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ABSTRACT

Trends in science and engineering (S/E) bachelor's, master's, and doctoral degrees awarded from 1950 to 1970 are summarized in this report. Major findings demonstrate that: (1) the number of S/E degrees awarded annually is now below the levels reached in the early to mid-seventies and that this recent decline follows a long uptrend that began in the mid-fifties; (2) the S/E share of all degrees fell during the last decade in all degree levels and whereas S/E fields accounted for about 60% of all doctorates until 1969, they now account for only 50%; (3) women have earned an increasingly large share of S/E degrees at all levels since 1950; and (4) the trends in the number of degrees are affected by changes in the relevant populations (demographic factors) and also non-demographic factors. (Author/JN)

SCIENCE RESOURCES STUDIES HIGHLIGHTS

NATIONAL SCIENCE FOUNDATION WASHINGTON, D.C. 20550 OCTOBER 7, 1981 NSF 81-320

Trends in Science and Engineering Degrees, 1950 through 1980[1]

This report incorporates data provided by other Federal agencies as part of their general statistics programs. The degree data were collected and provided by the National Center for Education Statistics (NCES), U.S. Department of Education. The focus of this report is on degrees in science and engineering (S/E) fields and, where appropriate, the NCES data have been reclassified according to the National Science Foundation field categories. Estimates of population in the various age categories were published by the Bureau of the Census.

Highlights

- The number of S/E degrees awarded annually is now below the levels reached in the early to midseventies. This recent decline follows a long uptrend that began in the mid-fifties. Bachelor's and first-professional degrees peaked in 1974 at 305,000 and have been near 290,000 in the last five years. Master's degrees reached their high point of 56,700 in 1977 but declined by 1980 to 54,500. Doctor's degrees reached their highest number at 18,600 in 1973 but have been below 17,000 in the last four years.

- The S/E share of all degrees fell during the last decade in all degree levels. S/E fields, which accounted for about 60 percent of all doctorates until 1969, now account for only 50 percent. During this period the S/E share of master's degrees fell from 25 percent to 18 percent, and first-level degrees from 32 percent to 29 percent.

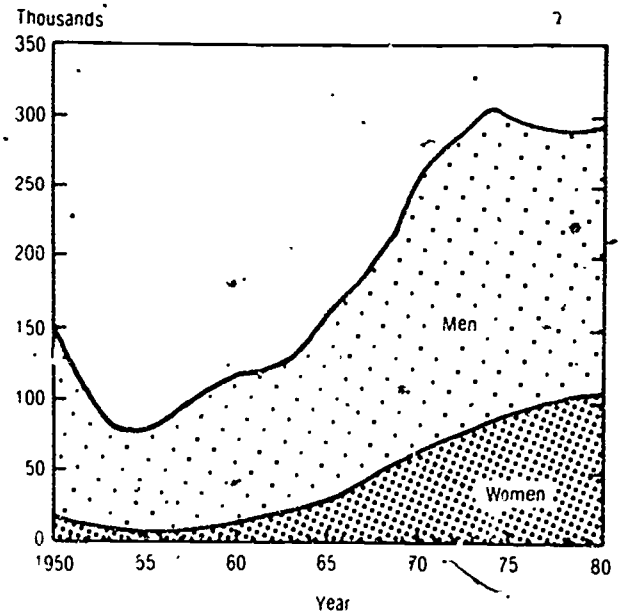
- Women have earned an increasingly larger share of S/E degrees at all levels since 1950. In 1980 they earned 36 percent of the first-level degrees, 27 percent of the master's degrees, and 21 percent of the doctorates. In 1970 these shares were 26 percent, 17 percent, and 9 percent, respectively.

- The trends in the number of degrees are affected by changes in the relevant populations (demographic factors) and nondemographic factors. Beginning in the early sixties, the population of 22-year-olds—the typical age of baccalaureate recipients—grew rapidly and was an important factor in the increasing number of degrees awarded. Almost 40 percent of the increase in the number of S/E baccalaureates from the low level in 1955 to 1980 may be attributable to growth in the population of 22-year-olds.

