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ABSTRACT

A context in which existing items may provide a convenient source of questions for questionnaires was explored through a case study making use of existing comparison groups, Two programs at Oak Ridge Associated Universities (ORAU), the Science and Engineering Research Semester (SERS) and the Laboratory Graduate Research Participation (Lab Grad) program, are educational programs which have been undergoing follow-up assessments, but for which setting up a control group for each cohort of interest is not feasible. Researchers at ORAU and the Argonne National Laboratory have developed the following evaluation questionnaires for these programs in which certain key items conform to those from large national surveys sponsored by federal agencies: (1) the Survey of Earned Doctorates; (2) the Survey of Doctorate Recipients; (3) the Survey of Recent Science, Social Science, and Engineering Graduates; and (4) the National Survey of Natural and Social Scientists and Engineers. While lifting items from existing instruments is not a substitute for thoughtful instrument development, the technique can be useful and cost-effective if the comparison group is identified before the instrument is designed. There are 10 illustrative figures and a 22-item list of references. (SLD)

Questionnaire Design in Broad-Based Evaluation Studies: Letting Someone Else Collect Comparison Group Data

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Questionnaire Design in Broad-Based Evaluation Studies: Letting Someone Else Collect Comparison Group Data[1]

In education and social science settings, one of the most commonly used techniques for collecting evaluation data is the paper-and-pencil questionnaire. Because the value of the data--and the evaluation itself--is at least partially dependent on the quality of the data collection device, questionnaire design is an integral part of a comprehensive evaluation effort.

Many fine books on survey research and questionnaire design discuss a wide variety of elements that are important to the development of the survey instrument--item wording, selection of response options, format of items and response options, item order, appearance, etc. (Babbie, 1973; Berdie, Anderson, & Niebuhr, 1986; Fink & Kosecoff, 1985; Fowler, 1988; Labaw, 1980). At least one aspect of questionnaire design that tends to be overlooked (or given only very general attention) in these books has to do with considering the use of selected items from existing sources in order to improve the technical characteristics of the instrument itself or to expand the usefulness of the data collected in the survey. Certainly this possibility can be considered to be subsumed in the sections of the aforementioned books that discuss the importance of the survey researcher having well-defined objectives for his/her survey and the importance of designing an instrument that is consistent with those objectives, but such general caveats do little to alert an interested researcher about alternatives that might already exist or how to integrate existing items into new instruments.

Chelimsky (1985) supports the use of existing data in evaluations, but her focus is on using data for administrative purposes (e.g., evaluation design, sampling design), rather than in adopting items from an existing instrument. Sudman & Bradburn (1982, p. 14), on the other hand, encourage the questionnaire developer to examine existing instruments for possible items, both for technical reasons (e.g., established reliability) and the possibility of comparing results with similar studies.

The purpose of this paper is to explore one context in which existing items may provide a convenient source of questions. More importantly, when properly used, these items can significantly expand the usefulness and generalizability of the information that is collected, with little or no increase in the total cost of data collection. By sharing their experiences, the authors hope to raise the awareness of other survey

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researchers about the potential advantages of adopting items from existing instruments. Because we do not endorse such item adoption as a standard questionnaire design practice, however, we will discuss some of the factors that should be considered before making such a decision.

Perspective

If given a choice, most researchers would prefer to execute a true experimental design in conducting program evaluations. Such designs, if properly conceptualized and carefully implemented, allow the researcher to reach defensible conclusions about the existence and extent of programmatic effects. Unfortunately, many situations exist in which the use of a true experimental design is either impossible or impractical. These situations include such factors as ethical constraints (e.g., problems of withholding positive treatments), sampling constraints (e.g., inability to randomly select and/or randomly assign subjects to treatment groups), and the potential contamination of the treatment and control groups.

In the context of evaluating the effects of national educational programs in a competitive (i.e., grants and contracts) environment, the considerations are apt to be much more mundane. If a researcher proposes to implement an aggressive, empirically sound, true experimental evaluation design, his/her proposal would probably not be financially competitive with proposals that use less rigorous evaluation designs. The likelihood of its inherent scientific superiority being valued highly enough by the sponsoring agency to warrant its being funded instead of a less expensive, less rigorous alternative, is not at all predictable. Often sponsors are (understandably) more concerned with showing the positive outcomes of a program (so that they can justify its continuation) than they are with determining which of these outcomes may be clearly attributable to the program. Because positive outcomes are often easy to identify and frequently seem to be acceptable indicators of the worth of a program in the eyes of those who fund them, the program sponsors are often reluctant to commit funding to sophisticated evaluation procedures that could otherwise be spent on the program itself.

