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ABSTRACT

Opinions of senior academic officials about changes in the quality of students in science and engineering (S/E) fields over the past 5 years were surveyed in 1982. Responses were received from officials from 387 institutions with undergraduate programs and 298 schools with graduate programs. Sixty-one percent of the officials believed that undergraduate student quality had not changed significantly; among officials at graduate institutions, three of every five believed the quality of applicants for graduate study in S/E fields had not changed significantly; three-quarters of the officials at the 100 institutions with the greatest baccalaureate production in S/E fields believed that the distribution of their most able students had shifted toward S/E fields; computer science was most cited as a recipient field by 32 percent of the officials, engineering by 18 percent, and the physical sciences by 6 percent; and the officials based their judgment of the quality of graduate school applicants most often on faculty perceptions, closely followed by undergraduate grade point averages. Detailed statistical tables, questionnaires, and technical notes are included. (SW)

STUDENT QUALITY IN THE SCIENCES AND ENGINEERING: OPINIONS OF SENIOR ACADEMIC OFFICIALS

Frank J. Atelsek

HIGHER EDUCATION PANEL REPORT NUMBER 58
AMERICAN COUNCIL ON EDUCATION

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1984

A Survey Funded by the National Science Foundation, the U.S. Department of Education, and the National Endowment for the Humanities

AMERICAN COUNCIL ON EDUCATION

J. W. Peltason, President

The American Council on Education, founded in 1918, is a council of educational organizations and institutions. Its purpose is to advance education and educational methods through comprehensive voluntary and cooperative action on the part of American educational associations, organizations, and institutions.

The Higher Education Panel is a survey research program established by the Council for the purpose of securing policy-related information quickly from representative samples of colleges and universities. *Higher Education Panel Reports* are designed to expedite communication of the Panel's survey findings to policy-makers in government, in the associations, and in educational institutions across the nation.

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Student Quality in the Sciences and Engineering: Opinions of Senior Academic Officials

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As ever, our very special thanks go to the Panel's campus representatives and those academic officers who provided the opinions and information for this report.

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HIGHLIGHTS

The survey findings are based on the opinions of academic officials at institutions with undergraduate programs and with graduate programs in the sciences and engineering. A separate study was conducted for the humanities. Its results are reported in HEP Report No. 59, Student Quality in the Humanities: Opinions of Senior Academic Officials.

Undergraduate Students

- Most officials (61 percent) believed that student quality had not changed significantly over the last five years. About one-fourth thought that quality had improved and roughly one-sixth, that significant declines in quality had taken place.

- At private institutions, officials at doctorate-granting institutions more often expressed a positive view about student quality than did their colleagues at institutions without doctoral programs (32 percent and 18 percent, respectively). Such differences in view did not occur among officials at public institutions.

- Officials were asked whether their most able undergraduate students were shifting toward or away from the science and engineering (S/E) fields. The majority opinion (53 percent) was that no such shifts had occurred over the past five years. Of the remainder, most believed that the shifts were toward the S/E fields rather than away from them (40 percent and 7 percent, respectively).

- The latter opinion about the most able students shifting toward the S/E fields was especially prevalent among the 100 institutions with the greatest baccalaureate production in S/E fields. Three quarters of the officials at such institutions believed that the distribution of their most able students had shifted. Further, all were of the opinion that the shifts were toward S/E fields.

- Changes in student views about their employment chances after receiving the baccalaureate degree was considered the dominant reason for shifting majors to S/E fields.

- About two-fifths of the officials also believed that the distribution of their most able majors in S/E fields had shifted over the past five years. Of these shifts, computer science was most cited as a recipient field by 32 percent of the officials, engineering by 18 percent, and the physical sciences by 6 percent.

Applicants for Graduate Study

- Among officials at graduate institutions, three of every five believed the quality of applicants for graduate study in S/E fields had not changed significantly over the previous five years. Only one in eight thought the quality of applicants had declined. Of the 28 percent who believed quality had improved, six out of ten believed the improvements were confined to a few S/E fields rather than to S/E applicants overall.

o The officials based their judgments of the quality of graduate school applicants most often on faculty perceptions, closely followed by undergraduate grade-point averages.

o Almost half of the officials thought applicants with baccalaureates from foreign institutions were as qualified for S/E graduate study as applicants with U.S. baccalaureates. Of the remaining officials, however, the preponderant majority (by a ratio of over four to one) believed that applicants with U.S. baccalaureates had significantly better qualifications.

Doctorate Recipients

o In comparing the quality of recent Ph.D. recipients (1981-82) with those from the 1976-77 period, two-thirds of the officials saw no significant difference between the two groups. Of the remaining one-third, however, four of every five thought the 1981-82 group was significantly better qualified.

BACKGROUND

In the fall of 1982, the National Science Foundation requested a Higher Education Panel study of the opinions of senior academic officials about changes in the quality of students in science and engineering fields over the last five years. The Foundation sought this information as part of its larger concern about the current status of science and engineering in this country.

At the same time, the National Endowment for the Humanities was interested in obtaining information about the quality of students in the humanities. It was decided, therefore, to conduct the two surveys concurrently.[1] The science and engineering questionnaires--one concerning undergraduates and one concerning graduate students--were sent to the Panel representative on each applicable campus with the request that they be completed by senior academic officers acquainted with the institution's academic atmosphere over the past five years. It was suggested that the dean of the college of arts and sciences or, at the larger institutions, the dean of the sciences division would be the appropriate respondent for the undergraduate questionnaire, and that the dean of the graduate school could best complete the graduate questionnaire. However, as always, the final decision was left to the individual HEP representative on each campus.

Copies of both the undergraduate and graduate survey instruments [illegible] in Appendix A. The undergraduate form went to all [illegible] colleges and universities in the Panel except theological seminaries, independent technical schools, and schools of art. The graduate form was sent only to those institutions that had awarded 10 or more doctorate degrees in 1982. This

[1] See HEP Rep. No. [illegible], Student Quality in the Humanities: Opinions of Senior Academic Officials (Washington: American Council on Education, February 1983).

restriction was to assure that the results would be representative of those institutions that provide most of the nation's graduate training. Thus, the estimates reported here are not unduly influenced by institutions whose programs at the graduate level are small and incidental to their primary mission in higher education.

METHODS SUMMARY

The Higher Education Panel [illegible] is a [illegible] research program created in 1971 by the American Council on Education. Its purpose is to conduct surveys on topics of current policy interest to the higher education community and to government agencies.

The Panel is a disproportionate stratified sample of 760 colleges and universities drawn from the population of more than 3,000 institutions listed in the National Center for Education Statistics' Education Directory, Colleges and Universities. All institutions in the population are grouped according to the Panel's stratification design, which is based upon institution type (university, four year college, two year college), control (public, private), and size (full time equivalent enrollment). For any given survey, either the entire Panel or an appropriate subgroup is used.

The survey operation is dependent upon a network of campus representatives at the Panel institutions, whose presidents have agreed to participate. The representatives receive the Panel questionnaires and direct them to the most appropriate campus officials for response.

The questionnaire was mailed in November 1982 and mail and telephone follow-ups began in December. By January 31, 1983, the close of the field phase, responses had been received from 83% of the 686 Panel institutions with

undergraduate programs and 298 of the 383 institutions with graduate programs, for response rates of 80 and 78 percent, respectively. Data from these institutions were statistically adjusted by computing institutional weights based upon the ratio of respondents to the number of institutions in the population, separately for each stratum. The data in this report show estimates for 1,362 institutions with undergraduate baccalaureate programs in the sciences and engineering and for 441 institutions with graduate programs in science and engineering (limited to those that awarded more than 50 master's degrees and/or are Ph.D.-granting institutions.)

Appendix A presents the [illegible] estimates and a comparison of respondents and nonrespondents, according to various institutional characteristics.

FINDINGS

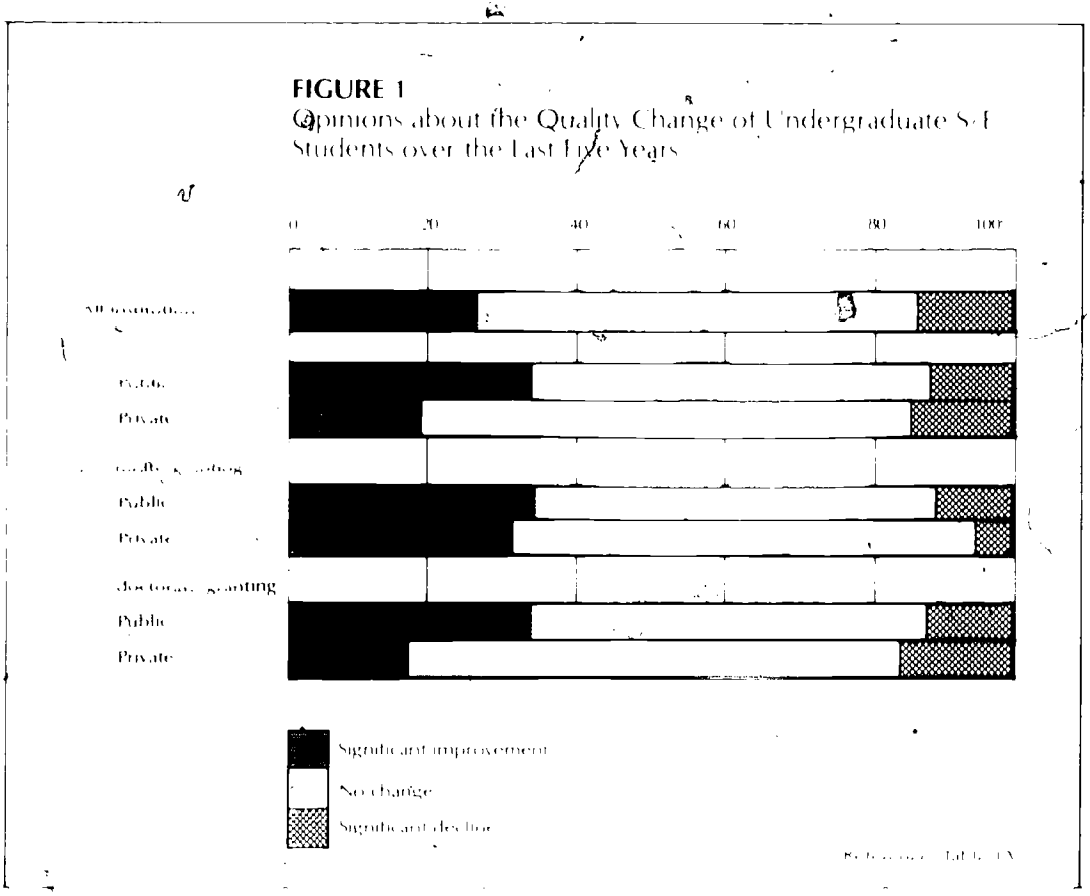
The findings of this survey reflect the opinions of senior academic officers about changes in the quality of students majoring in science and engineering (S&E) fields over the past five years. The survey results for undergraduate students and graduate students are presented in separate sections below.

