general, women from both societies were more likely to have pursued an advanced degree than were men, but there were no significant differences among the groups in terms of their plans for additional education. This sex difference in current educational level becomes negligible when the sample is limited to engineers with a BS degree in electrical, computer or mechanical engineering.

Attitudes Toward Graduate Work. Eighty-nine percent of the respondents planned to continue their education, but only half of them planned to continue in engineering. Management appears to be the primary nonengineering field attracting engineers for graduate study. Over one-half of the respondents indicated they would prefer a management-oriented graduate program to a program emphasizing design or research. Although the majority of our respondents plan to continue their education, 65% of them agreed that a bachelor's degree was sufficient preparation for work in their field. Hence, it appears that our respondents are not continuing their education out of a sense of necessity, but more likely as a means of advancing their careers. Over one-half of the respondents reported that their educational background was a "must" or "very important" for both their first job and their present job.

Job Status and Professional Activities

What types of jobs do these IEEE and ASME members have? It is interesting to note that over one-half of the respondents received early on-the-job experience through Co-op employment or other engineering-related employment during their undergraduate years. Women members of ASME were somewhat more likely to have had this experience than were any of the other respondents (69% vs. 51% all others).

Present Job Status. Survey respondents answered a number of questions regarding the status of their present (1981) job. For roughly one-half of the respondents, their present job was their first job after receiving their BS degree. Table 4 summarizes the information on job status. The majority of the respondents worked in some form of manufacturing in the field of electrical or mechanical engineering or a related branch of engineering (e.g., computer engineering). There was a significant difference among the groups in terms of job function. Women (especially women in IEEE) were more likely to be working in research or development, while men were somewhat more likely to be involved in sales, teaching or consulting. The majority of respondents viewed their present job as primarily technical in nature. Men rated their supervisory responsibilities significantly higher than did women. This sex difference in supervisory responsibility was especially evident among members of IEEE, where over a third of the men but only 3% of the women reported that their present job involved supervision of professional and/or managerial personnel. This difference may be partially a function of the slightly greater number of years of engineering experience of men in IEEE. There is a low positive correlation between years of engineering experience and level of supervisory responsibility ($r=.27$, $p<.01$). Finally, there was no significant difference among the groups in terms of (1981) salary, the median income being approximately $26,000.

TABLE 4
Job Characteristics

		IEEE		ASME	
Type of Employer [c]	T	M	F	M	F
Electrical/Electronics Manufacturing	21%	45%	42%	7%	15%
Durable Manufacturing (e.g. Machinery, Aircraft)	17	3	0	27	20
Other Manufacturing	21	3	18	21	31
Other Private Business	32	42	33	34	26
Government; Education	9	6	6	11	9
(No. of cases)	(229)	(33)	(33)	(82)	(81)
Principal Field [c]					
Electrical Engineering	16	58	38	4	3
Mechanical Engineering	43	0	0	59	62
Other Engineering	37	33	56	36	31
Non-Engineering	4	9	6	1	5
(No. of cases)	(229)	(33)	(32)	(83)	(81)
Function [a]					
Research/Development	26	16	50	18	29
Design	24	32	28	24	20
Operations, Production; Construction	24	13	13	30	28
Sales, Teaching; Consulting; Other	14	23	3	19	10
Management	11	16	6	8	14
(No. of cases)	(225)	(31)	(32)	(83)	(79)
Tech-Admin Function					
Technical	58	57	71	52	59
Technical/Administrative	28	33	13	36	24
Administrative	14	10	16	12	17
(No. of cases)	(220)	(30)	(31)	(81)	(78)
Technical Responsibility					
Simple-General	22	19	22	15	30
Standard	28	23	19	40	22
Complex-Pioneering	50	58	59	46	48
(No. of cases)	(227)	(31)	(32)	(83)	(81)
Supervisory Responsibility [a]					
None	51	35	69	47	55
Supervision Technical/Non-Technical Personnel	34	26	28	41	33
Supervision Professional & Managerial Personnel	15	39	3	12	13
(No. of cases)	(226)	(31)	(32)	(83)	(80)

a=$p<.05$, c=$p<.001$

Involvement in National Problems. Survey respondents also indicated their degree of involvement in a number of areas of national interest. Table 5 present the percentage of respondents in each group who had some involvement in problem areas of national concern. There were several significant differences among the groups. Members of ASME were more likely to be involved in energy and fuel supplies and environmental protection, while members of IEEE were more likely to be involved in communications and crime prevention and control. In addition, a greater percentage of men than women were involved with energy and fuel supplies and agricultural production.

TABLE 5
Percentage of Respondents Indicating Some Involvement in a Variety of Areas of National Interest

		IEEE		ASME	
Areas	T	M	F	M	F
Energy & Fuel Supplies	67[c]	69	33	81	65
Health	24	25	15	24	28
Defense	35	44	39	41	25
Environmental Protection	45[b]	37	21	54	51
Education	36	41	33	39	32
Space	19[a]	37	12	17	15
Crime-Prevention/Control	9[b]	26	12	5	4
Agricultural Prod.	16[c]	32	6	23	7
Welfare & Family Services	4	7	0	4	5
Community Development	16	19	9	19	16
Transportation	27	32	18	30	25
Communication	26[c]	39	51	19	18

a=$p<.05$, b=$p<.01$, c=$p<.001$

Professional Activities. Survey respondents were asked to indicate whether they had participated in a variety of professional activities during the past year. Eighty-nine percent of the respondents had read about new engineering and science developments. A larger percentage of ASME members (93%) than IEEE members (83%) subscribed to engineering or science periodicals while a larger percentage of IEEE (49%) than ASME (31%) members read new books about engineering and science. Twenty percent of the respondents had taken a nongraduate-credit course in engineering or science, while 24% completed a graduate credit course and 32% attended a short course on management. Twenty-three percent of all respondents had attended a national technical meeting, while 46% had attended a local technical meeting. There were no group differences on these latter activities. Over 95% of the respondents belonged to one or more professional societies, and 12% had published at least one article. A significantly larger percentage of ASME (62%) than IEEE (24%) members were registered professional engineers or engineers-in-training.

Job Satisfaction

Seventy-three percent of the respondents indicated that they were fully satisfied or felt they had made the best choice of engineering as a career. A majority of respondents (66%) was also fully satisfied or felt they were doing well with their progress in their career. Finally, in a global assessment of job satisfaction, 80% indicated that they were very satisfied or satisfied with their present job. There were no significant differences among the groups on these measures.

Respondents were further presented with a list of factors describing different aspects of professional positions which could affect their job satisfaction. Respondents rated how important each factor was to them personally and how characteristic it was of their present job. Table 6 presents the percentage of respondents in each group rating each factor as "very" important personally or "very" characteristic of their job. The factors have been rank-ordered according to their importance rating by the entire sample. As can be seen in the table, there were few differences among the groups in their ratings of these factors. The two most important factors were "opportunity to engage in satisfying work" and the "opportunity to use one's skills and abilities in challenging work." These factors tend to be intrinsic to the job itself. Next in importance were human relations factors: "people working together", "well managed/progressive company", and "pleasant people to work with". Women tended to rate several factors as being more important than did men, especially availability of personal leave, flexible working hours, and an opportunity to work with people. These sex differences were also found in a recent survey of Purdue graduates.[2] Perhaps women are more sensitive to factors such as personal leave and flexible working hours as a means of balancing a career and family life.

When we examine to what extent these factors are characteristic of the engineers' jobs, we notice that only one factor (opportunity to work with people) was rated highly by more than one-half of the respondents. In contrast, 16 of the 36 factors were rated as very important by at least one-half of the respondents. The large discrepancies between the percentage of respondents rating a factor as "very" important and the percentage rating the same factor "very" characteristic occurred for several factors including "a well managed progressive company" (70% vs. 20%), "people working together" (79% vs. 29%), "opportunity to engage in satisfactory work" (83% vs. 40%) and "opportunity to use skills and abilities in challenging work" (81% vs. 42%).

Most of the significant differences in characteristic ratings among the groups seem to involve factors that women members of IEEE rated as being more characteristic of their job than

TABLE 6

Percentage of Respondents Rating Various Job Factors as "Very" Important and "Very" Characteristic of Their Present Jobs (Ranked-Ordered by Importance Rating)

Job Factors	IMPORTANCE					CHARACTERISTIC				
		IEEE		ASME			IEEE		ASME	
	T	M	F	M	F	T	M	F	M	F
Engage in satisfying work	83	81	88	75	90	40	40	53	41	33
Opportunity to use my skills	81	71	94	77	85	42	43	59	35	40
People working together	79	74	73	75	87	27	20	31	27	27
Co. is well-managed/progressive	70	61	73	59	83	20	17	16	23	21
Pleasant people to work with	68	65	82	61	71	42	48	47	43	36
An income to live comfortably	67	74	58	66	70	47	30	44	49	53
Delegate responsibility	65	61	75	57	72	42	37	48	39	44
Opportunity to innovate	62	61	64	73	51	39	40	49	41	33
Participation-work related decisions	58	55	55	51	67	27	17	19	29	32
Freedom to manage own work	58	71	58	58	55	44	43	50	42	43
Personal leave available	54[a]	42	70	45	62	42	43	45	48	34
Freedom from pressure to conform	54	48	49	53	61	33	37	34	34	29
Advance economically	54	65	49	56	51	31	20	34	33	31
Be original and creative	53	58	55	55	47	30[a]	33	52	27	24
Company realizes home responsibility	52	39	50	56	53	34	37	31	36	33
Know exact responsibilities	51	39	55	54	52	31	23	36	35	27
Work with ideas	50	55	55	50	46	30[a]	33	50	30	20
Wide variety of technical work	49	32	58	49	53	36	47	44	27	37
Problems with no ready made solution	49	61	50	49	43	46	57	56	42	41
Desirable geographical location	49	45	46	51	49	48[a]	40	72	46	44
Opportunity to keep abreast	48	45	61	50	42	26	37	31	27	20
Job security due to technical attain.	46	48	61	39	47	34	30	53	30	33
Opportunity to work with people	42[a]	29	42	33	57	51[a]	40	45	42	65
Work with things	39	27	44	46	35	33	28	39	35	30
Move into a management career	39	45	30	38	42	41	43	38	36	46
Exercise leadership	38	39	49	32	39	21	17	22	20	25
Flexible working hours	36[b]	16	52	28	47	26[a]	37	44	22	20
Preparation for top level careers	34[a]	29	41	22	46	8	0	3	8	13
Co-Workers interested/new devel.	33[a]	26	52	25	35	17[b]	17	38	10	16
Opportunities to help others	33	29	30	36	32	16	20	9	19	14
Significant contributions to society	28	29	27	28	27	11	10	13	12	10
Freedom from pressure	26	29	30	22	29	18	10	19	22	16
Assigned to different areas	23	13	24	18	31	21	10	28	22	22
Select own work projects	19[a]	8	33	13	22	8	10	16	6	5
Opportunity to enhance social status	18	26	12	14	22	15	17	6	13	21
Travel opportunities	17	16	13	16	18	20	27	19	15	22

a=$p<.05$, b=$p<.01$

did any other group. These factors include an "opportunity to work with ideas," "opportunity to be original and creative" and "opportunity to work with colleagues interested in the latest developments in their field." These differences may possibly result from the large proportion of women from IEEE who are involved in research and development (50%), an area most likely to require creativity and innovation. In addition to these differences, there was a tendency for IEEE members to be more likely to rate their jobs as having flexible working hours than were ASME members.

Opportunities for Women and Minorities. Finally, in assessing the job market, respondents were asked to compare the engineering opportunities for whites and minorities and for men and women. There were no significant differences among the groups in terms of their perceptions of opportunities for whites and minorities. Fifty percent indicated that minorities had better opportunities than whites, 24% believed the opportunities were about equal, and 27% indicated that whites had better opportunities. These results are probably a function of the small proportion of minorities in the sample. [Analysis of this question by race/ethnic group using all survey respondents (n=2,852) showed that 75% of the Black, 42% of the Hispanic, and 71% of the foreign national respondents but only 34% of the whites believed engineering opportunities were better for whites than minorities.] When it came to evaluating opportunities for men and women, some significant differences were noted. Fifty-five percent of the IEEE and ASME men indicated that women had better opportunities than men, while only 37% of the women agreed with this viewpoint. In addition, ASME members were more likely than were IEEE members to say that women had better opportunities (51% vs. 34%, respectively).

Attitudes Toward Women. Further insight was provided in an analysis of attitudes towards women in the engineering work force. Table 7 presents the percentage of respondents from each group agreeing with a number of statements concerning the role of women in the work force. In general, all respondents have favorable attitudes towards working women; however, a greater proportion of women than men agree with the statements. Opinions among the men were somewhat divided concerning the effect of pregnancy on the effectiveness of women employees and whether or not a woman should be more concerned with helping her husband advance his career rather than working on her own. The largest discrepancy in the opinions of the men and women respondents concerned working mothers. While over 80% of the women believe that a full-time employed woman can be just as good a mother as a woman who is not employed, less than one-half of the men endorsed this viewpoint. This type of discrepancy could lead to some difficulties for women engineers who choose to resume full-time employment shortly after having a child. However, the general attitude towards women in the engineering work force seems favorable. The results reported here are consistent with the results from the analysis of all survey respondents (not restricted by society membership).[3]

TABLE 7

Percentage of Respondents Agreeing with Statements Concerning the Role of Women in the Work Force

		IEEE		ASME	
	T	M	F	M	F
Women can be successful engineering competitors.	95[a]	94	100	90	99
Women can assume industry leadership roles.	93	94	91	89	96
Women are good self-confident engineers.	92	85	97	89	96
Women engineers do not have to sacrifice femininity.	85[a]	82	94	76	91
Pregnancy does not make women less effective engineers.	74[c]	64	88	61	86
Wife's career more important than helping husband in his career.	63[a]	59	73	50	73
Full-time employed mother as good as mother not employed.	63[c]	42	84	46	80

a=p<.05, c=p<.001

Self Assessments

How do IEEE and ASME members believe their abilities compare to those of the average adult who has attended college? Table 8 presents the percentage of engineers in each group rating themselves as at least above average on a variety of traits and abilities. Clearly recent engineering graduates have very high self images. In particular they see their strengths to be in problem solving, academic and mathematical abilities. Men rated themselves higher than women did in terms of mechanical ability and athletic ability. On the other hand, women rated themselves higher than did men in writing ability and being understanding of others. In general, engineers viewed themselves as above average in most of the abilities listed. No significant difference between IEEE and ASME members in their self-assessments was found.

TABLE 8

Percentage of Respondents Rating Themselves on the Following Traits as "Above Average" or "Highest 10%" When Compared With the Average Adult who has Attended College

		IEEE		ASME	
	T	M	F	M	F
Problem solving ability	88	91	97	84	87
Academic ability	87	84	88	83	91
Mathematical ability	84	81	91	80	86
Drive to achieve	79	84	79	73	82
Mechanical ability	73[c]	81	47	85	68
Visualization ability	72	71	79	74	67
Self-confidence(intellectual)	71	72	76	68	73
Understanding of others	68[a]	50	76	62	78
Leadership ability	68	78	66	59	74
Writing ability	60[a]	53	73	47	69
Originality	60	63	58	63	56
Verbal ability	52	59	61	40	58
Self-confidence(social)	43	28	46	40	51
Sensitivity to criticism	40	25	46	40	43
Public speaking ability	40	47	39	32	46
Athletic ability	35[a]	38	33	46	24
Artistic ability	24	16	33	20	27

a=p<.05, c=p<.001

Occupational Themes. Finally, respondents rated themselves and the typical engineer in their field as similar or dissimilar to six occupational themes, or types, of characteristics identified by Holland.[4] Table 9 presents the percentage of respondents in each group giving ratings of "very" or "somewhat similar" to each type of characteristic. In general, both IEEE and ASME respondents viewed the typical engineer as being realistic, investigative and conventional. This result is consistent with our findings from previous surveys.[5] IEEE and ASME respondents rated themselves as being similar to the same three traits. The only significant difference among the groups on these ratings involved IEEE members rating themselves as being slightly more investigative than ASME members did. It is interesting to note that among this group of respondents, a large proportion see themselves as being artistic and social while very few view the typical engineer in their field to be artistic or

TABLE 9
Percentage of Respondents Rating the Typical Engineer in Their Field and Themselves as Very or Somewhat Similar to Various Occupational Themes or Types of Career Characteristics

		IEEE		ASME	
Typical Engineer	T	M	F	M	F
Realistic/technical/mechanical	85	84	94	86	81
Investigative, scientific	79	81	91	78	73
Conventional, methodical	74	72	76	72	75
Enterprising, profit-oriented	46	34	46	48	49
Social, helping, guiding	22	34	9	21	23
Artistic, musical, independent	13	22	15	8	13
Self					
Realistic/technical/mechanical	87	91	85	85	85
Investigative, scientific	85[a]	91	94	88	76
Conventional, methodical	69	66	64	76	66
Artistic, musical, independent	56	63	64	46	61
Social, helping, guiding	52	66	55	44	54
Enterprising, profit-oriented	42	50	47	45	34

a=$p<.05$

social.

Conclusions

In conclusion, an interesting perspective concerning recent men and women mechanical and electrical engineers emerged from this study. Although there were few sex or field differences, some of the differencs are not only interesting, but also should be a matter of concern to engineers and engineering educators.

Although women tend to make engineering career decisions later than men do, their initial job responsibilities and professional activities are similar. The vast majority are employed in industry in engineering positions and are quite satisfied with their jobs and their career progress to date. Most respondents felt that a BS degree was sufficient preparation for a career in engineering. Yet, a surprisingly high majority of the electrical and mechanical engineers were pursuing, or planning to pursue, graduate work; such pursuits were about equally divided between the same or a closely related engineering field, or in business administration or another nonengineering field.

The strong work orientation of men and women electrical and mechanical engineers emerges not only in major factors influencing the choice of engineering as a career but also in the job values that these engineers stressed as important to them personally. What also emerges is that their jobs do not always enable them to realize these high ideals. Of special concern was the fact that a significant minority did not describe their job as "very" satisfying or challenging, nor did they believe that the organizations in which they worked were well-managed or characterized by people interested in working together.

The recent graduates in this sample have very high self-concepts, especially regarding their problem-solving, mathematical and academic abilities — with the men having somewhat higher perceptions of their mechanical and athletic abilities and the women, higher with regard to their writing ability and understanding of others. Women and minorities tended to indicate that current opportunities in engineering for men and whites are better, but men and whites believed the converse to be true. Relatively favorable perceptions of the roles of women as engineers, managers and co-workers also emerged. Women graduates also indicated that women can successfully combine an engineering career and motherhood, but men were more divided regarding this duality.