The extent to which a professional evaluator is willing to develop and undertake a program assessment that is less scientifically rigorous than he/she might like is a highly personal matter, but this is an issue that will not be considered here. The realities of contract evaluation often dictate that compromises be made in "best practice" techniques. This does not mean that competitively-won evaluations are necessarily inferior evaluations. Nor does it mean that program effects cannot be established for evaluations that do not use true experimental designs. The purpose of this paper is to offer suggestions, based on the experiences of the authors, on how evaluations undertaken in a competitive arena in which true experimental designs are not viable can be designed in such a way that meaningful comparative data can be examined. This approach is consistent with Patton's (1982) notion of practical evaluation, and is responsive to his call for generating "a great deal of really useful information with extremely scarce resources" (p.19).

Making Use of Existing Comparison Groups: A Case Study

Context

Oak Ridge Associated Universities (ORAU) is a private, not-for-profit corporation sponsored by 59 colleges and universities and is a management and operating contractor for the U.S. Department of Energy. Through its Science/Engineering Education Division, ORAU conducts educational program evaluation and assessment studies for a variety of sponsors. In general, the objectives of the evaluation and assessment activities include providing quantitative and qualitative measures of the impact of these programs on participants, assessing programmatic achievements, providing information for the improvement of program operations, and determining the extent to which the programs meet their objectives. The educational programs are intended to enhance some element of the production of scientists and engineers (S/Es) in this country--for example, the recruitment and retention of students to S/E programs of study and S/E careers; the pursuit of graduate S/E degrees; the extent of research involvement by scientists and engineers; or addressing the current underrepresentation of women and minorities in S/E study and S/E careers.

One such program is the Science and Engineering Research Semester (SERS) program, which is sponsored by the Office of University and Science Education, U.S. Department of Energy (DOE). The SERS program provides research appointments to about 150 U.S. undergraduate students each year at one of six DOE national laboratories. Participants have the opportunity to become involved in "hands-on" research, working with scientific teams engaged in long-range investigations and using state-of-the-art facilities and equipment. SERS research appointments are available in biomedicine, chemistry, materials science, engineering, physics, environmental science, geoscience, mathematics, computer science, artificial intelligence, energy systems, and waste technology. One the objectives of the SERS program is "to encourage students to seek graduate degrees and research careers in science and engineering disciplines or areas supportive of the DOE mission" (Stevenson et al., 1991, p. 8).

Another such program is the Laboratory Graduate Research Participation (Lab Grad) program. The Lab Grad program is an important component of the University/DOE Laboratory Cooperative Program, which is also supported by the Office of University and Science Education in DOE. The program enables about 200 graduate students annually to conduct thesis or dissertation research in residence at a DOE facility. Lab Grad participants work with laboratory scientific staff and are able to make use of equipment and facilities that are not generally available on university campuses. Participants' research projects must complement ongoing research at the host facilities and must meet degree requirements for the students' graduate programs. Among the stated objectives for the Lab Grad program are "to encourage graduate students to pursue careers and to continue to work in areas supportive of the DOE mission" (Vivio & Stevenson, 1990, p. 4).

Need for Comparison Groups

The SERS and Lab Grad programs are typical of educational programs for which the authors have been conducting follow-up assessments for several years. The problems inherent in evaluating the extent to which these programs meet general (but clearly primary) objectives such as those above are considerable. The measurement of short-term effects (e.g., pre- and post- research-experience attitudinal comparisons) are of very limited use, as far as determining whether participants will indeed go on to pursue graduate degrees or research careers in science or engineering. Long-term follow-up of former participants is essential to reaching firm conclusions about the attainment of such objectives. The special difficulties in maintaining current addresses for students and early-career graduates are well established. Assuming that some former participants do indeed pursue graduate degrees and/or research careers in science or engineering, it is difficult to attribute those choices to the SERS or Lab Grad programs without some basis for comparison. Identifying, surveying, and following-up a control group of non-SERS non-Lab-Grad students for each cohort of SERS or Lab Grad participants is economically infeasible for these programs.

Identification of Appropriate Comparison Groups

In order to assess the degree to which programs like SERS or Lab Grad have met these general objectives in the absence of traditional control groups, researchers at ORAU and Argonne National Laboratory have turned to several national data bases containing information on scientists and engineers. In cooperation with the National Science Foundation (NSF) and the National Research Council, questionnaires have been developed in which key items used in the evaluation of the programs being evaluated conform to those used in large national studies sponsored by NSF, DOE, and other federal agencies. Using questions and response options from these national surveys makes it possible to compare program participants to national norms with respect to many relevant variables.