UNDERGRADUATE STUDENTS

Quality of Students. Overall, most officials (three of every five) did not believe that undergraduate student quality had changed significantly, while one fourth saw improvement, and fewer than one-sixth believed significant declines in quality had taken place (figure 1). A greater proportion of officials at public institutions took a more positive view than did those at

private institutions, with significant improvements in student quality cited by 35 percent vs. 19 percent.

FIGURE 1
Opinions about the Quality Change of Undergraduate S-F Students over the Last Five Years



In the public sector, the views of officials at both doctorate granting institutions and at colleges without doctoral programs were similar. At private institutions, however, opinions varied widely between the two groups. Officials at the doctorate-level institutions were far more positive about improvement in student quality than their colleagues at colleges without doctoral programs--32 percent of the former noted improvement and only 5 percent attested to declines. At nondoctorate-granting institutions, about as many officials saw declines as saw improvements (17 percent and 18 percent, respectively).

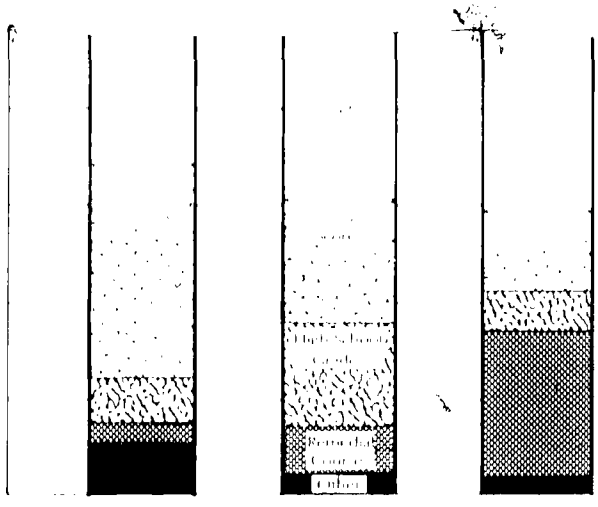
The respondents were asked to rank the three principal indicators on which their opinions were based. The indicators were weighted inversely, i.e., the

indicator ranked first in importance was multiplied by 3, the second-ranked was multiplied by 2, and the third-ranked, by 1. Thus, all indicators represent weighted values. By this procedure, the indicators were ranked as follows:

	Percentage of Weighted Score
Faculty perceptions	33
Achievement test scores	29
High school grades	21
Remedial requirements of entering students	11
Other	6

Officials who believed [illegible] improvement [illegible] cited upon trend in achievement scores (44 percent) and faculty perceptions (32 percent) as their principal indicators (Figure 2). Most officials who thought student quality had declined based their opinions either on faculty perceptions (41 percent) or on trends in remedial courses in mathematics (32 percent).

FIGURE 2
Principal Indicators of Quality Change of Undergraduate S E Students by Direction of Change



Shift Between Fields. When asked to consider whether the most able students had been shifting toward or away from S/E fields over the past five years, the majority of the officials, again, felt no such changes had occurred (53 percent). Of those who did report a shift, however, the overwhelming view (by a ratio of almost 6 to 1) was that the shift was toward the S/E fields (figure 3).

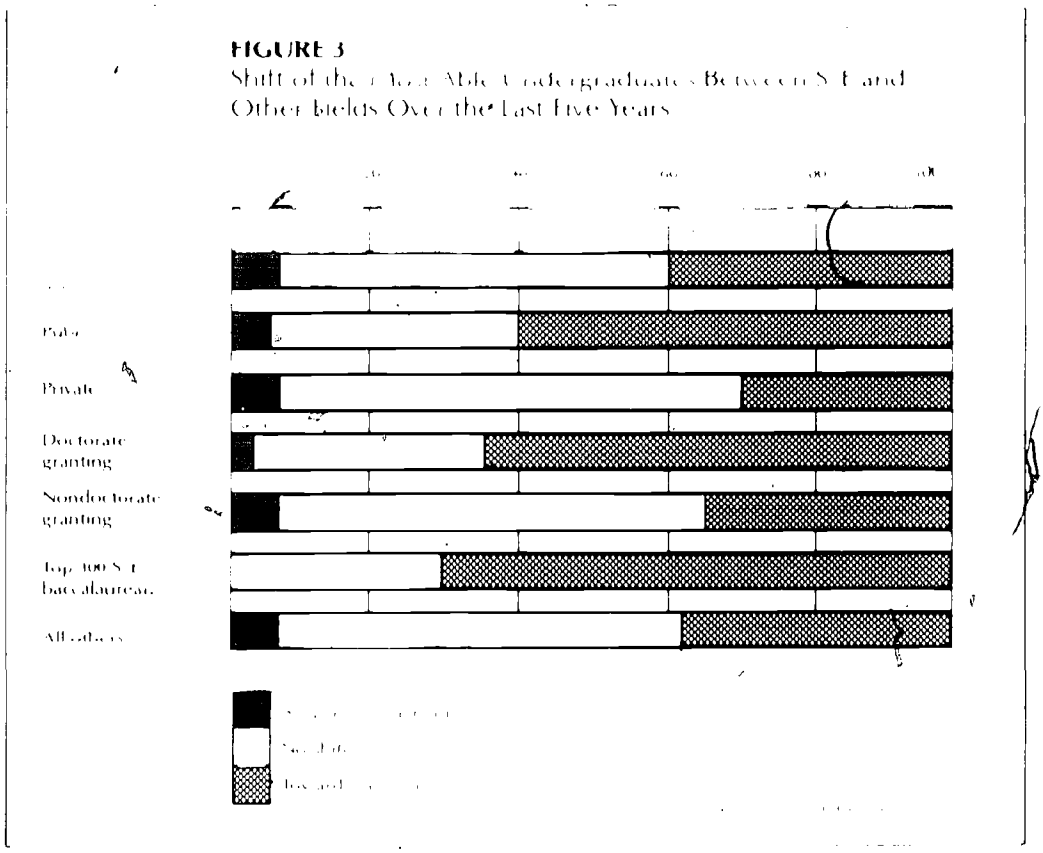


FIGURE 3
Shift of the Most Able Undergraduates Between S/E and Other Fields Over the Last Five Years

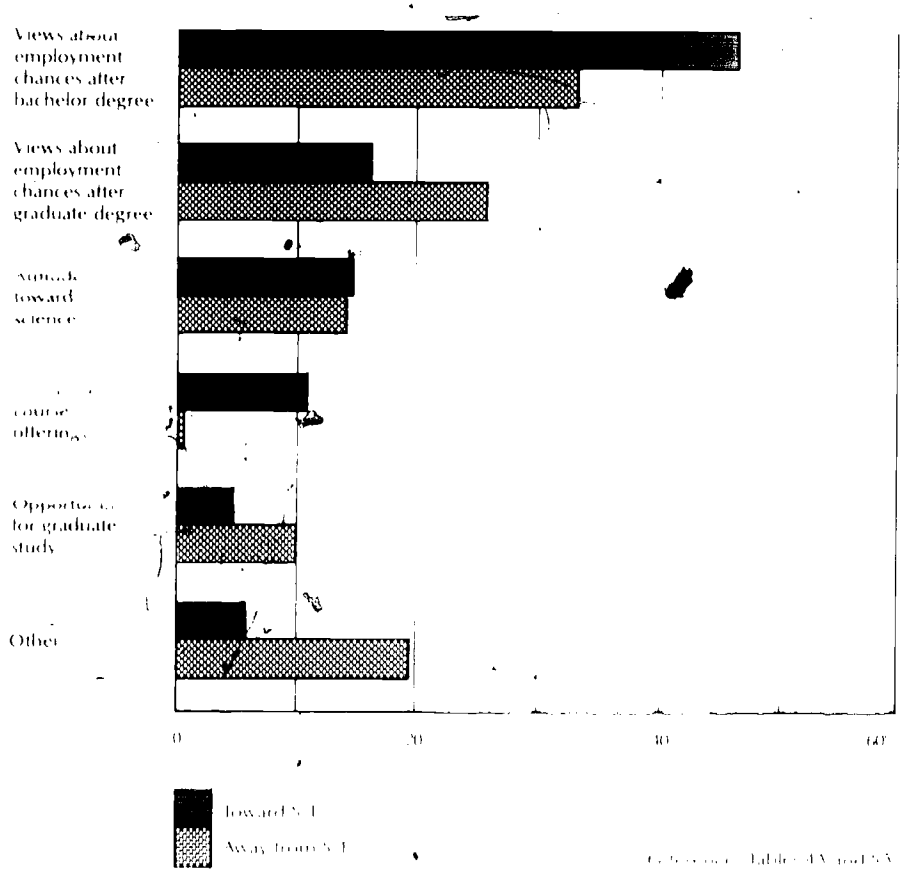
These views differed substantially according to the type and control of institution. Those officials at private institutions were almost twice as likely as officials at public institutions to report that no shifts had taken place (63 percent vs. 34 percent). At doctorate-granting institutions in both sectors, most officials judged that such shifts had taken place. Further, the vast share claimed the shifts were toward the S/E fields.

