DOCUMENT RESUME

ED 361 194 SE 053 602

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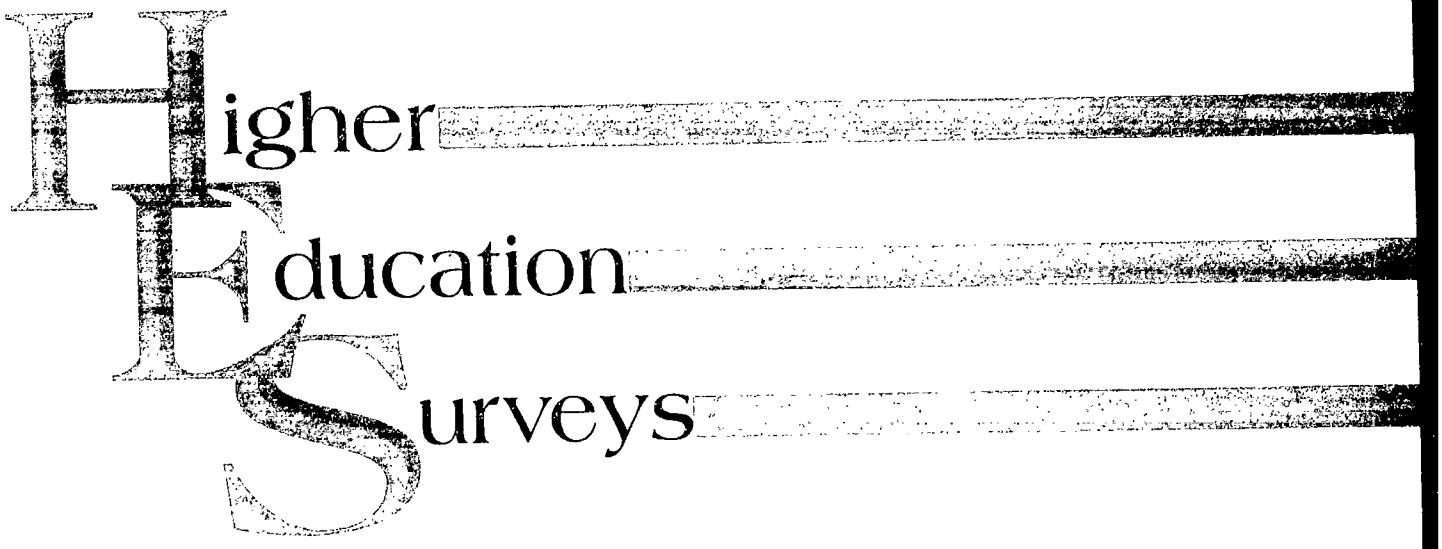
TITLE Survey on Undergraduate Education in Geology. Higher Education Surveys Report, Survey Number 15--Geology.
INSTITUTION Westat, Inc., Rockville, MD.
SPONS AGENCY Department of Education, Washington, DC.; National Endowment for the Humanities (NFAH), Washington, D.C.; National Science Foundation, Washington, D.C.
PUB DATE Dec 92
NOTE 66p.
PUB TYPE Reports - Research/Technical (143) -- Statistical Data (110)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *College Faculty; *College Science; Earth Science; *Geology; Higher Education; *Science Departments; *Science Education; Surveys; Undergraduate Students; Undergraduate Study

ABSTRACT

In 1991, a survey questionnaire concerning undergraduate education in geology was sent to a nationally representative sample of 597 four-year colleges and universities. Of these, 275 had an undergraduate geology department or a department with a geology program, and met the criteria for inclusion in the study. Responses were received from 262 of the 275 eligible institutions. The data were weighted to provide national estimates about instruction staff, computer resources, course offerings, and issues and concerns in undergraduate education in geology. Some of the highlighted results included the following. Almost all research universities (92%) had geology programs, but only 68% of doctoral institutions and much smaller portions of comprehensive (40%) and liberal arts institutions (15%) offered geology programs. Bachelor's degrees were offered by 88% of the departments with geology programs, 42% offered master's degrees, 23% offered doctorates, and 3% associate's degrees. Almost two-thirds (63%) of the departments stated that the number of students who declared a major in geology increased in the last 5 years. In evaluating the six components of undergraduate education in geology, department chairs assessed curriculum and faculty/staff resources more positively than they did laboratory equipment for undergraduate instruction, facilities, student preparation, and teaching assistants. A large majority (80%) stated they offered undergraduate geology students access to departmental computers for undergraduate research and coursework. (PR)

SURVEY ON UNDERGRADUATE EDUCATION IN GEOLOGY



Higher Education Surveys Report
Survey Number 15 - Geology
December 1992

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

SURVEY ON

UNDERGRADUATE EDUCATION IN GEOLOGY

Sponsored by:

The National Science Foundation
Directorate for Social, Behavioral, and Economic Science
Division of Science Resources Studies

Written for:

The National Science Foundation
Directorate for Geosciences
Division of Earth Sciences

and

Directorate for Education and Human Resources
Division of Undergraduate Education

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Acknowledgments

This survey on undergraduate education in geology was conducted by Westat, Inc., under the direction of the National Science Foundation's (NSF) Division of Science Resources Studies, at the request of the Division of Earth Sciences and the Division of Undergraduate Education.
Nancy M. Conlon, Senior Analyst, Division of Science Resources Studies, directed the project for NSF and conducted the review of this report. Elizabeth Farris, HES Project Director, managed the project for Westat. The following persons assisted in developing the study and providing technical review.

- James F. Hays, Director, Division of Earth Sciences, National Science Foundation
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- Mary J. Golladay, Director, Education and Human Resources Program, Division of Science Resources Studies, National Science Foundation

Other individuals at the National Science Foundation also contributed to the questionnaire design and presentation of survey results.

From Westat, Pat Cruz was the data preparation supervisor for the survey, and Debbie Alexander supervised the telephone followup. Mary Jo Nolin assisted with report preparation.

We also acknowledge the indispensable contribution of the many department chairs, faculty, and staff members at the sampled institutions who reviewed and completed the survey questionnaire.

Highlights

In spring 1991, a survey questionnaire of undergraduate education in geology was sent to a nationally representative sample of 597 four-year colleges and universities. Of these, 275 had an undergraduate geology department or a department with a geology program, and met the criteria for inclusion in the study. The remaining 322 institutions did not meet the criteria. Responses were received from 262 of the 275 eligible institutions. The data were weighted to provide national estimates about instructional staff, computer resources, course offerings, and issues and concerns in undergraduate education in geology.

- Almost all research universities (92 percent) had geology programs, but only two-thirds (68 percent) of doctoral institutions and much smaller proportions of comprehensive (40 percent) and liberal arts institutions (15 percent) offered geology programs.

- A large majority of departments with geology programs (88 percent) offered bachelor's degrees in geology; 42 percent offered master's degrees, 23 percent offered doctorates, and 3 percent, associate's degrees.

- Almost two-thirds (63 percent) of the chairs of departments with geology programs stated that the number of students who declared a major in geology had increased (31 percent) or stayed about the same (32 percent) in the last 5 years; 36 percent indicated that the number of majors had decreased.

- When evaluating six components of undergraduate education in geology, department chairs assessed curriculum and faculty/staff resources more positively than they did laboratory equipment for undergraduate instruction, facilities for undergraduate instruction, student preparation, and teaching assistants.

- Three-fourths of department chairs rated opportunities for undergraduate research through independent study or advanced coursework, and the availability of field trips/field work as good. Both of these aspects of undergraduate education in geology were rated particularly highly relative to most other issues and concerns.

- The academic preparation of entering freshmen was ranked as the most important concern to chairs of departments with geology programs. The amount of instructional laboratory space and equipment, along with student interest and motivation, were the other concerns most often ranked as the greatest problems by chairs of geology programs.

- Over 80 percent of chairs of departments with geology programs stated that their department offers undergraduate geology students access to departmental computers for undergraduate research and coursework. Virtually all chairs also stated that their students had access to campus-wide computer resources.

- In fall 1990, an estimated 5,200 undergraduate and 1,690 graduate courses were offered by the estimated 489 four-year colleges and universities with geology programs. An average of 10.6 undergraduate geology courses and an average of 8.2 graduate geology courses were taught by institutions offering courses at those levels.

- An estimated 2,850 full-time and 480 part-time faculty taught geology courses to undergraduates in fall 1990. Of these full-time faculty, 52 percent were full professors, 27 percent were associate professors, 18 percent were assistant professors, and 3 percent were lecturers or instructors.

- The average (mean) number of faculty teaching geology to undergraduates at each program was 5.8 full-time and 1.0 part-time faculty. The average full-time faculty included 3.0 full professors, 1.6 associate professors, and 1.1 assistant professors.

- The vast majority (96 percent) of full-time faculty teaching geology to undergraduates held doctoral degrees; 4 percent had master's degrees, and 1 percent held bachelor's degrees as their highest degree.

- The full-time faculty members who taught geology to undergraduates in fall 1990 were 86 percent white, non-Hispanic men, 8 percent white, non-Hispanic women, and 2 percent Asian men. All other racial/ethnic and gender groups represented 1 percent or less of full-time faculty teaching undergraduate geology courses.

- An average of 79 percent of the contact hours for undergraduate instruction were taught by full-time faculty. "Contact hours" includes lectures, laboratories, and discussion groups. The remaining 21 percent were provided by teaching assistants (12 percent) and part-time faculty (9 percent).

- Over half of all the chairs of departments with geology programs (56 percent) stated that their departments had teaching assistants (TAs) in fall 1990. The large majority stated that TAs graded tests and papers, conducted laboratory sections, and held office hours. Less than one-half stated that TAs lectured occasionally or conducted group discussions, and 4 percent stated that TAs lectured on a regular basis.

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Introduction

This survey of geology programs at the Nation's colleges and universities represents one of the first efforts of the National Science Foundation (NSF) to gather information nationally on a number of topics in undergraduate science and engineering education. In the past, NSF has collected data on graduate education and has used, when necessary, existing data on undergraduate education collected by other Federal agencies and professional associations. However, in the last several years, NSF's budget for undergraduate education has been increased substantially, and programs are being developed to improve the proficiency of all students in science and mathematics. In order to develop new undergraduate education programs and evaluate existing ones, information on specific fields of science and engineering is needed.

This survey, and companion surveys of physics and sociology programs, are the first in a series of Higher Education Surveys of selected science and engineering departments that will capture information on undergraduate science and engineering in the Nation's universities, four-year colleges, and two-year colleges [1] The data developed in these surveys will provide current information to planners and policy makers in education, government, and industry.

This survey of undergraduate programs in geology requested information on the organization of the department or program that offers undergraduate geology courses, characteristics of the instructional faculty, issues and concerns of the department chairs, type of course offerings, and availability of computer resources to students enrolled in geology. The general purpose of the survey of undergraduate geology programs is two-fold. First, it provides baseline data on the characteristics of institutions, departments/programs, and faculty responsible for providing instruction in geology to undergraduates. Secondly, it allows NSF to determine the quality of available data, and the feasibility of collecting data on undergraduate education, other than earned degrees, by discipline.

The data were collected in spring 1991 from department chairs at a nationally representative sample of 597 four-year colleges and universities, representing a universe of approximately 1,370 four-year institutions (specialized institutions were excluded from the sample). The sample consisted of 104 research, 106 doctoral, 150 comprehensive, and 180 liberal arts institutions, and 57 historically black colleges and universities (HBCUs) that are not part of the HES panel.[2] Screening of institutions found 322 to be out-of-scope because they did not have an undergraduate program in geology.

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[1] Similar surveys were conducted of undergraduate programs in geology, physics, and sociology. In addition, surveys on undergraduate instruction in electrical, mechanical, and civil engineering have been completed. Findings from these surveys are presented in separate reports. Also, a survey of technical education in two-year institutions is scheduled to be conducted in winter 1992-93.

[2] See Appendix B for a brief description of the different types of institutions.

This resulted in an in-scope sample of 275 institutions. Questionnaires were not received from 4 institutions, and 9 institutions refused to participate in the survey. The overall response rate was 95 percent based on 262 responses from the 275 institutions that met the criteria for inclusion in the survey. Appendix B provides a more detailed discussion of the sample and survey methodology. The survey questionnaire is reproduced in Appendix C.

Definition of Programs and Courses

One of the purposes of the survey was to determine how much undergraduate instruction in geology was being provided in the Nation's four-year colleges and universities and to identify characteristics of the faculty providing this instruction. To broaden the coverage of the survey to include institutions that did not have geology departments but taught courses in geology, a decision was made to survey "departments that offered programs in geology" instead of geology departments.[3] Thus, an important methodological issue in this study was defining the term "geology program," since institutions defined their programs differently. Pretest results showed that potential respondents, the department chairs, would know if they had an undergraduate program in geology. However, after mailout, some respondents needed clarification on what constituted a geology program, a geology course, and a separate program in other disciplines.

The instruction at the top of the questionnaire directed the instrument to the attention of "the Chair of the Department of Geology, or the department that offers a program in geology." This instruction proved to be insufficient for two reasons. First, if an institution did not have a department or degree with that name, the questionnaire sometimes was discarded as not applicable for the school. For example, respondents at institutions with departments called Earth Sciences sometimes did not realize that they should complete the geology questionnaire. Second, respondents did not know what was meant by "program." Most respondents seemed to interpret this to mean "major." Thus, some respondents at institutions that offered a number of courses in geology but did not have a major in geology discarded the questionnaire as not applicable to them. These different interpretations of the instructions made clarification necessary. Accordingly, additional instructions were provided (post-mailout) that stated that an institution was considered to have a geology program if it "offered a major or minor in geology, or taught four or more geology courses on a regular basis." Given that programs were defined in this manner, figures presented in this report should not be interpreted as being estimates of the number of geology departments or the total number of faculty teaching geology in the country. There were fewer geology departments than there were programs because geology programs might be housed in departments with names other than geology.