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UTILITY OF SAT SCORES IN PREDICTING ENGINEERING AND UNIVERSITY RETENTION*

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Introduction

The utility or value of the College Entrance Examination Board's Scholastic Aptitude Tests (SATs) in predicting college success has been a topic of continuing and often heated debate across the country.[1] Numerous studies have previously examined the utility of SAT scores in differentiating engineering persistors from nonpersistors.[2-11] However, only in a few have persistors been found to be significantly higher ($p<.05$) than nonpersistor groups,[4,6,7,10] and these primarily using SAT-Math.[10] Moreover, only LeBold and Shell[10] found practical differences (i.e., half a standard deviation or more) among persistor-nonpersistor groups.

One purpose of this paper, therefore, is an examination of the utility of SAT scores in classifying beginning engineering students at Purdue University into both engineering and university retention groups after eight semesters of college, which serves as one definition or criteria of college success. Said examination focuses upon the utility of SAT scores in comparison with other cognitive factors and with noncognitive factors. A second purpose is a more indepth look at the scoring distributions of various persistor-nonpersistor groups for various measures of abilities to enable closer examination of average group differences as well as group overlap in score distributions.

Sample and Procedures

Students who begin engineering study at Purdue have entrance records which contain ability information such as is measured by the Scholastic Aptitude Tests, by high school average grades in math, science, and English, and by overall high school rank at graduation. The records also contain such information as the student's sex and their father's and mother's highest educational level and occupational level (as measures of socioeconomic status). Furthermore, just after their entrance to college in fall 1976, 419 of these beginning engineering students completed two occupationally oriented interest inventories: the Strong-Campbell Interest Inventory (SCII)[12] and the Purdue Interest Questionnaire (PIQ).[13] These inventories provided measures both of broad interests or orientations and of specific occupational interests.

During the spring semester of 1980 (eight semesters after entrance) the academic status of these 419 students was identified. Based upon this status, students were grouped according to six categories: (1) persistence in engineering; (2) transfer from engineering to (and persistence in) nonengineering fields at Purdue; voluntary withdrawal from Purdue without return with (3) a high cumulative GPA (higher than 4.50 on a 6-point scale) or (4) low cumulative GPA (4.50 or lower); (5) withdrawal while on academic probation; and (6) academic dismissal. Such subdivision of the general university withdrawal group was performed in order to ascertain possibly meaningful within-withdrawal differences (i.e., are all withdrawal students similar?).[14] Subdivision was performed using cumulative GPA as a second measure or criterion of academic success. In addition, persistor and transfer students were subgrouped according to specialization field in order to enable examination and generalization across these subgroups of specific differences which might be found among the general academic status groups. Table 1 provides a list of the academic status and specialization groups, as well as the factors, examined.

Prior to statistical group comparisons, each factor was examined to ascertain whether it was normally distributed for the total group of students. Any statistically ($p<.01$) skewed factor (as most were) was then transformed in order to normalize its data. For the engineering students SAT-Math was significantly skewed negatively ($p<.01$) and was thus normalized by transformation, but SAT-Verbal was not significantly skewed. Subsequently, for both general academic status and specialization, the utility of the SATs was examined using single-factor statistical tests (F-ratios) as well as multi-factor tests employed within multiple discriminant analysis for prediction of group membership. The results shed some light upon the questions, "Are the SATs of any value in predicting who will succeed in engineer-

* The Research reported here (except replication) was performed as part of the author's dissertation, "Utility of Cognitive and Noncognitive Factors in Predicting Academic Status and Curricular Specialization of Beginning Engineering Students" (Purdue University, 1982).

ing study and in college?" and "If of value, what is their relative worth compared with other factors with respect to predicting academic success?"

Results and Discussion

Within single-factor analysis of variance SAT-Math and SAT-Verbal were highly capable of significantly differentiating the six academic status groups ($p<.001$), but did not statistically differentiate these groups as well as at least six other factors did (ordered by F-ratio): PIQ Management, PIQ Nuclear Engineering, SCII Science, PIQ Engineering Persistence, rank, and science grade. Thus, relative to the total set the SATs performed rather well but did not perform the best. Even within the set of ability measures, high school rank and average science grade differentiated academic status groups better than the SATs did. The extent to which the various academic status and specialization groups averaged on SAT-Verbal, SAT-Math, and the four other ability measures is presented graphically in Figure 1.

Examined separately (and shown in Figure 1), SAT-Verbal best differentiated engineering persistors from transfers with persistors obtaining the highest average score of the six groups but were not differentiated from the four withdrawal groups. However, the differences among engineering persistors and transfers did not generalize across all persistor and transfer sub-groups. The greatest differentiation occurred between each of three engineering specialties (chemical, electrical, and aeronautical engineering) and two of the five transfer fields (technology and 'other' transfers).

Similarly, SAT-Math best differentiated engineering persistors from transfers, as well as university dismissals, with no appreciable differentiation between persistors and the other three withdrawal groups. In fact, the highest average SAT-Math scores of the six academic status groups occurred not for engineering persistors but for the two voluntary withdrawal groups. As with SAT-Verbal, moreover, differentiation between persistors and transfer students did not completely generalize across all persistor and transfer subgroups. The greatest differentiation occurred primarily between any of four persistence groups (aeronautical, chemical, or electrical engineers or science) and technology or "other" transfers, as well as general management students.

Under discriminant analysis, with prior group probabilities set to be equal across all groups in order to examine a factor's ability to differentiate the groups, the SATs in combination (but apart from other factors) significantly differentiated groups. However, they only allowed 23 percent of the six academic status groups and 11 percent of the 13 specialization groups to be correctly reclassified into groups. Moreover, the SATs did not help differentiate (beyond the other ability measures and the noncognitive measures) to a practical degree the academic status groups, correct reclassification remaining relatively unchanged between 44 percent (without SATs) and 42 percent (with SATs), although SAT-Math did improve differentiation and reclassification of transfers,

TABLE 1. Academic status and specialization groups examined and cognitive and noncognitive factors analyzed.

ACADEMIC STATUS	SPECIALIZATION	FACTORS
Engineering Persistors	Aero. Engineers	SAT-Verbal
	Chem. Engineers	SAT-Math
	Civil Engineers	H.S.Math Grade
	Electr. Engrs.	H.S.Science Gr
	Industr. Engrs.	H.S.English Gr
	Mech. Engineers	Sex
	Other Engineers	Father's Educ.
		Father's Occup.
Transfers from Engineering	General Mgmt.	Father's SES
	Industr. Mgmt.	Mother's Educ.
	Science/Math	Mother's Occup.
	Technology	Mother's SES
	Other Transfers	SCII:
		Realistic
High Achieving Withdrawals	Voluntary Withdrawals	Investig.
Low Achieving Withdrawals		Artistic
		Social
		Enterpris.
		Convent'al
Probationary Withdrawals		Agriculture
Academic Dismissal		Nature
		Adventure'
		Military S.
		Mechanical
		Science
		Mathematics
		Med. Sci.
		Med. Serv.
		Music/Dram.
		Art
		Writing
		Teaching
		Social Serv.
		Athletics
		Domestic Arts
		Religious Act.
		Public Speak.
		Law/Politics
		Merchandizing
		Sales
		Business Mgmt
		Office Pract.
		Engineer-Fem.
		Engineer-Male
		Achiev.Orient.
		Introv-Extrov.
		PIQ:
		Aero. Engr.
		Agric. Engr.
		Chemical Engr.
		Civil Engr.
		Electr. Engr.
		Industr. Engr.
		Interdisc. E.
		Land Survey.
		Materials Sci.
		Mechan. Engr.
		Nuclear Engr.
		Hum/SocSci/Ed.
		Management
		Science/Math
		Technology
		Agriculture
		Engr. Persist.

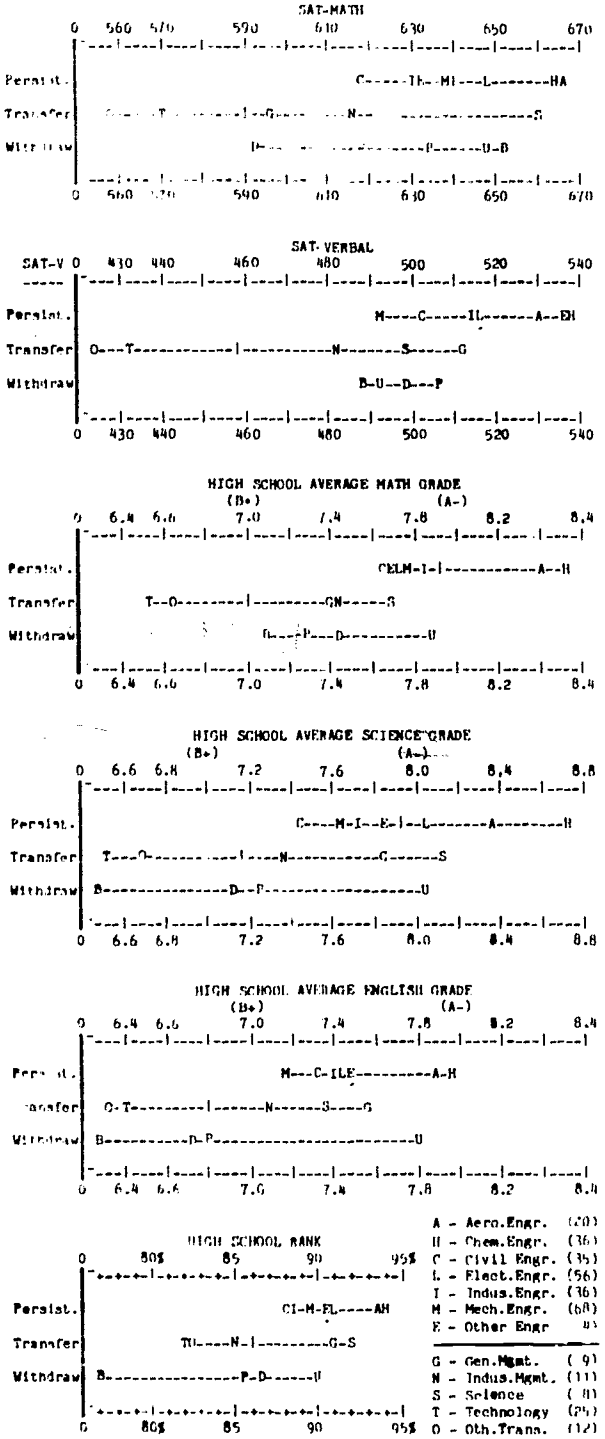

FIGURE 1. Plots of average transformed score values for academic status and specialization groups on various measures of ability and aptitudes retransformed back to the original scales.

probationary withdrawals, and academic dismissals. When only the ability measures were considered, however, SAT-Math did improve reclassification from 34 to 41 percent, primarily improving reclassification of transfers and probationary withdrawals.

With all factors examined, to a practical degree the SATs (i.e., SAT-Verbal) helped differentiate academic status groups only when these groups were subdivided into specialization groups, increasing classification accuracy from 44 to 51 percent. Thus, in general the SATs did contribute slightly to prediction of academic success (although such contributions were minor compared to those of other factors) but contributed appreciably to prediction of specializations within academic status.

Replication

Because the sample sizes of the withdrawal and specialization groups were very small in some cases, the results of the above analyses may be indicative but are tentative until larger samples can be examined. In an effort to do this somewhat, data for all beginning engineering students at Purdue University between the years 1973 and 1977, inclusively, were examined with respect to the ability measures considered above. This was done in order to graphically compare both academic status and specialization groups with respect to SATs and pre-college academic achievement measures. Also of importance were the policy decisions of whether to use ability measures to restrict the 'quality' of the entering engineering student (and hopefully improve retention) and of which measures to use if the decision is made to use some.

The approximately 5400 students entering engineering at Purdue during one of these five years were followed up after at least eight semesters (ten for the pre-1977 groups) and classified according to academic status and curricular specialization. From their entrance records their SAT scores and the high school achievement information studied earlier were examined. Where sample sizes allowed, specializations were also subdivided according to college performance (as measured by the cumulative GPA) into higher achievement, lower achievement, and probationary achievement subgroups. If less than nine students represented the latter group of any one specialty, those students were eliminated rather than being included with the lower achievement group. Thus, students can be compared (1) across academic status, (2) within specialization across college performance, and (3) across specializations. The median and interquartile ranges (25th to 75th percentiles) for these various groups and subgroups are presented in Figures 2 through 8. However, whereas Figure 2 presents the median and range for each (sub)group separately, the ranges for subgroups are merged within Figures 3 through 8 so as to provide only one line for each academic status and specialization group. It might be kept in mind that the distributional standard deviations

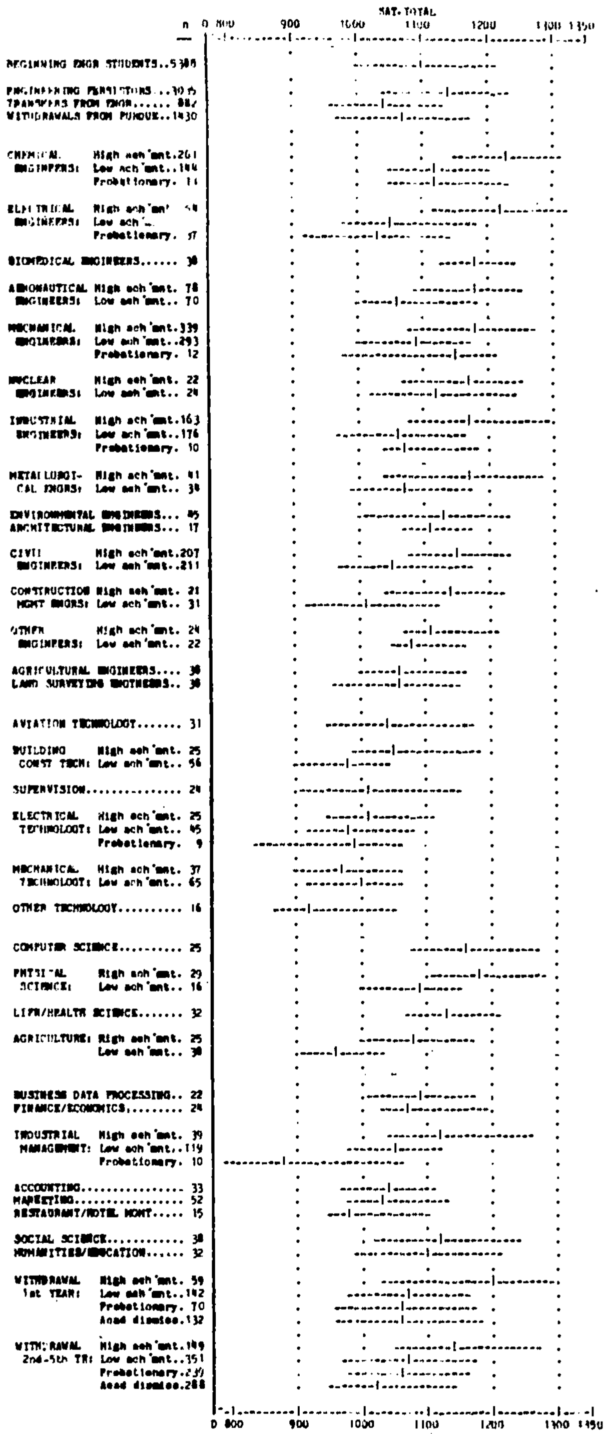

FIGURE 2. Median SAT-Total scores and interquartile ranges (25th to 75th percentiles) for beginning engineering students at Purdue 1973-1977 followed up after eight or more semesters.

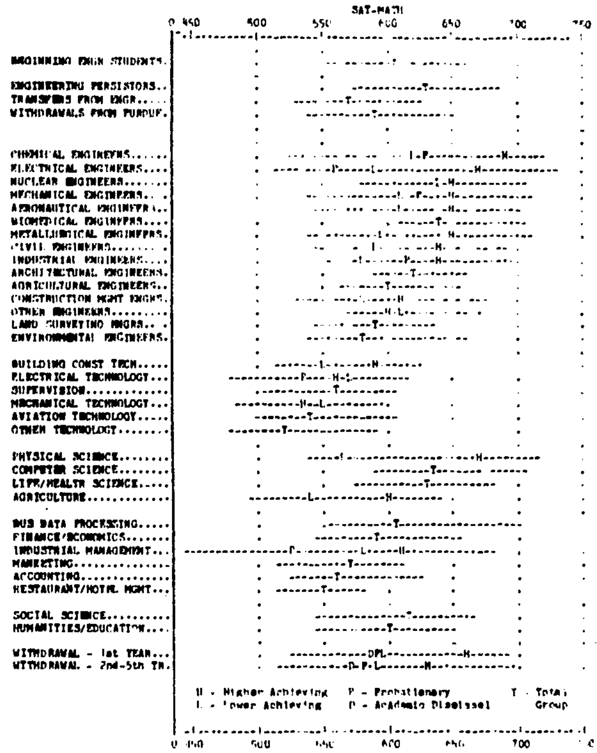

FIGURE 3. Median SAT-Math scores and interquartile ranges (25th to 75th percentiles) for beginning engineering students at Purdue 1973-1977 followed up after eight or more semesters.

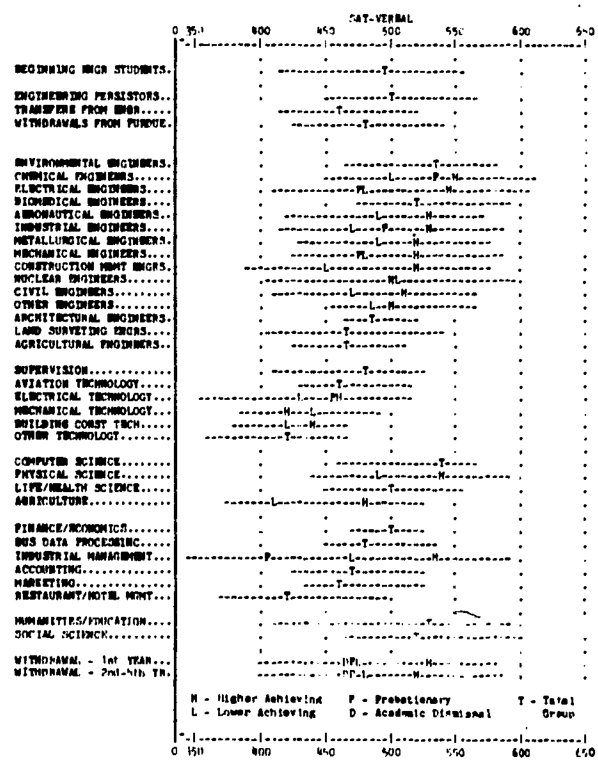

FIGURE 4. Median SAT-Verbal scores and interquartile ranges (25th to 75th percentiles) for beginning engineering students at Purdue 1973-1977 followed up after eight or more semesters.

for the total group of 5400 students were approximately 150 for SAT-Total, 85 for SAT-Verbal and SAT-Math, 16 percentile points for high school rank, 1.8 points (on a 9-point scale) for average math grade and average science grade, and 1.6 points for average English grade in high school.