These opinions were especially prevalent among the top 100 institutions as measured by S/E baccalaureate production, institutions that awarded 43 percent of such degrees in 1977-78. Three-fourths of these high producers not only reported shifts in focus among their most able students, but also, without exception, that the changes were in the direction of the S/E fields (figure 3).

In ranking the three most important reasons for the shifts, the officials, by a wide margin, attributed them to changes in students' perceptions of employment opportunities following receipt of the baccalaureate. This reason alone accumulated 47 percent of the weighted score values (figure 4). The

FIGURE 4

Reasons for the Shift of the Most Able Undergraduates Toward or Away from S/E Fields over the Last Five Years



second-ranked reason concerned employment also, i.e., students' views about getting work after graduate training. Together, these two employment-related reasons accounted for 60 to 79 percent of the weighted scores, depending on the type of institution.

Among the small minority of officials who believed their most able students were shifting away from the science/engineering fields, the reasons given for the shift also dwelled upon chances for employment. One-third (33 percent) cited employment after the baccalaureate; one-quarter (26 percent), after graduate training.

Shifts within S/E and engineering fields. Overall a majority of officials (57 percent) did not believe their most able undergraduate students had shifted fields within the sciences and engineering (table A). Proportionately fewer officials at public institutions (39 percent) had this opinion, compared with 67 percent at private institutions. Similarly, only 37 percent at doctorate-granting institutions, compared with 61 percent at nondoctorate-granting institutions, held this static view. A high percentage of officials at institutions that provide most of the S/E baccalaureate production reported a shift among fields. Of the top 100 S/E baccalaureate institutions, 83 percent claimed that the majority of their most able students had shifted among the S/E fields. In contrast, only 40 percent of the officials at all other institutions took this view.

Of the fields reported to have increased their share of the most able students, three were major recipients. Computer science was most frequently cited by officials as being among the top three fields to which their most able students were shifting (32 percent), followed by engineering (18 percent), and the physical sciences (6 percent). Detailed tables 6A and 6B give the breakdown of the perceived shifts within the sciences and engineering. The "draw" of

Table A

Science and Engineering Fields Credited with the Greatest Increase in Share of the Most Able S/E Majors

			Most Cited Recipient Fields		
	No Change	Shift in S/E Major	Computer Sciences	Engineering	Physical Sciences
Percent of all institutions	57%	43%	32%	18%	6%
Doctorate-granting	37	63	44	44	6
Nondoctorate-granting	61	39	29	12	6
Public	39	61	44	30	10
Private	67	33	25	11	4
Top 100 S/E baccalaureate granting	17	83	58	67	8
Other than top 100	60	40	30	14	6

Note: Percentages are not addable. Institutions were permitted to identify as many as three fields that had the greatest increases in the share of the most able students.

computer science is substantial for all categories of institutions. Various specialties in engineering (especially electrical and mechanical) also showed substantial drawing power of able students, particularly at the top 100 S/E institutions.

APPLICANTS FOR GRADUATE STUDY

Graduate deans were asked about changes they had seen in the quality of applicants for graduate study in the sciences and engineering over the past five years. The pattern of response was similar to that for undergraduates. About 60 percent did not believe any significant change had taken place, but of those who observed change, most thought it to be in the direction of improvement in student quality. Figure 5 shows the distribution of opinion about the direction and degree of these changes across institutional settings.

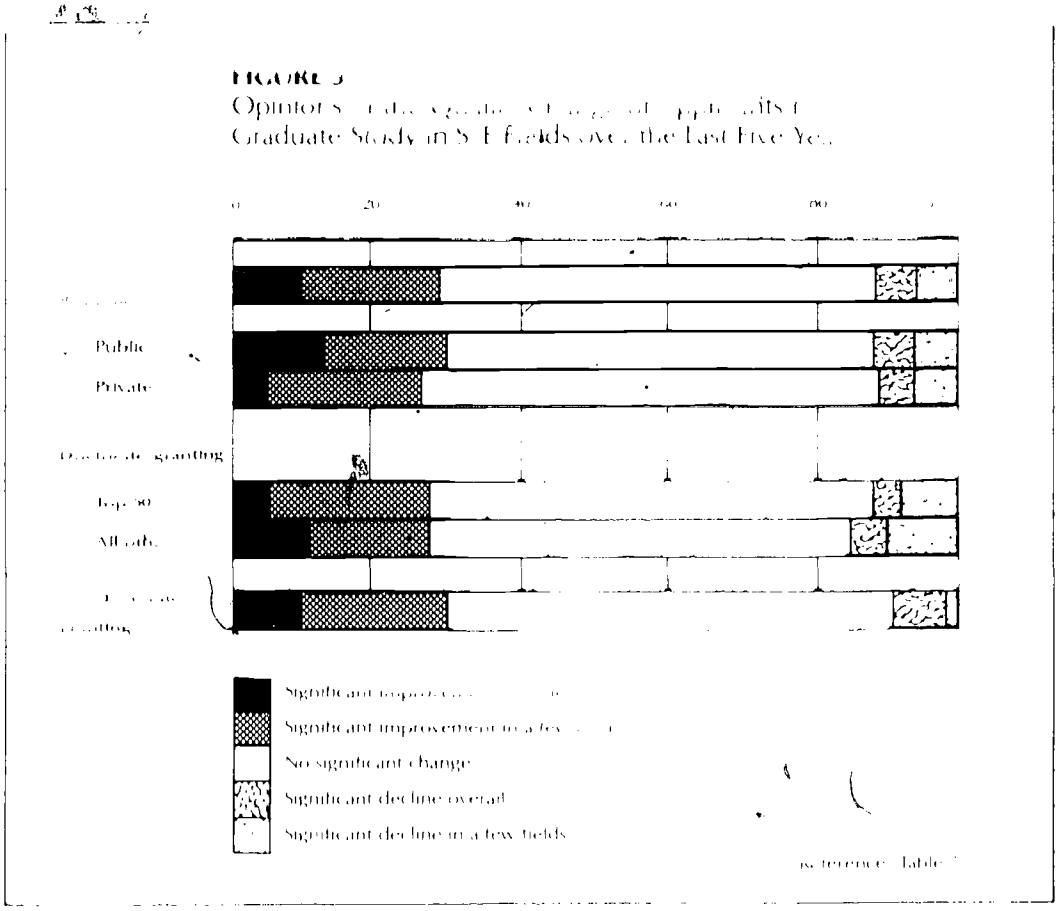


Table B shows that those graduate deans who saw no significant change in the quality of graduate school applicants relied fairly heavily on undergraduate grade-point averages (33 percent) and faculty perceptions (31 percent) as a basis for their opinions. Those who believed quality was declining cited a

drop in the number of applications from high-quality institutions (32 percent) and faculty perceptions (30 percent) as being the principal bases for their views. Graduate deans who believed quality had improved highlighted two indicators to support their opinions: faculty perceptions, and applicants' Graduate Record Examination scores.

Table B

Indicators Most Mentioned to Support Opinions About Quality of Graduate Student Applicants in Science and Engineering

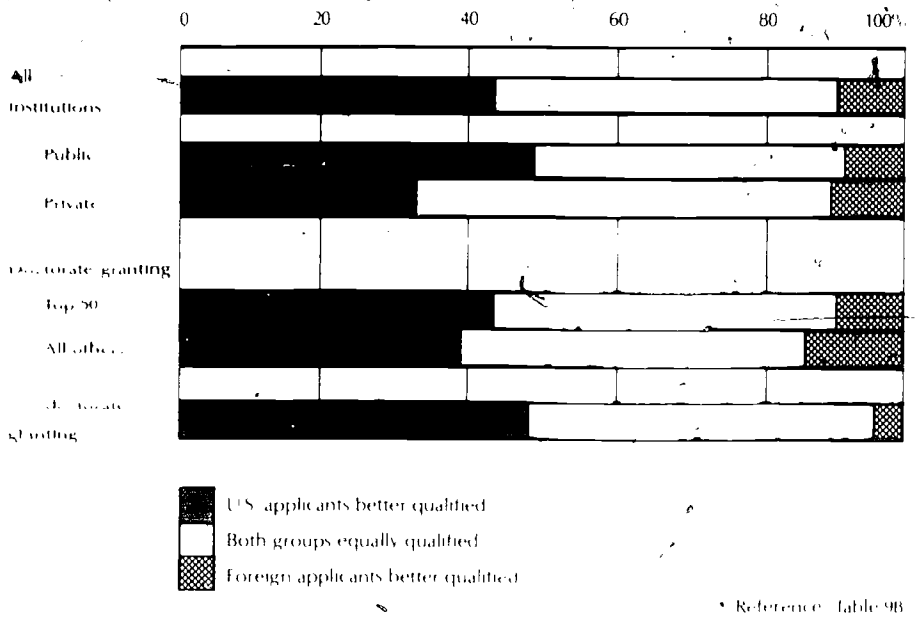
All Institutions

	No Change	Improvement	Decline
Faculty perceptions	31%	36%	30%
Undergraduate grade point averages	33	19	19
GRE scores	23	23	13
Applicants from high quality institutions	11	13	32
Other	2	9	6

graduate study had [illegible] applicants, and these were chiefly the most doctorate-granting institutions (see detailed table 6A).