Introduction

Demographic factors cause some observers to believe that the leveling off in the production of S/E graduates since 1974 is but a prelude to further declines expected to begin in the mideighties. Policymakers, however, need to consider other factors affecting degree production which are very difficult to evaluate, such as propensity of youths to enter college, and continuation and completion rates. This report is intended to illuminate the discussion by providing a summary and analysis of the salient features of post-World War II S/E degree production. An analysis of factors that led to the

Chart 1. Science/engineering bachelor's and first-professional degrees by sex: 1950 to 1980



SOURCES: National Science Foundation and National Center for Education Statistics, Department of Education

[1]Degree data are compiled for a 12-month period, July through June, of the following year. For convenience, degrees in a given July through June period will be referred to by the year in which the period ended, e.g., 1980 means the 12-month period ending June 1980.

(Prepared in the Supply and Education Analysis Group, Division of Science Resources Studies)

current situation, although not necessarily predictive, should assist in understanding possible developments.

The history of post-World War II degree production in the United States has exhibited three distinct phases: (1) The period 1946-55 was characterized by explosive growth and subsequent sharp decline; (2) the period 1955-74 witnessed a remarkable continuous increase in degree production in both S/E and non-S/E fields; and (3) since 1974, annual degree production has tended to decline in some fields.

In the first phase (1946-55) S/E bachelor's and first-professional degrees rose to 155,000 in 1950 and then declined to 81,000 in 1955 as educational benefits for most veterans terminated (chart 1). Growth in the 1946-50 period was the result of those whose education was interfupted by military service, additional desire for a college education gained through war-time experience, and perhaps equally important, the educational benefits available under the G.I. Bill.

The second period, beginning with the post-war low in 1955, featured increases every year until the high point of 305,000 degrees was reached in 1974. A variety of factors combined to sustain this remarkable long-term growth. "Sputnik," launched in October 1957, influenced the passage of the National Education Defense Act of 1958 which authorized direct, low interest-rate student loans, graduate fellowships, and several forms of assistance to institutions. Emphasis on the space effort attracted many young people to the physical sciences and engineering. At about the same time, student participation in the biological and social science fields also increased. The Higher Education Act of 1965 initiated major student assistance programs including work-study and, effective in fiscal year 1967, educational opportunity grants and insured loans. Also in the midsixties the first wave of the postwar baby-boom generation reached college age

In the 1974-80 period, the third-phase, S/E bachelor's degrees declined about 4 percent to 292,000. During this period, the availability of student aid has increased, total enrollments in higher education have continued to grow, and the demographic declines have not yet reduced the size of the traditional college age population. On the other hand, the proportion of part-time and unclassified students increased, the S/E share of total bachelor's degrees declined, and the number of S/E bachelor's degrees per thousand 22-year-olds also declined.

There are notable differences in the stability of the S/E share of total degrees at the three levels (chart 2). Bachelor's degrees have shown the greatest stability. Since 1953 the S/E share of bachelor's and first-professional degrees rose from 28 percent to 32 percent and then retreated to 29 percent. Until 1969 the S/E share of doctorates was relatively stable at slightly over 60 percent, but it subsequently declined and leveled off at 50 percent in the last three years. Master's degrees exhibited the greatest variability, ranging from 30 percent in 1965 to less than 18 percent in 1976 and 1977.