Depending on the objective being assessed and the point in time at which the assessment is made (relative to the completion of participation in the educational program), items from one or more of the following national surveys (for which NSF is the primary sponsor) are used: (a) the Survey of Earned

Doctorates, (b) the Survey of Doctorate Recipients, (c) the Survey of Recent Science, Social Science, and Engineering Graduates (a.k.a. the New Entrants Survey), and (d) the National Survey of Natural and Social Scientists and Engineers (a.k.a. the Survey of Experienced Scientists and Engineers or the Postcensal Survey). Each of these surveys is described below, based on the data collection procedures used in the 1980s. (The Science Resources Studies Division at NSF has undertaken a major restructuring of these data collection efforts for the 1990s, but all of the procedures for the new system are not yet in place.)

Survey of Earned Doctorates. This survey is conducted annually for NSF by the National Research Council to collect information on the number and characteristics of recipients of doctoral degrees in the United States. The data gathered in this survey are used to construct the Doctorate Records File (DRF), which is virtually a census of all recipients of research doctorates (excluding professional or clinical degrees such as the J.D., M.D., and D.V.M.) awarded by U.S. educational institutions since 1958. The DRF contains almost 1,000,000 records. (National Science Foundation [NSF], 1987, pp.15-19; Thurgood & Weinman, 1989)

Survey of Doctorate Recipients. The Survey of Doctorate Recipients is one of three NSF surveys that cover various S/E subpopulations. Together, these three surveys comprise NSF's Scientific and Technical Personnel Data System (STPDS). Conducted biennially for NSF by the National Research Council since 1973, the Survey of Doctorate Recipients is designed to provide national estimates of the supply and utilization of science and engineering doctorates. This longitudinal survey is based on a sample drawn from the DRF, and is stratified on several characteristics (source and type [S/E or non-S/E] of degree, sex, field of doctorate, year of doctorate, racial/ethnic identification, and citizenship). The sample size in 1987 was approximately 60,000, which represents about a 1-in-13 sample of S/E doctorates. Data are collected for major demographic and employment-related variables. Demographic variables include age, citizenship, marital status, sex, race, and ethnicity. Employment-related variables include employment status, employment sector, primary work activity, and salary. (Holmstrom, 1988; NSF, 1987, pp. 21-25)

New Entrants Survey. A component of the STDPS, the objective of this cross-sectional biennial survey, conducted for NSF by the Institute for Survey Research at Temple University, is to provide data on the demographic and employment characteristics of individuals who receive bachelor's or master's degrees in S/E fields from U.S. institutions. The survey population is limited to S/E degree recipients who were citizens or permanent resident aliens at the time of their degree award. A two-stage probability sample is used, with the primary sampling unit being universities and colleges, stratified by geographic region, public/private institutional status, type of curriculum offered, proportion of graduates with S/E majors, and two special strata consisting of universities and colleges that have a predominantly black student body or that have high concentrations of Hispanics. The secondary sampling unit consists of graduates drawn from the sample of universities and colleges. Individuals drawn from institutions in the special strata are oversampled in order to increase the reliability of data on racial/ethnic groups. The sample size for the 1986 survey, which included the graduating classes of 1982, 1984, and 1985, was about 36,000. Like the Survey of doctorate recipients, data are collected for major demographic and employment-related variables. Demographic variables include age, citizenship, marital status, sex, race, and ethnicity. Early career employment-related variables include employment status, employment sector, primary work activity, and salary. (Holmstrom, 1988; NSF, 1987, pp. 27-39)

Survey of Experienced Scientists and Engineers. An integral component of the STPDS, this biennial longitudinal survey provides data on the number and characteristics of individuals who were identified as being part of the S/E population during the preceding decennial census. The original (i.e., based on the 1980 decennial census) sample of about 138,000 people was stratified on the basis of education, occupation, sex, and race. Information is collected on education and training (level and field of degree), demographic characteristics (age, citizenship, marital status, sex, race, handicapped status, and ethnicity), employment status, and employment profile (occupation, type of employer, primary work activity, salary, work experience, etc.). (NSF, 1987, pp. 3-13)

Selection of Items

Only those items from the "parent" surveys that are clearly relevant to the objectives of the program being assessed are selected for inclusion in the instruments for the programs being assessed. These may include general demographic items (e.g., gender, race, citizenship) as well as items that relate to specific program-related characteristics (e.g., academic major, degree level, employment specialty). Demographic differences between the two survey populations may result in rival hypotheses about program effects, so it is useful to have the same response options in both instruments if at all possible.