One general observation from the various figures is not only variation of average ability within engineering but the even greater variation across transfer fields. Moreover, the strong relationship between ability scores and academic achievement is indicated by the differences within specialties across performance levels with higher achievers having earlier attained higher SAT scores and grades in high school.

One question that might be asked is whether cutoff scores or grades should be used as a standard for admittance to engineering study. Examination has shown that cutoff scores could be used which would prevent more nonpersistors than persistors from entering engineering. If one set a SAT-Total score standard of 950, 22 and 19 percent of transfers and withdrawals, respectively, but only 10 of persistors, would have been prevented from entering engineering (with almost all the persistor 10 percent being lower achievers). This standard could be raised or lowered depending upon the 'quality' of student desired or the number of students that could be admitted.

It seems that a better procedure, however, might be to set a high standard (such as the present total beginning engineering group median score) and strongly recommend (require?) that students not meeting that standard explore vocational or career guidance, using such inventories as the Strong-Campbell Interest Inventory and the Purdue Interest Questionnaire, to get a better idea of what field(s) they might be most comfortable in, whether these be engineering or nonengineering specialties. It seems that if more students explored their vocational interests as well as their specific abilities engineering retention would be higher and the student graduating in engineering might be more satisfied, having become more confident of their choice at an earlier time.

Such vocational exploration should not be confined only to those below the standard but

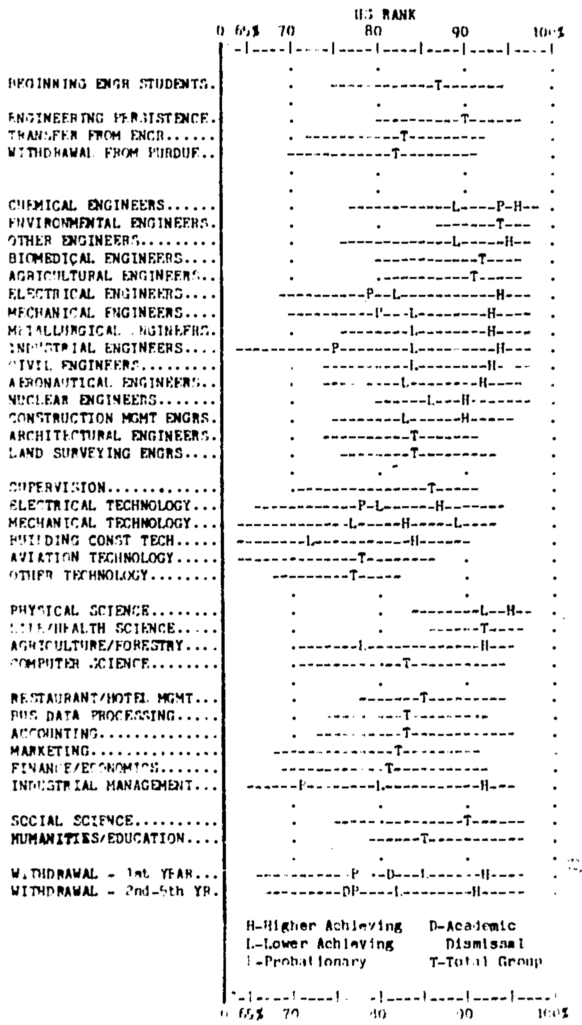

FIGURE 5. Median High School rank and interquartile ranges (25th to 75th percentiles) for beginning engineering students at Purdue 1973-1977 followed up after eight or more semesters.

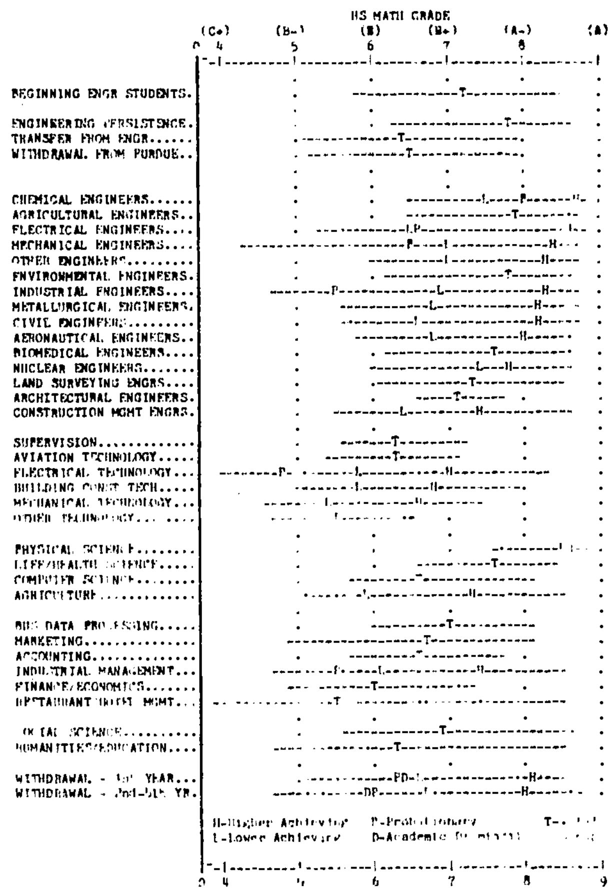

FIGURE 6. Median High School average math grades and interquartile ranges (25th to 75th percentiles) for beginning engineering students at Purdue 1973-1977 followed up after eight or more semesters.

could also be used by those above the standard. Examination of the figures reveals that a large percentage of those in certain nonpersistor specializations (computer, physical, life, and social science, the humanities and education, certain management fields, and high achieving university withdrawals) also attained the standard. Thus, vocational exploration could help the high ability student determine early whether engineering is the career for them.

It appears that the SATs could provide a good standard and basis for such vocational exploration. However, it also appears from the earlier study and from examination of Figures 5 - 8 that high school performance measures (or a composite) might perform just as well as a standard and basis. For example, the high school rank standard might be the 85th or 90th percentile (or the total group median, the 87th percentile).

Acknowledgement

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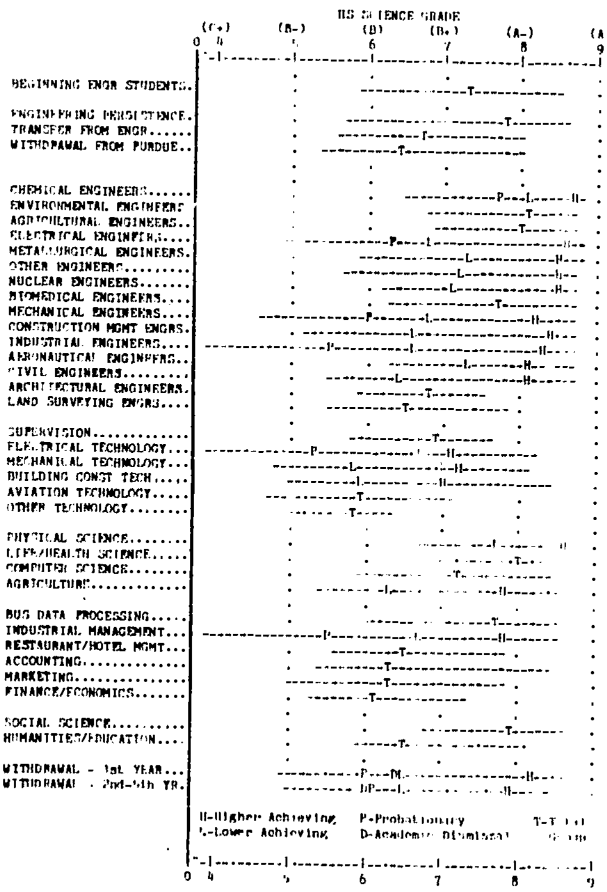

FIGURE 7. Median High School average science grades and interquartile ranges (25th to 75th percentiles) for beginning engineering students at Purdue 1973-1977 followed up after eight or more semesters.

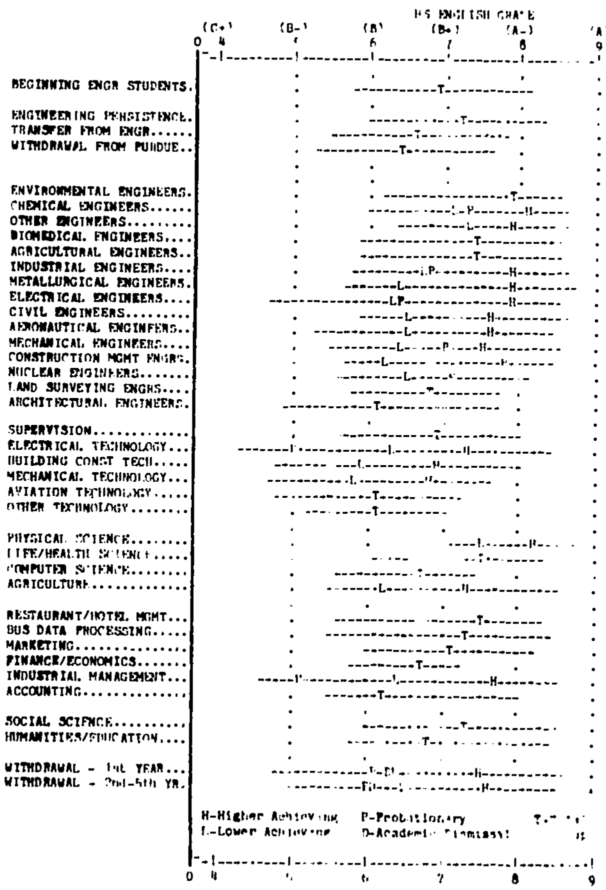

FIGURE 8. Median High School average English grades and interquartile ranges (25th to 75th percentiles) for beginning engineering students at Purdue 1973-1977 followed up after eight or more semesters.

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THE NEW ENGINEER: BLACK AND WHITE, MALE AND FEMALE[1]*

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The engineering profession, like many other professions, has recently experienced an unprecedented growth in the number and proportion of women and underrepresented minorities (Black and Hispanic) who have entered and graduated from U.S. engineering colleges. This report examines and compares the early career decisions, initial and 1981 employment, professional activities and post-graduate education of these new non-traditional engineering graduates with their traditional peers.

METHOD AND DATA SOURCES

The data discussed in this paper was derived from the National Engineering Career Development Study sponsored by a RISE grant from NSF. Among the materials mailed to a sample of members of the major engineering societies and graduates of engineering schools was a comprehensive engineering career development survey. About one-half of the 6,000 surveys mailed were returned, with only minor differences in the response rates for men (52%) and women (57%). The primary sources of Black and Hispanic graduates were engineering institutions with relatively high numbers of minority graduates. However, the returns from these institutions were somewhat lower (31%) than were the returns from the engineering societies (55%).

Over 400 items were included in the final survey form which was pre-tested using survey forms of various lengths and using various follow-up procedures. Women and minorities were oversampled in order to provide adequate data for comparison purposes. This report is based on 1720 men and 1080 women, including 128 Black Americans, 133 Hispanic Americans, 2273 White Americans and 79 Foreign Nationals.

The resulting data base was then used to examine (1) initial and current employment factors, (2) professional activities, (3) educational level and attitudes, and (4) self-reports of factors influencing the career decisions of male and female and of minority and majority engineering graduates. Non-parametric statistics (primarily Chi-Square,) and some parametric methods (ANOV) were used to identify similarities and differences by sex and by ethnic background.

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RESULTS

Table 1 summarizes the primary background data on the survey sample. The Black and White subsamples were more likely to include women than were the Hispanic and Foreign National subsamples. The overall median age at the time of the survey (1981) was 28 years: 31 years for men and 27 for women; 28 years for Blacks, 27 years for Hispanics, 28 years for Whites and 29 years for Foreign Nationals. These data indicate that there is some confounding of sex with age and experience, but that this is rather minimal for ethnic comparisons, although women are somewhat over-represented among White Americans. Relatively few differences between male and female and between minority and majority engineering graduates were found in their initial and current (1981) employment, professional activities, educational and demographic characteristics and the factors influencing their career decisions, when experience or year of BS degree were controlled. Thus, it appeared that male and female engineers tend to have more in common with each other than they have differences with respect to the factors studied. Majority and minority engineers also tended to be similar. However, some differences were observed, and the remainder of this paper focuses on these differences.

Two previous papers have been based on the data base collected from this national sample, but they were limited to recent graduates less than 5 years experience, (Jagacinski et al., 1982; LeBold et al., 1982). Two other papers were based on a sample of Purdue engineering graduates (Jagacinski & LeBold, 1981; LeBold & Jagacinski, 1981) matched by year of BS and field of engineering. In all four papers, we have observed relatively few sex differences. However, there have been some data, from these and other sources (McAfee, 1981) which indicate that, although recent male and female graduates are relatively similar in the education, initial employment and professional activities, there are some significant differences among male and female graduates with more experience (10 or more years). In this exploratory paper, we will examine some of these similarities and differences. However the experiential comparisons will be limited to the male and female sub-samples, because the number of ethnic minorities is small and, as previously noted, the age differences are minimal.

Table 2 indicates that the employment status type of employment, and functional responsibilities of male and female and ethnic minority and majority graduates are relatively similar. However, the data does suggest that there are slightly higher unemployment rates among Black and Foreign National graduates and that Black graduates are a little more likely to be employed full-time in non-engineering areas than are White graduates (22% vs. 10%). Male graduates are more likely to be employed in technical management than are females (18% vs. 11%). However, in one previous paper based on graduates with less than five years experience, we found no sex difference, (7% male vs. 9% female) in management responsibilities (Jagacinski et al., 1982). In another paper based only on recent mechanical and electrical engineers, we found small but significant interaction effects, with electrical engineering men being more likely to be in management (16% vs. 6%). However, mechanical engineering women are more likely (8% vs. 14%) to be in management than are their male counterparts or peers (LeBold et al., 1982). These two studies, however, found no significant difference in the technical responsibility level or the technical-administrative mix of recent male and female engineering graduates.

In order provide further insight into this complex matter, and because data are available on over 1000 female and over 1700 male engineering graduates, technical and supervisory responsibilities and current (1981) salaries were examined. Figure 1 indicates that the percentage of male and female graduates having relatively high technical (Levels 6-8) responsibilities,[2] that increases with experience (years since the BS degree), with no significant statistical or practical sex differences for each level of experience. On the other hand, as may be noted in Figure 2, when supervisory responsibilities were examined, there was no practical or statistically significant difference between male and female graduates during the first five years. After ten years, however, the sex differences are practical and statistically significant, with over half of the men, but somewhat less than half of the women, supervising professional or managerial personnel. These results are also reflected in the salaries of male and female engineering graduates. Figure 3 indicates relatively small salary differences for those with less than 10 years experience. However highly significant salary differences were observed for engineers with more than 10 years experience, with men reporting about 25%, or $5000, higher annual salaries than women with comparable experience. Whether or not these differences will persist in the future as new engineers become more experienced is a matter of speculation and conjecture. The authors believe these differences will be dependent upon a number of factors, including willingness of peers and management to provide women engineers with supervisory experience and their collective and individual track records when given such opportunities. Supporting data included in this paper and other studies would indicate that women should have high potential for becoming managers in view of their communication skills and sensitivity to human needs.

Table 3 indicates that there are some small but significant sex and ethnic differences in the professional activities of graduate engineers. Males and Foreign Nationals were more likely than others to read and purchase new engineering books, attend national meetings, present papers, and publish articles. However, the latter sex differences may be due to the fact that women were younger and not as likely to have had sufficient experience. Women and Foreign Nationals are more likely than their peers to subscribe to engineering periodicals, to take graduate engineering courses and to become a member of two or more national societies.

Table 4 indicates that small but significant sex and ethnic differences were observed in job satisfaction, with men and White graduates being more satisfied with their occupation and employment than are women and ethnic minorities. However, the majority of all groups reported generally high satisfaction with their employment and occupation.

Table 5 indicates that there are statistically significant sex and ethnic differences in the current and planned educational levels of engineering graduates. Except for Hispanic Americans, the majority of all groups had pursued or are pursuing some post-BS degree education and the overwhelming majority (75% or more) planned additional education. However, the type of graduate work planned varied across groups; with women and Black Americans leaning more towards graduate work in management and men and Foreign Nationals, leaning toward engineering-oriented graduate work and training.

2. An eight point scale ranging from simple-routine work with no experience (Level 1) to complex tasks requiring thorough knowledge (Level 6) through pioneering work requiring outstanding knowledge (Level 8) was used.

Table 6 indicates that males and Black-Americans were more likely than others to have first considered engineering and made a final decision on engineering as a career during or before the first two years of high school. Table 7 provides some further insight into the factors that influence the career decisions of engineers. Note that the "work"-related factors tend to be the most important factors followed, by "school", "people", and "activity" factors. Some interesting sex differences were also observed, with women being more likely than men to cite challenge, independence, college teachers, mothers, female engineers and computers as being important. In contrast, men were more likely than women to report the importance of relevant work experiences, construction and mechanical hobbies, building electrical devices and model airplanes, farm experiences, hobby magazines and flying aircraft. There were also some ethnic differences observed, notably the importance of science fiction, science fairs, science clubs, and building electrical devices and model airplanes among Black Americans and the importance of technical publications, science fair, science clubs, and junior achievement among Foreign Nationals.

In spite of the similarities in the career and employment patterns of male and female engineers and minority and majority engineering graduates, each group perceived the other's "grass as being greener" as far as opportunities in engineering were concerned. The majority (80%) of Black American engineers indicated that Whites had better or equal engineering opportunities, but the majority (67%) of White engineers believed either that opportunities were equal or that minorities had better opportunities. A significant majority (73%) of the women engineers indicated that men had equal or better engineering opportunities than women, in contrast to smaller male majority (60%) who had a similar perception.