[3]This decision was based on discussions with NSF and Westat staff, department chairs, and staff of professional associations.

Clarification was also provided for determining whether geology courses that were taught by departments other than the geology department should be included in the study. For example, respondents were not sure if "Introduction to Earth Science" should be considered a geology course. They were asked to consider the course content in order to make that determination.

To determine the organization of departments in which geology programs were housed, department chairs were asked if their department had a separate program for any discipline in addition to geology (e.g., a separate program in oceanography or geography). It was believed that this question would allow a more comprehensive view of an institution's curriculum related to geology to be studied. During data collection, it became apparent that respondents were not sure what was meant by a "separate program." Some were listing subareas of the discipline (e.g., geochemistry or geophysics) even if they did not offer a degree in those subareas, while others considered these subareas to be part of geology. Chairs at some institutions where geology was offered in a multidiscipline department, such as a department of physical sciences, were listing diverse disciplines such as physics, chemistry, and mathematics as "separate programs." Respondents at other institutions that listed a department name as "physical sciences" indicated that they did not have any separate programs. Respondents that called with questions were told that subareas of geology should be considered to be part of geology, not separate programs, and that when completing the questionnaire, diverse disciplines, such as physics and chemistry, should be separated from geology if at all possible. Results showed that between 79 percent and 83 percent (depending on the question) of the department chairs responded for geology programs only, with the rest responding for geology plus other programs.

Section V of the questionnaire asked department chairs to give the number of "different undergraduate and graduate geology courses, as identified by course title or number" taught in their department. Respondents tended to count laboratories and discussion groups that were affiliated with lecture courses differently. If a respondent called to ask how discussion groups and laboratories should be counted, they were told to include them as part of the lecture course. However, since this instruction was not explicit on the questionnaire, it is not known to what extent this classification was done by all institutions. Discussions with respondents and inspection of microfiche college catalogs indicated that course numbering for labs and discussion groups were handled differently at different institutions. At some institutions they were assigned the same course number as the lecture with which they were associated, and at some they were given a different course number than the lecture. Some respondents also said that a student could enroll in a laboratory if he/she was not enrolled in the lecture portion of the course, although students rarely, if ever, actually did this. Results, therefore, reflect the institutions' definition of "course," which may or may not have included laboratories, discussions, or both.

Report Overview

Data in this report, unless otherwise specified, are presented as "total" figures, which represent all four-year colleges and universities grouped together, and by institutional control (public and private) and type (research, doctoral, comprehensive, and liberal arts). These classifications are defined in Appendix B (see page B-7). While the total numbers are the major focus in the text, additional information by control and type are presented in the tables and figures.

The estimates in this report are based on sample data that have been weighted to produce national estimates.[4] Because these estimates are subject to sampling variability, numbers in the tables, figures, and text have been rounded. Percentages and averages have been calculated on the actual estimates rather than the rounded values. Specific statements of comparison made in the text are significant at the 95 percent confidence level or better.

Programs and Degrees

In spring 1991, an estimated 489 four-year colleges and universities had geology departments or departments with programs in geology.[5] Of these 489 geology programs, 68 percent (334 programs) were located at public institutions and 32 percent (155 programs) at private institutions. By type of institution, approximately half (237 programs) were located at comprehensive institutions, 20 percent (96 programs) at research institutions, 17 percent (85 programs) at liberal arts colleges, and 15 percent (72 programs) at doctoral institutions. The percentages of institutions with geology programs varied significantly by type, with the highest concentration among the research universities and the lowest among the liberal arts colleges. As shown in Table 1, almost all research universities (92 percent) had geology programs, but only two-thirds (68 percent) of doctoral universities and much smaller proportions of comprehensive institutions (40 percent) and liberal arts institutions (15 percent) had geology programs.

Less than half (42 percent) of the respondents indicated that their department with programs in geology also had separate programs for other disciplines in addition to geology (unpublished tabulation). These separate programs tended to be in related areas, such as geophysics or geography, or in other physical sciences, such as chemistry and physics.

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[4]Nonresponse adjustment weights were also calculated. Weights were calculated based on (1) the original sample stratum of the institution, (2) whether or not the institution was an historically black college or university, and (3) its response status, i.e., respondent, ineligible, or nonrespondent.

[5]All departments offering programs in geology will be referred to as "departments with programs in geology" or "geology programs" for the remainder of the report. The number of geology programs in this survey differs from the number of geoscience departments listed in the American Geological Institute (AGI) *Directory of Geoscience Departments* for a number of reasons. This survey included only geology departments or departments with geology programs at four-year colleges and universities. An institution was considered to have a geology program if it offered a major or minor in geology, or taught four or more geology courses on a regular basis. The AGI directory includes both two-year and four-year institutions, and includes all kinds of geoscience departments (e.g., oceanography, planetary sciences), not just geology.

Table 1. Number of institutions, and number and percentage of institutions with geology programs, by control and type of institution: United States

Institutional characteristic	Number of institutions[1]	Number of institutions with geology programs[2]	Percentage of institutions with geology programs
Total	1,368	489	36%
Control			
Public	495	334	67
Private	873	155	18
Type			
Research	104	96	92
Doctoral	106	72	68
Comprehensive	591	237	40
Liberal arts	567	85	15

[1]Represents all research, doctoral, comprehensive, and liberal arts colleges and universities in the United States.

[2]An institution was considered to have a geology program if it offered a major or minor in geology, or taught four or more geology courses on a regular basis.

NOTE: Details may not add to totals because of rounding.

SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

Level of Degrees

The vast majority of geology programs (88 percent) offered bachelor's degrees in geology (Table 2); 42 percent offered master's degrees, 23 percent offered doctorates, and 3 percent offered associate's degrees. Geology programs at public institutions were more likely to award master's degrees in geology than were geology departments at private institutions (50 percent versus 25 percent). The other levels of degree did not differ significantly by institutional control.

The level of training in geology available to students varied according to the type of institution at which the program was located. Students studying geology at research universities had the opportunity to pursue advanced training in geology -- 97 percent of geology programs at research institutions offered master's degrees in geology and 85 percent offered doctorates (Table 2). Advanced study in geology was also available to a somewhat lesser extent in programs at doctoral institutions, where 80 percent of the geology programs offered master's degrees and 39 percent offered the doctorate in geology. The pattern was different at comprehensive and liberal arts institutions; 85 percent of the geology programs at comprehensive institutions conferred bachelor's degrees, but only 23 percent offered master's degrees and 2 percent offered doctorates. Similarly, at liberal arts colleges, 81 percent of the departments with geology programs awarded bachelor's degrees, 3 percent awarded master's degrees, and none awarded doctorates in geology.

Table 2. Percentage of departments with geology programs conferring degrees at each level, by control and type of institution: United States

Level of geology degrees	Total	Control		Type			
		Public	Private	Research	Doctoral	Comprehensive	Liberal arts
Associate's	3	4	2	0	0	5	3
Bachelor's	88	91	83	97	99	85	81
Master's	42	50	25	97	80	23	3
Doctorate	23	25	19	85	39	2	0

SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

Geology Majors

Chairs of departments with programs in geology were asked to indicate whether they perceived the number of students who declared a major in geology to have increased, stayed about the same, or decreased over the last five years. Approximately one-third of the respondents indicated each of the categories -- 31 percent stated that the number of majors had increased, 32 percent said the number had remained about the same, and 36 percent indicated that the number had decreased (Table 3).

The number of geology majors was more likely to be perceived as decreasing at research institutions than at doctoral, comprehensive, and liberal arts institutions. Half of the department chairs at research institutions stated that the number of geology majors had decreased, compared to 38 percent of chairs at doctoral, 34 percent at comprehensive, and 23 percent at liberal arts institutions. Increases in the number of majors were perceived by the chairs at approximately one-quarter to one-third of the different types of institutions.

Table 3. Percentage of chairs of departments with geology programs indicating that the number of students who declared a major in geology over the last 5 years has increased, stayed about the same, or decreased, by control and type of institution: United States

Change in number of majors	Total	Control		Type			
		Public	Private	Research	Doctoral	Comprehensive	Liberal arts
Increased	31	31	31	32	23	35	29
Stayed about the same. . . .	32	27	46	18	39	31	48
Decreased	36	42	23	50	38	34	23

NOTE: Percentages may not add to 100 because of rounding.

SOURCE: Higher Education Surveys. Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

Issues and Concerns in Undergraduate Education

Chairs of departments with geology programs evaluated selected aspects of six components of undergraduate education in geology on a scale of very poor to very good: student preparation and motivation, curriculum, laboratory equipment for undergraduate instruction, facilities for undergraduate instruction, faculty and staff resources, and teaching assistants (Appendix Table A-1).[6] Overall, curriculum and faculty/staff resources received positive assessments; laboratory equipment and facilities for instruction were judged less favorably than other areas. In addition to the ratings, respondents ranked the top five problematical issues in order of their severity.

Ratings of Aspects of Undergraduate Education

Most chairs of departments with geology programs indicated that entering freshmen had average or poor academic preparation, and that students had an average or poor computer background. For instance, 31 percent rated the academic preparation of entering freshmen as poor, 50 percent judged it to be average, and only 19 percent designated it as good. Chairs of departments at different types of institutions differed on this measure, however, with programs at research universities (28 percent) and liberal arts colleges (39 percent) more likely than those at doctoral (14 percent) or comprehensive (10 percent) institutions to have rated the academic preparation of their freshmen as good. Evaluation of the computer background of students was even more negative; students in 45 percent of the programs were perceived to have a poor background in computers, 43 percent an average background, and 12 percent a good background. Interest and motivation of geology students was rated as good by 49 percent of the department chairs. However, half of the respondents rated this issue as average (37 percent) or poor (13 percent). As discussed in the next section, student interest and motivation was seen as a significant problem by many chairs.

High quality textbooks, both introductory and advanced, were the norm in geology programs. More than 80 percent of the respondents rated their texts as good. Opportunity for research and field work also received positive evaluation. Approximately three-quarters of the department chairs reported good opportunity for their students to engage in undergraduate research through independent study or advanced coursework. Chairs of departments with geology programs at doctoral institutions were less likely to evaluate the opportunity for undergraduate research as good (67 percent) than chairs at research, comprehensive, or liberal arts institutions (72 percent, 76 percent, and 84 percent, respectively). Seventy-four percent of the respondents rated the availability of field trips or field work for their geology students as good.

Evaluation of laboratory equipment and facilities for undergraduate education was not as positive overall. The quality of instructional

[6] As shown in item 4 on the questionnaire in Appendix C, each category included more than one item. Respondents were asked to rate each item on a 5-point scale from very poor to very good. The analysis reported here is based on that scale collapsed into 3 categories, *poor*, *average*, and *good*.

laboratory equipment was considered good in half of the geology programs, but 22 percent of the department chairs reported that their equipment was poor. More respondents at programs at liberal arts colleges (64 percent) than respondents at research institutions (41 percent) evaluated highly (i.e., rated as good) the quality of their laboratory equipment. Although about one-third of the chairs of departments with programs indicated that they had a good amount of instructional laboratory equipment, another one-third reported the amount of laboratory equipment they had was not sufficient. The picture of facilities for undergraduate instruction was similar. About 40 percent of the respondents indicated they had good quality laboratory space for instructing students, and slightly more than one-third stated they had a good amount of laboratory space and demonstration lecture facilities that were good.

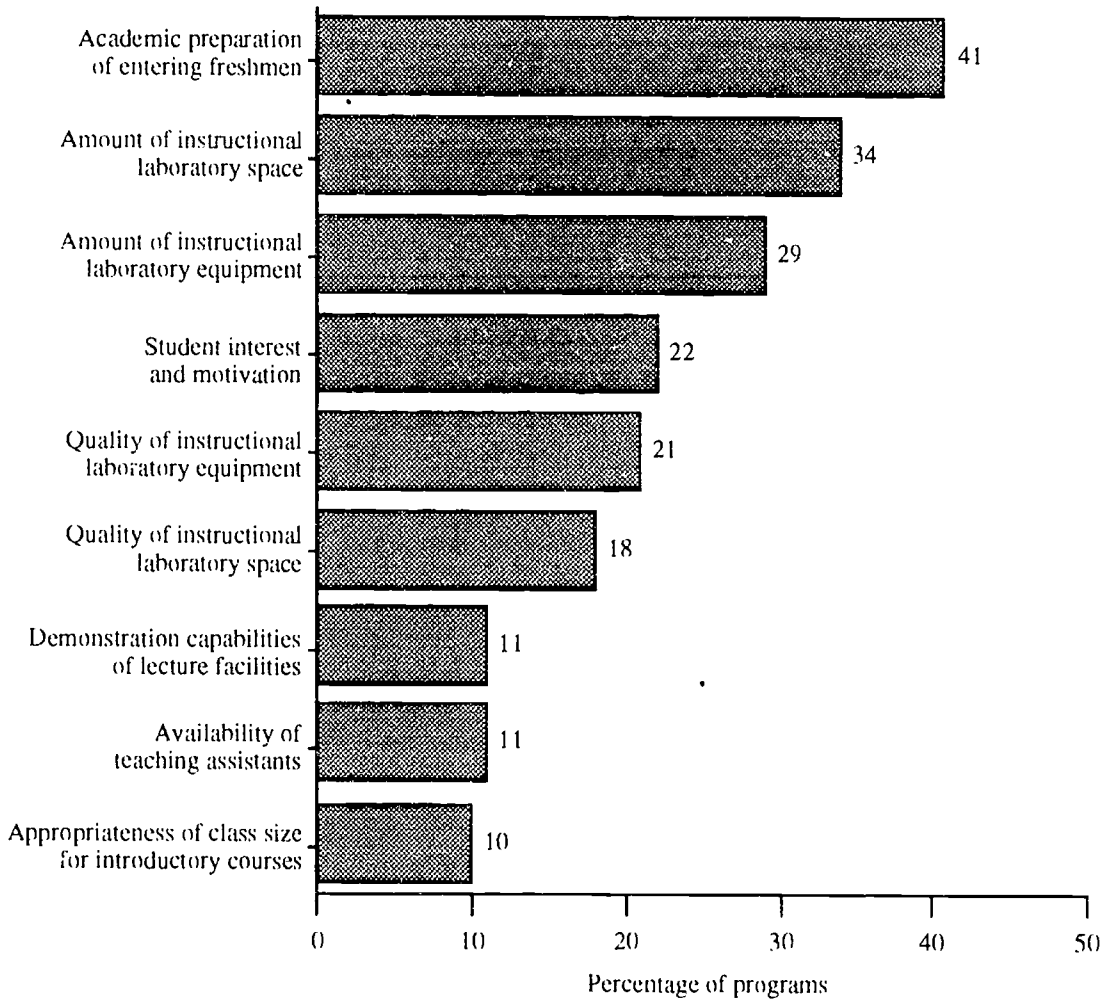
The faculty and staff resources in geology programs received positive ratings. For example, over 60 percent of the department chairs rated introductory class size as good, and about 90 percent cited advanced class size as good. More than two-thirds of the chairs reported good recruitment and retention of qualified faculty. Finally, three-quarters of the department chairs evaluated highly the language ability of faculty members whose first language is not English.