At those institutions that had received foreign applications, almost half the officials (47 percent) believed that applicants with foreign baccalaureates and those with U.S. baccalaureates had approximately equal qualifications (see figure 6). Of the remainder, the preponderant majority, by a ratio of more than 4 to 1 overall, considered applicants from U.S. institutions significantly better qualified. It might be noted, however, that at doctorate-granting

FIGURE 6
Quality Comparison of Applicants with Foreign Baccalaureates and Those with U.S. Baccalaureates for S/E Graduate Study



* Reference: Table 9B

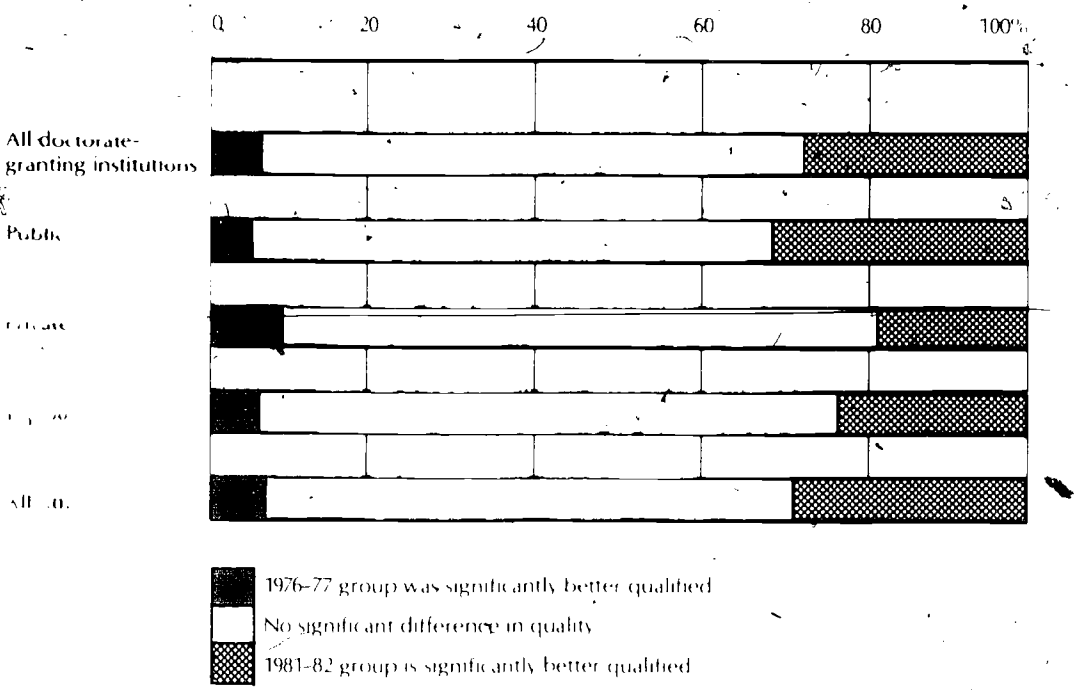
institutions, 14 percent of the respondents indicated that holders of foreign baccalaureates were significantly better qualified; at nondoctorate institutions, only 4 percent were of that opinion.

DOCTORATE RECIPIENTS

In comparing the [illegible] years earlier (1976-77), 66 percent of the graduate deans saw no significant difference in the quality. The proportion with this view was somewhat higher at private institutions and at the top 50 institutions as measured by S/E doctorate production (72 percent each).

Among officials who believed a change in quality had taken place, over three-fourths indicated that the more recent doctorate recipients were better qualified than the earlier recipients. This opinion was more pronounced at public than at private institutions, with the ratio of opinions about improving

FIGURE 7
Quality Comparison of 1976–77 and 1981–82 S/E Doctorate Recipients



Reference: Table 10

versus declining student quality ranging from 6 to 1 at public institutions to only 2 to 1 at private institutions.

Among officials who believed the earlier graduates were better qualified, the indicator that showed the highest weighted score was the change in the quality of the applicants (52 percent). That same indicator aggregated a score of 24 percent among officials who thought the 1981-82 doctorates were better qualified. Other reasons cited by this latter group were that (1) the content of doctoral programs had improved since the mid 1970s (17 percent), (2) the level of research support had increased (16 percent), (3) their recent doctorates were being offered postdoctoral appointments at quality departments (11 percent), and (4) more of the recent doctorates were being offered employment in business and industry (10 percent).

COMPARISON WITH THE HUMANITIES

As mentioned earlier, a parallel study of student quality in the humanities, sponsored by the National Endowment for the Humanities, was also conducted. The findings of that survey provide a number of similarities and contrasts with the present survey.

In both surveys, about three of every five officials attested that student quality remained fairly constant over the past five-year period. This similarity held for both undergraduates and applicants for graduate study. Of the remainder who felt significant changes had taken place, proportionately more of the officials saw quality improvements among S/E undergraduates than among those in the humanities (25 percent and 16 percent, respectively). Opinions about the quality of applicants for graduate study in the two academic areas were about the same. Just over one-fourth of the graduate deans reported significant improvement (28 percent in S/E fields; 26 percent in the humanities). Smaller percentages reported significant decline (12 percent in S/E fields, 10 percent in the humanities).

Substantial contrasts between the surveys emerged when the academic officials were asked their opinions about shifts in the distribution of their most able students. In the survey of the humanities, 70 percent thought that the most able students were indeed shifting, and the vast majority believed the changes were leading students away from, rather than toward, the humanities (65 percent and 5 percent, respectively).

In the survey of S/E fields, only 47 percent of the officials perceived a shift among their most able students and, by a ratio of seven to one, almost all believed the shifts were <u>toward</u> the S/E fields.

From another perspective, officials were asked to assess the extent to which their most able undergraduate students majoring in the humanities or S/E

disciplines were changing fields within these areas of study. Almost nine out of ten officials believed that no important changes were occurring among the humanities disciplines. In the S/E survey, however, more than four of every ten officials acknowledged such shifts in student concentrations. The fields prominently mentioned as recipients in the shifts included the computer sciences (32 percent) and engineering (18 percent).

CONCLUSIONS

Many recent task force and commission reports have expressed both generalized and specific concerns about educational quality in the U.S., pointing to such indicators as declines in standardized test scores, shortages of qualified secondary school teachers in the sciences and mathematics, and notable declines in science enrollments in high school.

The results of this survey indicate that academic officials at most of the nation's institutions with baccalaureate programs in the sciences and/or engineering felt that in the recent past the quality of S/E students has been either holding its own or improving. The compatibility of these findings with other, more objective, data about S/E students was examined recently in a National Science Foundation review of the highlights of this survey. The positive views of the academic officials noted in this report find some support in the trends of standardized test scores:

o Scholastic Aptitude Test (SAT) scores among high school seniors intending to major in science or mathematics in college remained quite stable through the sixties and early seventies, with only a modest decline by 1980. For college-bound students as a group overall, however, mean SAT scores declined steadily from the mid-sixties and throughout the seventies.

o As recently as 1982, the SAT scores (both verbal and mathematics scores) for students intending to major in the sciences and engineering substantially exceeded the mean scores for all college-bound students.

o At the graduate level, almost nine of every ten deans in the survey thought applicant quality was improving or at least had remained stable. Partial confirmation of the officials' favorable opinions about student quality is available in Graduate Record Examination (GRE) scores. In recent years, GRE scores did not vary much for students intending to apply for graduate study in S/E fields. Within this overall trend, quantitative test scores increased for all S/E major field groups, although verbal scores decreased somewhat in the mathematical sciences and engineering, while analytical test scores have been relatively stable since 1977-78.

DETAILED STATISTICAL TABLES

Note: In the following tables, detail may not sum to totals because of rounding.

over

Change in Quality of Students	Total	All Doctc gran
Total estimate (N)	(1,362)	(2
Total	100.0	1(

Table 2A

Principal Indicators of Change in Quality of Undergraduate S/E Students over the Last Five Years, by Control and Type of Institution, 1982

(In percentages)

Principal Indicator of Change	All Institutions			Public Institutions			Private Institutions		
	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting
(Total score)	(7,466)	(1,292)	(6,174)	(2,540)	(750)	(1,789)	(4,926)	(541)	(4,385)
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Faculty perceptions	32.5	27.0	33.6	34.0	27.6	36.7	31.7	26.1	32.4
Achievement test scores	29.4	36.1	27.9	29.5	34.5	27.4	29.3	38.3	28.1
High school grades	20.8	21.5	20.7	18.2	21.0	17.0	22.2	22.1	22.2
Remedial work in mathematics	11.5	11.2	11.6	14.4	12.1	15.4	10.1	9.9	10.1
Other	5.8	4.3	6.2	4.0	4.7	3.6	6.8	3.6	7.2
RANK ORDER									
Faculty perceptions	1	2	1	1	2	1	1	2	1
Achievement test scores	2	1	2	2	1	2	2	1	2
High school grades	3	3	3	3	3	3	3	3	3
Remedial work in mathematics	4	4	4	4	4	4	4	4	4
Other	5	5	5	5	5	5	5	5	5

Table 2B

Principal Indicators of Change in Quality of Undergraduate S/E Students over the Last Five Years, by Baccalaureate Production and Type of Institution, 1982

(In percentages)

Principal Indicator of Change	All Institutions			Top 100 S/E Baccalaureate Institutions			All Other S/E Baccalaureate Institutions		
	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting
(Total score)	(7,466)	(1,292)	(6,174)	(537)	(470)	(67)	(6,929)	(821)	(6,107)
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Faculty perceptions	32.5	27.0	33.6	27.1	24.6	44.2	32.9	28.3	33.5
Achievement test scores	29.4	36.1	27.9	32.2	35.5	23.1	29.1	37.6	28.0
High school grades	20.8	21.5	20.7	25.4	27.4	11.5	20.4	18.1	20.8
Remedial work in mathematics	11.5	11.2	11.6	8.8	8.5	11.5	11.8	12.7	11.6
Other	5.8	4.3	6.2	6.5	6.1	8.6	5.8	3.2	6.1
RANK ORDER									
Faculty perceptions	1	2	1	2	3	1	1	2	1
Achievement test scores	2	1	2	1	1	2	2	1	2
High school grades	3	3	3	3	2	3	3	3	3
Remedial work in mathematics	4	4	4	4	4	3	4	4	4
Other	5	5	5	5	5	5	5	5	5

Table 2C

Principal Indicators of Change in Quality of S/E Undergraduates over the Last Five Years, by Direction of Change

(In percentages)

Indicator	All Institutions		
	No Significant Change	Significant Improvement	Significant Decline
Faculty perceptions	39	32	41
Achievement test scores	24	44	17
High school grades	23	9	7
Remedial work in mathematics	10	4	32
Other	4	11	3

Table 3A

Shift in Distribution of the Most Able Undergraduate Students Between S/E and Other Fields over the Last Five Years, by Control and Type of Institution, 1982