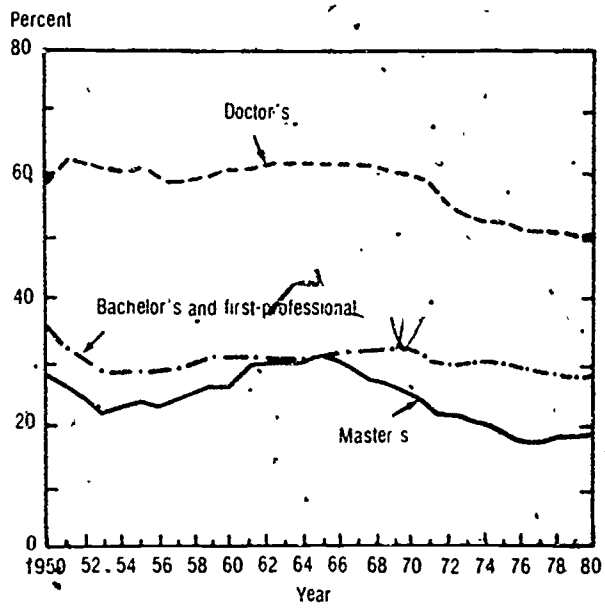
Since general trends in master's- and doctorate-level degree production have tended to be similar to those of bachelor's and first-professional degrees, this report will focus primarily on S/E bachelor's and first-professional degrees.

S/E Bachelor's and First-Professional Degrees

DEGREES BY FIELD

The total number of S/E baccalaureates awarded annually has fallen since 1974, but there have been varying trends among the major fields (chart 3). The most notable has been in engineering, which increased by 53 percent from 1976 to a historic high of almost 60,000 in 1980. The most rapid rates of growth occurred in chemical, mechanical, and "other" engineering fields. Degrees in mathematical sciences have fallen by 22 percent since 1970, but this conceals two divergent trends. Degrees in mathematics have fallen 58 percent, from over 27,000 in 1970 to 11,500 in 1980, while degrees in computer sciences have risen from 1,500 to over 11,000 during the same period. Degrees in social sciences, which increased spectacularly during the Vietnam Era, have fallen sharply since 1974. Within the social sciences, degrees fell in psychology (19 percent), sociology (47 percent), political science (17 percent), and "other" social sciences (21 percent), but increased in economics (24 percent). The relatively level trend in physical sciences masks a 39-percent decrease in physics since 1969 and an increase of more than 300 percent in geological sciences since 1965.

Chart 2. Science/engineering degrees as a percent of total degrees at each level of degree: 1950 to 1980



SOURCES: National Science Foundation and National Center for Education Statistics, Department of Education

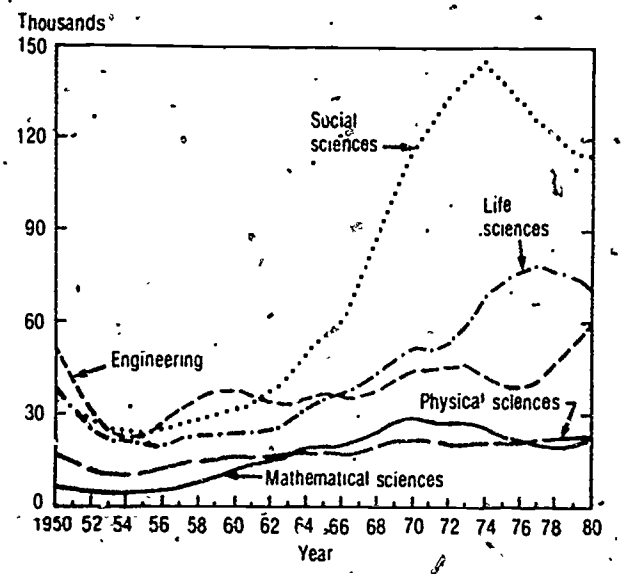
DEGREES AWARDED TO WOMEN

One of the striking developments of the postwar era has been the increasing participation of women in higher education. Women received only one fourth of all bachelor's and first-professional degrees in 1950 but almost one-half in 1980. In S/E fields, the share of degrees earned by women are less than in non-S/E fields but they increased at an even faster rate—from 12 percent in 1950 to 36 percent in 1980 (chart 4). Women received only 175 degrees in engineering in 1950, but 6,100 in 1980.