A final area of interest we e the self-perceptions of engineering graduates. Three major sources were used (1) some of the self-perception items used by Astin (1980) and his colleagues in the ACE studies of college freshmen, (2) Spence and Heimlichs (1978) studies of androgyny (viz instrumentality and expressiveness), and (3) Hollands (1973) theory of career types (realistic, investigative, artistic, social, enterprising, and conventional). When graduates were asked to give their self-perceptions of their abilities and interests, all groups had high self-images. Male graduates were more likely than female graduates to assess their athletic ability, mechanical ability, spatial visualization, originality and intellectual self-confidence as above average. Men were also more likely than women to assess themselves as being instrumental, realistic, enterprising and conventional. On the other hand, women were more likely than men to rate their mathematical and artistic abilities and their understanding of others as above average. Women were also more likely than men to assess themselves as expressive and having artistic and social-helping interests. These factors are examined in further detail in our other papers including a 1982 APA paper (Jagacinski et al., 1982), in two other AERA papers (Jagacinski et al., 1983; Shell et al., 1983) and in our forthcoming final report to NSF (LeBold, Linden, Jagacinski, & Shell, 1983).

This brief paper does not permit an exhaustive treatment of the data collected in this extensive survey. We are also hopeful of obtaining continuing support to analyze this rich source of data that includes over 2.5 million items of information.

CONCLUSIONS AND RECOMMENDATIONS

After many years in which male and white majority students and graduates have dominated engineering education and the engineering profession, there has been a very rapid increase in the number and proportion of women, Black Americans and Hispanic Americans entering the field. The new non-traditional students and professionals are receiving initial and subsequent employment opportunities and rewards similar to those of their male and majority peers. These women and minority engineers are also assuming similar professional responsibilities, and they are pursuing and planning graduate and continuing education programs similar to those of the male and majority graduates.

Some important similarities and differences were observed in the timing and factors that have influenced the career decisions of these new non-traditional graduates. The dominant theme is one of a dedicated and work-oriented constituency that should complement the traditional male and white majority group which have characterized engineering education and the engineering profession in the past.

In spite of these important equity gains, there are important differences in the perceptions and realities of career opportunities for women and minorities in engineering and other professions. These gains not only call for improved communications and research but also for action within engineering education and the engineering profession in particular, as well as education and professions in general.

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TABLE 1
Background Information on the Sample Group

	TOTAL	SEX MA	SEX FE		ETHNICITY BL	ETHNICITY HI	ETHNICITY WH	ETHNICITY FN	
1. Sex									
1. Male	63%	100%	0%	5	74%	83%	60%	87%	5
2. Female	37	0	100		26	17	40	13	
2. Race or Ethnic identification									
1. American Indian	0%*	0%*	0%*	5	0%	0%	0%	0%	5
2. Asian or Pacific Islander	4	5	3		0	0	0	49	
3. American Black	5	6	3		100	0	0	4	
4. Mexican American	2	3	1		0	49	0	1	
5. Puerto Rican	*	*	*		0	6	0	0	
6. American Cuban	1	2	*		0	23	0	3	
7. Other Hispanic	2	2	1		0	22	0	16	
8. White, Not Hispanic	84	80	90		0	0	100	19	
9. Other	1	2	1		0	0	0	9	
3. Citizenship									
1. U.S. Native-born	91%	88%	95%	5	98%	67%	98%	0%	5
2. U.S. Naturalized	5	7	3		2	33	2	0	
3. Foreign National	4	5	1		0	0	0	100	
4. Year of Birth (Age of respondent)									
1. 1901 to 1934 (46 or older)	10%	14%	3%	5	6%	2%	11%	1%	5
2. 1935 to 1945 (36 to 45)	14	17	9		9	6	14	16	
3. 1946 to 1950 (31 to 35)	17	20	12		27	28	16	28	
4. 1951 to 1955 (26 to 30)	33	32	33		34	31	33	43	
5. 1956 to 1960 (20 to 25)	26	16	43		24	33	27	13	
5. Marital Status									
1. Single	33%	26%	43%	5	41%	40%	32%	35%	2
2. Married now	62	70	49		48	57	63	63	
3. Separated, Divorced	5	4	7		11	2	5	3	
4. Widowed	*	*	*		0	1	*	0	
6. Total Number of Children									
1. 0	52%	39%	76%	5	42%	44%	53%	51%	3
2. 1	15	18	11		32	18	14	22	
3. 2	19	26	7		15	22	19	24	
4. 3 or more	14	18	6		11	16	14	4	
7. (No. of cases)	(2739)	(1720)	(1080)		(128)	(133)	(2273)	(79)	

* is less than .5%

$^{1}p<.05$, $^{2}p<.01$, $^{3}p<.001$, $^{4}p<.0001$, $^{5}p<.00001$

TABLE 2
Employment Status, Type of Employer, & Job Function
for Present Job by Sex & Ethnicity

	TOTAL	SEX		ETHNICITY			
		MA	FE	BL	HI	WH	FN
1. Your present employment status:							
1. Not employed/not seeking	1%	*%	1% [3]	0%	0%	1%	0% [5]
2. Not employed/seeking engr	1	1	1	3	2	1	6
3. Not employed/seek non-engr	*	*	*	1	0	*	*
4. Employed part-time in engr	2	1	2	1	0	1	9
5. Employed part time/non-engr	*	*	*	1	0	*	0
6. Employed full time/engr	81	80	82	69	79	81	79
7. Employed full time/non-engr	10	10	10	22	9	10	3
8. Self-employed, engineer	2	2	1	0	2	2	1
9. Self-employed, non-engr	1	2	1	1	3	1	0
10. Retired from engineering	1	1	*	0	0	1	0
11. Retired from non-engr	*	*	*	0	0	*	0
12. Other	3	3	3	3	5	3	3
2. Type of Employer							
1. Manufacturing	48%	42%	45%	49%	36%	45%	45%
2. Other Private Business	30	40	40	32	42	40	40
3. Government & Health Services	12	11	13	15	21	10	0
4. Educational Institutions	5	7	4	4	2	5	17
3. Principal Function							
11. Pre-Professional	2%	1%	3% [5]	0%	7%	2%	0% [5]
12. Research	9	9	8	5	2	9	22
13. Development	11	10	13	10	7	11	14
14. Design	20	21	20	27	20	20	18
15. Operations	7	6	8	3	7	7	4
16. Production & maintenance	7	6	7	8	6	7	5
17. Testing & inspection	3	2	3	3	10	2	1
18. Construction	4	4	3	1	9	4	3
19. Sales & service	3	4	2	3	5	3	0
20. Teaching	3	3	2	6	1	3	8
21. Technical management	16	18	11	15	12	16	13
22. Non-technical management	3	4	3	8	4	3	0
23. Consulting	7	8	8	1	3	8	9
24. Other	7	6	9	10	5	7	4

* is less than .5%

[1] $p<.05$, [2] $p<.01$, [3] $p<.001$, [4] $p<.0001$, [5] $p<.00001$

TABLE 3
Professional Activities of Survey Respondents

	TOTAL	SEX: MA	SEX: FE	ETHNICITY: BL	ETHNICITY: HI	ETHNICITY: WH	ETHNICITY: FN
1-11. Engaging in each activity during the past year							
1. Discuss new engr developments	68%	69%	66%	62%	60%	69%	62%[1]
2. Read about new engr developments	79	79	79	83	80	79	88
3. Subscribe to engr periodicals	79	78	82[2]	66	71	81	84[5]
4. Read new books on engr or sci	40	44	34[5]	44	42	39	55[1]
5. Purchased new books on engr/sci	40	43	35[4]	44	41	38	65[5]
6. Attended local technical meetings	46	46	47	36	39	47	54[1]
7. Took non-grad credit engr course	16	15	16	18	14	15	24
8. Completed grad courses in engr	15	13	17[2]	23	17	14	33[5]
9. Attended national tech meeting	28	30	24[2]	20	13	29	37[5]
10. Presented one or more tech papers	11	13	8[5]	5	6	12	18[2]
11. Attended short course on mgmt	28	27	30	35	26	28	23
12. Professional Registration							
1. Registered Professional Engineer	14%	20%	5%	5%	10%	15%	19%[5]
2. Registered Engineer in Training	34	30	40	16	29	37	15
3. Not a Registered Engineer	52	50	55	79	61	48	66
13. Number of National Societies							
1. None	4%	4%	5%[1]	19%	12%	3%	5%[5]
2. 1	43	45	39	33	48	43	36
3. 2 or more	53	51	56	48	40	53	59
14. One or more Articles Published	31%	37%	21%[5]	21%	18%	33%	51%[2]
15. One or more Books Published	3%	4%	2%	0%	1%	4%	2%
16. Applied for one or more Patents	12%	16%	5%	12%	6%	12%	10%
17. One or more Patents Granted	6%	9%	2%	5%	5%	7%	3%

[1] $p<.05$, [2] $p<.01$, [3] $p<.001$, [4] $p<.0001$, [5] $p<.00001$

TABLE 4
Satisfaction With Career Choice, Career Progress And Work

	TOTAL	SEX: MA	SEX: FE	ETHNICITY: BL	ETHNICITY: HI	ETHNICITY: WH	ETHNICITY: FN
1. How satisfied are you with your choice of occupation?							
1. Still uncertain	1%	1%	2% [2]	1%	2%	1%	4%
2. Not satisfied; reconsidering	5	4	7	10	5	5	8
3. Satisfied, some doubts	21	20	24	22	26	21	25
4. Made best choice	47	48	45	44	44	48	46
5. Fully satisfied	25	26	23	23	24	26	18
2. How satisfied are you with your progress in your occupation?							
1. Not satisfied	15%	13%	18% [5]	28%	15%	14%	19% [2]
2. Fairly satisfied	24	22	28	22	23	24	29
3. Feel I'm doing well	45	46	41	38	49	45	38
4. Fully satisfied	16	18	13	12	13	17	14
3. General level of satisfaction with work in present job.							
1. Very satisfied	30%	33%	26% [5]	20%	28%	31%	17% [5]
2. Satisfied	50	51	49	46	52	50	63
3. Neutral	14	12	15	20	15	13	13
4. Dissatisfied	5	4	7	7	2	5	6
5. Very dissatisfied	1	1	2	7	3	1	1

$^{1}p<.05$, $^{2}p<.01$, $^{3}p<.001$, $^{4}p<.0001$, $^{5}p<.00001$

TABLE 5
Current and Planned Education of Survey Respondents
and Attitudes Toward Graduate Work

	TO-TAL	SEX MA	FE		ETHNICITY BL	HI	WH	FN	
1. Current Educational level				5					5
11. No degree	1%	1%	*%		1%	0%	1%	0%	
12. Bachelor's/no grad work	35	33	39		36	56	35	9	
13. Bachelor's/some non-engr grad work	16	14	18		27	22	15	8	
14. Bachelor's/some engr grad work	5	4	6		3	1	5	3	
15. Master's in engr	25	27	21		16	13	25	54	
16. Master's in business admin	5	6	4		1	2	6	4	
17. Master's in other non-engr	3	3	3		5	0	3	3	
18. Master's in engr and another field	2	2	2		2	0	2	3	
19. Doctorate, engr	5	6	2		0	1	4	14	
20. Doctorate, non-engr	1	1	1		2	0	1	0	
21. Other	3	3	5		7	6	3	4	
2. Planned Educational Level									
11. None	19%	24%	10%	5	4%	14%	20%	19%	5
12. Some grad work in engr	20	21	18		14	15	21	14	
13. Some grad work in non-engr	12	13	10		16	13	12	9	
14. Master's in engr	12	10	15		11	20	12	6	
15. Master's in management	20	17	26		30	23	20	17	
16. Master's in non-engr	2	1	3		0	2	2	3	
17. Master's in engr and another field	4	2	6		3	5	4	1	
18. Doctorate in engr	7	7	6		8	2	6	19	
19. Doctorate in non-engr	2	2	2		3	0	2	4	
20. Other	4	4	4		9	6	3	8	
3. Preferred Graduate Program									
1. Design oriented engr program	21%	22%	19%	1	21%	29%	20%	20%	1
2. Research oriented engr program	17	17	17		13	11	17	29	
3. Management oriented program	56	56	56		59	57	56	46	
4. Other	6	5	7		7	2	6	5	
4. "Strongly agree" or "agree" with statement									
1. Graduate study is not needed	59%	59%	59%		60%	61%	59%	42%	1
2. "On Job" training is sufficient	47	47	46		57	55	46	32	2
3. Non-credit courses are sufficient	56	56	56		51	46	57	59	
4. Management Graduate work is needed	50	49	51		49	60	50	47	
5. Math & Sci Graduate work is needed	31	32	30		30	30	30	47	1
6. Engineering Graduate work is needed	47	48	46		41	47	46	74	5

* is less than .5%

$^{1}p<.05$, $^{2}p<.01$, $^{3}p<.001$, $^{4}p<.0001$, $^{5}p<.00001$

TABLE 6
Time of First Consideration and Final Decision of an Engineering Career

	TO-TAL	SEX		ETHNICITY			
		MA	FE	BL	HI	WH	FN
1. First Consideration							
1. Before High school	18%	22%	11% [5]	32%	18%	17%	20% [2]
2. During grades 9 or 10	19	23	12	14	24	18	18
3. During grades 11 or 12	39	38	41	33	42	40	36
4. During first year of college	11	10	14	15	13	11	9
5. During second year of college	5	3	9	3	2	6	5
6. During 3rd or 4th year of college	3	2	5	1	1	4	8
7. After college	5	2	8	3	1	5	4
2. Final Decision							
1. Before High school	4%	5%	2% [5]	14%	5%	3%	9% [5]
2. During grades 9 or 10	6	8	3	14	9	6	4
3. During grades 11 or 12	43	48	34	44	46	43	42
4. During first year of college	19	18	21	10	28	19	20
5. During second year of college	12	10	17	11	9	13	7
6. During 3rd or 4th year of college	7	5	10	5	3	7	10
7. After college	9	6	12	2	0	9	9

[1] $p<.05$, [2] $p<.01$, [3] $p<.001$, [4] $p<.0001$, [5] $p<.00001$

TABLE 7

Percentage of Respondents Rating the Following Factors as of "Very" or "Some" Importance in Influencing Their Decision to Study Engineering

	TO-TAL	SEX MA	SEX FE	ETHNICITY BL	ETHNICITY HI	ETHNICITY WH	ETHNICITY FN
1. Work Related Factors							
30. Liking for problem solving	85%	84%	88%[2]	85%	82%	86%	83%
42. Challenge	83	81	89[5]	83	87	84	90
31. Being curious or creative	83	83	82	88	82	82	84
43. Salary	75	74	77	82	72	75	73
44. Creativity	74	73	76	75	74	74	86
49. Independence	68	62	78[5]	70	73	68	73
41. Type of work	64	63	65	53	58	65	58[1]
46. Prestige	62	62	63	58	72	61	73[1]
45. Security	61	59	64[2]	64	64	61	68
48. Leadership	56	54	60[2]	57	69	55	70[2]
22. Relevant work experience	42	46	36[5]	44	36	42	35
47. Rapid advancement	48	45	53[3]	53	61	46	62[3]
32. Wanting to be of service to others	45	44	46	47	49	43	59[1]
2. School Related Factors							
18. College engineering courses	75%	74%	76%	80%	79%	74%	79%
13. High School science courses	69	71	66[1]	80	69	69	69
12. High School math courses	67	66	68	79	71	66	69[1]
21. Career or occupational information	57	57	58	66	67	56	57[1]
14. College math courses	55	53	59[2]	66	66	53	62[2]
17. College science courses	50	52	47[1]	60	63	49	60[3]
16. College physics courses	48	49	46	61	62	46	54[4]
20. Aptitude tests	45	45	45	47	39	46	40
15. College chemistry courses	35	37	33	51	41	34	45[3]
19. Interest inventory results	24	25	23	25	16	25	21
11. Career education courses	17	19	14[2]	30	25	16	17[4]
40. Pre-college seminars	10	8	12[3]	20	12	9	8[3]
3. People Related Factors							
2. Father (or male guardian)	61%	60%	61%	50%	59%	62%	58%
5. H.S. math or science teachers	48	49	47	53	48	48	57
6. College teacher(s)	44	41	50[5]	44	44	44	49
1. Mother (or female guardian)	44	41	49[4]	52	46	44	38
4. Friends	36	37	34	41	35	35	49
8. Male engineer(s)	32	32	32	26	37	31	43
3. Other relative	27	27	27	30	38	25	41[3]
10. High School counselor(s)	22	24	18[2]	37	19	22	6
7. College counselor(s)	22	21	26[2]	34	31	21	26[3]
9. Female engineer(s)	8	4	15[5]	11	10	8	6
4. Activity Related Factors							
34. Using a computer	32%	28%	39%[5]	42%	42%	31%	39%[2]
37. Construction hobbies	31	40	16[5]	40	39	30	32[1]
36. Mechanical hobby	29	40	12[5]	40	36	28	43[3]
29. Science Fiction	23	24	20[1]	39	33	21	30[5]
24. Technical publications	21	25	14[5]	28	27	18	43[5]
35. Building electrical devices	20	26	12[5]	48	28	18	32[5]
26. Outdoor activities	19	21	17[1]	19	22	19	22
38. Building model airplanes	18	26	5[5]	31	26	16	30[5]
25. Science Fair participation	16	18	12[3]	30	12	14	32[5]
39. Farm Experiences	15	20	8[5]	11	18	15	11
23. Hobby Magazines(eg Pop. Mechanics)	15	22	4[5]	27	17	14	23[3]
33. Flying aircraft	12	14	8[5]	20	17	10	15[3]
27. Science Clubs	12	13	11	25	10	11	23[5]
28. Junior Achievement	4	5	3	11	7	3	17[5]

[1] $p<.05$, [2] $p<.01$, [3] $p<.001$, [4] $p<.0001$, [5] $p<.00001$

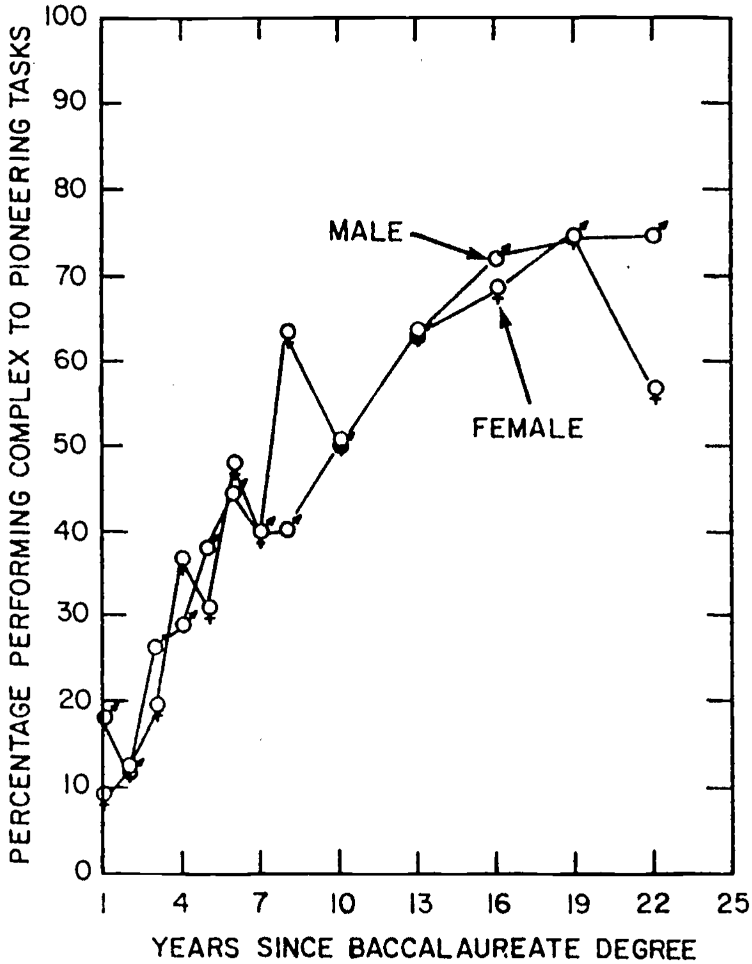

Figure 1 Percentage of Men and Women Engineers Reporting High Technical Responsibility (viz., Complex to Pioneering Work) by Years Since BS Degree.