(In percentages)

Kind of Shift	All Institutions			Public Institutions			Private Institutions		
	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting
Total estimate (N)	(1,362)	(229)	(1,132)	(472)	(135)	(337)	(889)	(93)	(795)
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No change	52.8	32.9	56.9	34.0	27.7	36.5	62.8	40.4	65.5
Shift toward S/E fields	40.4	63.6	35.7	59.8	69.2	56.0	30.1	55.6	27.1
Shift away from S/E fields	6.8	3.5	7.4	6.2	3.1	7.5	7.1	4.0	7.4

Table 3B

Shift in Distribution of the Most Able Undergraduate Students Between S/E and Other Fields over the Last Five Years, by Baccalaureate Production and Type of Institution, 1982

(In percentages)

Kind of Shift	All Institutions			Top 100 S/E Baccalaureate Institutions			All Other S/E Baccalaureate Institutions		
	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting
Total estimate (N)	(1,362)	(229)	(1,132)	(98)	(85)	(13)	(1,263)	(143)	(1,119)
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No change	52.8	32.9	56.9	24.9	25.7	20.0	55.0	37.2	57.3
Shift toward S/E fields	40.4	63.6	35.7	75.1	74.3	80.0	37.7	57.2	35.2
Shift away from S/E fields	6.8	3.5	7.4	0.0	0.0	0.0	7.3	5.6	7.5

Table 4A

Reasons for Shift in Distribution of the Most Able Undergraduate Students Toward the S/E Fields over the Last Five Years, by Control and Type of Institution, 1982

(In percentages)

Reasons for Shift	All Institutions			Public Institutions			Private Institutions		
		Doctorate-granting	Nondoctorate-granting		Doctorate-granting	Nondoctorate-granting		Doctorate-granting	Nondoctorate-granting
(Total score)	(3,058)	(817)	(2,241)	(1,594)	(517)	(1,077)	(1,464)	(300)	(1,164)
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Employment after bachelor's	46.7	50.2	45.4	48.3	51.0	47.1	44.9	48.8	43.9
Employment after graduate study	16.7	19.7	15.6	15.8	18.1	14.7	17.7	22.5	16.4
Change in attitude toward science	14.4	15.7	14.0	16.7	19.6	15.3	11.9	9.0	12.7
Change in variety of course offerings	10.7	4.4	13.0	10.1	3.2	13.4	11.3	6.5	12.6
Opportunities for graduate study	4.7	4.2	4.8	5.9	4.3	6.7	3.3	4.1	3.2
Change in perception of student aid availability	1.6	1.4	1.7	1.3	1.7	1.0	2.0	0.8	2.2
Other	5.2	4.4	5.5	1.9	2.0	1.8	8.9	8.4	9.0
RANK ORDER									
Employment after bachelor's	1	1	1	1	1	1	1	1	1
Employment after graduate study	2	2	2	3	3	3	2	2	2
Change in attitude toward science	3	3	3	2	2	2	3	3	3
Change in variety of course offerings	4	4	4	4	5	4	4	5	4
Opportunities for graduate study	6	6	6	5	4	5	6	6	6
Change in perception of student aid availability	7	7	7	7	7	7	7	7	7
Other	5	4	5	6	6	6	5	4	5

Table 4B

Reasons for Shift in Distribution of the Most Able Undergraduate Students Toward the S/E Fields over the Last Five Years, by Baccalaureate Production and Type of Institution, 1982

(In percentages)

Reasons for Shift	All Institutions			Top 100 S/E Baccalaureate Institutions			All Other S/E Baccalaureate Institutions		
	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting
(Total score)	(3,058)	(817)	(2,241)	(406)	(350)	(55)	(2,652)	(466)	(2,185)
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Employment after bachelor's	46.7	50.2	45.4	52.4	51.9	55.8	45.8	48.9	45.2
Employment after graduate study	16.7	19.7	15.6	19.1	18.4	23.3	16.3	20.7	15.4
Change in attitude toward science	14.4	15.7	14.0	17.7	18.3	14.0	13.9	13.7	14.0
Change in variety of course offerings	10.7	4.4	13.0	2.0	2.3	0.0	12.0	5.9	13.3
Opportunities for graduate study	4.7	4.2	4.8	4.1	4.4	2.3	4.8	4.1	4.9
Change in perception of student aid availability	1.6	1.4	1.7	1.0	1.1	0.0	1.7	1.6	1.7
Other	5.2	4.4	5.5	3.7	3.5	4.7	5.5	5.0	5.6
RANK ORDER									
Employment after bachelor's	1	1	1	1	1	1	1	1	1
Employment after graduate study	2	2	2	2	2	2	2	2	2
Change in attitude toward science	3	3	3	3	3	3	3	3	3
Change in variety of course offerings	4	4	4	6	6	-	4	4	4
Opportunities for graduate study	6	6	6	4	4	5	6	6	6
Change in perception of student aid availability	7	7	7	7	7	-	7	7	7
Other	5	4	5	5	5	4	5	5	5

Table 5A

Reasons for Shift in Distribution of the Most Able Undergraduate Students Away from the S/E Fields over the Last Five Years, by Control and Type of Institution, 1982

(In percentages)

Reasons for Shift	All Institutions			Public Institutions			Private Institutions		
	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting
(Total score)	(529)	(47)	(481)	(171)	(25)	(146)	(357)	(22)	(335)
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Employment after bachelor's	32.8	39.5	32.1	42.1	50.0	40.7	28.3	27.8	28.3
Employment after graduate study	25.9	32.4	25.3	12.0	21.5	10.3	32.6	44.4	31.8
Change in attitude toward science	12.6	12.4	12.6	21.5	23.6	21.1	8.3	0.0	8.8
Opportunities for graduate study	9.8	7.9	10.0	9.4	0.0	11.0	10.0	16.7	9.6
Change in perception of student aid availability	5.8	7.8	5.6	8.8	4.9	9.5	4.4	11.1	3.9
Change in variety of course offerings	0.3	0.0	0.3	0.9	0.0	1.0	0.0	0.0	0.0
Other	12.9	0.0	14.2	5.4	0.0	6.3	16.5	0.0	17.6
RANK ORDER									
Employment after bachelors's	1	1	1	1	1	1	2	2	2
Employment after graduate study	2	2					1	1	
Change in attitude toward science	4	3	4	2				-	5
Opportunities for graduate study	5	4	5	4	-		4	3	4
Change in perception of student aid availability	6	5	6	5	4	5	6	4	6
Change in variety of course offerings	7	-	7	7	-	7	-	-	-
Other	3	-	3	6	-	6	3	-	3

Table 5B

Reasons for Shift in Distribution of the Most Able Undergraduate Students Away from the S/E Fields over the Last Five Years, by Baccalaureate Production and Type of Institution, 1982

(In percentages)

Reasons for Shift	All Institutions			Top 100 S/E Baccalaureate Institutions			All Other S/E Baccalaureate Institutions		
	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting
(Total score)	(529)	(47)	(481)	(0)	(0)	(0)	(529)	(47)	(481)
Total	100.0	100.0	100.0	Not applicable; none of the top 100 S/E baccalaureate institutions reported a shift of its most able undergraduates away from the S/E fields in the last five years.			100.0	100.0	100.0
Employment after bachelor's	32.8	39.5	32.1				32.8	39.5	32.1
Employment after graduate study	25.9	32.4	25.3				25.9	32.4	25.3
Change in attitude toward science	12.6	12.4	12.6				12.6	12.4	12.6
Opportunities for graduate study	9.8	7.9	10.0				9.8	7.9	10.0
Change in perception of student aid availability	5.8	7.8	5.6				5.8	7.8	5.6
Change in variety of course offerings	0.3	0.0	0.3				0.3	0.0	0.3
Other	12.9	0.0	14.2				12.9	0.0	14.2
RANK ORDER									
Employment after bachelor's	1	1	1	Not applicable; see above.			1	1	1
Employment after graduate study	2	2	2				2	2	2
Change in attitude toward science	4	3	4				4	3	4
Opportunities for graduate study	5	4	5				5	4	5
Change in perception of student aid availability	6	5	6				6	5	6
Change in variety of course offerings	7	-	7				7	-	7
Other	3	-	3				3	-	3

Table 6A

Shift in Distribution of the Most Able Undergraduate Student Majors Within S/E Fields over the Last Five Years, by Control and Type of Institution, 1982

(In percentages)

Kind of Shift in Distribution	All Institutions			Public Institutions			Private Institutions		
	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting
Total estimate (N)	(1,362)	(229)	(1,132)	(472)	(135)	(337)	(889)	(93)	(795)
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No change	57.1	37.4	61.1	39.0	30.5	42.4	66.7	47.3	69.0
Change to:									
Agricultural sciences	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biological sciences	4.8	8.0	4.2	8.6	6.5	9.5	2.8	10.3	2.0
Computer science	31.7	43.5	29.3	44.2	52.0	41.0	25.1	31.5	24.4
Earth sciences	5.5	7.9	5.0	11.6	13.4	10.9	2.2	0.0	2.5
Environmental sciences	0.3	0.0	0.4	0.5	0.0	0.7	0.3	0.0	0.3
Geology	4.9	7.3	4.4	10.5	12.4	9.7	2.0	0.0	2.2
Other earth sciences	0.3	0.6	0.3	0.9	1.0	0.9	0.0	0.0	0.0
Engineering	17.6	43.8	12.3	29.8	50.8	21.3	11.2	33.7	8.5
Aeronautical	0.4	2.0	0.1	0.9	2.0	0.5	0.2	2.0	0.0
Chemical	2.8	14.8	0.3	4.8	13.8	1.1	1.7	16.3	0.0
Civil	0.7	0.6	0.8	0.8	1.0	0.7	0.7	0.0	0.8
Electrical	9.0	32.1	4.3	14.7	37.1	5.7	6.0	25.0	3.8
Environmental	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Industrial	0.5	0.8	0.5	0.3	0.0	0.4	0.7	2.0	0.5
Mechanical	4.1	14.4	2.0	6.0	17.0	1.5	3.1	10.7	2.2
Petroleum	0.9	4.0	0.3	2.6	6.8	0.9	0.0	0.0	0.0
Other engineering	8.7	14.0	7.6	14.9	16.4	14.2	5.4	10.7	4.8
Mathematics	5.4	2.7	6.0	5.7	2.7	7.0	5.3	2.7	5.6
Physical sciences	6.0	6.3	5.9	9.8	6.8	11.0	4.0	5.6	3.8
Astronomy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chemistry	4.3	3.4	4.5	6.5	2.9	8.0	3.1	4.0	3.0
Physics	1.7	1.7	1.7	3.5	2.8	3.8	0.7	0.0	0.8
Other physical sciences	0.3	1.8	0.0	0.6	2.0	0.0	0.2	1.6	0.0
Psychology	1.1	1.2	1.1	0.6	1.0	0.5	1.4	1.6	1.4
Social sciences	2.9	5.7	2.3	3.2	5.0	2.5	2.7	6.7	2.2
Anthropology	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Economics	1.7	4.5	1.1	1.5	4.0	0.5	1.8	5.3	1.4
Geography	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Linguistics	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Political science	0.6	0.6	0.6	1.5	0.0	2.1	0.1	1.3	0.0
Sociology	0.5	0.0	0.6	0.0	0.0	0.0	0.7	0.0	0.8
Other social sciences	0.1	0.6	0.0	0.3	1.0	0.0	0.0	0.0	0.0
Other S/E fields*	5.6	3.8	5.9	11.3	2.6	14.9	2.5	5.4	2.2