Teaching assistants were not used in all geology programs; 44 percent of the programs did not have teaching assistants in the fall of 1990. (The use of teaching assistants is discussed in more detail later in the report.) The presence of teaching assistants varied by institutional type. For example, 98 percent of chairs of programs at research institutions indicated they had teaching assistants in the fall of 1990, but only 34 percent of chairs of programs at comprehensive institutions stated that they used teaching assistants. For those chairs that did complete the ratings for teaching assistants, the availability of teaching assistants was rated good by only 33 percent (Appendix Table A-1). Chairs of departments at research institutions (46 percent) were more likely than chairs at doctoral (44 percent), comprehensive (19 percent), or liberal arts (29 percent) institutions to report the availability of teaching assistants as good. Overall, the quality of teaching assistants was rated good by over 60 percent of the chairs of the geology programs. The majority of department chairs (62 percent) rated the language abilities of teaching assistants whose first language is not English as average (33 percent) or poor (29 percent). These ratings differed considerably from those for faculty whose first language is not English, with only 25 percent of chairs rating faculty language abilities as average (19 percent) or poor (6 percent).

Greatest Problems for Undergraduate Education

Survey respondents were asked to select the five most critical problems for undergraduate education in geology from among the educational items that they rated and to rank them according to their severity. The academic preparation of entering freshmen emerged as the largest concern. Respondents for nearly one-quarter of the programs cited it as their greatest problem (unpublished tabulation), and 41 percent ranked it as one of the three most critical problems for undergraduate geology education (Figure 1).

Figure 1. Aspects of undergraduate education in geology ranked as the top three greatest problems by 10 percent or more of chairs of departments with geology programs: United States



SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

Laboratory facilities and equipment emerged as the other significant issue for geology programs. The amount of instructional laboratory space available to geology programs was judged to be the greatest problem for 17 percent of the programs, and it ranked in the top three problems for 34 percent. Seven percent of the department chairs ranked the amount of laboratory equipment available for instructing undergraduates as their greatest problem, and 4 percent gave that ranking to the quality of their laboratory space. Student interest and motivation (ranked first by 8 percent of department chairs of geology programs), and recruitment and retention of qualified faculty (ranked first by 4 percent) were also among the most frequently mentioned as the most significant problem for undergraduate geology education.

Computer Resources

Departmental Computer Resources

Over 80 percent of chairs of departments with geology programs stated that they offer their undergraduate students access to departmental computers for undergraduate research and coursework. The department chairs that provided computer access for their students were asked to rate their computer resources on a five-point scale ranging from very poor to very good, and the scale was collapsed into three categories (poor, average, and good) for this analysis (Appendix Table A-2). Over two-thirds of the chairs reported that the computer equipment available for undergraduate use was of good quality; however, only 36 percent gave the same rating to the amount of computer equipment available for undergraduate geology students, and 37 percent reported that the amount of equipment was poor. Evaluations of the quality of space for computer use and the amount of that space were even lower. Only about one-quarter of the department chairs rated those resources as good, and slightly more than 40 percent judged them to be poor. The ratings for the quality of computer software were better, with 40 percent of the chairs reporting having good quality instructional software for their undergraduates and 50 percent, good quality software for undergraduate research. Slightly less than one-quarter of the programs reported that their software of either category was of poor quality.

Campus-wide Computer Resources

Virtually all of the chairs of departments with geology programs reported that their students have access to campus-wide computer resources for undergraduate research and coursework. In general, the campus equipment and space were rated more highly than that of the department, but the instructional software received a lower rating (Appendix Table A-3). For example, over two-thirds of the department chairs gave the quality of campus computer equipment to which their students have access a good rating, and 55 percent rated the amount of equipment as good. About 45 percent rated the amount and the quality of computer space as good, but less than 40 percent gave that rating to the quality of instructional software or the quality of research software. Twenty-eight percent of the chairs of departments with geology programs rated instructional software as poor, while 36 percent gave that rating to the research software available to geology students through campus computers.

There were few differences in evaluation of computer resources for undergraduate geology students among programs in the different types of higher education institutions. However, a greater percentage of department chairs in doctoral institutions (35 percent) rated the amount of departmental computer space as good than did department chairs in research (24 percent), comprehensive (23 percent), or liberal arts (20 percent) institutions. Conversely, a greater percentage of department chairs at liberal arts colleges (66 percent) rated the amount of campus computer space as good than did those in research (43 percent), doctoral (39 percent), or comprehensive (40 percent) institutions.

Course Offerings

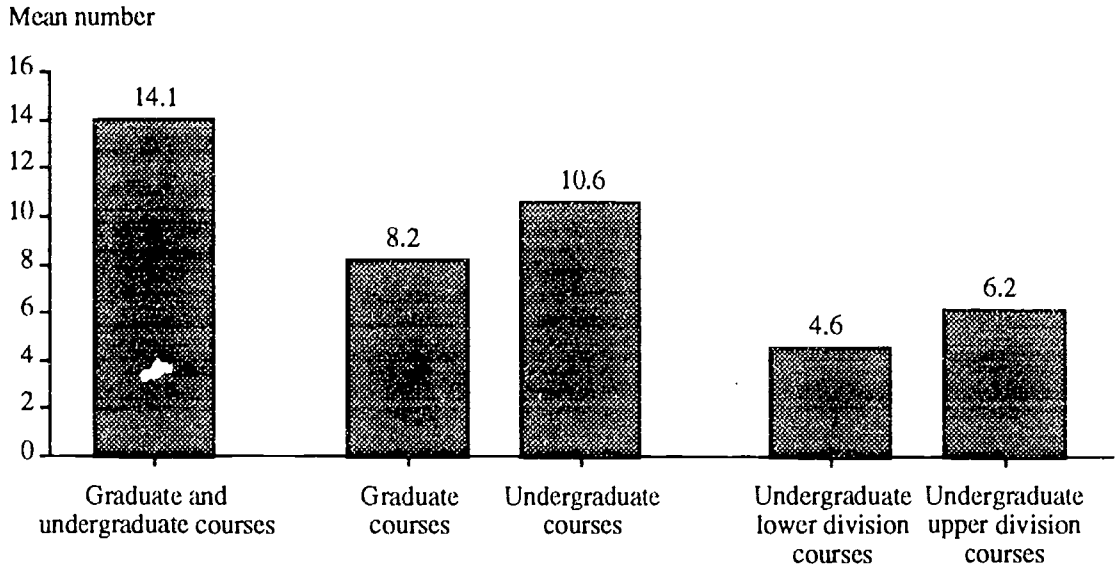
For fall 1990, chairs of departments with geology programs reported that almost 7,000 graduate and undergraduate geology courses were offered by the 489 four-year colleges and universities with geology programs (Appendix Table A-4). Of these 6,890 geology courses, 1,690 were graduate and 5,200 were undergraduate courses. The undergraduate geology courses included 2,220 lower division and 2,950 upper division courses.

The average (mean) number of combined graduate and undergraduate geology courses taught in departments with a program in geology in fall 1990 was 14.1[7] (Figure 2). An average of 8.2 graduate and 10.6 undergraduate courses were taught in geology programs by institutions offering courses at those levels. An average of 4.6 undergraduate lower division courses and 6.2 upper division courses were offered by geology programs.

About three-quarters (77 percent) of the approximately 7,000 geology courses were offered at public institutions (Appendix Table A-4). An average of 15.8 geology courses were offered by programs at public institutions, and an average of 10.3 by programs at private institutions. By level of instruction, an average of 8.3 graduate geology courses were taught by programs at public institutions that offered graduate geology courses, and an average of 7.5 courses were taught at private institutions that offered graduate geology courses. An average of 11.7 undergraduate courses were offered by programs at public institutions, and an average of 8.3 courses were offered at private institutions. An average of 4.9 lower and 6.8 upper division geology courses were offered at public institutions. For private institutions, 4.0 lower and 4.6 upper division geology courses were offered. The difference in the average number of courses taught at public and private institutions is statistically significant for total geology courses, undergraduate courses, and upper division courses.

[7]The mean number of total graduate and undergraduate geology courses is smaller than the sum of the mean number of graduate courses plus the mean number of undergraduate courses. This is due to differences in the bases used to calculate the means. An institution is included in the base used to calculate total means if the institution offered either graduate or undergraduate courses; an institution is included in the base number used to calculate the mean number of graduate and mean number of undergraduate courses only if the institution offered these specific types of courses.

Figure 2. Mean number of geology courses taught in fall 1990, by course level: United States



NOTE: The mean number of total graduate and undergraduate geology courses is smaller than the sum of the mean number of graduate courses plus the mean number of undergraduate courses. This is due to differences in the bases used to calculate the means. An institution is included in the base used to calculate total means if the institution offered either graduate or undergraduate courses; an institution is included in the base number used to calculate the mean number of graduate and mean number of undergraduate courses only if the institution offered these specific types of courses. Other details may not add to totals because of rounding.

SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

The number of combined graduate and undergraduate geology courses taught by programs at the different types of institutions ranged from 580 at liberal arts institutions to 2,600 at comprehensive institutions. An average of 23.7 undergraduate and graduate geology courses were taught by programs at research institutions, 20.0 at doctoral, 11.0 at comprehensive, and 6.8 at liberal arts institutions. The differences between these numbers are statistically significant.

Instructional Staff

The survey collected two sets of counts of faculty providing instruction in geology. First, it requested the total number of full-time and part-time faculty teaching geology in fall 1990. Second, it asked for counts of faculty who taught geology to undergraduates in fall 1990. Both sets of counts were requested by rank for full-time faculty. Later questionnaire items solicited information only on the characteristics (i.e, highest degree, gender, and race/ethnicity) of faculty who taught geology to undergraduates.

Total Instructional Staff

In fall 1990 there were an estimated 3,220 full-time and 530 part-time faculty teaching geology courses at both the undergraduate and graduate levels in the Nation's four-year colleges and universities (Table 4). The majority (54 percent) of full-time faculty were full professors, 25 percent were associate professors, 18 percent were assistant professors, and 3 percent were lecturers or instructors (Figure 3). Slightly over three-quarters of full-time faculty were teaching geology at public institutions and the remaining 24 percent, at private institutions. Figure 4 shows that 40 percent of full-time faculty taught geology at research institutions, 20 percent taught at doctoral institutions, 34 percent at comprehensive institutions, and 7 percent at liberal arts colleges.

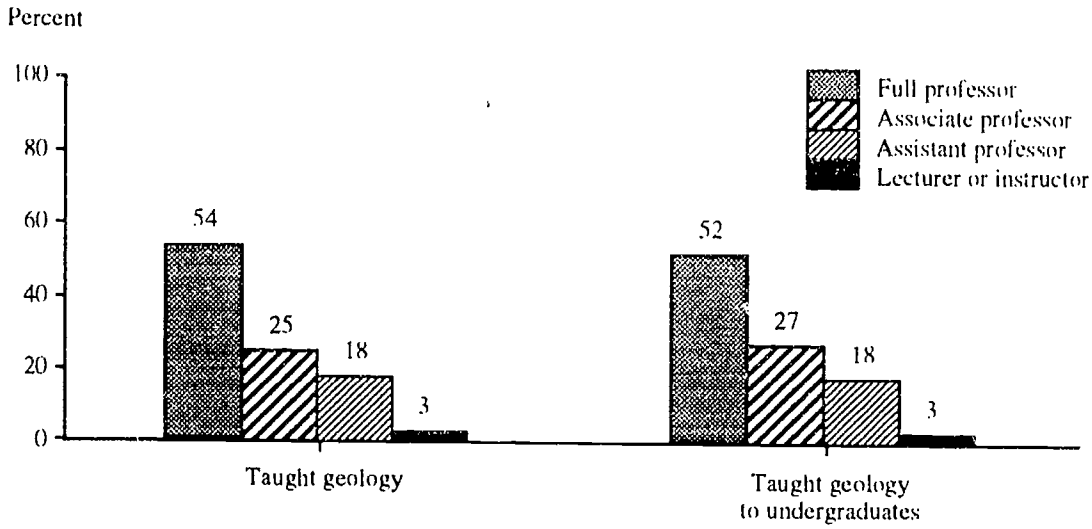
Table 4. Number of faculty, by faculty category, who taught geology in fall 1990, by control and type of institution: United States

Faculty category	Total	Control		Type			
		Public	Private	Research	Doctoral	Comprehensive	Liberal arts
Number of four-year colleges and universities with geology departments . .	489	334	155	96	72	237	85
Total faculty	3,750	2,850	890	1,380	710	1,390	270
Total full-time faculty . . .	3,220	2,460	760	1,280	630	1,080	230
Full professor	1,720	1,340	390	730	300	600	90
Associate professor. . .	820	650	170	300	190	280	60
Assistant professor . . .	590	420	170	220	130	180	50
Lecturer or instructor . .	80	50	30	30	10	20	20
Total part-time faculty. . .	530	400	130	100	80	310	40

NOTE: The numbers of faculty have been rounded to the nearest 10. Details may not add to totals because of rounding. In addition, the total full-time faculty includes 10 unranked faculty members, who are not reported in the table because that category contained so few responses.