The comparisons to be made from the use of such existing data clearly cannot generate conclusions as definitive as those drawn from a true experimental design. In order to increase the relevance of these comparisons, nevertheless, it is important to minimize the number and severity of uncontrolled influences on the comparisons. The careful selection and construction of items on the new instrument is critical to maintaining the credibility and usefulness of the comparisons.

Figures 1 and 2 are examples of seemingly straightforward demographic items that vary from one survey to another. Because respondents are influenced by the choices they are offered, it is important that the researcher pay attention to the response options used in the data collection instrument from which the comparison group information came. In the case of items for which the characteristics being measured may be related to the expected outcomes of the evaluation (e.g., when rival hypotheses emerge), the evaluator should adopt the same item wording and response options whenever possible. This means that he/she will have to have already identified the comparison group(s) and the desired comparisons when the evaluation instruments are constructed.

Figures 3, 4, and 5 are examples of items from the NSF-sponsored surveys that have been integrated into follow-up assessments of DOE-sponsored programs like SERS and Lab Grad. Although the type-of-employer item (Figure 3) is rather general in nature, it was important to offer the same response options as the national surveys in order to make legitimate comparisons between the DOE participants and broader groups of scientists and engineers. The primary-work-activity item (Figure 4) and the area-of-national-interest item are more specific and are intimately tied to the objectives of DOE-sponsored educational programs.

Designing and Interpreting Comparisons

Once the data are collected from former program participants using items drawn from the NSF questionnaire(s), the precision of the comparisons desired (or the precision that is possible) determines how the comparison data are derived and presented. In some cases, only very general "benchmarks" are needed in order to permit a reader to achieve a reasonable perspective on reported characteristics of program participants. It may not matter that the groups are not strictly comparable. Published data often suffice for this purpose. When more precise comparisons are desired (and both data sets and survey methodologies suggest its appropriateness), special tabulations are requested from the NSF survey contractor or special tabulations are generated by ORAU from a DOE-owned sponsors' data tape.

Benchmark comparisons. Figures 6, 7, and 8 are examples of comparisons drawn from published data and/or special analyses of national data sets that are directly related to the objectives of DOE educational programs. In Figure 6, the primary work activity of Lab Grad respondents is compared to various groups of scientists and engineers. All but one of these comparisons are drawn from published data. One has only to consider the difficulty of interpreting--even in the most general terms--the data from former Lab Grad participants in the absence of the other columns in order to recognize the value of these nonequivalent comparisons. Even though each of the comparison groups is not comparable to the former Lab Grads in at least some respect (e.g., age, degree field, degree level, year surveyed), the distribution of work activities of these groups are nevertheless instructive in gauging the work activities of the Lab Grads. The comparisons in Figures 7 and 8 likewise provide a valuable backdrop against which the Lab Grads' involvement in federally funded work can be viewed.

More definitive comparisons. The follow-up assessment of former participants in the SERS program provided opportunities for deriving more precise comparisons by using the data tape of the 1988 New Entrants Survey. The 1988 survey includes graduates of the classes of 1985-1986 and 1986-1987. For the purposes of the SERS report, a special tabulation was performed using only those students earning bachelor's degrees in science or engineering fields during the academic year 1986-1987.

Data for the 1988 New Entrants Survey was collected in the spring of 1988, so the 1986-1987 graduates would have been out of school for approximately one year. Likewise most individuals who were SERS participants as juniors in the academic year 1987-1988 and those who were SERS participants as seniors in the academic year 1988-1989 would have been out of school for approximately one year in the fall of 1990 when data were collected for the follow-up assessment. As a result, this comparison, although imperfect, allows one to see how former participants in the SERS program differ from science and engineering students who received their bachelor's degrees at about the same time.

Figure 9 depicts a comparison of the academic status of former SERS participants and 1987 S/E bachelor's degree recipients. Even though some of the SERS participants had not received their undergraduate degrees (meaning that the proportion who ultimately attend graduate school is an underestimate in the figure), the extent to which former SERS participants were pursuing graduate degrees was clearly remarkable compared to the 1987 S/E bachelor's recipients. This tendency is directly relevant to the objectives of the SERS program. Likewise the undergraduate degree fields of the SERS participants are more consistent with those subsumed under DOE's mission than are those of S/E bachelor's recipients in general (see Figure 10).