Table 68

Shift in Distribution of the Most Able Undergraduate Student Majors Within S/E Fields over the Last Five Years, by Baccalaureate Production and by Type of Institution, 1982

(In percentages)

Kind of Shift in Distribution	All Institutions			Top 100 S/E Baccalaureate Institutions			All Other S/E Baccalaureate Institutions		
	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting
Total estimate (N)	(1,362)	(229)	(1,132)	(98)	(85)	(13)	(1,263)	(143)	(1,119)
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No change	57.1	37.4	61.1	17.1	18.2	10.0	60.3	49.0	61.7
Change to:									
Agricultural sciences	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Biological sciences	4.8	8.0	4.2	5.6	6.4	0.0	4.8	9.0	4.2
Computer science	31.7	43.5	29.3	57.6	54.2	80.0	29.6	37.1	28.7
Earth sciences	5.5	7.9	5.0	9.4	10.9	0.0	5.1	6.1	5.0
Environmental sciences	0.3	0.0	0.4	0.0	0.0	0.0	0.4	0.0	0.4
Geology	4.9	7.3	4.4	8.1	9.3	0.0	4.7	6.1	4.5
Other earth sciences	0.3	0.6	0.3	1.3	1.6	0.0	0.2	0.0	0.3
Engineering	17.6	43.8	12.3	67.4	68.5	60.0	13.7	28.8	11.7
Aeronautical	0.4	2.0	0.1	4.6	5.3	0.0	0.1	0.0	0.1
Chemical	2.8	14.8	0.9	18.3	19.6	10.0	1.5	12.0	0.2
Civil	0.7	0.6	0.8	0.0	0.0	0.0	0.8	0.9	0.8
Electrical	9.0	32.1	4.3	50.7	52.4	40.0	5.7	19.9	3.9
Environmental	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Industrial	0.5	0.8	0.5	3.2	2.2	10.0	0.3	0.0	0.4
Mechanical	4.1	14.4	2.0	22.6	24.5	10.0	2.6	8.3	1.9
Petroleum	0.9	4.0	0.3	5.4	6.2	0.0	0.5	2.7	0.3
Other engineering	8.7	14.0	7.6	23.6	24.1	20.0	7.5	7.9	7.4
Mathematics	5.4	2.7	6.0	0.0	0.0	0.0	5.9	4.4	6.1
Physical sciences	6.0	6.3	5.9	8.0	6.2	20.0	5.8	6.4	5.8
Astronomy	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chemistry	4.3	3.4	4.5	4.0	3.1	10.0	4.3	3.5	4.4
Physics	1.7	1.7	1.7	2.6	0.0	20.0	1.6	2.7	1.5
Other physical sciences	0.3	1.8	0.0	2.7	3.1	0.0	0.1	1.1	0.0
Psychology	1.1	1.2	1.1	1.3	1.6	0.0	1.1	1.1	1.1
Social sciences	2.9	5.7	2.3	10.5	12.1	0.0	2.3	1.8	2.3
Anthropology	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Economics	1.7	4.5	1.1	9.2	10.6	0.0	1.1	0.9	1.1
Geography	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Linguistics	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Political science	0.6	0.6	0.6	0.0	0.0	0.0	0.7	0.9	0.6
Sociology	0.5	0.0	0.6	0.0	0.0	0.0	0.5	0.0	0.6
Other social sciences	0.1	0.6	0.0	1.3	1.6	0.0	0.0	0.0	0.0
Other S/E fields	5.6	3.8	5.9	2.4	2.7	0.0	5.8	4.4	6.0

Table 7

Opinions of Change of Quality of Applicants for Graduate Study in S/E Fields over the Last Five Years, by Control and Type of Institution, 1982

(In percentages)

Degree of Change	All Institutions					Public Institutions			Private Institutions		
		Doctorate-granting			Nondoctorate granting		Doctorate-granting	Nondoctorate-granting		Doctorate granting	Nondoctorate granting
	Total	All	Top 50	All Other		Total			Total		
Total estimate (N)	(441)	(230)	(50)	(180)	(210)	(292)	(138)	(154)	(149)	(93)	(56)
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
No significant change	60.0	58.9	60.8	58.3	61.2	58.4	54.3	62.0	63.1	65.6	58.9
Significant improvement overall	10.2	11.0	5.7	12.5	9.4	12.7	14.7	10.8	5.4	5.5	5.4
Significant improvement in a few fields	18.0	16.0	21.0	14.6	20.3	16.7	19.8	14.7	20.8	14.7	35.6
Significant decline overall	5.7	4.7	4.0	4.9	6.4	6.7	7.7	5.8	4.8	3.6	6.0
Significant decline in a few fields	6.0	9.5	8.5	9.7	2.7	6.0	7.8	4.8	6.0	9.6	0.0

Table 8a

Technical Indicators of Change in Quality of Applicants for Graduate Study in S/E Fields over the Last Five Years, by Doctorate-granting Status and Type of Institution, 1982

(In percentages)

Indicators of Change in Quality	All Institutions		Doctorate-granting Institutions						Nondoctorate-granting Institutions	
			All		Top 50		Others			
	Rank	Percent	Rank	Percent	Rank	Percent	Rank	Percent	Rank	Percent
(Total score)		(2,401)		(1,325)		(270)		(1,055)		(1,136)
Total		100.0		100.0		100.0		100.0		100.0
Faculty perceptions	1	29.1	1	26.7	1	32.8	2	24.9	2	31.8
Undergraduate grade point averages		20.0	3	24.0	4	20.4	1	25.1	1	32.1
Applications from graduates of high quality undergraduate institutions	3	17.8	3	23.3	2	23.8	3	23.1	4	16.0
Graduate Record Exam (GRE) scores	4	19.7	4	22.2	3	20.5	4	22.7	3	16.9
Other	5	4.4	5	4.0	5	2.5	5	4.2	5	2.9

Table 88

Principal Indicators of Change in Quality of Applicants for Graduate Study in S/E Fields over the Last Five Years, by Control and Type of Institution, 1982

(In percentages)

Indicators of Change in Quality	All Institutions			Public Institutions			Private Institutions		
	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting	Total	Doctorate-granting	Nondoctorate-granting
(Total scored)	(2,401)	(1,275)	(1,126)	(1,605)	(774)	(831)	(796)	(501)	(295)
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Faculty perceptions	29.1	26.7	31.8	26.0	25.0	27.0	35.2	29.3	45.1
Undergraduate grade point averages	28.0	24.0	32.4	29.4	25.2	33.3	25.1	22.2	30.1
Applications from graduates of high quality undergraduate institutions	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Graduate Record Exam (GRE) scores	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other	3.4	3.0	2.9	3.5	3.5	3.5	3.4	4.5	1.5
Faculty perceptions	1	1	1	2	2	1	1	1	1
Undergraduate grade point averages	1	1	1	1	1	1	1	1	2
Applications from graduates of high quality undergraduate institutions	3	3	4	3	3	4	4	3	3
Graduate Record Exam (GRE) scores	4	4	3	3	4	3	4	4	4
Other	5	5	5	5	5	5	5	5	5

Table 9A

Percentages of Institutions with Foreign Applicants for Graduate Study in S/E Fields, by Control and Type of Institution, 1982

(In percentages)

Type of Institution	All Institutions: Total	Doctorate-granting: All	Doctorate-granting: Top 50	Doctorate-granting: All Other	Nondoctorate-granting	Public Institutions: Total	Doctorate-granting	Nondoctorate-granting	Private Institutions: Total	Doctorate-granting	Nondoctorate-granting
Total estimate (N)	(441)	(230)	(50)	(180)	(210)	(292)	(138)	(154)	(149)	(93)	(56)
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Institutions with foreign applicants	89.2	96.5	100.0	95.5	81.2	89.1	98.2	81.0	89.4	94.0	81.8
Institutions with no foreign applicants	10.8	3.5	0.0	4.5	18.8	10.9	1.8	19.0	10.6	6.0	18.2

Table 9B

[illegible] of Applicants for Graduate [illegible] Study, [illegible] Foreign [illegible] with Holders of U.S. Baccalaureates, by Control and Type of Institution, 1982

(In percentages)