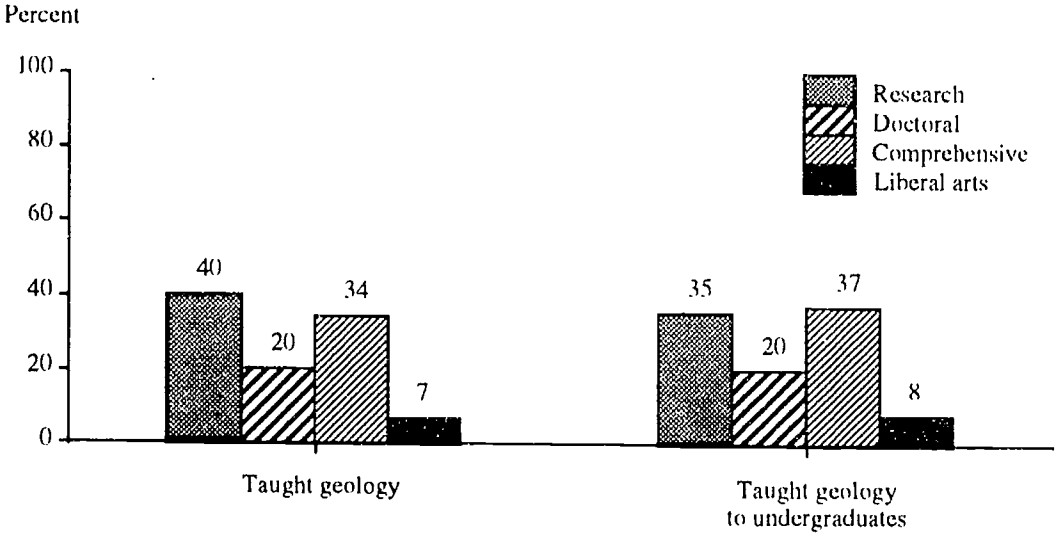
SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

Figure 3. Percentage distribution of full-time faculty who taught geology and those who taught geology **to undergraduates** in fall 1990, by faculty rank: United States



SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

Figure 4. Percentage distribution of full-time faculty who taught geology and who those taught geology **to undergraduates** in fall 1990, by institutional type: United States



NOTE: Percentages may not add to 100 because of rounding.

SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

The average (mean) number of faculty in each program teaching geology in fall 1990 was 6.6 full-time faculty and 1.1 part-time faculty (Table 5). The full-time faculty members included, on average, 3.5 full professors, 1.7 associate professors, and 1.2 assistant professors. At public institutions, an average of 7.4 full-time faculty taught geology, and at private institutions, an average of 4.9 faculty taught geology.

The average number of full-time faculty teaching geology courses varied considerably by the type of institution at which the geology program was located. In fall 1990, an average of 13.3 full-time faculty were teaching geology at research universities, 8.8 were teaching at doctoral institutions, 4.6 at comprehensive institutions, and 2.7 at liberal arts colleges.

Table 5. Mean number of faculty, by faculty category, who taught geology in fall 1990, by control and type of institution: United States

Faculty category	Total	Control		Type			
		Public	Private	Research	Doctoral	Comprehensive	Liberal arts
Number of four-year colleges and universities with geology departments . .	489	334	155	96	72	237	85
Total faculty	7.7	8.6	5.8	14.4	9.9	5.9	3.2
Total full-time faculty . . .	6.6	7.4	4.9	13.3	8.8	4.6	2.7
Full professor	3.5	4.0	2.5	7.6	4.2	2.5	1.1
Associate professor . . .	1.7	1.9	1.1	3.1	2.6	1.2	0.7
Assistant professor . . .	1.2	1.3	1.1	2.3	1.8	0.8	0.6
Lecturer or instructor . .	0.2	0.2	0.2	0.3	0.2	0.1	0.2
Total part-time faculty . . .	1.1	1.2	0.8	1.0	1.1	1.3	0.5

NOTE: Details may not add to totals because of rounding.

SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

Instructional Staff Teachir Undergraduates

There were an estimated 2,850 full-time and 480 part-time faculty teaching geology to undergraduate students in fall 1990 (Table 6). Of the full-time faculty teaching undergraduates, 52 percent were full professors, 27 percent were associate professors, 18 percent were assistant professors, and 3 percent were lecturers or instructors (Figure 3). The majority (76 percent) of the full-time faculty teaching geology to undergraduates were located in programs at public institutions; the remaining 24 percent were at private institutions. Figure 4 shows that 35 percent of the faculty teaching geology to undergraduates were located at research institutions, 20 percent were teaching at doctoral institutions, 37 percent were at comprehensive institutions, and 8 percent were at liberal arts colleges.

Table 6. Number of faculty, by faculty category, who taught geology **to undergraduates** in fall 1990, by control and type of institution: United States

Faculty category	Total	Control		Type			
		Public	Private	Research	Doctoral	Comprehensive	Liberal arts
Number of four-year colleges and universities with geology departments . . .	489	334	155	96	72	237	85
Total faculty	3,340	2,540	800	1,080	630	1,360	260
Total full-time faculty. . . .	2,850	2,160	690	1,010	560	1,060	230
Full professor	1,480	1,150	330	550	260	580	90
Associate professor. . . .	760	590	170	260	170	270	60
Assistant professor. . . .	520	370	150	170	120	180	50
Lecturer or instructor. . .	80	50	30	30	10	20	20
Total part-time faculty. . . .	480	370	110	70	70	300	40

NOTE: The numbers of faculty have been rounded to the nearest 10. Details may not add to totals because of rounding. In addition, the total full-time faculty includes 10 unranked faculty members, who are not reported in the table because that category contained so few responses.

SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

The average (mean) number of faculty teaching geology to undergraduates was 5.8 full-time and 1.0 part-time faculty members (Table 7). The full-time faculty members teaching undergraduates included, on average, 3.0 full professors, 1.6 associate professors, and 1.1 assistant professors. At public institutions, there were an average of 6.5 full-time faculty teaching geology to undergraduates; at private institutions, the average was 4.4 faculty members teaching geology to undergraduates.

There was considerable variation by type of institution in the average number of faculty teaching geology to undergraduates. In fall 1990, an average of 10.5 full-time faculty taught geology to undergraduates at research institutions, an average of 7.8 taught at doctoral institutions, 4.5 taught at comprehensive institutions, and 2.7 taught at liberal arts colleges. At each type of institution, the largest average number of full-time faculty teaching geology to undergraduates were full professors.

Table 7. Mean number of faculty, by faculty category, who taught geology **to undergraduates** in fall 1990, by control and type of institution: United States

Faculty category	Total	Control		Type			
		Public	Private	Research	Doctoral	Comprehensive	Liberal arts
Number of four-year colleges and universities with geology departments . .	489	334	155	96	72	237	85
Total faculty	6.8	7.6	5.2	11.3	8.8	5.7	3.1
Total full-time faculty . . .	5.8	6.5	4.4	10.5	7.8	4.5	2.7
Full professor	3.0	3.4	2.1	5.7	3.7	2.5	1.1
Associate professor . . .	1.6	1.8	1.1	2.8	2.3	1.2	0.7
Assistant professor . . .	1.1	1.1	1.0	1.8	1.7	0.8	0.6
Lecturer or instructor . .	0.2	0.1	0.2	0.3	0.1	0.1	0.2
Total part-time faculty . . .	1.0	1.1	0.7	0.8	1.0	1.3	0.4

NOTE: Details may not add to totals because of rounding.

SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

Most (88 percent) full-time faculty who taught geology also taught geology to undergraduates (Table 8). There was no consistent pattern by faculty rank, ranging from 86 percent of full professors and 89 percent of assistant professors to 93 percent of associate professors and 94 percent of lecturers/instructors teaching undergraduates. There was considerable variation, however, by institutional type. About three-quarters (79 percent) of full-time geology faculty at research institutions taught geology to undergraduates; proportions for the other types of institutions were 88 percent at doctoral institutions, 98 percent at comprehensive institutions, and 100 percent at liberal arts colleges.

Table 8. Percentage of geology faculty, by faculty category, who taught geology **to undergraduates** in fall 1990, by control and type of institution: United States

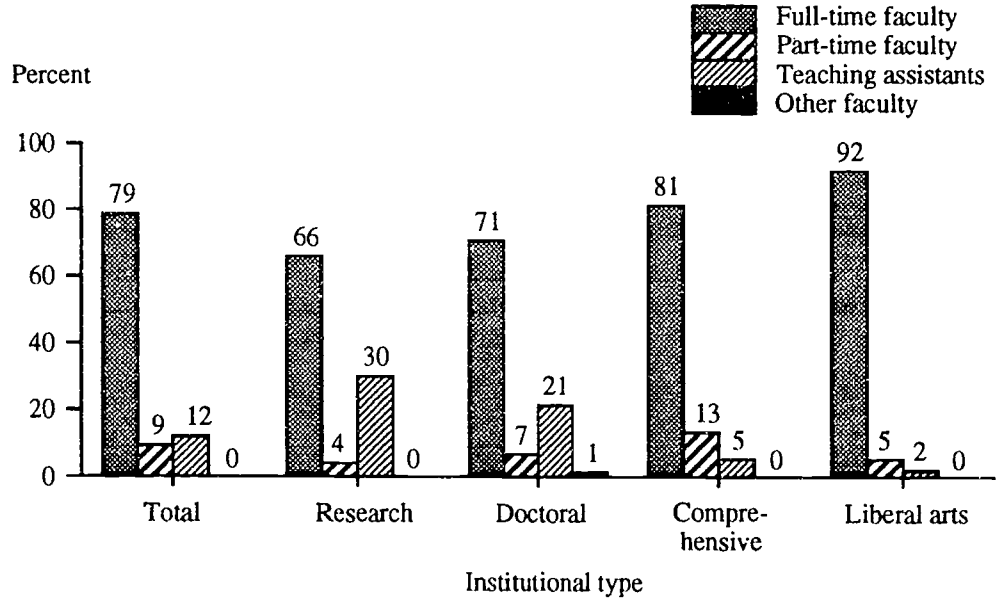
Faculty category	Total	Control		Type			
		Public	Private	Research	Doctoral	Comprehensive	Liberal arts
Total full-time faculty. . . .	88	88	90	79	88	98	100
Full professor	86	86	86	74	87	97	100
Associate professor. . . .	93	92	97	88	89	99	100
Assistant professor. . . .	89	88	92	79	92	98	100
Lecturer or instructor. . .	94	94	94	90	82	100	100
Total part-time faculty. . . .	91	93	87	74	86	98	93

SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

Mean Instructional Contact Hours

For fall 1990, chairs of departments with geology programs reported that an average of 79 percent of the contact hours for undergraduate instruction were taught by full-time faculty (Figure 5). "Contact hours" was defined to include lectures, laboratories, and discussion groups. The remaining 21 percent of instructional contact hours were provided by teaching assistants (12 percent) and part-time faculty (9 percent). There was considerable variation by institutional type, which was influenced strongly by the presence of teaching assistants at the various types of institutions. Almost all (92 percent) instructional contact hours at liberal arts colleges were provided by full-time faculty, while at research institutions, 66 percent of instructional contact hours were provided by full-time faculty. Teaching assistants provided only 2 percent of instructional contact hours in liberal arts colleges, while they provided 30 percent of the instructional contact hours at research institutions.

Figure 5. Mean percentage of undergraduate instructional contact hours in geology programs in fall 1990 for various types of teaching staff, by institutional type: United States



NOTE: Percentages may not add to 100 because of rounding.

SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

Highest Degree

The vast majority (96 percent) of full-time faculty teaching geology to undergraduates in fall 1990 had doctoral degrees (Table 9). Only 4 percent had master's and 1 percent bachelor's degrees as their highest degree. The pattern was the same at both public and private institutions, with more than 90 percent of the full-time undergraduate faculty holding doctorates. This pattern was also the case at research, doctoral, and comprehensive institutions, where 95 percent or more of the full-time undergraduate faculty had doctoral degrees. While a large majority (84 percent) of full-time undergraduate faculty at liberal arts colleges also had doctorates, 12 percent had master's and 4 percent had bachelor's degrees as their highest degree.

The majority (54 percent) of part-time faculty teaching undergraduates had master's degrees as their highest degree; about one-third (36 percent) had doctorates, and 10 percent held bachelor's degrees. At research and doctoral institutions, over 60 percent of part-time undergraduate geology faculty had doctorates. The percentages with doctorates at liberal art colleges and comprehensive institutions were 46 percent and 23 percent, respectively.

Table 9. Percentage of full-time and part-time faculty, by highest degree, who taught geology to **undergraduates** in fall 1990, by control and type of institution: United States

Highest degree	Total	Control		Type			
		Public	Private	Research	Doctoral	Comprehensive	Liberal arts
Full-time faculty							
Doctorate	96	96	94	99	97	95	84
Master's	4	3	4	1	3	5	12
Bachelor's	1	*	1	*	0	*	4
Part-time faculty							
Doctorate	36	35	42	65	62	23	46
Master's	54	56	46	33	35	65	38
Bachelor's	10	10	12	3	3	13	16

* = less than 0.5 percent.