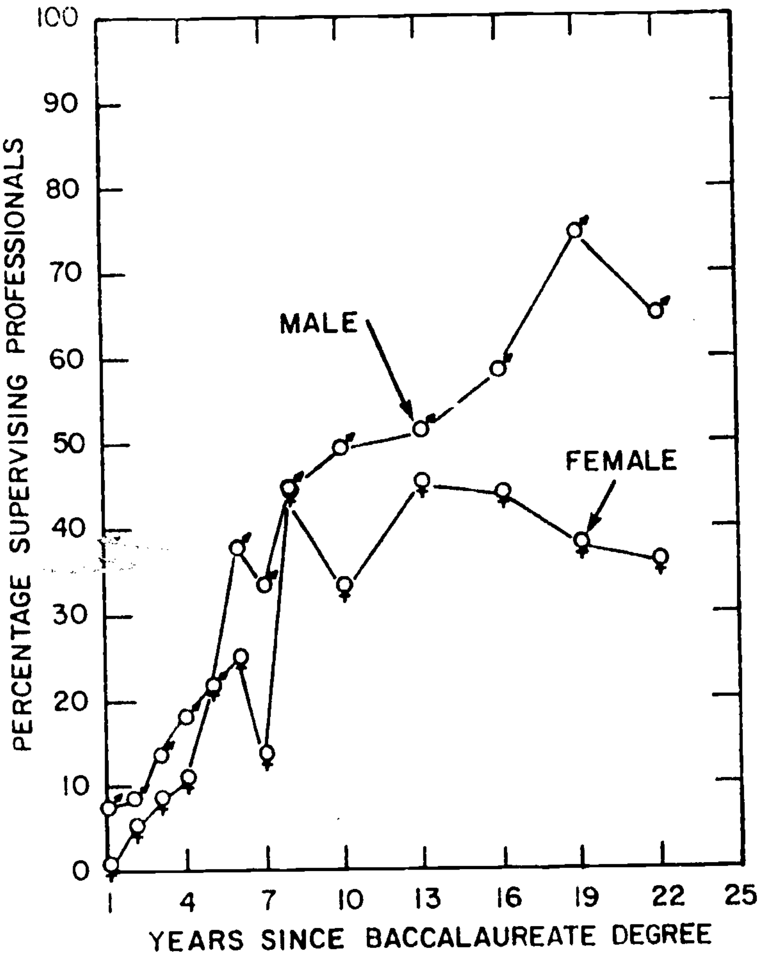

Figure 2 Percentage of Men and Women Engineers Supervising Professional or Managerial Personnel by Years Since BS Degree.

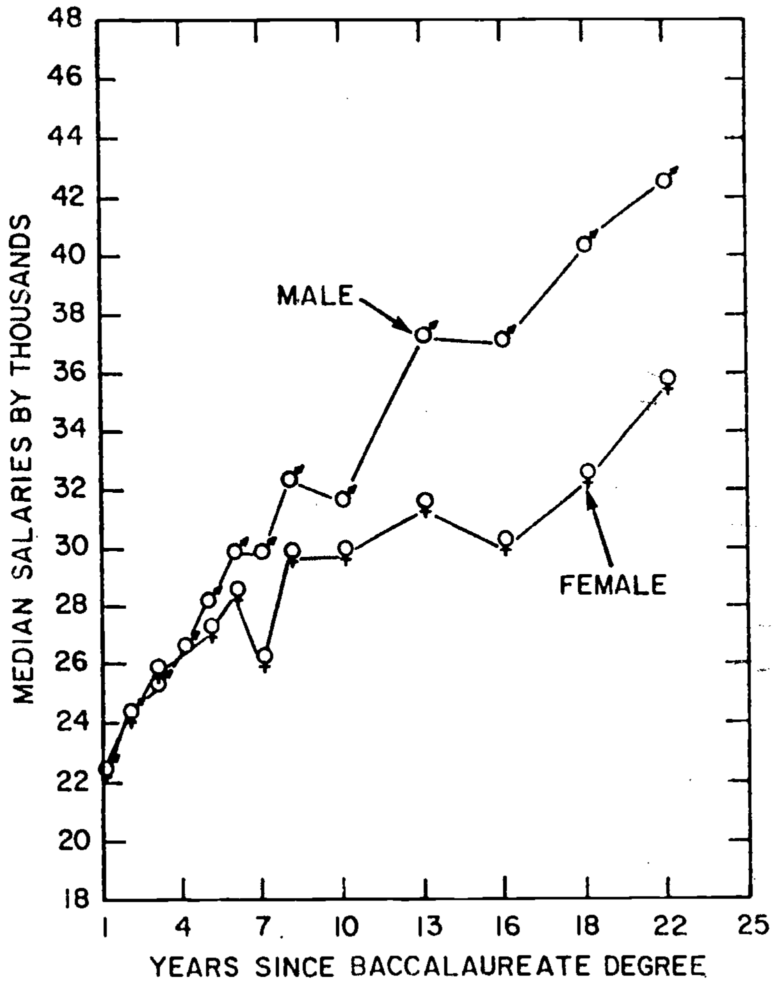

Figure 3 Median Salaries in Thousands of Dollars for Men and Women Engineers by Years Since BS Degree.

INTEREST PROFILES OF PROFESSIONAL ENGINEERS

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INTEREST PROFILES OF PROFESSIONAL ENGINEERS*

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Introduction

The Strong-Campbell Interest Inventory (SCII) has been the most extensively used and researched interest inventory with college (and prospective college) students and with college graduates. Moreover, the SCII possesses "the longest history of any psychological test in widespread use today" (Campbell & Hansen, 1981, p. v). Despite this long history, the Engineer scale(s) have been examined infrequently in contrasting engineering specialties. Nevertheless, research that has been conducted using the Engineer scale(s) (Barany & LeBold, 1971; Hansen, undated; Lewis, Wolins, & Hogan, 1965; Shell, 1982) has indicated meaningful group differences in mean scores which could be used to help students considering engineering or trying to select an appropriate specialty field within engineering. Furthermore, the Occupational Themes and Basic Interest Scales, much younger by comparison, apparently have been used infrequently (or at least seldom reported in publications) in examining engineers or engineering students and especially in comparing or contrasting specialties within engineering. Because of the 1981 revisions to the SCII, a crossvalidation of the Engineer scales and an examination of the Theme Scales and Basic Interest Scales with respect to professional engineers would be very beneficial in understanding the nature of those who pursue engineering.

There also seems to be a lack of information concerning the extent to which an independent sample might average lower on its relevant Occupational Scale than did its corresponding norm group. Such lower group means might result in part from three factors. First of all, discrepancies in average scores simply might result from the use of independent random samples of the same population (i.e., sampling error), in which case an independent sample might average either higher or lower than the norm group, usually by no more than two T-score units (approximately three standard errors of the mean). Secondly, discrepancies might result because the two samples do not represent the same population. In this case, the independent sample again might average higher or lower than the norm group with the difference reflecting the difference in populations and not bound by a two-unit probability limit. Thirdly, discrepancies might result from a regression-to-the-mean effect. In this case, an independent sample would average lower than the norm group and closer to the mean of "men-in-general" or "women-in-general." The extent to which the independent sample averages lower than the norm group would then tend to reflect the difference between the occupational population and the relevant general occupational universe. Thus, the

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more an occupational population differs from the general universe -- as does engineering -- the greater the extent of regression-to-the-mean effect with an independent sample.

Objectives

The present research focused upon the use of the SCII in occupational counseling of prospective engineering students or of professionals. Specifically, the objectives have been: (1) to identify an interest profile for professional engineers using the revised SCII (Campbell & Hansen, 1981); (2) to compare and contrast interest profiles of meaningful subgroups of engineers, classified according to sex, ethnic background, current career field, level of career satisfaction, and number of years since obtaining the bachelor's degree; and (3) to examine the extent to which the standard score means of independent samples (with respect to the norm samples) on the SCII's two Engineer scales differ from the means of their respective norm samples. Thus, this research seeks to "picture" the interests of professional engineers as a total general group and as separate meaningful subgroups. Furthermore, it seeks to estimate the extent to which the SCII norm groups do not accurately represent the average scores of their represented groups.

Procedures

Sample

During the spring and fall of ~~1981,~~ SCII data were collected from professional engineers as part of the National Engineering Career Development Study. The sample consisted primarily of members of professional enginering societies but also included graduates from several specific universities and colleges with engineering programs. Complete data were available for 488 engineers of whom 174 were women and 314 were men. Data were also available for 20 minority engineers (Black and Hispanic Americans), which can serve as a preliminary examination group for comparing minorities and nonminorities. The engineers tended to be recent graduates, less than ten years in professional practice. In general, the women possessed less experience than the men.

Methodology

Standard score means were first calculated for the total sample of engineers for each SCII Occupational Theme, each Basic Interest Scale, the male and female Engineer scales, and the two Special Scales (Academic Comfort and Introversion-Extroversion). The total sample was then classified into subgroups according to sex, ethnic background, current main career field, level of satisfaction with their current position (on a 5-point scale), and number of years since obtaining the Bachelor's degree (categorized into five groups). Subgroups were contrasted using five-way regression ANOVA by means of the SPSS ANOVA program (NIE, Hull, Jenkins, Steinbrenner, & Bent, 1975) in order to eliminate interaction effects and to identify subgroup differences which are unique to a particular classification schema.

In keeping with procedures followed in selecting the SCII standardization and norm samples of Engineers, it was then decided to restrict the sample of professional engineers to only those who were satisfied with their current position in order to reexamine the SCII results. After thus restricting the full sample, subgroup comparisons were again performed using the subsample of 369 professional engineers. Within this sample, career fields were subsequently subdivided according to sex in order to facilitate examination of male-female differences within each field across the scales.

Results and Discussion

Professional Engineers In General

SCII means for the full sample (n=488) of professional engineers are presented in Table 1. These professional engineers exhibited above average realistic and investigative interests and below average social, artistic, and enterprising interests. In terms of basic interests, professional engineers were highly interested in mathematics especially, but also in mechanical activities and science. They were much less interested (and possibly disinterested) in social service, writing, music or dramatics, art, medical service, religious activities, merchandising, office practices, teaching, domestic arts, and sales. Professional engineers exhibited interests similar to those of professionals with doctoral degrees but indicated greater than average introversion, i.e., orientation toward individual rather than group or social activities.

Of special interest were the male and female Engineer scales. Professional engineers averaged at the female norm group mean on the women's scale but below the male norm group mean on the men's scale. Thus, the professional engineers in general exhibited interests similar to the interests of norm group female engineers but less similar to the interests of norm group male engineers.

In summary, professional engineers in general seem highly oriented to the pursuit of scientific knowledge but even more oriented to the application of this knowledge to practical problems. They are more oriented to personal than to group endeavors although not toward artistic activities. Their individualistic, nonsocial, and nonenterprising orientation may be related largely to their extensive scientific and physical-problem orientation. Thus, on a bipolar continuum they appear to be more oriented toward physical science problems than toward human (or behavioral science) problems.

Sex Differences. As noted in Table 1, numerous significant ($p<.0001$) and practical differences were observed between male and female professional engineers. Moreover, these differences tended to parallel similar differences among professional men and women in general, although the magnitude of interests were not comparable. While men were more highly oriented toward practical or realistic activities (such as mechanical activities, military activities, and adventure), as well as athletics, women were more highly oriented toward nature, domestic arts, and general artistic activities. Women also tended to have interests more similar to persons with doctorate degrees than did men.

Differences also existed, however, between the interest patterns of the men and women engineers and the patterns of professional men and women in general.

TABLE 1. Strong-Campbell Interest Inventory Standard Score Means of Professional Engineers Grouped According to Total, Sex, Ethnicity, Current Main Career Field, Satisfaction Level, and Years Since Bachelor's Degree with Grouping Factor Interactions Removed in ANOVA tests.

SCII SCALE	GENERAL NORMS		ENGR NORMS			SEX		ETHNIC GROUP		CURRENT MAIN CAREER FIELD								SATISFACTION LEVEL			YEARS SINCE BACHELOR'S					TOTAL STANDARD DEV.
	M	F	M	F	TOT	M	F	Min	Maj	AgE	ChE	CE	EE	IE	ME	RE	OtE	VS	S	NS	A	B	C	D	E	
OCCUPATIONAL THEMES:																										
Realistic	54	45	60	56	57	58	54e	55	57	63	54	57	55	56	59	60	55c	57	57	56	56	58	57	57	55	10
Investigative	51	48	57	57	55	55	55	55	55	55	57	52	56	53	55	56	55d	55	55	53	55	55	54	55	55	8
Artistic	47	53	45	51	45	43	48e	47	45	42	47	43	47	45	45	48	45a	45	45	46	47	47	45	43	44	10
Social	49	51	44	43	43	43	43	45	43	44	44	44	43	43	41	41	42	43	43	43	45	43	41	44	43a	10
Enterprising	52	48	48	47	46	47	46	49	46	47	47	46	47	48	45	47	47	47	47	46	47	46	46	47	47	8
Conventional	50	50	51	50	50	50	50	51	50	52	50	50	51	54	48	48	50c	51	50	49	50	49	49	50	52	8
(Holland Code)	REI	ASC	RIC	IRC	RIC	RIC	IRC	RIC	RIC	RIC	IRC	RIC	IRC	RCI	RIC	RIC	IRC	RIC	RIC	RIC	RIC	RIC	RIC	RIC	RIC	
BASIC INTEREST SCALES:																										
R Agriculture	51	49	53	50	51	52	50c	49	52	59	49	54	49	48	52	58	48e	51	51	52	51	53	51	51	51	10
Nature	48	52	49	53	50	48	53e	46	50	55	49	50	48	49	50	57	46b	49	50	51	51	53	49	49	47	11
Adventure	54	46	52	51	52	53	49e	54	51	53	50	52	51	49	52	54	52	52	51	50	52	52	53	52	48e	9
Military Activities	53	47	53	50	51	53	48e	51	51	51	49	52	50	52	51	53	51	53	50	48a	50	48	50	53	54	10
Mechanical Activities	54	45	61	57	58	59	55e	58	58	62	56	56	58	57	61	59	57d	59	58	56	57	58	59	58	57	9
I Science	52	48	59	57	56	56	55	56	56	58	58	52	58	53	57	58	56e	57	56	54	56	56	56	56	56	8
Mathematics	52	48	60	60	60	60	59	59	60	60	60	58	61	61	59	59	60e	61	60	58c	59	59	60	60	61	5
Medical Science	50	50	51	52	50	49	50	49	50	49	52	48	51	49	49	54	50a	49	50	49	50	50	50	51	48	10
Medical Service	47	53	46	47	45	45	45	47	45	47	46	46	46	45	44	47	44	45	46	45	47	47	44	45	44a	7
A Music/Dramatics	46	54	44	52	45	43	50e	47	45	43	47	43	47	46	46	48	46	45	45	47	48	47	45	42	44	10
Art	45	55	44	52	45	42	49e	45	45	43	45	42	47	44	45	48	44a	44	45	46	47	47	44	42	43	10
Writing	47	52	44	50	44	42	46e	44	44	41	46	42	45	44	42	45	44	44	43	44	44	45	42	42	45b	10
S Teaching	48	52	48	45	46	45	46	46	46	45	47	46	47	44	43	44	45a	46	45	45	46	46	44	46	47	9
Social Service	47	52	40	42	41	40	42b	42	40	41	42	41	41	41	39	38	41	40	40	42a	42	41	38	42	41c	8
Athletics	53	47	50	45	49	52	45e	51	49	51	48	53	48	47	48	50	48a	49	49	48	51	48	50	49	48e	10
Domestic Arts	43	57	43	51	46	43	51e	44	46	45	45	46	47	47	45	45	45	45	47	47	49	48	44	45	42a	10
Religious Activities	48	51	46	45	45	45	45	46	45	48	46	46	45	45	45	44	44	46	45	45	47	45	43	46	47b	10
E Public Speaking	52	48	47	47	47	47	46	50	47	46	47	47	48	46	46	47	47	48	47	46	48	46	45	47	49	9
Law/Politics	52	47	49	48	48	48	48	50	48	48	49	48	47	48	47	47	49	49	48	48	49	47	47	49	49	9
Merchandising	50	50	46	48	45	45	47	47	45	44	45	45	46	50	44	46	44	45	45	46	46	46	44	45	46	9
Sales	53	47	48	46	46	47	45c	49	46	45	46	47	47	46	46	45	46	46	46	46	46	46	46	46	48	8
Business Management	52	48	50	49	49	49	48	51	49	49	49	48	48	54	48	49	49b	50	49	48	48	48	48	50	51	9
C Office Practices	47	53	45	46	45	44	45	43	45	45	44	45	46	46	43	44	45	45	45	45	45	44	43	45	46	7
OCCUPATIONAL SCALES:																										
F Engineer	40	22	54	50	50	52	47e	50	50	54	49	47	50	49	55	53	50e	52	51	48c	47	50	53	51	50c	10
M Engineer	28	19	50	41	44	46	40e	41	44	48	43	40	44	41	48	45	44e	45	44	41a	40	43	45	45	45	11
SPECIAL SCALES:																										
Academic Comfort	44	48	51	54	49	47	52e	48	49	47	54	45	51	46	47	51	50e	50	48	48	49	50	47	48	50	13
Introvert-Extrovert	50	50	56	54	56	57	56	53	56	58	56	56	55	56	58	55	57	55	56	57	54	57	58	58	55	11
SAMPLE SIZE	300	300	228	201	488	314	174	20	427	19	64	109	88	41	93	26	49	139	230	98	103	101	123	81	81	

TOT - Total Group
M - Male
F - Female
Min - Minority
Maj - Majority

AgE - Agricultural Engineering
ChE - Chemical Engineering
CE - Civil Engineering
EE - Electrical Engineering
IE - Industrial Engineering

ME - Mechanical Engineering
RE - Resource (Mining, Geological, Mineral, Petroleum) Engineering
OtE - Other Engineering

VS - Very Satisfied
S - Satisfied
NS - Not Satisfied

A - 1-2 Years
B - 3-4 Years
C - 5-9 Years
D - 10-18 Years
E - 19-70 Years

a - p<.05 b - p<.01 c - p<.005 d - p<.001 e - p<.0001

Women-in-general tended to exhibit more interest than men-in-general in medical service, office practices, and teaching, while men-in-general tend to exhibit more interest in science, mathematics, law and politics, public speaking, and business management. However, no such differences were found for women and men engineers. Thus, these results indicate that women engineers possess interests which are intermediate between male engineers and women-in-general, but more similar to the former.