Comparison	All Institutions: Total	Doctorate-granting: All	Doctorate-granting: Top 50	Doctorate-granting: All Other	Nondoctorate-granting	Public Institutions: Total	Doctorate-granting	Nondoctorate-granting	Private Institutions: Total	Doctorate-granting	Nondoctorate-granting
Institutions with foreign applicants (N)	(393)	(222)	(50)	(172)	(171)	(260)	(135)	(125)	(133)	(87)	(46)
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Both groups have approximately equal qualifications	46.9	46.1	46.3	46.0	47.9	42.1	43.3	40.7	55.8	50.4	66.0
Foreign applicants have significantly better qualifications	9.8	13.9	10.4	14.9	[illegible]	9.0	11.0	6.0	11.3	17.4	0.0
Applicants from U.S. institutions have significantly better qualifications	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Table 10

Comparison of Quality of 1981-82 S/E Doctorate Recipients with Those of 1976-77, by Type and Control of Institution

(In percentages)

Quality Comparison	Doctorate-granting Institutions				
	Total	Public	Private	Top 50	All Others
Total estimate (N)	(192)	(123)	(68)	(50)	(142)
Total	100.0	100.0	100.0	100.0	100.0
No significant difference in quality	65.8	62.3	72.2	71.7	63.8
1981-82 group is significantly better qualified	27.5	32.4	18.5	22.7	29.1
1976-77 group was significantly better qualified	6.7	5.3	9.3	5.7	7.1

Table 11

Principal Indicators that 1981-82 S/E Doctorate Recipients Were Significantly Better Qualified than 1976-77 Doctorate Recipients, by Type and Control of Institution

(In percentages)

Principal Indicators of Quality	Doctorate-granting Institutions									
	Total		Public		Private		Top 50		All Others	
	Rank	Percent	Rank	Percent	Rank	Percent	Rank	Percent	Rank	Percent
(Total score)	(311)		(237)		(73)		(68)		(243)	
Total		100.0	-	100.0	-	100.0	-	100.0		100.0
Change in quality of graduate school applicants	1	23.5	1	24.8	2	19.0	1	20.8	1	24.2
Change in content of doctoral program	2	17.4	2	16.9	2	19.0	3	16.7	3	17.0
Change in level of research support	3	15.9	3	13.9	1	22.4	7	6.3	2	18.6
Change in number of new doctorates being offered postdoctoral appointments at quality departments	[illegible]	11.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	11.6
Change in number of new doctorates being offered employment in business and industry	6	10.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	6	[illegible]
Change in number of new doctorates being offered tenure-track appointments in major universities	7	[illegible]	7	8.[illegible]	6	5.2	5	12.5	7	6.2
Change in number of new doctorates who held nationally competitive awards for graduate study	8	2.5	8	2.7	8	1.7	8	2.1	8	2.6
Other	4	11.8	5	11.1	4	13.8	2	18.8	5	9.8

Table 12

Principal Indicators that 1976-77 S/E Doctorate Recipients Were Significantly Better Qualified than 1981-82 S/E Doctorate Recipients, by Type and Control of Institution

(In percentages)

Principal Indicators of Quality	Total		Doctorate-granting Institutions							
	Total		Public		Private		Top 50		All Others	
	Rank	Percent	Rank	Percent	Rank	Percent	Rank	Percent	Rank	Percent
(Total score)		(66)		(31)		(34)		(13)		(53)
Total	-	100.0	-	100.0	-	100.0	-	100.0	-	100.0
Change in quality of graduate school applicants	1	52.5	1	49.1	1	55.6	1	33.3	1	57.1
Change in number of new doctorates being offered tenure-track appointments in major universities	2	13.6	[illegible]	[illegible]	6	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Change in number of new doctorates being offered postdoctoral appointments at quality departments	3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Change in number of new doctorates who held nationally competitive awards for graduate study	4	7.[illegible]		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]
Change in level of research support	4	7.7		4.0	3	11.1		0.0	4	9.5
Change in content of doctoral program	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]		[illegible]
Change in number of new doctorates being offered employment in business and industry		0.0		0.0		0.0		0.0		0.0
Other	6	3.9		0.0	4	7.4		0.0	6	4.8

Appendix A: Survey Instrument

AMERICAN COUNCIL ON EDUCATION
ONE DUPONT CIRCLE
WASHINGTON, D. C. 20036

November 12, 1982

HIGHER EDUCATION PANEL
(202) 833-4757

Dear Higher Education Panel Representative:

Attached are Higher Education Panel Surveys, Numbers 58 and 59, "Student Quality in the Sciences and Engineering" and "Student Quality in the Humanities," respectively. The former is sponsored by the National Science Foundation, the latter, by the National Endowment for the Humanities. Each seeks the opinion of knowledgeable academic officials on the quality of students--both undergraduate and graduate--in the academic areas indicated.

Anecdotal information from department heads, deans, and faculty suggest that there may be quality changes in today's science, engineering, and humanities students compared with those of a decade ago. In order to be better able to decide what action, if any, is appropriate, the Foundation and the Endowment wish to learn more about the nature of these perceptions and how widespread they are.

Each questionnaire has two parts--one for undergraduates, the other for graduate students. The undergraduate section may be most appropriately completed by the dean of undergraduate instruction at larger institutions or by the dean of the college at smaller institutions; we recommend that the graduate sections be completed by the graduate dean. As usual, however, we rely on your determination of the most appropriate respondent.

Please understand that your institution's response will be protected to the maximum extent permissible by law. As with all our surveys, the data you provide will be reported in summary fashion only and will not be identifiable with your institution. This survey is authorized by the National Science Foundation Act of 1950, as amended. Although you are not required to respond, your cooperation is needed to make the results comprehensive, reliable, and timely.

Please ask the person whose opinions will be reflected on the questionnaires to return them to us by November 29, enclosed in the postpaid preaddressed envelope.

If you have any problems or questions, please do not hesitate to telephone us collect at (202)833-4757. Thank you, once again, for your assistance.

Sincerely,

Frank J. Atelsek
Panel Director

Enclosures

AMERICAN COUNCIL ON EDUCATION

Higher Education Panel Survey No. 58

OBM No. 3145-0009
Exp. 6/30/84

STUDENT QUALITY IN THE SCIENCES AND ENGINEERING

NOTE

This survey is designed to elicit the opinions of senior academic officers at the undergraduate and graduate levels concerning the quality of students in the science and engineering (S/E) fields. Please bear in mind that we seek your judgment and impressions, not "hard" institutional data. There are two parts to this questionnaire. One (buff) requests opinions concerning undergraduates; the other (yellow) requests opinions concerning graduate students. Some of you may have received only one questionnaire, others may have received both. Please follow the appropriate instructions, and return the completed questionnaire(s) to the American Council on Education.

Fields of Science and Engineering

This listing of disciplines is illustrative rather than exhaustive.

- Agricultural sciences
- Biological sciences
- Computer science
- Earth sciences
  - Environmental sciences
  - Geology
- Engineering
  - Aeronautical
  - Chemical
  - Civil
  - Electrical
  - Environmental
  - Industrial
  - Mechanical
  - Petroleum
- Mathematics
- Physical sciences
  - Astronomy
  - Chemistry
  - Physics
- Psychology
- Social sciences
  - Anthropology
  - Economics
  - Geography
  - Linguistics
  - Political science
  - Sociology

PART I—UNDERGRADUATE STUDENTS

The following questions are designed to elicit your *opinion or judgment* of the quality of undergraduate students who are majoring in the sciences (including psychology and the basic social sciences) or engineering (S/E) fields. If your institution has *no undergraduates majoring in the sciences or engineering*, please check here ☐, provide the information requested at the end of this form, and return it to the American Council on Education.

1 **In your opinion, how has the quality of students who major in science and engineering (S/E) fields at your institution changed over the past 5 years?**

1.1 There has been no significant change

1.2 There has been a significant *improvement* in the quality of S/E students

1.3 There has been a significant *decline* in the quality of S/E students

2 **What are the principal *indicators* upon which you base your opinion? Please *rank order the three most important indicators* (1 = most important, etc.).**

2.1 Trends in achievement test scores of entering students

2.2 Trends in high school grades or high school class rank of entering students

2.3 Trends in requirements for remedial courses in mathematics

2.4 Faculty perceptions

2.5 Other, specify

2.6 Other, specify

3. **In your opinion, over the past 5 years has there been a shift in the distribution of your most able students between science and engineering fields and other fields?**

3.1 ___ No (Go to question 5.)

3.2 ___ Yes, *toward* S/E fields
3.3 ___ Yes, *away from* S/E fields
} (Go to question 4.)

4. **If you answered "yes" to question 3, what, in your opinion, are the most important reasons for the shift in the distribution of your most able students? Please *rank order the three most important reasons* (1 = most important, etc.).**

4.1 ___ Change in perception of employment opportunities following receipt of the baccalaureate
4.2 ___ Change in perception of opportunities for employment following graduate or professional training
4.3 ___ Change in perception of opportunities for admission to graduate or professional school
4.4 ___ Change in attitude toward science and technology
4.5 ___ Change in the variety of course offerings at this institution
4.6 ___ Change in perception of availability of student financial aid for undergraduate study
4.7 ___ Other, specify _____
4.8 ___ Other, specify _____

5. **Of those students with S/E majors, in your opinion, has there been a shift in the distribution of your most able students by field *within* the *sciences and engineering* over the past 5 years.**

5.1 ___ No (Please complete the section at the end of this form and return it to ACE.)

5.2 ___ Yes (Go to question 6.)

6. **If you answered "yes" to question 5, please indicate in the blanks below the three S/E fields that have had the *greatest increase in the share* of your most able students. (Refer to the list of fields on page 1.)**

1 _____

2 _____

3 _____

Thank you for your assistance. Please return this form by **November 29, 1982** to

Higher Education Panel
American Council on Education
One Dupont Circle
Washington, DC 20036

Please keep a copy of this form for your records.
Person completing the form

Name _____

Title _____

Telephone _____

If you have any questions or problems concerning this survey, please call HEP staff collect at (202) 833-4758.