Making Use of Existing Comparison Groups: Other ORAU Examples

In the evaluation of a selective program for high school science and mathematics teachers, there was no control group. Instead, comparisons were sought from existing research and data bases. Professional organizations, such as the National Science Teachers Association (NSTA), provide one source of comparative data. NSTA annually surveys teachers who taught one or more sections of science in public or private high schools in the United States. Information includes such information as the number of sections of science or math taught, gender, school type, level, and school size.

The National Center for Education Statistics, under the Office of Educational Research and Improvement of the U.S. Department of Education, annually compiles a *Digest of Education Statistics*, based on information from several sources, including surveys and activities of the Center. The 1990 report has one chapter containing over 100 pages of tables on elementary and secondary education. The Center annually surveys public schools and periodically surveys teacher characteristics. Summary data on students, staff, and finances are provided by states. Data are also incorporated on achievement (from the National Assessment of Educational Progress), racial/ethnic enrollment (from the Office of Civil Rights), teacher characteristics, teaching assignments, and average salaries (from the National Education Association and the American Federation of Teachers), private school enrollment (from the National Catholic Educational Association), mandatory ages of attendance, requirements for graduation, and minimum competency testing for students and teachers (from the Education Commission of the States), scores on the Scholastic Aptitude Test for college-bound seniors (from the College Entrance Examination Board), and the proportion of high school graduates who go on to college (from the Bureau of Labor Statistics). In addition to totals, data for some items are presented by state and/or broken down by other categories.

Results of other large-scale or targeted surveys can be located by searching the cataloging systems of the Educational Resources Information Center (ERIC), PSYCHLIT, or others. Such a search helped identify articles about teachers of exemplary science programs (Penick, Yager, & Bonnstetter, 1986). The articles on exemplary programs referenced (for a comparison population) a national survey of science, mathematics, and social studies education conducted under the auspices of the National Science Foundation (Weiss, 1978). It was possible to compare characteristics of program participants with those who were identified as having exemplary science programs.

The literature search also helped to locate research studies that had used instruments for measuring variables of interest in the study. Two other sources for noncommercial instruments in science education are handbooks published by the ERIC Science, Mathematics, and Environmental Education Clearinghouse (Mayer, 1974; Munby, 1983). While standardized achievement tests for students are available, instruments for measuring attitudes of teachers related to the program were more difficult to find. When the most soundly developed instrument related to project outcomes was selected (Thompson & Shrigley, 1986), there were no norms for comparison. The instrument was, however, used on a pre- and post- basis to measure changes in participant attitudes.

Conclusions

The techniques described in this paper clearly do not represent a panacea for evaluation ills. The use of existing data sources for comparison groups is neither helpful nor advisable in many situations. Lifting items from existing instruments is not a substitute for thoughtful instrument development. In cases in which it makes sense to compare program participants to well-defined external populations or to general populations, however, researchers might do well to consider using these techniques in planning their evaluations. To maximize the interpretability of the results, the comparison group--together with the questionnaire(s) that produced the data associated with that group--must be identified and evaluated before assessment instruments are designed. This requires that the researcher not only acquire the instrument but that he/she have a thorough understanding of the methodology (e.g., sampling frame, sample design, survey and analysis techniques, response rate, nonresponse adjustments) of the data collection effort. Once the researcher understands the characteristics of the potential comparison group, he/she must consider the limitations of the design nuances and the content of the items themselves with regard to the validity, robustness, and relevance of any comparisons that might be made. Properly handled, however, the use of existing data for comparison purposes can be a useful and cost-effective alternative to traditional control-group evaluation designs.

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Figure 1. Examples of Variation in Response Options for Demographic Items: Race/Ethnicity

from Survey of Earned Doctorates, 1989-90

9. What is your racial background? (Check only one.)
   - 0 ☐ American Indian or Alaskan Native
   - 1 ☐ Asian or Pacific Islander
   - 2 ☐ Black
   - 3 ☐ White

10. Are you Hispanic? ☐ No ☐ Yes —> 0 ☐ Mexican American
   - 1 ☐ Puerto Rican
   - 2 ☐ Other Hispanic

from 1990 Survey of Natural and Social Science and Engineering Graduates

29. Are you:
   1. ☐ American Indian or Alaskan Native
   2. ☐ Asian or Pacific Islander
   3. ☐ Black
   4. ☐ White
   5. ☐ Other, PLEASE SPECIFY

from 1990 Information Sheet for Participants in the U.S. Department of Energy Science and Engineering Research Semester Program