Of particular importance, not only did men average higher than women on the male Engineer scale, but also on the female engineer scale. This finding may be best explained by a combination of two "facts." First, male engineers tend to exhibit a larger number of general (and strong) engineering characteristics than do female engineers, while female engineers tend to exhibit a larger number of traditionally nonengineering characteristics. Secondly, women engineers are more similar than men engineers to women-in-general, as well as to men-in-general, in terms of engineering characteristics.

Ethnic Differences. The underrepresented minority engineers (Black and Hispanic Americans) exhibited interests which were very similar to interests of majority engineers. Although undoubtedly due to the small number of minority engineers, no mean differences were significant at $p=.05$. However, few differences were large enough to have been sufficiently practical if the number of minority engineers had been large enough to adequately indicate great significance.

Career Field Differences. As shown in Table 1, numerous career field differences were found. With respect to general occupational themes and relative to the other fields, agricultural engineers exhibited the most realistic or practical interests and were one of the groups to exhibit the least artistic interests. In contrast, chemical engineers were one of the groups to display the most artistic interests, but they also exhibited the least realistic interests. Civil engineers were one of the groups to express the least investigative and artistic interests, while electrical engineers exhibited among the most artistic interests. Industrial exhibited the most conventional interests but among the least investigative interests. Mechanical and resource (mining, geological, mineral, and petroleum) engineers displayed among the least conventional interests, with resource engineers exhibiting among the most artistic interests. As also noted in Table 1, the three-letter Holland code differed from the engineer-in-general code of RIC (Realistic, Investigative, Conventional) for four of the eight fields: chemical, electrical and "other" engineers (IRC) and industrial engineers (RCI).

With respect to basic interests, relative to the other fields, engineers were among the most interested in mechanical activities, agriculture, science, and nature. Chemical engineers were among the most interested in science and teaching but among the least interested in agriculture. Civil engineers were the most interested in athletics but among the least interested in art, medical science, science, and mathematics. Electrical engineers were among the most interested in mathematics, science, art, and teaching, but were among the least interested in agriculture. Industrial engineers were among the most interested in mathematics and business management but among the least interested in athletics, agriculture, and science. Mechanical engineers were among the most interested in mechanical activities but were the least interested in teaching.

Resource engineers were among the most interested in agriculture, science, nature, medical science, and art. All other engineers were among the least interested in nature and agriculture. Finally, chemical engineers exhibited the most comfort in academic situations, and civil engineers, the least comfort.

Career field differences were also found for both the male and female Engineer scales (see Table 1). Exhibiting the most female engineering interests were mechanical, agricultural, and resource engineers, while civil engineers exhibited the least interest. Similarly, mechanical and agricultural engineers displayed the most male engineering interests, and civil and industrial engineers, the least.

Satisfaction Level Differences. found for levels of job satisfaction (see Table 1). Accordingly, those engineers who were uncertain about, or dissatisfied with, their current position exhibited the least interest in military activities and mathematics and had fewer female or male engineering interests.

Experience Level Differences. Several significant and practical differences were found for number of years since Bachelor's degree, as shown in Table 1. Those engineers with less than five years of experience (the first two groups) were the most interested in domestic arts and medical service. Those engineers with three or four years of experience were among the least interested in athletics. Those with five to nine years of experience were the least interested in social service and religious activities and the least interested in writing. Those with 10 to 18 years of experience were among the least interested in writing, while those with 19 or more (up to 70) years of experience were the least interested in domestic arts and adventure and among the least interested in athletics. These last results are understandable considering the average of the last group.

An interesting finding was the presence of a few quadratic (rather than linear) group differences for a few scales. Such effects were found for the Social Occupational Theme, for basic interests in writing, social service, and religious activities, and for the female Engineer scale. Thus, based on these differences, engineers with the least experience, or the most experience expressed greater interest in religious activities, writing, and social service but fewer interests which are typical of female engineers than did engineers with a moderate amount of experience. Three possible explanations for this phenomenon include (1) historical group differences inherent within the age samples, (2) the changing nature of an individual pursuing an engineering career, and (3) developmental changes occurring within individuals during a career in engineering. Such a phenomenon may merit future research.

In summary, therefore, the interest profile of a "typical" engineer is not adequate to characterize all engineers but simply results as an averaging effect. Rather than being "made from a common mold," engineers can be divided into meaningful groups according to sex, specific engineering career field, level of job satisfaction, number of years of experience, and probably numerous others (e.g., job functions performed), with each subgrouping possessing its own unique (but homogeneous) profile of characteristics.

Satisfied Professional Engineers in General

For the restricted sample of satisfied engineers (more comparable than the original sample to the norm sample), standard-score means are presented in Table 2. As this table shows, few and only slight variations in mean scores resulted, as compared to the means for the full sample in Table 1. This is true whether one considers the total sample means or subdivides the sample into the meaningful groupings. Thus, to report the separate group differences here would duplicate Table 1 results.

Because of the numerous sex differences found in the interests of engineers and because of the relatively large number of men and women in the sample, separate SCII mean scores are presented in Table 3 for men and women within the career fields, satisfaction levels, and years of experience groups. Although statistical tests of significance were not performed on each male-female comparison individually, numerous differences may be noted in the table, which tend to parallel the main effects sex differences (as already noted in Table 2). However, as noted in Table 3, only four significant interaction-with-sex differences were observed: interest in agriculture, adventure, social service, and athletics.

Mean Score Reduction in SCII Engineer Scales

The last major objective in the present research is the examination of the extent to which similar, but independent, engineer samples obtain mean scores on their like-sex SCII Engineer scale lower than their respective norm group. Thus, as noted in Table 2, although women engineers experienced inappreciable mean reduction on their female Engineer scale, men engineers experienced an appreciable reduction on their male Engineer scale from the norm group mean of 50 to the present mean of 46. This reduction would thus suggest that, for male engineers, the scale cutoff scores should be adjusted when used for individual counseling in order to compensate for this finding. For example, with the present sample, a score of 37 on the male Engineer scale (comparable to a score of 41 by the norm group) should represent somewhat similar interests with male engineers rather than the mid-range interests a score of 37 represents on the profile. Thus, with the present sample, a male Engineer score of 37 represents the 18th percentage of male engineer interests, although the norm group places it at the 10th percentile. It should be noted, however, that such mean score reduction is probably important only for individuals scoring just below the range of somewhat similar interests.

It might also be noted again that significant career field differences were found among women on the female Engineer scale and among men on the male Engineer scale. Thus, among women, mechanical engineers were highest (and civil engineers, lowest) on the female Engineer scale. Similarly among men, mechanical and industrial engineers were highest (and civil engineers, lowest) on the male Engineer scale.

In summary, the two Engineer scales do not equally represent the subfields of engineering, nor does the male Engineer scale represent adequately the interests of male engineers. The former lack of subfield or specialty representation may be explained, however, by the fact that each career field within the total current sample is not represented the same as within the norm group. The

TABLE 2. Strong-Campbell Interest Inventory Standard Score Means of Satisfied Professional Engineers Grouped According to Total, Sex, Ethnicity, Current Main Career Field, Satisfaction Level, and Years Since Bachelor's Degree with Grouping-Factor Interactions Removed in ANOVA tests.

SCII SCALE	GENERAL NORMS		ENGR NORMS			SEX		ETHNIC GROUP		CURRENT MAIN CAREER FIELD								SATISFACTION LEVEL		YEARS SINCE BACHELOR'S					TOTAL STANDARD DEV.
	M	F	M	F	TOT	M	F	Min	Maj	AgE	ChE	CE	EE	IE	ME	RE	OtE	VS	S	A	B	C	D	E	
OCCUPATIONAL THEMES:																									
Realistic	54	45	60	56	57	59	54e	55	57	62	55	58	56	55	59	59	55	57	57	56	58	57	58	56	9
Investigative	51	48	57	57	55	55	56	55	55	55	57	52	57	53	56	56	56c	55	55	55	55	54	56	55	8
Artistic	47	53	45	51	45	42	48e	48	45	41	46	42	47	45	44	47	46a	45	45	46	47	44	43	44	10
Social	49	51	44	43	43	43	43	45	43	41	46	44	44	43	41	41	42	43	43	45	42	41	44	43	9
Enterprising	52	48	48	47	47	47	46	49	46	45	47	46	47	49	45	47	47	47	46	47	46	45	47	48	8
Conventional	50	50	51	50	51	51	50	51	51	51	51	50	51	55	49	49	50a	51	50	51	50	49	50	53	8
(Holland Code)	REI	ASC	RIC	IRC	RIC	RIC	IRC	RIC	RIC	RIC	IRC	RIC	IRC	CRI	RIC	RIC	IRC	RIC	RIC	RIC	RIC	RIC	RIC	RIC	
BASIC INTEREST SCALES:																									
R Agriculture	51	49	53	50	51	52	50c	50	51	60	49	55	50	48	51	58	47e	52	51	51	53	52	51	51	10
Nature	48	52	49	53	50	48	53e	45	50	57	50	50	49	49	49	57	47b	49	50	51	52	50	49	47	11
Adventure	54	46	52	51	52	53	49e	54	52	52	50	53	52	49	52	54	52	53	51	52	52	54	53	49e	9
Military Activities	53	47	53	50	51	53	48e	53	51	50	50	52	51	52	51	54	51	53	50a	51	50	50	53	54	10
Mechanical Activities	54	45	61	57	58	60	56e	58	58	62	58	57	59	56	61	58	57b	59	58	58	59	58	59	58	9
I Science	52	48	59	57	56	56	57	55	56	59	58	53	58	54	57	58	57e	57	56	56	55	56	57	56	8
Mathematics	52	48	60	60	60	60	60	59	60	62	60	58	62	62	60	59	60e	61	60	60	60	60	61	61	5
Medical Science	50	50	51	52	50	49	51	49	50	49	52	48	51	49	50	54	51	49	50	51	50	49	52	48	10
Medical Service	47	53	46	47	45	45	46	47	45	44	46	45	47	46	44	48	45	45	46	47	47	44	46	44a	7
A Music/Dramatics	46	54	44	52	45	43	50e	48	45	40	46	42	47	47	45	47	47a	45	45	47	47	45	42	44	10
Art	45	55	44	52	45	42	49e	46	45	41	46	41	47	44	45	48	46a	44	45	47	46	44	42	44	10
Writing	47	52	44	50	44	42	46e	45	44	39	46	42	46	45	42	44	46	44	43	44	45	42	42	46a	10
S Teaching	48	52	48	45	46	46	46	47	46	42	47	47	48	44	43	44	45a	46	46	46	45	44	46	47	9
Social Service	47	52	40	42	40	39	41	42	40	37	43	40	41	41	39	38	41	41	40	41	40	37	42	40a	8
Athletics	53	47	50	45	49	51	45e	51	49	50	47	52	49	47	48	49	46	49	49	50	48	50	49	48b	10
Domestic Arts	43	57	43	51	46	43	51e	45	46	42	45	46	48	48	45	46	46	45	47	49	49	45	45	42a	10
Religious Activities	48	51	46	45	46	46	46	46	46	49	47	46	46	45	45	43	45	46	45	47	45	43	46	48a	10
E Public Speaking	52	48	47	47	47	48	46	51	47	46	48	48	48	48	46	47	48	49	47	48	46	46	48	49	9
Law/Politics	52	47	49	48	49	49	48	51	49	48	50	49	47	49	48	47	51	49	48	50	47	47	50	49	9
Merchandising	50	50	46	48	45	45	46	47	46	42	46	45	46	52	44	46	45b	46	45	46	46	44	45	47	9
Sales	53	47	48	46	46	47	44c	50	46	44	46	46	48	47	46	45	46	47	46	46	46	45	46	48	8
Business Management	52	48	50	49	49	50	48	52	49	48	51	48	48	55	48	49	49a	50	49	49	49	48	50	51	9
C Office Practices	47	53	45	46	45	45	45	44	45	42	42	46	46	46	43	43	45	45	45	45	44	43	45	47	7
OCCUPATIONAL SCALES:																									
F Engineer	40	22	54	50	51	52	49e	50	51	57	50	48	50	49	55	52	50e	52	51	49	52	53	52	50a	9
M Engineer	28	19	50	41	44	46	41e	40	45a	41	44	42	45	40	49	44	44e	45	44	42	45	45	46	45	11
SPECIAL SCALES:																									
Academic Comfort	44	48	51	54	49	47	53e	49	49	47	54	45	52	47	48	50	52d	50	49	49	50	47	49	50	13
Introvert-Extrovert	50	50	56	54	56	56	56	51	56	60	55	56	54	55	58	54	56	55	57	53	57	57	57	55	11
SAMPLE SIZE	300	300	228	201	369	243	125	16	332	13	46	81	69	29	70	24	37	139	230	78	71	83	69	68	

TOT - Total Group
M - Male
F - Female
Min - Minority
Maj - Majority

AgE - Agricultural Engineering
ChE - Chemical Engineering
CE - Civil Engineering
EE - Electrical Engineering
IE - Industrial Engineering

ME - Mechanical Engineering
RE - Resource (Mining, Geological, Mineral, Petroleum) Engineering
OtE - Other Engineering

VS - Very Satisfied
S - Satisfied

A - 1-2 Years
B - 3-4 Years
C - 5-9 Years
D - 10-18 Years
E - 19-70 Years

a - $p<.05$ b - $p<.01$ c - $p<.005$ d - $p<.001$ e - $p<.0001$

TABLE 3. Strong-Campbell Interest Inventory Standard Score Means for Men and Women Satisfied Engineers Grouped By Current Main Career Field, Satisfaction Level, and Years Since Bachelor's Degree with Significant Grouping-Factor Interactions-by-Sex indicated.

SCII SCALE	CURRENT MAIN CAREER FIELD														SATISFACTION				YEARS SINCE BACHELOR'S DEGREE									
	ChE		CE		EE		IE		ME		RE		OtE		VS		S		A		B		C		D		E	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
OCCUPATIONAL THEMES:																												
Realistic	56	55	59	54	57	54	64	50	61	55	61	57	55	54	59	55	59	54	59	54	63	53	58	56	60	53	56	54
Investigative	57	58	52	51	55	58	54	53	55	57	57	53	56	57	54	58	55	55	55	55	56	55	53	56	55	59	55	52
Artistic	45	49	41	46	44	51	40	48	43	47	46	49	46	48	42	49	43	48	42	49	45	48	43	48	41	48	44	44
Social	45	47	44	42	43	46	45	41	42	40	42	40	42	43	43	44	43	42	44	45	43	42	41	40	45	41	43	45
Enterprising	47	48	46	44	48	47	50	49	45	44	49	43	48	45	47	46	47	46	48	47	46	46	45	45	48	44	48	46
Conventional	52	50	51	48	51	51	59	53	48	50	50	47	51	47	51	50	51	50	51	50	50	50	48	52	51	48	54	45
(Holland Code)	IRC	IRC	RIC	RIC	RIC	IRC	RCI	CIR	RIC	IRC	RIC	RIA	IRC	IRA	RIC	IRC	RIC	IRC	RIC	IRC	RIC	IRC	RIC	RIC	RIC	IRC	RIC	RIE
BASIC INTEREST SCALES:																												
R Agriculture	49	50	56	53	50	49	50	46	53	46	57	59	47	46	52	50	52	49	51	51	55	50	52	50	54	43	50	53b
Nature	47	55	49	54	47	53	49	49	48	51	54	61	46	48	48	54	49	53	48	53	51	54	47	55	49	49	47	48
Adventure	50	50	56	45	53	53	50	49	54	47	57	51	52	48b	54	50	53	49	54	50	57	47	54	51	54	48	49	48
Military Activities	52	46	53	48	51	50	60	47	53	48	56	50	52	48	55	49	52	48	52	49	53	46	51	49	55	49	54	47
Mechanical Activities	58	57	57	54	61	56	64	51	63	59	60	56	57	57	59	57	60	55	61	56	63	54	58	58	60	56	58	55
I Science	58	58	53	53	57	59	58	51	57	57	57	58	57	60	56	58	56	56	56	56	58	55	55	57	56	61	56	52
Mathematics	60	61	58	59	62	62	63	61	61	60	61	55	61	60	61	61	60	60	61	59	60	60	60	62	60	62	61	60
Medical Science	51	55	48	47	49	55	49	49	49	51	55	53	52	49	49	51	50	51	50	51	49	51	48	52	51	54	49	44
Medical Service	46	46	45	45	46	48	48	45	44	44	47	49	45	44	45	45	46	46	47	47	47	47	44	44	46	43	44	45
A Music/Dramatics	[illegible]	50	40	46	43	52	41	51	43	48	44	52	46	50	42	51	43	49	42	51	44	50	43	48	40	48	44	47
Art	43	51	40	47	44	50	39	46	42	49	46	51	45	49	42	50	42	49	42	50	44	49	41	49	40	48	43	44
Writing	45	47	41	44	43	50	42	46	41	44	44	45	45	48	43	48	42	45	40	46	43	47	40	46	40	47	46	43
S Teaching	48	47	46	49	47	50	45	44	45	40	43	44	45	45	45	47	46	45	46	46	45	46	45	43	46	45	47	50
Social Service	42	44	40	39	39	43	42	40	38	40	36	41	40	44	40	42	39	41	38	44	38	41	37	38	42	39	40	42a
Athletics	48	45	54	46	50	48	52	45	51	42	54	42	48	42a	51	45	52	45	52	48	52	43	53	43	52	41	49	43
Domestic Arts	42	52	44	54	47	50	43	51	43	48	40	54	44	52	43	50	44	51	45	52	46	52	43	50	44	48	41	47
Religious Activities	47	47	47	42	45	47	45	44	45	45	44	42	43	48	47	44	45	46	45	47	46	45	43	42	46	45	48	44
E Public Speaking	48	47	48	45	49	46	48	47	46	47	48	45	50	44	50	45	47	46	48	48	47	45	46	45	49	45	49	49
Law/Politics	49	51	50	46	48	47	49	49	47	50	49	44	51	50	50	48	48	48	49	50	48	46	47	47	51	49	49	50
Merchandising	45	46	45	46	45	47	50	53	44	44	48	43	46	42	45	46	45	46	44	47	45	47	43	45	46	44	47	47
Sales	46	46	47	44	50	46	49	46	47	44	48	41	47	44	47	45	47	44	48	45	47	45	45	45	48	42	48	45
Business Management	51	51	49	47	48	48	56	54	48	48	53	44	51	43	50	49	49	48	48	49	48	50	48	48	51	45	52	49
C Office Practices	45	44	46	45	46	46	49	45	43	45	43	44	45	45	45	45	45	45	44	45	43	46	43	44	45	43	47	43
OCCUPATIONAL SCALES:																												
F Engineer	51	50	49	45	53	47	53	47	57	53	55	48	51	48	52	50	52	48	53	46	56	47	53	53	52	52	50	50
M Engineer	45	42	43	40	47	41	50	34	50	46	45	41	45	41	46	42	46	41	47	39	49	40	45	45	46	45	46	41
SPECIAL SCALES:																												
Academic Comfort	52	57	43	50	49	57	46	47	46	51	48	52	51	54	47	56	47	52	45	52	47	53	45	52	47	57	50	50
Introvert-Extrovert	55	52	55	59	54	55	59	52	58	57	51	59	54	58	55	55	57	56	54	53	57	56	57	58	56	60	55	55
SAMPLE SIZE	29	15	57	18	38	26	10	18	43	25	12	9	25	9	93	38	131	85	29	44	36	33	54	22	48	17	57	7

ChE - Chemical Engineering
CE - Civil Engineering
EE - Electrical Engineering
IE - Industrial Engineering
ME - Mechanical Engineering

RE - Resource (Mining, Geological, Mineral, Petroleum) Engineering
OtE - Other Engineering

VS - Very Satisfied
S - Satisfied

M - Male
F - Female

A - 1-2 Years
B - 3-4 Years
C - 5-9 Years
D - 10-18 Years
E - 19-70 Years

a - p<.05 b - p<.01 c - p<.005 d - p<.001 e - p<.0001 norm group was more restricted in representing a variety of specialties, concentrating more heavily on electrical and mechanical engineers.