THE RELATION OF DEGREES TO POPULATION

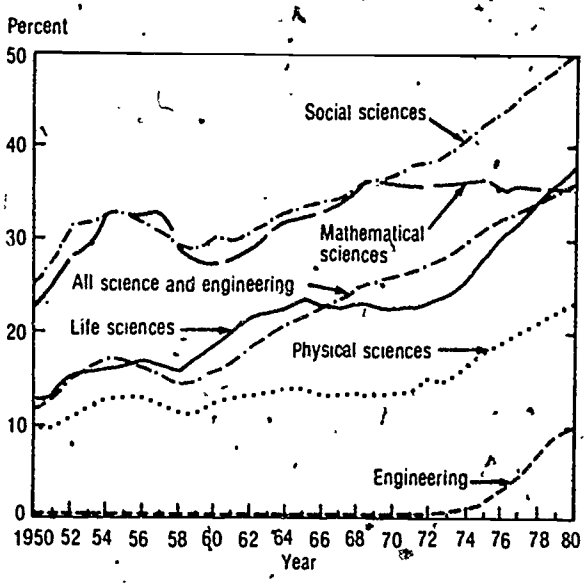
The size of the traditional college age population is generally considered to be one of the basic factors in determining degree production potential. There were about 2,066,000

Chart 3. Bachelor's and first-professional degrees by major science/engineering field: 1950 to 1980



SOURCES National Science Foundation and National Center for Education Statistics, Department of Education

Chart 4. Women as a percent of bachelor's and first-professional degree recipients by field: 1950 to 1980



SOURCES National Science Foundation and National Center for Education Statistics, Department of Education

persons 22 years of age,[2] the normal age for baccalaureate recipients, in the U.S. population in July 1955.[3] In 1955, the lowest year in the production of S/E bachelor's and first-professional degrees since World War II, 39 S/E degrees were awarded per thousand 22-year-old persons in the population. If the degrees per thousand 22-year-olds had remained constant at the 1955 rate, the number of S/E bachelor's degrees produced in 1980 would have been only about 82,000 higher than in 1955. Actual degree production was 211,000 higher. Therefore, almost 40 percent of the increase from 1955 to 1980 may be attributable to demographic changes and about 60 percent to changes in other factors. The other factors include changes in the value of education as perceived by young people, their parents, and employers; the availability of desired educational opportunities; and economic capability of would-be students, including the availability of various types of student aid such as educational opportunity grants.

The annual average over 5-year periods of bachelor's and first-professional S/E degrees per thousand 22-year-olds increased until the latest 5-year period. (See text table.) Since 1974, the annual rate declined sharply from 114 to 89 per thousand for men, but remained stable near 50 per thousand for women. The decline for men reflects the fact that the number of degrees declined after 1974 even though the number of 22-year-olds continued to increase. Projections of population do not indicate any major changes in the number of 22-year-olds by the year 1984. Therefore, demographic factors should have little influence on the number of bachelor's degrees in the near future and changes over the next few years will be primarily the result of changes in nondemographic factors. The population of 22-year-olds is projected to decrease from 1984 through 1990, to a level about 17 percent less than the estimated 1980 population.

Sex	1951-55	1956-60	1961-65	1966-70	1971-75	1976-80
Total	43	50	56	69	80	72
Men	74	84	89	104	113	93
Women	13	15	22	35	47	50

SOURCE: National Science Foundation and Bureau of the Census, Department of Commerce

S/E Master's Degrees

Master's degrees are awarded primarily in non-S/E fields reflecting the predominance of education, and business and management at this degree level. In 1965 S/E degrees accounted for 30 percent of all master's degrees but the proportion then declined and leveled off at about 18 percent in the last six years (chart 2).

Because of the influence of non-S/E fields, discussion of the S/E share of master's degrees masks their growth in absolute numbers. After a low point of 13,000 in 1954, S/E master's-degree production increased steadily to 54,000 in 1973. A peak of 56,700 was achieved in 1977 but it was followed by a decline to 54,500 in 1980.