AMERICAN COUNCIL ON EDUCATION

Higher Education Panel Survey No. 58

OBM No. 3145-0009
Exp. 6/30/84

STUDENT QUALITY IN THE SCIENCES AND ENGINEERING

NOTE

This survey is designed to elicit the opinions of senior academic officers at the undergraduate and graduate levels concerning the quality of students in the science and engineering (S/E) fields. Please bear in mind that we seek your judgment and impressions, not "hard" institutional data. There are two parts to this questionnaire. One (buff) requests opinions concerning undergraduates; the other (yellow) requests opinions concerning graduate students. Some of you may have received only one questionnaire, others may have received both. Please follow the appropriate instructions, and return the completed questionnaire(s) to the American Council on Education.

Fields of Science and Engineering

This listing of disciplines is illustrative rather than exhaustive.

Agricultural sciences	Engineering	Mathematics	Social sciences
Biological sciences	Aeronautical	Physical sciences	Anthropology
Computer science	Chemical	Astronomy	Economics
Earth sciences	Civil	Chemistry	Geography
Environmental sciences	Electrical	Physics	Linguistics
Geology	Environmental	Psychology	Political science
	Industrial		Sociology
	Mechanical		
	Petroleum		

PART II—GRADUATE STUDENTS

The following questions are designed to elicit your *opinion or judgment* concerning aspects of the quality of incoming graduate students and recipients of doctoral degrees in science and engineering (S/E) fields. If your institution has *no graduate students working toward advanced degrees in the sciences or engineering*, please check here ☐ and return the questionnaire to the American Council on Education.

1. **In your opinion, how has the quality of applicants for graduate study in science and engineering (S/E) at your institution changed over the past 5 years? Please select the *single* most appropriate response below.**

   1.1 ☐ There has been *no* significant *change*

   1.2 ☐ There has been a significant *improvement* in the quality of S/E applicants *overall*

   1.3 ☐ There has been a significant *improvement* in the quality of S/E applicants in a *few fields*

   1.4 ☐ There has been a significant *decline* in the quality of S/E applicants *overall*.

   1.5 ☐ There has been a significant *decline* in the quality of S/E applicants in a *few fields*.

2. **What are the principal *indicators* upon which you base your judgment? Please *rank order the three most important* indicators (1 = most important, etc.).**

   2.1 ____ Trends in Graduate Record Examination (GRE) scores.

   2.2 ____ Trends in undergraduate grade point averages.

   2.3 ____ Trends in the number of applications received from graduates of high quality undergraduate institutions.

   2.4 ____ Faculty perceptions.

   2.5 ____ Other: specify

   2.6 ____ Other: specify

3. **How do the applicants for graduate S/E study in Fall 1982 with baccalaureates from foreign institutions compare in quality to applicants with baccalaureates from U.S. institutions? If you had no foreign applicants, check here ☐ and go to question 4.**

   3.1 ____ Both groups have approximately equal qualifications.

   3.2 ____ The foreign applicants have significantly better qualifications

   3.3 ____ The applicants with baccalaureates from U.S. institutions have significantly better qualifications

4. **Did your institution award any doctorates in the S/E fields in 1981–82?**

   4.1 ____ Yes (Go to question 5.)

   4.2 ____ No. (Please provide the information requested at the end of the form and return it to the American Council on Education.)

5. **If you checked "yes" in question 4, in your opinion, how do the 1981–82 S/E doctorate recipients from your institution compare with those of 5 years earlier? If your institution had no doctorate recipients in 1976–77, please check here ☐ and return the form to the American Council on Education.**

   5.1 ____ No significant difference in quality

   5.2 ____ The 1981–82 group is significantly better qualified

   5.3 ____ The 1976–77 group was significantly better qualified

6. **If you checked either 5.2 or 5.3, what were the principal indicators upon which you base your judgment? Please *rank order the three most important indicators* (1 = most important, etc.).**

   6.1 ____ Change in the quality of graduate school applicants.

   6.2 ____ Change in the number of new doctorates from this institution who held nationally competitive awards for graduate study.

   6.3 ____ Change in content of the doctoral programs at this institution

   6.4 ____ Change in the number of new doctorates from this institution being offered post doctoral appointments at the quality departments

   6.5 ____ Change in the number of new doctorates from this institution being offered tenure track appointments in major universities

   6.6 ____ Change in the number of new doctorates from this institution being offered employment in business and industry.

   6.7 ____ Change in the level of research support at this institution.

   6.8 ____ Other; specify. _____

   6.9 ____ Other; specify. _____

Thank you for your assistance. Please return this form by **November 29, 1982** to:

Higher Education Panel
American Council on Education
One Dupont Circle
Washington, DC 20036

Please keep a copy of this form for your records
Person completing the form:

Name _____

Title _____

Telephone _____

If you have any questions or problems concerning this survey, please call HEP staff collect at (202) 833-4757

APPENDIX B: TECHNICAL NOTES

Weighting

For this survey two questionnaires were developed. One for institutions with undergraduate students majoring in the sciences or engineering; the other, for institutions with graduate students working toward degrees in those fields. Excluded were independent law, medical, and business schools; theological seminaries; schools of performing arts and other professional institutions.

The undergraduate questionnaires were sent to four-year colleges and universities that awarded the baccalaureate and were members of the Panel Table B 1 shows the institutional population, the number of respondents to the undergraduate questionnaire for each stratum, and those that reported science or engineering majors. The 387 respondents represented 80 percent of the institutions to which the questionnaires were sent. Twenty-four of the

Table B 1

Stratification Design
(Undergraduate Questionnaire)

Type of Institution	Population Total	Respondents Total	Respondents with S/E Programs
Total	1,744	387	363
01 Public universities	112	87	86
02 Private universities	74	55	53
04 Public black four-year colleges FTE 3,000+	13	6	5
05 Public nonblack four-year colleges FTE 8,750+	106	74	72
07 Private nonblack four-year colleges FTE 8,750+	13	7	5
09 Public four-year colleges FTE 3,700 - 8,750	76	33	33
10 Public four-year colleges FTE < 3,700	186	26	25
11 Private four-year colleges FTE 2,000 - 8,750	126	30	30
12 Private four-year colleges FTE 1,000 - 1,999	264	40	38
13 Private four-year colleges FTE < 1,000	774	29	16

respondents indicated that they did not have undergraduates majoring in the sciences or engineering.

The graduate questionnaire was sent to institutions that awarded master's degrees or doctorates. However, in order to have the survey results reflect the opinions of those officials at institutions that account for a significant share of the graduate education effort, tabulations include only data from institutions that awarded 50 master's degrees or more in 1980-81. Table B-2 shows that 298 institutions returned graduate questionnaires. This represents 78 percent of the panel institutions to which this questionnaire was mailed. Forty four respondents were not included in the tabulations because they either did not have graduate programs in the sciences or engineering, or had awarded fewer than 50 master's degrees.

Table B-2

Stratification Design
(Graduate Questionnaire)

	Type of Institution	Population	Respondents	Respondents with S/E Programs[a]
	Total	657	298	254
01	Public universities	112	87	87
02	Private universities	74	54	51
04	Public black four-year colleges FTE 3,000+	12	7	6
05	Public nonblack four-year colleges FTE 8,750+	98	66	60
07	Private nonblack four-year colleges FTE 8,750+	12	8	6
09	Public four-year colleges FTE 3,700 - 8,750	70	34	28
10	Public four-year colleges FTE < 3,700	81	13	4
11	Private four-year colleges FTE 2,000 - 8,750	84	19	10
12	Private four-year colleges FTE 1,000 - 1,999	56	4	2
13	Private four-year colleges FTE < 1,000	58	6	0

[a]Included in this column are responses from doctorate-granting institutions and institutions that awarded 50 or more master's degrees in 1980-81.

The weighting technique used was the standard one employed for Panel surveys. Data received from Panel members were adjusted for item and institutional nonresponse within each cell. Then institutional weights were applied to bring Panel data up to estimates representative of the national population.

Comparison of Respondents and Nonrespondents

Table B-3 compares the undergraduate survey respondents and nonrespondents against several variables. Higher-than-average response rates were recorded for private, nondoctorate granting colleges and by institutions in the South. Lower than average response rates were shown by institutions in the West.

Table B-3

Comparison of Respondents and Nonrespondents: Undergraduate Student Questionnaire

(In percentages)

Institutional Characteristics	Respondents (N=387)	Nonrespondents (N=99)	Response Rate
Total	100.0	100.0	79.6
Control			
Public	58.4	63.6	78.2
Private	41.6	36.4	81.7
Type and control			
Public doctorate-granting	27.4	28.3	79.1
Private doctorate-granting	16.0	18.2	77.5
Public nondoctorate-granting	31.0	35.3	77.4
Private nondoctorate-granting	25.6	18.2	84.6
Region			
East	27.1	28.3	78.9
Midwest	31.3	28.3	81.2
South	27.9	17.2	86.4
West	13.7	26.2	67.1
Total undergraduate full-time-equivalent enrollment (1976)			
Less than 1,000	12.4	11.1	81.4
1,000 - 4,999	37.0	32.3	81.7
5,000 and above	50.6	56.6	77.8

Table B-4 compares the graduate survey respondents and nonrespondents against the same variables. Higher-than-average response rates were recorded for medium-sized institutions (FTE enrollments between 1,000 and 5,000 students) and for institutions in the South and Midwest. Lower-than-average response rates occurred among small institutions and those in the West.

Table B-4

Comparison of Respondents and Nonrespondents:
Graduate Student Questionnaire

(In percentages)

Institutional Characteristics	Respondents (N=385)	Nonrespondents (N=101)	Response Rate
Total	100.0	100.0	77.8
Control			
Public	69.5	67.1	78.4
Private	30.5	32.9	76.5
Type and control			
Public doctorate-granting	35.5	32.9	79.1
Private doctorate-granting	20.5	22.4	76.3
Public nondoctorate-granting	33.9	34.1	77.7
Private nondoctorate-granting	10.1	10.6	76.9
Region			
East	25.8	28.2	76.2
Midwest	27.2	16.5	85.3
South	32.9	24.7	82.4
West	14.1	30.6	61.8
Total undergraduate full-time-equivalent enrollment (1976)			
Less than 1,000	3.0	4.7	69.2
1,000 - 4,999	30.9	27.1	80.0
5,000 and above	66.1	68.2	77.3

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