Conclusions

From the results discussed it seems evident that the "typical" engineer is actually a composite of rather heterogeneous groups of engineers. SCII scales have major utility for differentiating engineering specialties and for counseling potential engineers (and probably even students). However, sex, career field, satisfaction, and experience differences were also observed. Thus, although engineers tend to differ from nonengineers in interests, major subgroup differences within the engineering profession also occur. Moreover, for men, interpretation of the male Engineer scale should incorporate a slight correction for the reduction of the mean score found.

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Engineering Careers: Women in a Male-Dominated Field

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Abstract

Responses from a national survey of engineers were used to compare the background and career characteristics of men and women engineers differing in the number of years since they completed their BS degrees (5 years or less, 6-10, 11-15, 16-20 years). The parents of women engineers were more likely to hold college degrees and to be employed in professional positions than were the parents of male engineers. Fewer women than men reported being married. Among those who had received their degree more than five years ago, more women than men had obtained advanced degrees.

Younger engineers and men made their decision to pursue engineering sooner than did older engineers and women. Engineers rated work-related factors as most important in influencing their decisions to pursue engineering careers.

While men and women reported comparable levels of technical responsibility in their current jobs, women reported lower levels of supervisory responsibility and lower salaries than men. The discrepancy was most apparent among engineers who had received their BS degree more than 10 years ago. Women also rated their jobs lower than did men on career advancement opportunities and were less satisfied with the progress they had made in their careers. However, the vast majority of engineers reported being satisfied with their current jobs, with older engineers reporting greater satisfaction than younger engineers.

Engineering Careers: Women in a Male-Dominated Field[1]

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During the past 10 years, there has been a dramatic increase in the number of women enrolled in engineering schools throughout the country. In 1972, women represented just 2.9% of the freshman engineering students and 2.3% of the full-time undergraduate engineering students (Engineering Manpower Commission, 1973). As of the fall of 1981, women represented 15.8% of the freshmen and 14.5% of the full-time undergraduates in engineering (Engineering Manpower Commission, 1982). This increase is a result of a number of factors, including better job opportunities for women in engineering, high-school recruitment programs, a greater sensitivity to sex-bias in career counseling among high-school guidance counselors and special programs for women engineering students at colleges and universities.

Together with the increased numbers of women in engineering and other male-dominated fields has come an increased interest in the characteristics of women who enter male-dominated fields (e.g., Lemkau, 1979; Greenfield, Greiner, & Wood, 1980; Matthews, Collins, & Cobb, 1974). Past research has found that women in male-dominated occupations generally come from intact families with high parental education and a high rate of maternal employment (Lemkau, 1979). Women in male-dominated fields also tend to place more importance on career-related success than do women in female-dominated fields (Greenfield, Greiner, & Wood, 1980). In addition, as a result of their small numbers in the field, women in male-dominated careers often suffer from feelings of isolation, lack of support from male colleagues, loneliness or sex discrimination (Kanter, 1977; Mathews, Collins & Cobb, 1974; Standley & Soule, 1974).

Studies of women in engineering have generally involved students rather than engineers in the field (Greenfield, Holloway & Remus, 1982; Ott, 1978a, 1978b). While some research studies found differences in academic preparation (Jagacinski & LeBold, 1981) and academic and career characteristics (Ott, 1978a) of male and female engineering students, other studies have reported similarities between male and female engineering students (Gardner, 1975; Greenfield, Holloway & Remus, 1982). In a longitudinal study of engineering students at Kansas State University, Lindholm and Hummel (1980) reported that, as the number of women entering engineering increased, their academic performance became more similar to that of their male colleagues; that is, it declined. It may be that women who entered engineering 10 years ago had to be at the very top of their high-school class. On the other hand, today there is greater acceptance of women in engineering so that, although women who are attracted to the field are very bright, perhaps they need not be brighter than their male classmates.

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When the ratio of men to women in a given field begins to change, it is quite possible that the characteristics and experiences of individuals entering that field may change. Today's woman engineering student is less likely to find that she is the only woman in her classes than was the woman engineering student 10 years ago. Kanter (1977) has suggested that, when the ratio of men to women in an occupational field decreases, more attention will be focused on the woman's competence rather than her uniqueness. Although the ratio of men to women in the field of engineering is still very high, the presence of just two or three women engineers in a given department might lead to different experiences than those that would occur with only one woman in the department. The research study reported here examines differences between men and women engineers who have been in the field for different lengths of time. Of special interest is the comparison of recent graduates (out of school 5 years or less) with those who have been in the field up to 10, 15, and 20 years. The variables examined include demographic and background characteristics, factors influencing decisions to study engineering, current job status, job values and job satisfaction, attitudes towards women in engineering and perceptions of the opportunities for women and minorities in engineering.

Method

A national survey of professional engineers was conducted during 1981 as part of the National Engineering Career Development Study. Samples of men and women engineers were identified with the help of the major engineering societies and several universities and colleges having engineering programs. Women and minorities were oversampled so that comparisons relevant to the purposes of the study could be made. The National Engineering Career Development Survey was sent to each engineer in the sample. The survey was 12 pages long and included sections covering employment, education, background characteristics, factors influencing decisions to study engineering, self-assessments of abilities and other traits, job values and job satisfaction. Two follow-up letters were sent to non-respondents. Surveys were returned by 2,852 engineers representing approximately 50% of the original sample.

The research presented here was limited to respondents who had received their BS degree within the past 20 years and were employed full-time in engineering at the time of the survey (N=1961). Men and women were assigned to one of four groups, depending upon the number of years since they had received their BS degree: (1) 5 years or less, (2) 6-10 years, (3) 11-15 years, (4) 16-20 years. Analyses were conducted in order to compare men and women engineers in these different BS groups on a variety of dimensions. Analysis of variance and chi-square procedures were used to test for significant differences. Because the sample size was so large and many tests were made, only differences significant beyond the .01 level are considered. However, results which are significant between the .01 and .05 levels will be noted in the tables for the benefit of the reader.

Results

Background and Demographic Characteristics

Table 1 presents information about the background and demographic characteristics of the respondents. The majority of our respondents were white, with a greater percentage of women than men reporting their race as white. Men in our sample were more likely to be married than were the women ($p<.001$). Approximately one-half of the women were married, with slightly more of the women in the older BS groups reporting being married. The increase in the percentage of married respondents with the increase in years since BS was much more dramatic for men than for women. In terms of current educational level, the majority of engineers who had graduated more than five years ago had attained advanced degrees. Women in the older BS groups were more likely to have attained a degree beyond the BS than were the men in the older BS groups ($p<.001$).

The fathers of women engineers were more likely to hold professional positions than were the fathers of male engineers ($p<.01$). In fact, nearly one-fourth of the women's fathers were engineers themselves. In addition, the fathers of women engineers were more likely to have attained a BS or advanced degree than were the fathers of male engineers ($p<.001$). There was also a general trend for a greater percentage of fathers of recent graduates to have advanced degrees. Moreover, the mothers of women engineers were more likely to hold professional positions and were somewhat less likely to be homemakers than were the mothers of male engineers ($p<.001$). As with the fathers, the mothers of women and younger engineers were more likely to have bachelors or advanced degrees ($p<.001$) than were the mothers of men and older engineers. These results are consistent with previous studies of women in male-dominated fields (Lemkau, 1979; Standley & Soule, 1974; Valentine, Ellinger & Williams, 1975).

An examination of those engineers who reported being married revealed that approximately one-third to one-half of the women in each BS group were married to engineers. For each BS group, over 80% of the married women engineers had spouses who were engineers or professionals, while less than one-half of the wives of male engineers were engineers or professionals. Moreover, women's spouses were more likely to have BS or advanced degrees ($p<.001$) than were the the spouses of male engineers.

Career Decisions

Respondents were asked to indicate when they first considered a career in engineering and when they made their final decisions. Analysis of both variables revealed significant sex differences ($p<.001$ for each). Almost one-half of the men first considered engineering prior to their junior year in high school, with approximately 75% having considered it before entering college (see Table 2). On the other hand, one-third to one-half of the women first considered engineering after entering college. Among women in the two younger BS groups, about one-third first considered engineering after entering college, while this figure was closer to one-half for the two older BS groups. Among the men, more than one-half made their final decisions to pursue a career in engineering prior to entering college. Over one-half of the women made this final decision after entering college. There was also a significant difference among the BS groups in terms of their final decisions to study engineering, with the two younger groups tending to make the decision sooner than did the two older BS groups ($p<.003$).

Engineers rated the importance of a large number of factors which may have encouraged them to pursue a career in engineering. Each factor was rated for its importance on a four-point scale, ranging from "none" to "very". Summary scales were formed by averaging individual's responses to related items. Five scales were developed: (1) people-related factors; (2) guidance-related factors; (3) work-related; (4) hobbies and activities; and (5) courses. Cronbach's coefficient alpha was computed for each scale, and these coefficients ranged from .67 to .87. Table 2 presents the mean scores obtained on each of these scales for men and women in the different BS groups.

The people-related scale was composed of eight items, including relatives, friends, engineers, college counselors and teachers. Analysis of the people-related scale values revealed a significant effect for BS group ($p<.001$). As can be seen in Table 2, people were a more important influence for engineers in the youngest BS group, than for older, or more experienced, engineers. It also appears that the people-related items were not highly important. The mean scale value for each group was approximately 2.0, which corresponds to "little" importance on the original four-point rating scale.

The second scale consisted of six items dealing with guidance instruments and activities, such as interest inventories, career education courses and guidance counselors. Analysis of the data obtained for this scale did not reveal significant differences among the groups. It also appears that the items on the guidance-related scale did not play a major role in the engineers' decisions to pursue a career in engineering, given the low mean values.

The work-related scale consisted of 12 items dealing with job characteristics (e.g. prestige, challenge, rapid advancement, liking for problem solving, security). There was a significant difference among the BS groups for this scale ($p<.001$). Examination of the means in Table 2 indicates that work-related factors were relatively more important for the younger BS groups than for the older BS groups. It also appears that work-related factors were fairly influential, given the potential range of the scale. For each group, the mean scale value for the work-related factors was higher than the mean scale values of the other four scales.

Fifteen items were included in the hobbies and activities scale. Some example items include science clubs, building electrical devices, hobby magazines and flying an aircraft. While these items were not very influential in an absolute sense, they were more important to male engineers ($p<.001$) and to engineers in the younger BS groups ($p<.005$) than to female engineers or engineers in the older BS groups.

The last scale consisted of seven items dealing with high school and college courses in math, science and engineering. Analysis of the data for this scale revealed a significant interaction effect ($p<.008$). An examination of the means in Table 2 shows that the courses were most important to women in the youngest BS group and least important to women in the oldest BS group. On the other hand, there was only minor variation in the importance ratings of courses for male engineers.

The overall pattern of means in Table 2 shows that most of the factors were rated as being more important by the youngest BS group than by the older BS groups. This may be partially a function of the relatively small amount of time since these engineers made their decisions to pursue careers in engineering. Engineers were asked to assess the importance of various factors to decisions which were made in the past. It may be harder for the engineers in the older BS groups to remember how important various factors were to them, thus leading to generally lower ratings by the older groups. In general, the work-related items and courses received the highest importance ratings for each group.

Current Job Status

Engineers answered a number of questions about the characteristics of their current (1981) positions. Respondents rated their degree of technical responsibility on an eight-point scale, ranging from simple-routine work requiring no experience (Level 1) to complex tasks requiring thorough knowledge of standard guides (Level 6) through pioneering work requiring outstanding knowledge of the most advanced techniques (Level 8). While degree of technical responsibility tends to increase with experience (years since BS, $p<.001$), no sex difference was found for this variable. Figure 1 illustrates the pattern of these results. For illustrative purposes, the dimension of years since BS degree has been divided into a larger number of groupings in the figure than was used in the tables.

Respondents also reported their degree of supervisory responsibility. A nine-point rating scale was used, ranging from no supervisory responsibility (Level 1) to supervision of professional engineering and scientific personnel (Level 5) up to the highest administrative post (Level 9). Analysis of this variable revealed two main effects ($p<.001$ for each) and a significant interaction ($p<.004$). Figure 2 presents the percentages of men and women engineers indicating level 5 (supervision of professionals) or higher according to the number of years since their BS degree. As can be seen in the figure, there are only minor differences between men and women who have been out of college five years or less. However, the curve for men generally increases across the whole range of years since BS degree, while the curve for women tends to level out after about eight years.

A similar pattern can be seen in the salary curves depicted in Figure 3. Again, men and women reported comparable median salaries for the first seven or eight years of experience, but beyond that point women reported substantially lower salaries than did men (interaction effect, $p<.001$). The salary curve may be largely a function of the observed differences in supervisory responsibility. Management represents a popular career path among engineers and greater supervisory responsibilities are likely to be associated with higher salaries. A larger percentage of men (17.2%) than of women (10.4%) reported the principal function of their current job as being management. These results should be interpreted with some caution, because women in the older BS groups were more likely to have had a break of at least 6 months in their career than were men in the older BS groups. However, other studies have also found some divergence in the salary curves of men and women engineers after 10 years of experience (Jagacinski & LeBold, 1981; McAfee, 1974; Rossi, 1972).

Job Values and Job Satisfaction

Engineers rated a large number of job characteristics in terms of how important each was to them personally and to what extent each factor characterized their current positions. These ratings were made on four-point scales, ranging from "none" to "very". The importance ratings were factor analyzed for the purpose of scale development. On the basis of this analysis, three scales were formed by averaging related items. The first scale dealt with intrinsic work characteristics (e.g., "opportunity to innovate and propose new ideas," "opportunity to work on problems for which there are no ready-made solutions."). The second scale involved career advancement (e.g., "a chance to exercise leadership," "adequate preparation for top level careers," "opportunity to move into a management career"), and the third factor involved aspects of the work environment (e.g., "flexible working hours," "pleasant people to work with," "I know exactly what my work responsibilities are"). Cronbach's coefficient alpha indices for the scales ranged from .76 to .82. Table 3 presents the mean scale scores for men and women in the various BS groups. The intrinsic factor was quite important to all respondents, regardless of sex or BS group. Analysis of the career-advancement factor revealed a significant interaction effect ($p<.002$). As can be seen in Table 3, career advancement was highly important to most groups but was rated somewhat lower by women in the two older BS groups than by any of the other groups. Finally, there was a significant difference among the BS groups in terms of the work-environment factor, with the younger BS groups placing greater importance on this factor ($p<.001$) than the older BS groups.

Scales were also formed for the ratings of how characteristic each factor was of engineers' current jobs in the same manner as for the importance ratings. Alpha coefficients for the characteristic rating scales were .89 for intrinsic, .85 for career advancement and .75 for work environment. As can be seen in Table 3, the means for the characteristic rating scales are generally lower than the means for the importance rating scales. This difference might be expected because the importance ratings represent an ideal and the characteristic ratings represent the reality. There was a significant difference among the BS groups on the intrinsic factor, with the older BS groups rating their positions higher on the intrinsic scale than did the younger BS groups ($p<.001$). For the career advancement factor, men rated their jobs higher than did women ($p<.003$). However, the interaction effect also approached significance ($p<.01\overline{3}$), which is reflected in the fact that there is little difference between the career advancement ratings of men and women in the youngest BS group but a substantial difference between the ratings of men and women in the other three BS groups. Given the lower ratings of the women in the two older BS groups, it should also be recalled that these two groups rated the career-advancement factor as being less important than did the other groups.

Finally, a significant difference was found among the BS groups for the work environment factor ($p<.008$), even though there is little variation among the means for this factor. The youngest and the oldest BS groups rated their positions higher on this factor than did the other BS groups. Again, it should be noted that this factor was more <u>important</u> to the youngest BS group than to the older BS groups..

Engineers also rated the extent to which they were satisfied with their work in their current position (five-point scale) and their satisfaction with their progress in their occupation (four-point scale). The group means for these variables are also presented in Table 3. Although a large majority of the respondents were satisfied with their work (rating of 4 or 5), a significant difference was found among the BS groups ($p<.006$), with a higher mean satisfaction rating for the older BS groups than for the younger BS groups. In terms of career progress, there was a significant difference between the ratings of men and women ($p<.001$), with men expressing greater satisfaction with their progress than did the women.