The distribution by field and the participation of females at the master's level differs from that of the baccalaureate level. With respect to field distribution, in 1980 life and social sciences accounted for 64 percent of the S/E bachelor's degrees awarded but less than one-half of the master's degrees. Engineering accounted for only 20 percent of the bachelor's degrees awarded but over 30 percent of the master's. With

[2] U.S. Department of Commerce, Bureau of the Census. *Current Population Reports*. Population Estimates. Estimates of the Population of the U.S. by Single Years of Age, Color, and Sex 1900 to 1959. Series P-25, No. 311, July 1965. Additional Bureau of Census publications in the P-25 series were used as follows: No. 519, April 1974; No. 704, July 1977; and No. 870, January 1980 (Washington, D.C.: Supt. of Documents, U.S. Government Printing Office.)

[3] The year 1955 is used as a reference point for this analysis because it represents a time when relatively few external forces were at work to increase college attendance.

respect to participation of females, women received only 10 percent of the S/E master's degrees in 1954 but their share increased to almost 27 percent in 1980. Increases in participation of women occurred in each major S/E field group

S/E Doctor's Degrees

The doctor's degree has been primarily an S/E degree throughout the postwar period, but it may be in danger of losing this distinction. Until 1969 S/E fields accounted for over 60 percent of all doctorates, but they accounted for only 50 percent in the last three years. The number of S/E doctorates increased from 3,900 in 1950 to 18,600 in 1973, and then declined to 16,200 in 1978. The number has increased slightly in the last two years. There have been changes in the emphasis by major field groups since the high point in 1973. The proportion of S/E degrees in life and social sciences increased from 52 percent to 60 percent in 1980 and the proportion in physical sciences, engineering, and mathematical sciences declined accordingly. The recent boom in engineering bachelor's degrees has no counterpart at the doctorate level, probably because the favorable employment opportunities available to engineering baccalaureate recipients reduces their incentive to pursue graduate studies.

Women receive a smaller share of S/E degrees at the doctorate level than at other degree levels. They have increased rapidly since 1970, however, increasing from 9 percent to 21 percent in 1980. This rate of increase for women was higher than at other degree levels during the last decade.

Continuation Rates from Bachelor's and First-Professional Degrees to Master's and Doctor's Degrees

As discussed earlier, the size of the relevant age cohort (i.e., 22-year-olds) has had an important influence on the number of bachelor's degrees produced. Analagously, the pool from which recipients of graduate degrees are drawn can be defined as the number of S/E bachelor's-degree recipients lagged the appropriate number of years.[4] Although the period of time required to complete a degree is not the same for all advanced degree recipients, on average S/E master's degrees may be appropriately related to bachelor's degrees two years earlier, and doctorate degrees to bachelor's degrees seven years earlier. S/E master's degrees as a percent of bachelor's degrees two years earlier increased from almost 19 percent in 1957[5] to 26 percent in 1968 and then declined to 19 percent in 1974 and remained near that level through 1980. If the 26-percent rate of the late sixties had been achieved in 1980, the number of S/E master's degrees would have increased by 30,000, from 45,000 in 1968 to 75,000 in 1980. The actual increase was only 9,000.

The same general pattern occurred at the doctorate level. The highest continuation rate, 13 percent, was not reached until 1970 and the subsequent decline to below 6 percent in 1980 was relatively more severe than the decline in the continuation rate for master's degrees. If the continuation rate had remained at the high of 13 percent, production of S/E doctor's degrees would have increased by over 20,000 from 17,600 in 1970 to 38,400 in 1980. Actual degree production fell slightly. The trends in doctorate continuation rates were similar for both men and women, but the gap between men and women has been narrowing.

The conclusion that can be drawn from this analysis parallels the one drawn for S/E bachelor's degrees. Nondemographic factors—such as the perceived value and availability of S/E graduate training and the ability of would-be graduate students to finance this training (including all types of student aid)—have been playing and will continue to play an important role in advanced S/E degree production.

[4] This pool is limited to S/E degrees although it is recognized that some S/E baccalaureates receive advanced degrees in nonscience fields and vice versa.

[5] Bachelor's degrees in 1955 are used as the starting point to avoid the years with large numbers of World War II veterans

NSF 81-320