NOTE: Percentages may not add to 100 because of rounding.

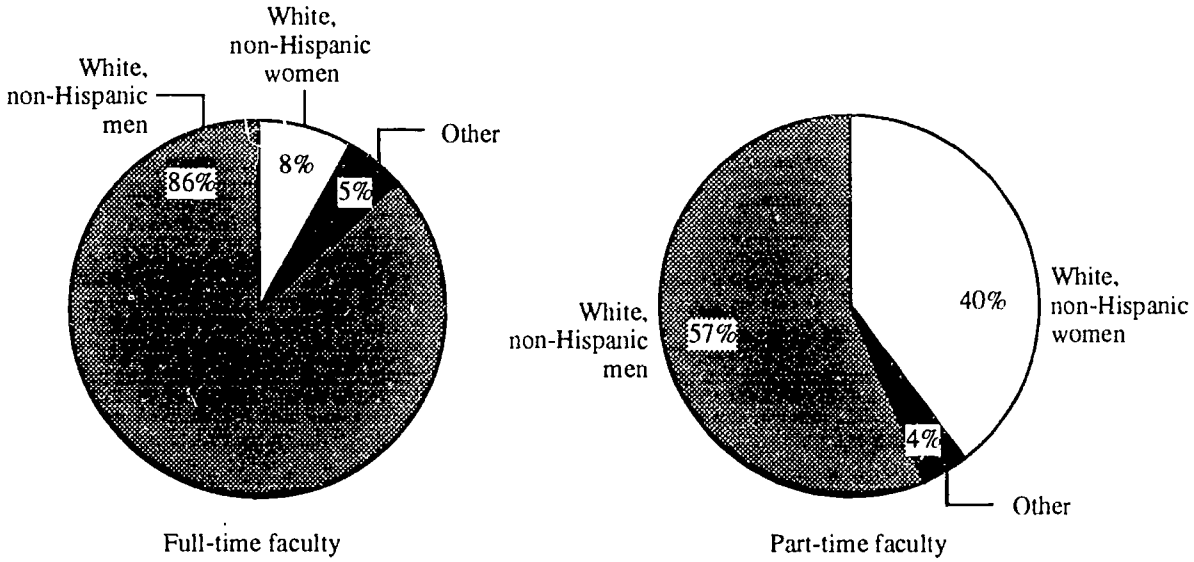
SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

Gender and Race/Ethnicity

The full-time faculty members who taught geology to undergraduates in fall 1990 were 86 percent white, non-Hispanic men, 8 percent white, non-Hispanic women, and 2 percent Asian men (Appendix Table A-5 and Figure 6). All other racial/ethnic and gender groups represented 1 percent or less of full-time faculty teaching undergraduate geology courses. The racial/ethnic and gender distributions of faculty were similar regardless of institutional control or type.

The gender distribution of part-time undergraduate geology faculty differed considerably from the distribution of full-time faculty, but racial/ethnic proportions were similar (Appendix Table A-6 and Figure 6). Almost all (97 percent) of the part-time undergraduate faculty were white, non-Hispanic (compared to 95 percent of full-time undergraduate faculty), with the majority (57 percent) being white, non-Hispanic men, and 40 percent being white, non-Hispanic women (compared to 86 percent and 8 percent, respectively, for full-time faculty). All other racial/ethnic and gender groups represented 1 percent or less of part-time faculty teaching undergraduate geology courses.

Figure 6. Percentage distribution of full-time and part-time faculty who taught geology **to undergraduates** in fall 1990, by racial/ethnic group and gender: United States



NOTE: Percentages may not add to 100 because of rounding. Other full-time faculty includes 2 percent Asian or Pacific Islander men, 1 percent black, non-Hispanic men, 1 percent Hispanic men, and 1 percent nonresident alien men. Other part-time faculty includes 1 percent Asian or Pacific Islander men, 1 percent black, non-Hispanic men, 1 percent Hispanic men, and 1 percent nonresident alien men.

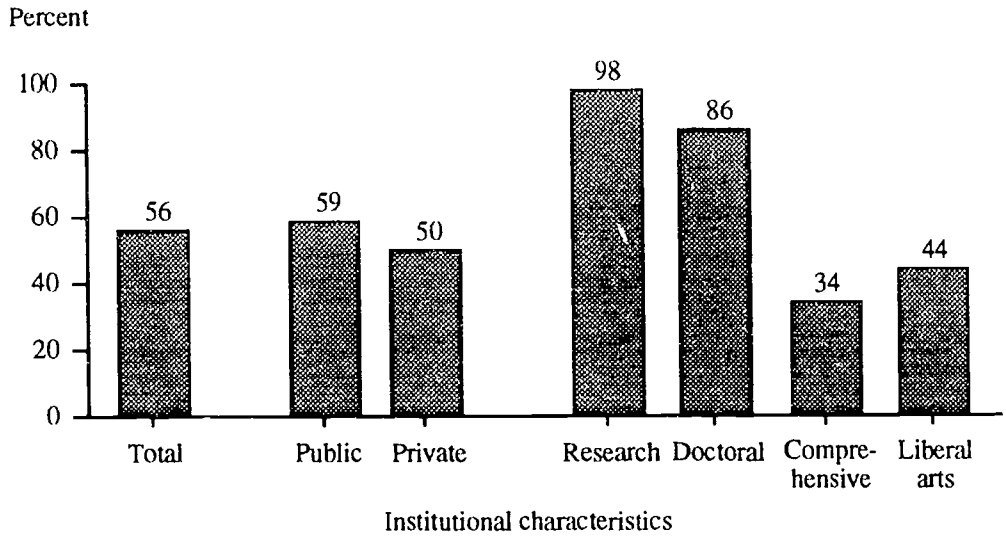
SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

When compared to national figures for all full-time faculty, minority representation among undergraduate geology faculty was lower than among all faculty. National estimates of the race/ethnicity of full-time faculty in the Nation's colleges and universities were 5 percent Asian, 4 percent black, and 2 percent Hispanic.[8]

Teaching Assistants

Over half of all geology programs (56 percent) had teaching assistants (TAs) in fall 1990 (Figure 7). Chairs at almost all (98 percent) of the research institutions indicated that their programs had TAs, as did chairs at 86 percent of the doctoral institutions. In comparison, 44 percent of department chairs at liberal art colleges and 34 percent of those at comprehensive institutions reported having TAs in their programs. The mean percentage of TAs who were graduate students was 70 percent (Figure 8). There was considerable variation by institutional type, ranging from 7 percent at liberal arts colleges to 99 percent at research institutions; this variation is related to the availability of graduate students at those types of institutions (since by definition, liberal arts colleges are primarily undergraduate colleges, and therefore graduate students are much less likely to be available as TAs).

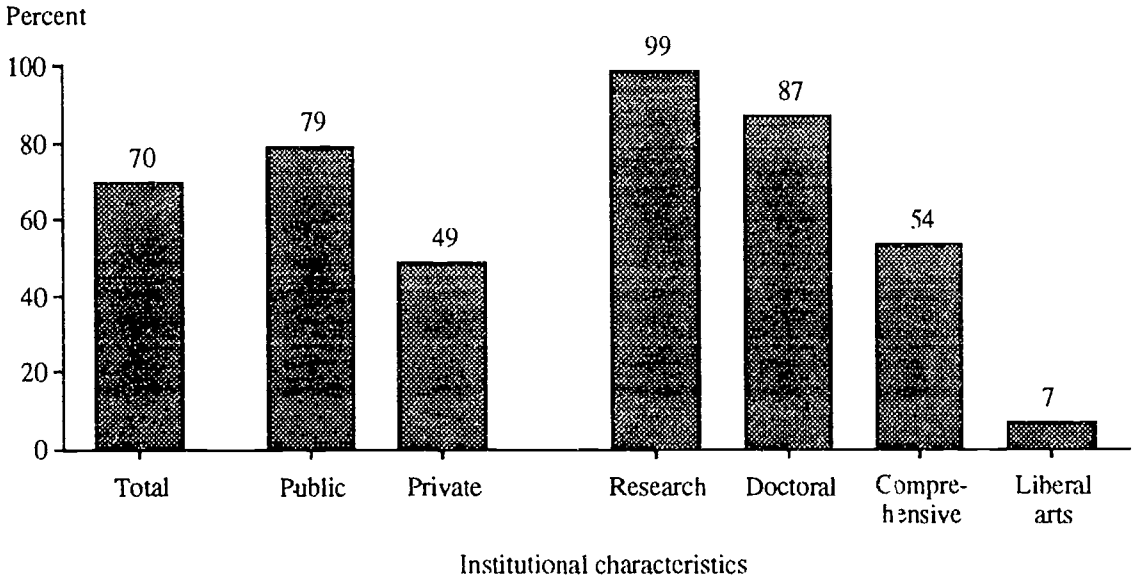
Figure 7. Percentage of departments with geology programs that had teaching assistants in fall 1990, by control and type of institution: United States



SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

[8] *The Chronicle of Higher Education Almanac*; August 28, 1991, p. 29.

Figure 8. Percentage of geology teaching assistants in fall 1990 who were graduate students, by institutional type: United States

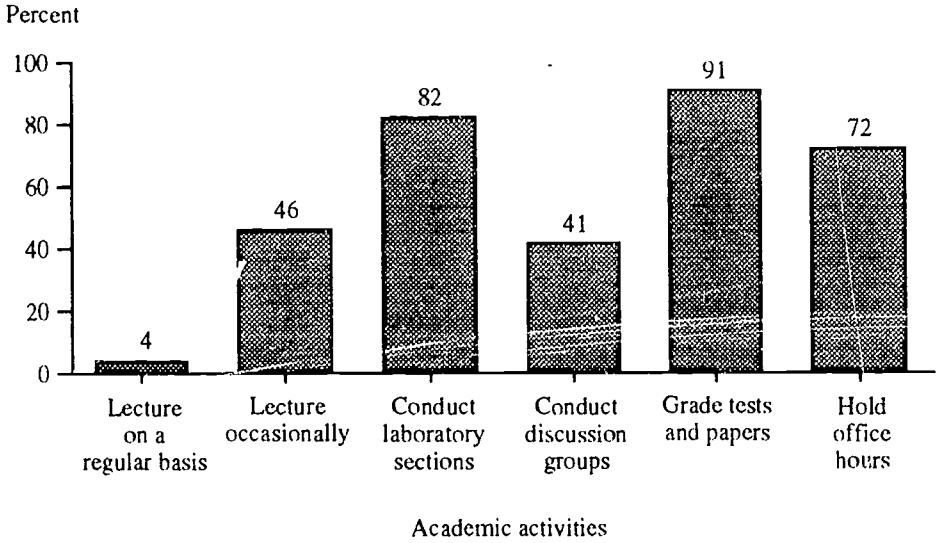


SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

Teaching assistants performed a variety of academic activities in geology programs (Figure 9). Most (91 percent) of the chairs of departments with geology programs indicated that TAs graded tests and papers, 82 percent reported that their TAs conducted laboratory sections, and 72 percent had TAs who held office hours. TAs were used to a lesser extent to conduct discussion groups and to lecture occasionally; 41 percent of the department chairs reported that their TAs held discussion groups and 46 percent stated that their TAs lectured occasionally. Only 4 percent indicated that their TAs lectured on a regular basis. Teaching assistants, on average, conducted 1.9 laboratory sections or discussion groups each term (unpublished tabulation).

Less than half (42 percent) of the programs that had TAs offered a course or seminar (at the institution or department level) to enhance the teaching and communication skills of teaching assistants (unpublished tabulation). The topics most frequently covered were teaching techniques and preparation of course material, covered by 92 percent and 84 percent, respectively, of the programs with a course or seminar for TAs. Department chairs at 57 percent of the programs with a course or seminar for TAs required all their teaching assistants to attend; 21 percent required only some teaching assistants to attend, and 22 percent did not require any teaching assistants to attend.

Figure 9. Percentage of teaching assistants in departments with geology programs who performed various kinds of academic activities: United States



SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

APPENDIX A
Detailed Tables

Detailed Tables

Table A-1. Percentage of chairs of departments with geology programs who rated various aspects of undergraduate education in their department as poor, average, or good, by type of institution: United States

Aspect of undergraduate education	Total	Type			
		Research	Doctoral	Comprehensive	Liberal arts
Academic preparation of entering freshmen					
Poor	31	38	38	34	8
Average	50	34	47	56	53
Good	19	28	14	10	39
Student interest and motivation					
Poor	13	12	16	15	8
Average	37	29	33	41	40
Good	49	59	51	44	52
Computer background of students					
Poor	45	28	58	56	25
Average	43	57	31	34	59
Good	12	16	10	9	16
Quality of introductory textbooks					
Poor	3	8	1	1	7
Average	16	16	16	14	21
Good	81	76	83	85	72
Quality of advanced textbooks					
Poor	3	5	1	1	5
Average	16	7	13	14	37
Good	81	88	85	85	58
Opportunity for undergraduate research through independent study or advanced coursework					
Poor	12	12	13	14	8
Average	13	16	20	11	8
Good	75	72	67	76	84
Availability of field trips/field work					
Poor	11	16	7	8	16
Average	15	19	17	14	10
Good	74	65	76	78	74
Quality of instructional laboratory equipment					
Poor	22	31	19	23	8
Average	28	27	34	26	28
Good	51	41	47	51	64

Table A-1. Percentage of chairs of departments with geology programs who rated various aspects of undergraduate education in their department as poor, average, or good, by type of institution: United States (continued)

Aspect of undergraduate education	Total	Type			
		Research	Doctoral	Comprehensive	Liberal arts
Amount of instructional laboratory equipment					
Poor	36	40	30	37	36
Average	28	29	31	29	23
Good	35	30	39	34	41
Quality of instructional laboratory space					
Poor	30	32	24	31	28
Average	29	29	30	31	24
Good	41	39	46	38	49
Amount of instructional laboratory space					
Poor	42	27	33	50	41
Average	24	35	32	16	27
Good	35	38	36	34	32
Demonstration capabilities of lecture facilities					
Poor	29	44	36	28	7
Average	35	25	36	32	56
Good	36	31	29	40	37
Appropriateness of class size for introductory courses					
Poor	17	22	24	17	3
Average	21	16	14	24	20
Good	63	62	62	59	77
Appropriateness of class size for advanced courses					
Poor	2	2	0	4	0
Average	7	7	10	8	3
Good	91	91	90	88	97
Recruiting and retention of qualified faculty					
Poor	12	7	9	12	20
Average	18	15	18	18	22
Good	70	79	74	70	58

Table A-1. Percentage of chairs of departments with geology programs who rated various aspects of undergraduate education in their department as poor, average, or good, by type of institution: United States (continued)

Aspect of undergraduate education	Total	Type			
		Research	Doctoral	Comprehensive	Liberal arts
Language abilities of faculty members whose first language is not English					
Poor	6	3	6	4	17
Average	19	12	27	14	33
Good	76	86	68	82	50
Availability of teaching assistants					
Poor	37	25	23	56	33
Average	30	29	34	25	38
Good	33	46	44	19	29
Quality of teaching assistants					
Poor	5	9	5	4	0
Average	34	25	34	43	32
Good	61	66	61	53	68
Language abilities of teaching assistants whose first language is not English					
Poor	29	36	29	20	0
Average	33	29	40	26	100
Good	38	35	31	54	0

NOTE: Percentages may not add to 100 because of rounding.

SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

Table A-2. Percentage of departments with geology programs that have computer equipment located within the department to which undergraduates have access, and the percentage of department chairs rating these departmental computer resources as poor, average, or good, by type of institution: United States

Departmental computer resources	Total	Type			
		Research	Doctoral	Comprehensive	Liberal arts
Have computer equipment in department	83	83	83	83	85
Quality of computer equipment					
Poor	7	5	9	6	8
Average	24	23	27	28	14
Good	69	72	64	66	79
Amount of computer equipment					
Poor	37	37	27	41	37
Average	27	20	29	28	31
Good	36	43	43	32	32
Quality of space for computer use					
Poor	42	40	34	47	35
Average	31	29	29	30	37
Good	27	31	36	23	28
Amount of space for computer use					
Poor	41	37	38	47	33
Average	34	39	28	30	47
Good	25	24	35	23	20
Quality of software for undergraduate instruction					
Poor	24	23	27	20	33
Average	37	39	27	43	24
Good	40	38	47	37	43
Quality of software for undergraduate research					
Poor	23	25	24	22	23
Average	27	26	22	30	26
Good	50	49	54	48	52

NOTE: Percentages may not add to 100 because of rounding.

SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

Table A-3. Percentage of departments with geology programs that have campus-wide computer equipment to which undergraduates have access, and the percentage of department chairs rating these campus-wide computer resources as poor, average, or good, by type of institution: United States

Campus-wide computer resources	Total	Type			
		Research	Doctoral	Comprehensive	Liberal arts
Have campus-wide computer equipment	99	96	100	100	100
Quality of computer equipment					
Poor	6	7	9	4	10
Average	25	25	31	26	16
Good	69	68	60	70	74
Amount of computer equipment					
Poor	13	20	19	8	15
Average	33	26	33	39	22
Good	55	54	49	53	63
Quality of space for computer use					
Poor	16	17	25	15	10
Average	36	34	28	41	31
Good	48	49	48	44	59
Amount of space for computer use					
Poor	16	17	23	16	10
Average	39	40	38	45	24
Good	45	43	39	40	66
Quality of software for undergraduate instruction					
Poor	28	22	29	29	28
Average	33	38	36	30	35
Good	39	40	35	41	38
Quality of software for undergraduate research					
Poor	36	27	28	43	34
Average	28	28	33	25	33
Good	36	45	39	33	33

NOTE: Percentages may not add to 100 because of rounding.

SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

Table A-4. Total number and mean number of geology courses taught in fall 1990, by control and type of institution: United States

Number of geology courses	Total	Control		Type			
		Public	Private	Research	Doctoral	Comprehensive	Liberal arts
Number of four-year colleges and universities with geology departments . .	489	334	155	96	72	237	85
Total graduate and undergraduate geology courses							
Total number.	6,890	5,300	1,590	2,270	1,440	2,600	580
Mean number	14.1	15.8	10.3	23.7	20.0	11.0	6.8
Total graduate geology courses							
Total number.	1,690	1,380	300	930	490	260	10
Mean number*	8.2	8.3	7.5	10.0	8.4	5.0	3.0
Total undergraduate geology courses							
Total number.	5,200	3,920	1,290	1,350	950	2,340	570
Mean number	10.6	11.7	8.3	14.0	13.1	9.9	6.7
Lower division geology courses							
Total number.	2,220	1,640	580	540	360	1,080	250
Mean number	4.6	4.9	4.0	5.7	4.9	4.6	3.2
Upper division geology courses							
Total number.	2,950	2,280	670	810	590	1,260	300
Mean number	6.2	6.8	4.6	8.5	8.2	5.4	3.8

*Based on programs that offered graduate geology courses.

NOTE: The mean number of total graduate and undergraduate geology courses is smaller than the sum of the mean number of graduate courses plus the mean number of undergraduate courses. This is due to differences in the bases used to calculate the means. An institution is included in the base used to calculate total means if the institution offered either graduate or undergraduate courses; an institution is included in the base number used to calculate the mean number of graduate and mean number of undergraduate courses only if the institution offered these specific types of courses. The total number of courses have been rounded to the nearest 10. Details may not add to totals because of rounding.

SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

Table A-5. Percentage of full-time faculty, by racial/ethnic group and gender, who taught geology to **undergraduates** in fall 1990, by control and type of institution: United States

Racial/ethnic group and gender	Total	Control		Type			
		Public	Private	Research	Doctoral	Comprehensive	Liberal arts
Total number of full-time faculty who taught geology to undergraduates in fall 1990.	2,850	2,160	690	1,010	560	1,060	230
Nonresident aliens							
Men.	1	1	1	1	1	*	1
Women	*	*	*	*	*	0	0
U.S. citizens and permanent residents							
Black, non-Hispanic							
Men.	1	1	1	*	0	2	1
Women	*	*	0	0	*	*	0
White, non-Hispanic							
Men.	86	86	88	87	88	84	86
Women	8	8	9	7	8	10	10
Hispanic							
Men.	1	1	0	1	*	1	0
Women	*	*	*	*	*	*	0
Asian or Pacific Islander							
Men.	2	3	1	3	2	3	0
Women	*	*	*	*	0	*	1
American Indian or Alaskan Native							
Men.	*	*	0	*	0	0	0
Women	0	0	0	0	0	0	0

* = less than 0.5 percent.

NOTE: The numbers of faculty have been rounded to the nearest 10. Details may not add to totals because of rounding. Percentages may not add to 100 because of rounding.

SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

Table A-6. Percentage of part-time faculty, by racial/ethnic group and gender, who taught geology to **undergraduates** in fall 1990, by control and type of institution: United States

Racial/ethnic group and gender	Total	Control		Type			
		Public	Private	Research	Doctoral	Comprehensive	Liberal arts
Total number of part-time faculty who taught geology to undergraduates in fall 1990.	480	370	110	70	70	300	40
Nonresident aliens							
Men.	1	1	1	3	2	0	0
Women	*	*	0	0	2	0	0
U.S. citizens and permanent residents							
Black, non-Hispanic							
Men.	1	1	0	1	2	1	0
Women	0	0	0	0	0	0	0
White, non-Hispanic							
Men.	57	57	55	73	67	52	47
Women	40	39	40	18	26	46	53
Hispanic							
Men.	1	1	1	0	2	1	0
Women	*	1	0	0	0	1	0
Asian or Pacific Islander							
Men.	1	*	2	4	0	0	0
Women	0	0	0	0	0	0	0
American Indian or Alaskan Native							
Men.	0	0	0	0	0	0	0
Women	0	0	0	0	0	0	0

* = less than 0.5 percent.

NOTE: Percentages may not add to 100 because of rounding.

SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

APPENDIX B
Technical Notes

Higher Education Surveys

The Higher Education Surveys (HES) system was established to conduct brief surveys of higher education institutions on topics of interest to Federal policy makers and the education community. The system is sponsored by the National Science Foundation, the U.S. Department of Education, and the National Endowment for the Humanities.

HES questionnaires typically request a limited amount of readily accessible data from a subsample of institutions in the HES panel, which is a nationally representative sample of 1,134 colleges and universities in the United States. Each institution in the panel has identified a HES campus representative, who serves as survey coordinator. The campus representative facilitates data collection by identifying the appropriate respondent for each survey and distributing the questionnaire to that person.

Survey Methodology

This mail survey was conducted at the request of the National Science Foundation (NSF) to provide information about instructional staff, computer resources, course offerings, and issues and concerns of departments teaching undergraduates.

The sample for this survey consisted of all the research (n=104), doctoral (n=106), and liberal arts institutions (n=180), and half of the comprehensive institutions (n=150) in the HES panel (n=540), and 57 historically black colleges and universities (HBCUs) that are not part of the HES panel. A packet containing questionnaires for geology, physics, and sociology programs, plus a cover letter, respondent designation form, and information copy of the questionnaire were sent to HES coordinators at these 597 institutions on February 27, 1991.* At the HBCUs, personalized letters were sent to the president of the institution, in lieu of a HES coordinator. The letter requested the institution's participation and asked that the coordinator pass the questionnaires along to the chairs of the geology, physics, and sociology departments, or the departments that offer undergraduate programs in geology, physics, and sociology. The coordinator was asked to return the respondent designation form, indicating to whom the questionnaires were sent. Telephone followup with coordinators who had not returned their respondent designation form began on March 18; telephone followup calls for questionnaire nonresponse began on March 25. Data collection was completed on June 7, 1991.

An overall response rate of 95 percent was obtained for each discipline. However, as shown in Appendix Table B-1, the number of institutions that offered programs in each discipline varied widely. Of the 597 institutions to which questionnaires were sent, 275 offered geology programs, 475 offered physics programs, and 529 offered sociology programs. Of these eligible

*Findings from the surveys of physics and sociology are available in separate reports.

Table B-1. Unweighted response rates for the geology, physics, and sociology questionnaires by institutional type

Discipline and institutional type	Complete	Nonresponse	Refusal	Ineligible*	Total
Geology					
Total	262	4	9	322	597
Research	92	1	3	8	104
Doctorate	70	1	1	34	106
Comprehensive	70	1	5	74	150
Liberal arts	28	1	0	151	180
Historically black colleges and universities	2	0	0	55	57
Physics					
Total	450	6	19	122	597
Research	97	1	4	2	104
Doctorate	90	0	5	11	106
Comprehensive	124	1	7	18	150
Liberal arts	103	3	2	72	180
Historically black colleges and universities	36	1	1	19	57
Sociology					
Total	502	9	18	68	597
Research	94	1	3	6	104
Doctorate	91	1	2	12	106
Comprehensive	135	1	4	10	150
Liberal arts	134	5	6	35	180
Historically black colleges and universities	48	1	3	5	57

*An institution was counted as ineligible for a particular discipline if the institution did not have an undergraduate program in that discipline.

SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

programs, completed questionnaires were received from 262 geology programs, 450 physics programs, and 502 sociology programs. Response rates by type of institution ranged from 92 to 100 percent. Data were adjusted for questionnaire nonresponse and weighted to national totals using the following procedure. A separate base weight was calculated for each of the adjustment classes, which were formed based on the stratum to which the school was assigned for sampling, and whether or not the school was an historically black college or university. The base weights for the adjustment classes were based upon the probability of selection of the sampled institutions within each adjustment class. Nonresponse weights were also calculated for each adjustment class, based on the ratio of the sum of the number of responses and the number of refusals to the number of responses. The final weight was the product of the base weight and the nonresponse weight. Appendix Table B-2 shows the universe size (i.e., weighted number of institutions), the unweighted number of eligible institutions, and the unweighted number of responding institutions by institutional characteristics for each discipline. Historically black colleges and universities (HBCUs) were placed in the appropriate institutional control and type for analyses. HBCUs met the criteria for inclusion in both institutional control categories (i.e., public and private), and all institutional type categories (i.e., research, doctoral, comprehensive, and liberal arts).

The item response rate was 99 percent or higher for most items on the questionnaire. The only items receiving a response rate lower than 99 percent were the ratings of campus-wide computer resources, which had response rates of 97 and 98 percent. Thus, item nonresponse was minimal, and statistics presented in this report may be interpreted as representing all geology programs as defined in this survey.

Reliability of Survey Estimates

The findings presented in this report are estimates based on the sample from the HES panel and, consequently, are subject to sampling variability. If the questionnaire had been sent to a different sample, the responses would not have been identical; some figures might have been higher, while others might have been lower. The standard error is a measure of the variability due to sampling when estimating a statistic. It indicates how much variability there is in the population of possible estimates of a parameter for a given sample size. Standard errors can be used as a measure of the precision expected from a particular sample. If all possible samples were surveyed under similar conditions, intervals of 1.96 standard errors below to 1.96 standard errors above a particular statistic would include the true population parameter being estimated in about 95 percent of the samples. This is a 95 percent confidence interval. For example, the estimated percentage of geology programs at public institutions rating the academic preparation of entering freshmen as poor is 35.8 percent, and the estimated standard error is 2.2. The 95 percent confidence interval for this statistic extends from

Table B-2. Universe size, unweighted number of eligible institutions, and unweighted number of responding institutions, by institutional characteristics for each discipline

Discipline and institutional characteristic	Universe*	Unweighted	
		Eligible	Respondents
Geology			
Total	489	275	262
Control			
Public	334	197	188
Private	155	78	74
Type			
Research	96	96	92
Doctorate	72	74	70
Comprehensive	237	76	72
Liberal arts	85	29	28
Physics			
Total	1,024	475	450
Control			
Public	444	251	238
Private	580	224	212
Type			
Research	102	102	97
Doctorate	96	96	91
Comprehensive	501	154	145
Liberal arts	325	123	117
Sociology			
Total	1,174	529	502
Control			
Public	475	261	249
Private	699	268	253
Type			
Research	98	98	94
Doctorate	95	95	92
Comprehensive	534	164	157
Liberal arts	447	172	159

*Universe sizes are based on sample data that have been weighted to produce national estimates. Because these estimates are subject to sampling variability, the breakouts by institutional characteristics may not equal the total.

SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

35.8 - (2.2 times 1.96) to 35.8 + (2.2 times 1.96), or from 31.5 to 40.1 percent. This means one can be 95 percent confident that this interval contains the true population value. Estimates of standard errors for the estimates were computed using a replication technique known as jackknife replication. Some key statistics and their estimated standard errors are shown in Appendix Table B-3.

For categorical data, relationships between variables with two or more levels have been tested in a two-way analysis, using chi-square tests at the 0.5 level of significance, adjusted for average design effect. If the overall chi-square test was significant, it was followed with tests using a Bonferroni t statistic, which maintained an overall 95 percent confidence level or better. Unless noted otherwise, all comparisons made in this report were statistically significant using these tests.

Survey estimates are also subject to errors of reporting and errors made in the collection of the data. These errors, called nonsampling errors, can sometimes bias the data. While general sampling theory can be used to determine how to estimate the sampling variability of a statistic, nonsampling errors are not easy to measure and usually require that an experiment be conducted as part of the data collection procedures or the use of data external to the study.

Nonsampling errors may include such factors as differences in the respondents' interpretation of the meaning of the questions, differences related to the particular time the survey was conducted, or errors in data preparation. During the design of the survey and survey pretest, an effort was made to check for consistency of interpretation of questions and to eliminate ambiguous items. The questionnaire was pretested with respondents like those who comple[illegible]he survey, and the questionnaire and instructions were [illegible]ensively reviewed by the National Science Foundation. Manual and machine editing of the questionnaires were conducted to check the data for accuracy and consistency. Cases with missing or inconsistent items were recontacted by telephone; data were keyed with 100 percent verification.

Relationships of Institutional Characteristics

The data in this report are presented as "total" figures, which represent all kinds of four-year institutions grouped together, and for institutions broken down by institutional control and "type." Historically black colleges and universities were placed in their appropriate institutional control and type for analyses. These classifications are as follows:

- Institutional control
  - Public
  - Private

Table B-3. Selected standard errors by institutional characteristics: United States

Question	Total	Control		Type			
		Public	Private	Research	Doctoral	Comprehensive	Liberal arts
Percent of institutions conferring bachelor's degrees							
Estimate	88.4	90.9	83.0	96.7	98.5	84.8	80.6
Standard error	1.8	1.1	4.7	*	*	2.8	5.9
Percent of institutions in which respondents rated the academic preparation of freshmen as poor							
Estimate	30.9	35.8	20.0	37.7	38.3	33.8	8.3
Standard error	2.2	2.2	5.2	*	*	4.1	4.9
Percent of institutions in which respondents rated the availability of field trips and field work as good							
Estimate	74.3	74.6	73.8	64.9	75.7	78.0	73.5
Standard error	1.9	2.1	4.2	*	*	3.0	7.6
Percent of institutions in which respondents rated the recruiting and retention of qualified faculty as good							
Estimate	70.2	71.2	68.2	78.7	73.6	70.1	58.0
Standard error	1.9	2.3	3.1	*	*	3.5	4.0
Percent of institutions with computer equipment located within the department							
Estimate	83.5	84.8	80.7	82.6	82.9	83.4	85.2
Standard error	1.9	1.9	4.7	*	*	3.4	5.6
Percent of institutions in which respondents rated the quality of departmental computer equipment as good							
Estimate	69.1	66.4	75.2	72.0	64.0	66.1	78.6
Standard error	2.9	3.5	5.0	*	*	5.5	5.9
Percent of institutions in which respondents indicated that the number of geology majors has increased over the last 5 years							
Estimate	31.3	31.4	31.1	31.6	23.1	34.8	29.5
Standard error	3.9	5.2	4.5	*	*	8.2	5.4
Total number of geology courses taught							
Estimate	6,891.0	5,299.8	1,591.2	2,274.1	1,438.9	2,601.0	577.1
Standard error	213.5	183.5	109.0	*	*	186.0	104.8

Table B-3. Selected standard errors by institutional characteristics: United States (continued)

Question	Total	Control		Type			
		Public	Private	Research	Doctoral	Comprehensive	Liberal arts
Total number of full-time faculty teaching geology							
Estimate	3,224.0	2,459.5	764.5	1,281.4	633.5	1,081.5	227.6
Standard error	80.5	69.5	40.7	*	*	69.9	40.0
Total number of full-time faculty teaching geology to undergraduates							
Estimate	2,852.2	2,164.2	688.0	1,007.3	560.9	1,056.4	227.6
Standard error	80.0	68.9	40.7	*	*	69.3	40.0

*The estimated standard error is zero for research and doctoral institutions, because all research and doctoral institutions were included in the sample with certainty. However, the bias component, which cannot be estimated with standard errors, contributes to the total error because of nc esponse adjustments. The total error will be very small, because the amount of nonresponse is very small (see Appen ix Table B-1).

SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

- Institutional type (based on the 1987 Carnegie classifications, which groups institutions into categories on the basis of the level of degree offered and the comprehensiveness of their missions)

  - Research universities: offer a full range of baccalaureate programs, are committed to graduate education through the doctorate, and give high priority to research.

  - Doctorate-granting universities: offer a full range of baccalaureate programs, and are committed to graduate education through the doctorate.

  - Comprehensive universities and colleges: offer baccalaureate programs, award more than half of their baccalaureate degrees in two or more occupational or professional disciplines, enroll at least 1,500 students, and frequently also offer graduate education through the master's degree.

  - Liberal arts colleges: are primarily undergraduate colleges, and award more than half of their baccalaureate degrees in liberal arts fields.

As can be seen in Figures B-1 and B-2, these institutional characteristics are related to each other:

- Among research universities, 68 percent are public.
- Among doctorate-granting universities, 59 percent are public.
- Among comprehensive colleges, 55 percent are public.
- Among liberal arts colleges, 94 percent are private.
- Among nonspecialized four-year public colleges and universities, 66 percent are comprehensive colleges, and 27 percent are about evenly split between research and doctorate-granting universities.
- Among nonspecialized four-year private colleges and universities, 61 percent are liberal arts colleges and 30 percent are comprehensive colleges.

Figure B-1. Percentages of each type of nonspecialized four-year colleges and universities that are public and private

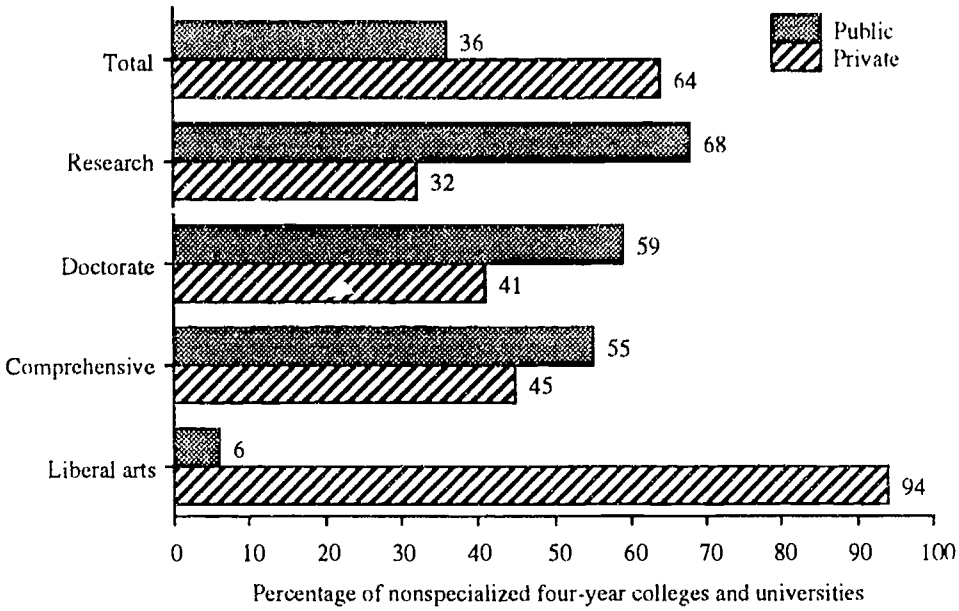
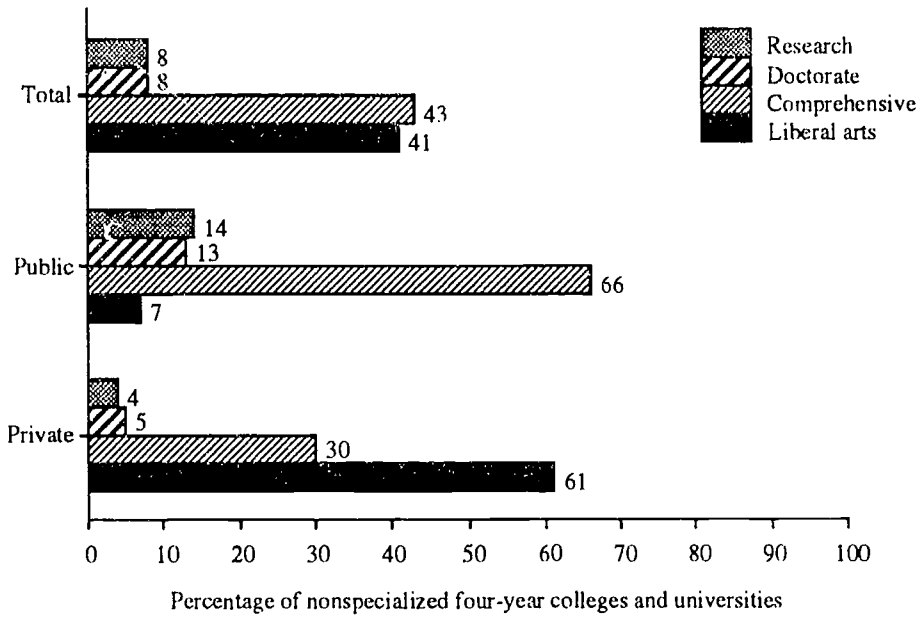


Figure B-2. Percentages of public, private, and all nonspecialized four-year colleges and universities that are research, doctorate, comprehensive, and liberal arts institutions



SOURCE: Higher Education Surveys, Survey on Undergraduate Education in Geology (HES 15), National Science Foundation, 1992 (survey conducted in 1991).

APPENDIX C
Survey Questionnaire

Higher Education Surveys

OMB 3145-0009
Exp. 6/30/91

SURVEY ON UNDERGRADUATE EDUCATION IN GEOLOGY

March 1991

Dear Colleague:

On behalf of the National Science Foundation (NSF), we would like to invite you to participate in this Higher Education Survey of undergraduate geology departments. This survey is the first in a series of Higher Education Surveys of selected science and engineering departments, which will capture information on undergraduate science and engineering in the Nation's universities, four-year and two-year colleges.

The National Science Foundation is now actively involved in programs to promote improvements in the quality of undergraduate education in science and engineering. In order to effect these improvements, national data on a wide variety of topics in this critical area are needed. The data developed in this survey will provide up-to-date information to planners and policy makers in education, government, and industry for decision-making which is so critical to the strength of the Nation and to us all.

This survey represents NSF's first effort to gather information, nationally, on a number of important topics in undergraduate science and engineering education. Your participation in the survey, while voluntary, is vital to the development of a national picture of undergraduate science and engineering.

The survey is being conducted for NSF as part of the Higher Education Surveys (HES) system. The data are being collected by the HES contractor, Westat, Inc., located in Rockville, Maryland. A copy of the report, summarizing the results of the survey, will be sent to your institution after this study is completed. If you have any questions about this survey, please call Dr. Laurie Lewis at Westat's toll-free number, 800-937-8281.

Thank you very much for your assistance. We look forward to your helping us with this important project.

Sincerely,

Robert F. Watson, Ph.D.
Director, Division of Undergraduate Science,
Engineering, and Mathematics Education
National Science Foundation

Ian D. MacGregor, Ph.D.
Acting Director
Division of Earth Sciences
National Science Foundation

Sponsored by the National Science Foundation, the National Endowment for the Humanities, and the Department of Education

HIGHER EDUCATION SURVEYS (HES)
SURVEY ON UNDERGRADUATE EDUCATION IN GEOLOGY

To the Chair of the Department of Geology, or the department that offers a program in geology.

DEFINITION: Geology includes all courses listed in your college catalog that are part of your undergraduate geology program. For example, if oceanography courses are part of your undergraduate geology program, they should be included in geology. If they are not part of your undergraduate geology program, oceanography should not be included in geology.

I. Department Organization

1a. Does your department have a separate program for any disciplines in addition to geology (e.g., a separate program in oceanography or geography)?

☐ Yes (GO TO QUESTION 1b)
☐ No (GO TO TOP OF PAGE 2)

1b. **IF YES TO Q1a:** For each discipline besides geology for which your department has a separate program, list the discipline, and indicate whether your department offers undergraduate courses, confers bachelor's degrees, or confers graduate degrees in that discipline. (Do not include interdisciplinary programs and institutes.)