Women and Minorities in Engineering

The survey included seven items dealing with opinions concerning working women. Respondents indicated whether they agreed or disagreed with these statements, using a four-point scale ranging from "strongly disagree" to "strongly agree". Some example items include: "It is acceptable for women to assume leadership roles in industry as often as men;" "Women possess the self-confidence required of a good engineer." Ratings for these items were averaged in order to provide a single measure of attitudes towards women in the work force. The alpha coefficient computed for this scale was .85. Group means for this variable are presented in Table 4. Women expressed significantly more favorable views than did men ($p<.001$). Although the interaction effect was not significant, it is interesting to note that, among the women, the youngest BS group had the least favorable attitudes, while among the men the oldest BS group had the least favorable attitudes. Although a sex difference was found on this scale, men did generally agree with most of the statements, but women were more likely to agree strongly with the statements than were the men.

Respondents were asked to evaluate the opportunities for minorities in engineering relative to whites. A five-point scale was used, with 1 indicating minorities have better opportunities, 3 meaning equal opportunities for minorities and whites and 5 meaning that whites have better opportunities. A significant difference among the BS groups was found ($p<.001$), with the younger BS groups being more likely than others to indicate that minorities have better opportunities and the older groups being more inclined than others to indicate that whites have better opportunities. The group means can be found in Table 4.

Respondents also rated engineering opportunities for women relative to men. Again, a five-point scale was used, with high scores signifying that men have better opportunities than women. Significant effects for sex ($p<.001$) and for BS group ($p<.001$) were found on this variable. As can be seen in Table 4, men in the two younger BS groups were somewhat more inclined than others to believe that women have better opportunities than men. As compared to men, women endorsed the opinion more strongly than men that men have better opportunities in engineering than do women. In general, the greater the number of years since completing their BS degrees, the more likely engineers were to endorse this opinion.

Discussion

Although men and women engineers appear to differ in many background characteristics, they appear to be influenced by similar factors in their decisions to pursue a career in engineering. It is notable that the more recent engineering graduates made their decision to pursue careers in engineering earlier than did the older graduates. This was true of both male and female engineers. It thus appears that efforts to recruit women into the field of engineering during high school have been somewhat successful. However, it is also noticeable that guidance-related factors were rated fairly low in importance relative to influencing the respondents to pursue careers in engineering. There may still be room for progress in this area through special recruitment efforts designed to attract women and minorities into engineering. Efforts to inform students about career opportunities in engineering during their freshman year of high school could help to overcome the problem of students not taking the necessary prerequisite courses during high school (e.g. math and science).

Pre-college summer seminars may be another way of providing prospective students with information about engineering careers. While many colleges and universities have made efforts to develop such programs, only a small proportion of the potential pool of students is being reached. In this study, approximately 80% of the engineers indicated that pre-college seminars were of no importance in influencing them to pursue a career in engineering. It is highly likely that most of these people never had a chance to attend a pre-college summer seminar.

Evidence of differences in the career advancement opportunities for men and women in engineering is quite disturbing. Women in the older BS groups reported lower levels of supervisory responsibility and lower salaries than did men. Women also rated their jobs lower than did men in terms of career advancement and were less satisfied with the progress they had made in their careers. Further evidence of this apparent inequity was found in terms of engineers' perceptions of the opportunities for women in engineering. Both women and older graduates (men and women) tended to endorse the opinion that men have better opportunities in engineering than do women. Moreover, McAfee (1974) has reported that women in engineering are less likely to be promoted than are men. In the present study, the discrepancy between men and women seems most apparent among the two oldest BS groups, i.e., engineers who were probably in the field at the time of McAfee's study. It is possible that the opportunities for women in engineering are changing as the number of women in engineering increases. No appreciable difference in supervisory responsibility was observed among engineers in the first BS group (out less than 5 years).

Respondents also indicated their starting salaries for their first position after attaining the BS degree. Starting salaries were comparable for men and women in the two younger BS groups; however, men reported higher starting salaries than did women in the older BS groups. Nevertheless, women also reported lower levels of supervisory responsibity than did men on their first jobs.

The reason(s) for these discrepancies in the positions of male and female engineers cannot be determined from this study. McAfee (1974) suggested that women are not promoted as often as men, because employers expect women to drop out of the labor force in order to raise children. However, McAfee also pointed out that labor force statistics show that women in professional positions work as many years as do their male colleagues. Rossi (1972) suggested that women may have lower salaries because they do not pursue advanced degrees. However, the present study shows that women in the older BS groups are more likely than their male colleagues to have obtained advanced degrees. Perhaps women do not have the management training required for supervisory positions, but women in our sample were more likely than were men to be pursuing or planning to pursue an MBA. It may also be that women are not given the opportunity to demonstrate their management abilities and, therefore, are less likely to be promoted. On the other hand, it is possible that the equity of the jobs of the younger graduates in our sample is a result of affirmative action legislation and that it will just be a matter of time before women are promoted to higher supervisory levels.

Whatever the reason(s) for this apparent inequity, it seems important that women be assured of equal opportunities in the field of engineering if we are to continue to tap this talented pool of potential engineers.

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TABLE 1
Background and Demographic Characteristics of Sample

	YEARS SINCE BS DEGREE								Significance of Tested Effects:		
	0-5 Yrs.		6-10 Yrs.		11-15 Yrs.		16-20 Yrs.				
	M	F	M	F	M	F	M	F	Sex	YrBS	Int.
Race											
Black	6%	3%	9%	4%	4%	3%	0%	0%	z	z	
Hispanic	11	2	8	2	5	3	0	0			
Asian	1	3	4	3	5	5	11	0			
White	78	91	72	89	79	89	83	100			
Foreign National	4	1	7	3	7	0	6	0			
Marital Status											
Married	51%	45%	76%	53%	87%	60%	92%	55%	z	z	z
Educational Level											
BS degree	63%	77%	38%	19%	20%	14%	18%	0%		z	z
MS degree(s)	36	24	55	76	66	60	52	73			
Ph.D.	1	0	7	5	14	26	30	27			
Father's Occupation											
Engineer	15%	23%	9%	24%	13%	28%	13%	19%	z		
Professional	42	41	39	42	36	33	42	52			
Other	43	36	52	34	51	39	45	29			
Mother's Occupation											
Engineer	0%	1%	0%	0%	0%	0%	0%	0%	z		x
Professional	18	22	12	25	13	35	13	10			
Homemaker	51	44	55	43	55	46	66	52			
Other	31	33	33	32	32	19	21	38			
Spouse's Occupation[a]											
Engineer	5%	58%	2%	48%	1%	34%	0%	29%	z		
Professional	38	25	33	35	35	53	46	57			
Homemaker	22	0	36	1	39	0	37	7			
Other	35	17	29	16	25	13	17	7			
(No. of Cases)	(274)	(263)	(276)	(69)	(115)	(32)	(70)	(14)			
Father's Education											
BS degree or higher	35%	50%	23%	43%	22%	40%	33%	38%	z	z	
Mother's Education											
BS degree of higher	24%	29%	15%	28%	13%	22%	17%	19%	z	z	
Spouse's Education[a]											
BS degree or higher	48%	84%	53%	79%	52%	82%	64%	71%	z		
(No. of Cases)	(554)	(600)	(395)	(127)	(140)	(47)	(78)	(21)			

[a] Based on respondents who were married.

x: $p<.05$; y: $p<.01$; z: $p<.001$

TABLE 2
Time of Decision to Pursue a Career in Engineering and Importance Ratings of Factors Influencing the Decision to Pursue a Career in Engineering

	YEARS SINCE BS DEGREE								Significance of Tested Effects:		
	0-5 Yrs.		6-10 Yrs.		11-15 Yrs.		16-20 Yrs.				
	M	F	M	F	M	F	M	F	Sex	YrBS	Int.
Time of Career Decision											
First Considered Engineering											
First two years H.S.	43%	18%	44%	34%	45%	37%	49%	38%	z	x	
Last two years H.S.	40	48	43	34	29	18	36	12			
After Entering College	17	34	13	32	26	45	15	50			
Final Decision											
First two years H.S.	12%	4%	13%	9%	18%	15%	15%	6%	z	y	
Last two years H.S.	47	36	53	37	37	27	39	38			
After Entering College	41	60	34	54	45	58	46	56			
Factors Influencing Career Decision (Mean Importance Ratings)[a]											
People-Related	2.03	2.15	1.93	1.88	1.89	1.96	1.94	1.92		z	
Guidance-Related	1.43	1.43	1.38	1.21	1.40	1.23	1.48	1.37		x	
Work-Related	2.86	3.00	2.78	2.86	2.66	2.78	2.69	2.59		z	
Hobbies and Activities	1.80	1.48	1.74	1.40	1.68	1.37	1.65	1.33	z	y	
Courses	2.56	2.66	2.60	2.40	2.52	2.44	2.53	2.26		x	y

[a]Four-point scales; higher numbers indicate greater importance.

x: $p<.05$; y: $p<.01$; z: $p<.001$

TABLE 3
Job Values and Job Satisfaction

	YEARS SINCE BS DEGREE								Significance of Tested Effects:		
	0-5 Yrs.		6-10 Yrs.		11-15 Yrs.		16-20 Yrs.				
	M	F	M	F	M	F	M	F	Sex	YrBS	Int.
Importance Ratings											
Intrinsic Factor	3.43	3.38	3.42	3.43	3.38	3.48	3.43	3.32			
Career Advancement	3.25	3.32	3.31	3.21	3.21	3.13	3.28	3.13		x	y
Work Environment	3.37	3.41	3.34	3.27	3.17	3.25	3.18	3.18		z	
Characteristic Ratings											
Intrinsic Factor	2.95	2.86	2.99	2.88	3.12	3.09	3.10	3.10		z	
Career Advancement	2.89	2.88	2.93	2.72	2.93	2.72	2.95	2.79	y		x
Work Environment	3.04	2.98	2.98	2.86	2.94	2.87	3.00	2.94		y	
Satisfaction Ratings											
With Work	4.02	3.89	4.03	3.70	4.15	4.11	4.16	4.10	x	y	
With Career Progress	2.69	2.57	2.63	2.35	2.64	2.34	2.62	2.38	z	x	

x: $p<.05$; y: $p<.01$; z: $p<.001$

TABLE 4
Women and Minorities in Engineering

	YEARS SINCE BS DEGREE								Significance of Tested Effects:		
	0-5 Yrs.		6-10 Yrs.		11-15 Yrs.		16-20 Yrs.				
	M	F	M	F	M	F	M	F	Sex	YrBS	Int.
Attitudes Towards Women[a] in the Workforce	2.93	3.49	2.93	3.57	2.89	3.60	2.76	3.60	z		
Opportunities for[b] Whites/Minorities	2.78	2.81	2.90	3.23	2.92	3.15	3.21	3.76	x	z	
Opportunities for[c] Men/Women	2.78	3.26	2.93	3.71	3.17	3.73	3.34	4.18	z	z	

[a]Four-point scale; higher values indicate more favorable attitudes.

[b]Means > 3.0 indicate Whites have better opportunities.

[c]Means > 3.0 indicate Men have better opportunities.

x, $p<.05$; y, $p<.01$; z, $p<.001$

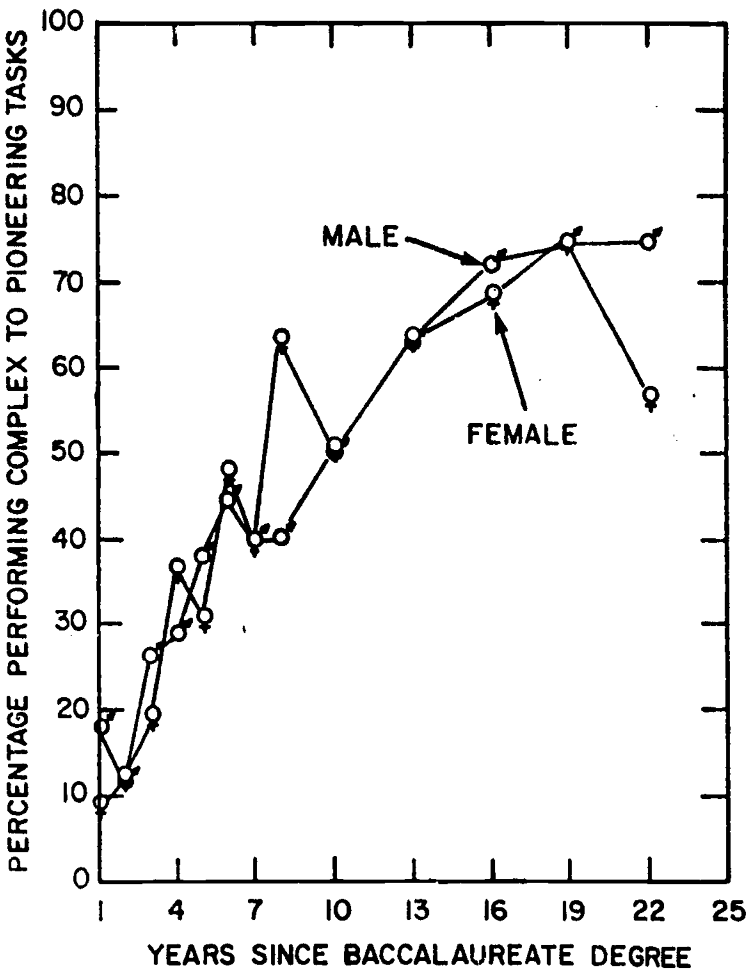

Figure 1 Percentage of Men and Women Engineers Reporting High Technical Responsibility (viz., Complex to Pioneering Work) by Years Since BS Degree.

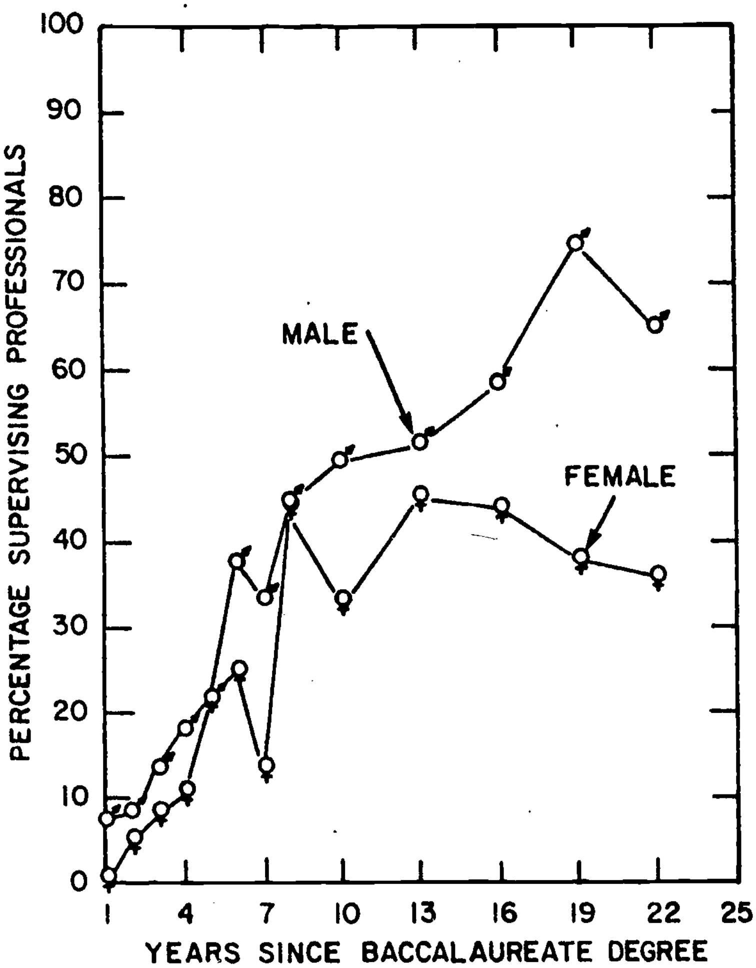

Figure 2 Percentage of Men and Women Engineers Supervising Professional or Managerial Personnel by Years Since BS Degree.

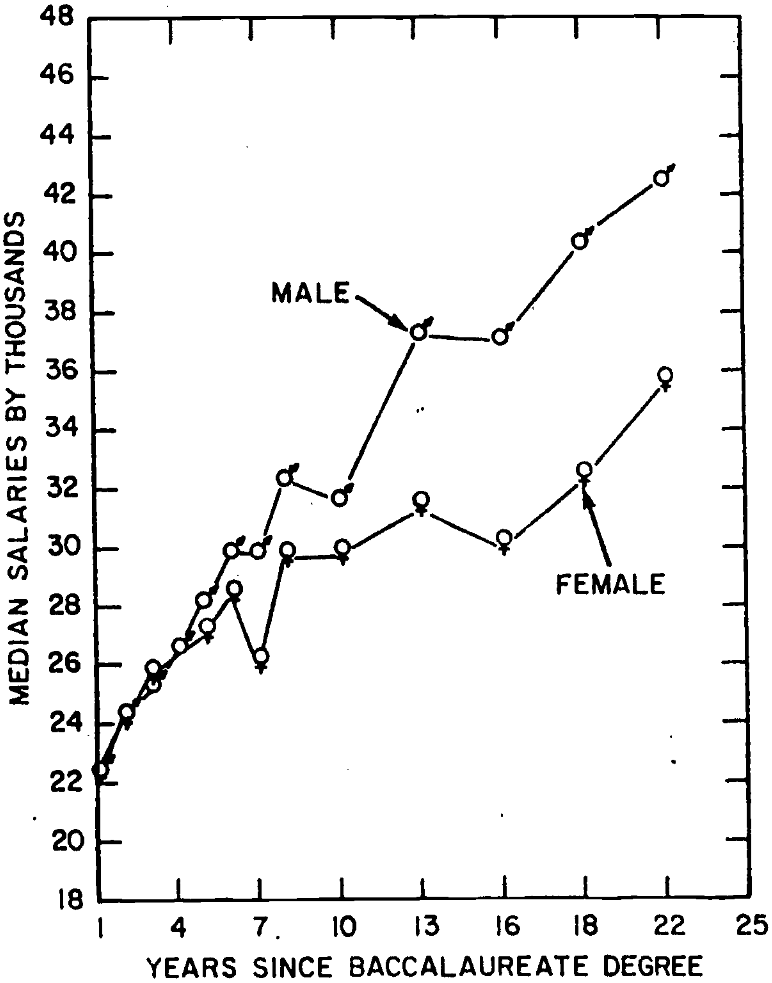

Figure 3 Median Salaries in Thousands of Dollars for Men and Women Engineers by Years Since BS Degree.