3. What is your racial background?
   1. ☐ American Indian or Alaskan Native
   2. ☐ Asian
   3. ☐ Pacific Islander
   4. ☐ Black
   5. ☐ Caucasian (Not Hispanic)
   6. ☐ Hispanic
   7. ☐ Other

Figure 1(continued). **Examples of Variation in Response Options for Demographic Items: Race/Ethnicity**

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from National Education Longitudinal Study of 1988 (Eighth Grade Questionnaire, NELS:88)

31A. Which best describes you? (MARK ONE)

Asian or Pacific Islander	—> GO TO 31B below
Hispanic, regardless of race	—> GO TO 31C below
Black, not of Hispanic origin	|
White, not of Hispanic origin	|—> SKIP TO Question 32, Page 16
American Indian or Alaskan Native	|

31B. Which of these best categorizes your background? (MARK ONE)

ASIAN OR PACIFIC ISLANDER

Chinese
Filipino
Japanese
Korean
Southeast Asian (Vietnamese, Laotian, Cambodian/Kampuchean, Thai, etc.)
Pacific Islander (Samoan, Guamanian, etc.)
South Asian (Asian Indian, Pakistani, Bangladeshi, Sri Lankan, etc.)
West Asian (Iranian, Afghan, Turkish, etc.)
Middle Eastern (Iraqi, Israeli, Labanese, etc.)
Other Asian

31C. Which of these best categorizes your background? (MARK ONE)

HISPANIC

Mexican, Mexican-American, Chicano
Cuban
Puerto Rican
Other Hispanic

31D. What is your race? (MARK ONE)

Black Hispanic
White Hispanic
Other Hispanic

Figure 2. Examples of Variation in Response Options for Demographic Items: Citizenship

from Survey of Earned Doctorates, 1989-90

7. Citizenship:
   - ☐ United States, native
   - ☐ United States, naturalized

   Non-United States
   - ☐ Permanent Resident of United States (Immigrant visa)
   - ☐ Temporary Resident of United States (Non-immigrant visa)

from 1990 Survey of Natural and Social Science and Engineering Graduates

26. Are you:
   1. ☐ U.S. citizen
   2. ☐ U.S. naturalized
   3. ☐ Non-U.S. immigrant (Permanent Resident)
   4. ☐ Non-U.S. citizen, nonimmigrant (Temporary Resident)

from 1989 Information Sheet for Former Participants in the U.S. Department of Energy Laboratory Graduate Thesis Research Program

5. Citizenship
   1. ☐ U.S. Native Born
   2. ☐ U.S. Naturalized
   3. ☐ Permanent Resident Alien
   4. ☐ Non-U.S.

Figure 3. Example of Item Adopted for Use in Focused Follow-Up Assessment: Type of Employer

7. Which category best describes the type of your principal employment OR postdoctoral appointment during FEBRUARY 1989?

0 ______ Self-employed
1 ______ Business or industry
2 ______ Junior college, 2-year college, technical institute
3 ______ Medical school (including university-affiliated hospital or medical center)
4 ______ 4-year college
5 ______ University, other than medical school
6 ______ Elementary, middle, or secondary school system
7 ______ Private foundation
8 ______ Hospital or clinic
9 ______ U.S. military service, active duty, or Commissioned Corps, e.g., USPHS, NOAA
10 ______ U.S. government, civilian employee
11 ______ State government
12 ______ Local or other government, specify ______________________
13 ______ Nonprofit organization, other than those listed above
14 ______ Other, specify ______________________

Source: 1989 Survey of Doctoral Scientists and Engineers

Figure 4. Example of Item Adopted for Use in Focused Follow-Up Assessment: Primary Work Activity

12. From the activities listed below, select your primary and secondary work activities for your principal job (as reported in #6), in terms of time devoted during a typical week.

Enter the appropriate codes (1-16) for each in the specified space.