Discipline	Offers undergraduate courses		Confers bachelor's degrees		Confers graduate degrees	
	Yes	No	Yes	No	Yes	No
	Yes	No	Yes	No	Yes	No
	Yes	No	Yes	No	Yes	No
	Yes	No	Yes	No	Yes	No

For all questions that follow, please provide information only for geology as defined in the box at the top of the questionnaire. If it is not possible to separate information for geology from the programs for the other disciplines offered by your department (i.e., those disciplines listed in Question 1b), please report information for your entire department as necessary, and indicate how you have responded for sections II, V, VI, and VII.

2. For each of the following types of degrees, indicate by circling "yes" or "no" in **Column A** whether your department confers that degree in geology.

   For each type of geology degree conferred, indicate in **Column B** the number of geology degrees conferred through your department in academic year 1989-90 (September 1989 through August 1990). If no geology degrees of that type were awarded in academic year 1989-90, enter zero.

Type of degree	**A.** Does department confer geology degrees of this type?	**B.** Number of geology degrees conferred through department in academic year 1989-90
a. Associate	Yes No	
b. Bachelor's	Yes No	
c. Master's	Yes No	
d. Doctorate	Yes No	

3. On which calendar system does your school operate? (CHECK ONE)

   ☐ Semester
   ☐ Quarter
   ☐ Other (PLEASE SPECIFY: _____)

II. Undergraduate Education - Issues and Concerns

The responses to **Q4** are for: (CHECK ONE)
- ☐ Geology only
- ☐ Geology plus the other disciplines (listed in Question 1b) offered by this department

4. In **Column A**, please rate on a scale from 1 to 5 (with 1 = very poor to 5 = very good) the following aspects of undergraduate geology education in your department. If the item is not applicable to your department (e.g., you do not have teaching assistants), circle a zero (0) for that item.

   In **Column B**, rank up to 5 items that present the greatest problems for undergraduate geology education in your department, and write the rank, with "1" indicating the greatest problem, "2" indicating the second greatest problem, etc. If there are no problems in your department, check here ☐, and skip Column B.

Aspects of undergraduate education in geology	**A.** (Circle one for each item) Not applicable 0	Very poor 1	2	3	4	Very good 5	**B.** Rank up to 5 problems (from this page)
a. Students							
1. Academic preparation of entering freshmen	0	1	2	3	4	5	_____
2. Student interest and motivation	0	1	2	3	4	5	_____
3. Computer background of students	0	1	2	3	4	5	_____
b. Curriculum							
1. Quality of introductory textbooks	0	1	2	3	4	5	_____
2. Quality of advanced textbooks	0	1	2	3	4	5	_____
3. Opportunity for undergraduate research through independent study or advanced coursework	0	1	2	3	4	5	_____
4. Availability of field trips/field work	0	1	2	3	4	5	_____
c. Laboratory equipment for undergraduate instruction							
1. Quality of instructional laboratory equipment	0	1	2	3	4	5	_____
2. Amount of instructional laboratory equipment	0	1	2	3	4	5	_____
d. Facilities for undergraduate instruction							
1. Quality of instructional laboratory space	0	1	2	3	4	5	_____
2. Amount of instructional laboratory space	0	1	2	3	4	5	_____
3. Demonstration capabilities of lecture facilities	0	1	2	3	4	5	_____
e. Faculty/staff resources							
1. Appropriateness of class size for introductory courses	0	1	2	3	4	5	_____
2. Appropriateness of class size for advanced courses	0	1	2	3	4	5	_____
3. Recruiting and retention of qualified faculty	0	1	2	3	4	5	_____
4. Language abilities of faculty members whose first language is not English	0	1	2	3	4	5	_____
f. Teaching assistants (include both graduate and undergraduate T.A.s if applicable)							
1. Availability of teaching assistants	0	1	2	3	4	5	_____
2. Quality of teaching assistants	0	1	2	3	4	5	_____
3. Language abilities of teaching assistants whose first language is not English	0	1	2	3	4	5	_____
g. Other (please specify below)							
1. Other_____	0	1	2	3	4	5	_____
2. Other_____	0	1	2	3	4	5	_____

III. Computer Resources

5. Is there computer equipment located within your department to which undergraduate students have access for undergraduate research and coursework? Do not include terminals linked to the campus-wide computer facility.

☐ Yes
☐ No (SKIP COLUMN A OF QUESTION 7)

6. Is there campus-wide computer equipment at your institution to which undergraduate students have access for undergraduate research and coursework?

☐ Yes
☐ No (SKIP COLUMN B OF QUESTION 7)

7. Please rate on a scale from 1 to 5 (with 1 = very poor to 5 = very good) the following aspects of the computer resources available to undergraduate students at your institution for undergraduate research and coursework.

In **Column A**, rate the computer resources located within your department to which undergraduate students have access for undergraduate research and coursework. If your department does not have such computer equipment, circle zero (0). Do not include terminals linked to the campus-wide computer facility.

In **Column B**, rate the campus-wide computer resources at your institution to which undergraduate students have access for undergraduate research and coursework. If your institution does not have such campus-wide computer equipment, circle zero (0).

Computer resources for undergraduates	A. Departmental resources (Circle one for each item)						B. Campus-wide resources (Circle one for each item)					
	Not applicable 0	Very poor 1	2	3	4	Very good 5	Not applicable 0	Very poor 1	2	3	4	Very good 5
1. Quality of computer equipment.....	0	1	2	3	4	5	0	1	2	3	4	5
2. Amount of computer equipment...	0	1	2	3	4	5	0	1	2	3	4	5
3. Quality of space for computer use.	0	1	2	3	4	5	0	1	2	3	4	5
4. Amount of space for computer use	0	1	2	3	4	5	0	1	2	3	4	5
5. Quality of software for undergraduate instruction.....	0	1	2	3	4	5	0	1	2	3	4	5
6. Quality of software for undergraduate research	0	1	2	3	4	5	0	1	2	3	4	5
7. Other (please specify below) a. Other_____	0	1	2	3	4	5	0	1	2	3	4	5
b. Other_____	0	1	2	3	4	5	0	1	2	3	4	5

IV. Academic Majors

If this department does not confer bachelor's degrees in geology, check here ☐ and skip to Question 11.

8. By what point in their undergraduate academic career do students majoring in geology have to formally declare a major? (CHECK ONE)

- ☐ At the time of application for admission to your institution
- ☐ By the end of the first academic year
- ☐ By the end of the second academic year
- ☐ By the end of the third academic year
- ☐ Other (PLEASE SPECIFY:_____)

9. Over the last 5 years, has the number of students who declared a major in geology at your institution: (CHECK ONE)

- ☐ Increased
- ☐ Stayed about the same
- ☐ Decreased

10. In your opinion, what are the most important reasons that college students who are interested in majoring in geology decide not to major in geology?

_____

_____

_____

_____

_____

11. What is the single most important thing the National Science Foundation (NSF) can do to improve undergraduate education in geology?

_____

_____

_____

_____

_____

V. Undergraduate Course Offerings

The responses to **Q12** are for: (CHECK ONE)
- ☐ Geology only
- ☐ Geology plus the other disciplines (listed in Question 1b) offered by this department

12. In Fall 1990, how many <u>different</u> undergraduate and graduate geology courses, as identified by course title or number, were taught in your department?

Number of courses: Provide the number of separate, for-credit courses (as identified by course title or number), <u>not</u> the number of sections.

Lower division courses: For-credit courses designed for undergraduates in the first two years of a four-year curriculum.

Upper division courses: For-credit courses designed for undergraduates during the third and fourth years of a four-year curriculum.

Joint level courses: If a course is a joint undergraduate and graduate level course, count it as an undergraduate level course.

(a) Total graduate and undergraduate geology courses (<u>not</u> sections) _____

(b) Total <u>graduate</u> geology courses (<u>not</u> sections) _____

(c) Total <u>undergraduate</u> geology courses (<u>not</u> sections) _____

(d) Lower division geology courses _____

(e) Upper division geology courses _____

(Check here if you cannot provide separate figures for lower and upper division geology courses ☐)

NOTE: The total graduate courses (b) plus the total undergraduate courses (c) should equal the total courses (a). The total lower division courses (d) plus the total upper division courses (e) should equal the total undergraduate courses (c).

VI. Instructional Staff

The responses to **Q13-Q16** are for: (CHECK ONE)
- ☐ Geology only
- ☐ Geology plus the other disciplines (listed in Question 1b) offered by this department

13. In each category of instructional staff below, in **Column 1** indicate the total number of people who taught at least one geology course in your department in Fall 1990, and in **Column 2** indicate the number who taught at least one geology course to undergraduates in Fall 1990.

- Consider a teacher full-time if he/she had full-time teaching/research/administrative responsibilities within your institution in Fall 1990.
- Count visiting faculty under the rank they have at their home institutions.
- Exclude members of your faculty who were on leave in Fall 1990.
- For teaching assistants, include both graduate and undergraduate students who are teaching assistants, if applicable.

Instructional staff	Geology teachers in Fall 1990	
	1. Total number teaching geology	2. Number who taught geology to **undergraduates**
a. Full-time faculty, total		
1. Full professor		
2. Associate professor		
3. Assistant professor		
4. Lecturer or instructor		
5. Unranked		
b. Part-time faculty, total		
c. Teaching assistants, total		
d. Other (please specify):		

14. In Fall 1990, what percent of the total undergraduate instructional contact hours (lecture, laboratory, discussion group) in your department was taught by full-time faculty, part-time faculty, teaching assistants, and other kinds of instructors?

Instructional staff	Percent
a. Full-time faculty	%
b. Part-time faculty	%
c. Teaching assistants	%
d. Other (please specify:)	%
TOTAL	100%

15. For those full-time and part-time faculty who taught geology to undergraduates in Fall 1990 (question 13, column 2, rows a and b), please indicate their highest degree.

Highest degree	Number who taught geology to undergraduates	
	Full-time faculty	Part-time faculty
Doctorate		
Master's		
Bachelor's		
Other (please specify):		

TOTAL: [ ] (should equal Q13, column 2, row a) [ ] (should equal Q13 column 2, row b)

16. For those full-time and part-time faculty who taught geology to undergraduates in Fall 1990 (question 13, column 2, rows a and b), please indicate their racial/ethnic group and gender.

Racial/ethnic group (see definitions below)	Full-time		Part-time	
	Men	Women	Men	Women
Non-resident aliens				
U.S. citizens and permanent residents:				
Black, non-Hispanic				
White, non-Hispanic				
Hispanic				
Asian or Pacific Islander				
American Indian or Alaskan Native				

TOTAL: [ ] (should equal Q13, column 2, row a) [ ] (should equal Q13, column 2, row b)

Racial/ethnic group

Non-resident alien: A person who is not a citizen of the United States and who is in this country on a temporary basis and does not have the right to remain indefinitely.

Black, non-Hispanic: A person having origins in any of the black racial groups in Africa, excluding persons of Hispanic origins.

White, non-Hispanic: A person having origins in any of the original peoples of Europe, North Africa, or the Middle East, excluding persons of Hispanic origins.

Hispanic: A person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race.

Asian or Pacific Islander: A person having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands. This area includes, for example, China, India, Japan, Korea, the Philippine Islands, and Samoa.

American Indian or Alaskan Native: A person having origins in any of the original peoples of North America and maintaining cultural identification through tribal affiliation or community recognition.

VII. Teaching Assistants

If there were no teaching assistants in your department in Fall 1990, check here ☐ and skip to the next page.

The responses to **Q17-Q22** are for: (CHECK ONE)
- ☐ Geology only
- ☐ Geology plus the other disciplines (listed in Question 1b) offered by this department

17. Please indicate below the percent of teaching assistants in your department in Fall 1990 who are graduate students and undergraduate students. Enter zero (0) if there were no teaching assistants of that type in Fall 1990.

a. Teaching assistants who are graduate students: _____%

b. Teaching assistants who are undergraduate students: _____%

TOTAL 100%

18. Do the teaching assistants in your department:

a.	Lecture on a regular basis?	☐ Yes	☐ No
b.	Lecture occasionally?	☐ Yes	☐ No
c.	Conduct laboratory sections?	☐ Yes	☐ No
d.	Conduct discussion groups?	☐ Yes	☐ No
e.	Grade tests and papers?	☐ Yes	☐ No
f.	Hold office hours?	☐ Yes	☐ No

19. How many laboratory sections and/or discussion groups does a teaching assistant in your department usually lead in a term (semester, quarter, etc.)? _____

20. Does your institution or department offer a course or seminar to enhance the teaching and communication skills of teaching assistants in your department?

- ☐ Yes (ANSWER QUESTIONS 21 AND 22)
- ☐ No (SKIP QUESTIONS 21 AND 22)

21. What is the content of this course or seminar? (CHECK ALL THAT APPLY)

- ☐ Teaching techniques
- ☐ Preparation of course materials
- ☐ Techniques for student academic or career advising
- ☐ English language skills
- ☐ Familiarization with American customs and behaviors
- ☐ Other (PLEASE SPECIFY: _____)

22. Are all teaching assistants in your department required to take this course or seminar? (CHECK ONE)

- ☐ All teaching assistants are required to attend
- ☐ Only some teaching assistants are required to attend
- ☐ No teaching assistants are required to attend

Do we have permission to release these data to the National Science Foundation with your institutional identification code? This would allow NSF to use data from other surveys to help analyze the results. All information published by NSF will be in aggregate form only.

☐ Yes
☐ No

Please sign_____

Thank you for your assistance. Please return this form by March 22 to:

Higher Education Surveys
WESTAT
1650 Research Boulevard
Rockville, MD 20850

Person completing this form:

Name:_____

Title:_____

Department name:_____

Telephone:_____

Please keep a copy of this survey for your records.

If you have any questions or problems concerning this survey, please call the HES Survey manager at Westat:

Laurie Lewis
(800) 937-8281 (toll-free)