_______ Primary activity _______ Secondary activity

1. _______ Teaching
2. _______ Basic research (i.e., study directed toward gaining scientific knowledge primarily for its own sake)
3. _______ Applied research (i.e., study directed toward gaining scientific knowledge in an effort to meet a recognized need)
4. _______ Development of equipment, products, systems
5. _______ Design of equipment, processes, models
6. _______ Management/administration of R&D
7. _______ Management/administration of educational/other programs
8. _______ Report and technical writing, editing
9. _______ Professional service to individuals, clinical diagnosis, psychotherapy
10. _______ Consulting
11. _______ Operations-production, maintenance, construction, installation
12. _______ Quality control, testing, evaluation
13. _______ Sales, marketing, purchasing, customer and public relations
14. _______ Statistical work--survey work, forecasting, statistical analysis
15. _______ Computer applications
16. _______ Other, specify: _______________

Source: 1989 Survey of Doctoral Scientists and Engineers

Figure 5. Example of Item Adopted for Use in Focused Follow-Up Assessment: Area of National Interest

18a. From this list of selected areas of national interest, indicate the ONE area to which you devoted the MOST professional time during a typical week at the job reported in #6.

1 ______ Energy and fuel
2 ______ Health
3 ______ Environment
4 ______ Education
5 ______ National defense
6 ______ Food or agriculture
7 ______ Biotechnology
8 ______ Mineral resources
9 ______ Community development and service
10 ______ Housing (planning, design, construction)
11 ______ Transportation
12 ______ Communications
13 ______ Space
14 ______ None of the above

Source: 1989 Survey of Doctoral Scientists and Engineers

Figure 6. Example of Benchmark Comparison Groups: Primary Work Activity

Primary Work Activity of 1979-1987 Lab Grad Survey Respondents and Other Scientists and Engineers

Activity	*Lab Grad Respondents*	*PhD S/Es of Age 30-39*[1]	*All PhD S/Es*[1]	*DOE-Funded PhD S/Es*[2]	*All S/Es*[3]	*Energy-Related S/Es*[4]
Applied Research	19.6%	23.9%	17.2%	31.2%	5.6%	7.3%
Basic Research	26.7%	22.4%	15.1%	21.8%	2.9%	2.6%
Development/Design of Products/Processes	3.5%	5.2%	4.5%	4.0%	18.9%	24.8%
SUBTOTAL – R&D	*49.8%*	*51.5%*	*36.8%*	*57.0%*	*27.4%*	*34.7%*
Computer Applications	3.9%	3.1%	2.8%	1.4%	10.2%	8.8%
Consulting	8.6%	2.3%	3.3%	5.0%	5.5%	7.4%
Management of Programs or R&D	5.1%	8.8%	16.2%	17.9%	27.7%	19.1%
Professional Services to Individuals	3.9%	10.3%	7.8%	0.2%	1.9%	
Teaching	7.1%	18.8%	26.2%	12.5%	7.7%	1.3%
All Others and No Response	21.6%	5.2%	6.9%	6.0%	19.6%	28.7% [5]
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

NOTES:

[1] *Characteristics of Doctoral Scientists and Engineers in the United States: 1987*, NSF 88-331

[2] ORAU data based on NSF's 1987 Survey of Doctorate Recipients

[3] *U.S. Scientists and Engineers: 1986*, NSF 87-322

[4] *Energy-Related Science and Engineering Personnel Outlook, 1987*; DOE/OR/00033-H1

[5] Includes Professional Services to Individuals

Source: *U.S. Department of Energy Laboratory Graduate Research Participation Program: Profile and Survey of 1979-1987 Participants*, April 1990, pp. 19-20.

Figure 7. Example of Benchmark Comparison Groups: Status of Federal Support

Status of Federal Support for 1979-1987 Lab Grad Survey Respondents and Other Scientists and Engineers

Status of Federal Support	*Lab Grad Respon-dents*	*All PhD S/Es*[1]	*All S/Es*[2]	*Energy-Related PhD S/Es*[3]
Funded	61.9%	43.7%	30.9%	42.2%
Not Funded	31.4%	52.7%	64.2%	56.7%
Not Sure and No Response	6.7%	3.6%	4.9%	1.1%
TOTAL	100.0%	100.0%	100.0%	100.0%

NOTES:

[1] *Characteristics of Doctoral Scientists and Engineers in the United States: 1987*, NSF 88-331

[2] *U.S. Scientists and Engineers: 1986*, NSF 87-322

[3] *Doctoral Scientists and Engineers Working in Energy-Related Activities, 1985*; DOE/ER-0322, May 1987

Source: *U.S. Department of Energy Laboratory Graduate Research Participation Program: Profile and Survey of 1979-1987 Participants*, April 1990, p. 21.

Figure 8. Example of Benchmark Comparison Groups: Federal Funding Source

Federal Funding Source of 1979-1987 Lab Grad Survey Respondents and Other Scientists and Engineers

Source of Federal Funds	*Lab Grad Respon-dents*	*All PhD S/Es*[1]	*All S/Es*[2]	*Energy-Related PhD S/Es*[4]
Department of Defense	17.1%	23.6%	40.0%	17.4%
Department of Energy	51.3%	13.5%	7.6%	55.1%
Environmental Protection Agency	8.2%	4.3%	3.8%	5
National Institutes of Health	11.4%	24.4%	5.9% 3	5
National Science Foundation	10.1%	17.2%	3.1%	11.1%
All Others	31.6%	47.5%	31.6%	49.6% 6
Uncertain of Support/Don't Know Source Agency	1.3%	6.0%	13.8%	
TOTAL	131.0%	136.5%	105.8%	133.2%

NOTES:

Percentages are the proportion of funded S/Es who receive support from each agency.

Totals add to more than 100% because some individuals are funded by more than one agency.

[1] *Characteristics of Doctoral Scientists and Engineers in the United States: 1987*, NSF 88-331

[2] *U.S. Scientists and Engineers: 1986*, NSF 87-322

[3] Includes all of DHHS

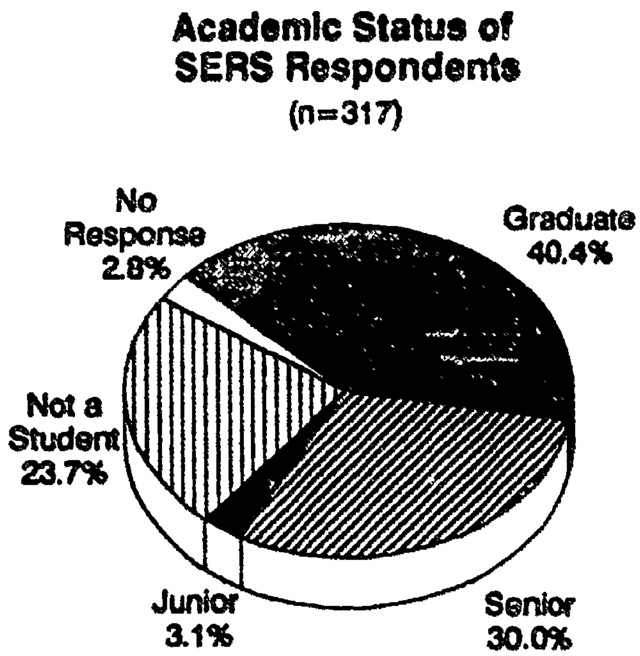
[4] *Doctoral Scientists and Engineers Working in Energy-Related Activities, 1985*; DOE/ER-0322, May 1987

[5] Included in All Others category

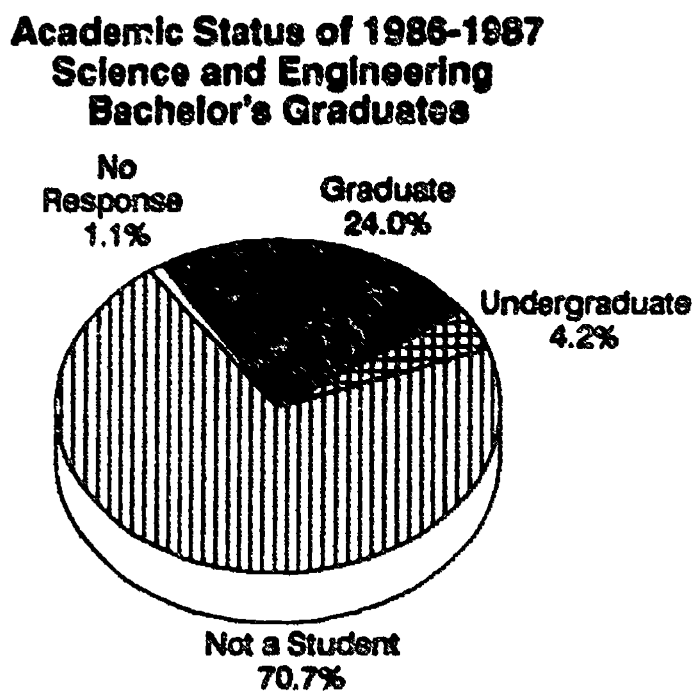
[6] Includes Don't Know Source Agency

Source: *U.S. Department of Energy Laboratory Graduate Research Participation Program: Profile and Survey of 1979-1987 Participants*, April 1990, p. 22.

Figure 9. Example of More Definitive Comparison Groups: Academic Status



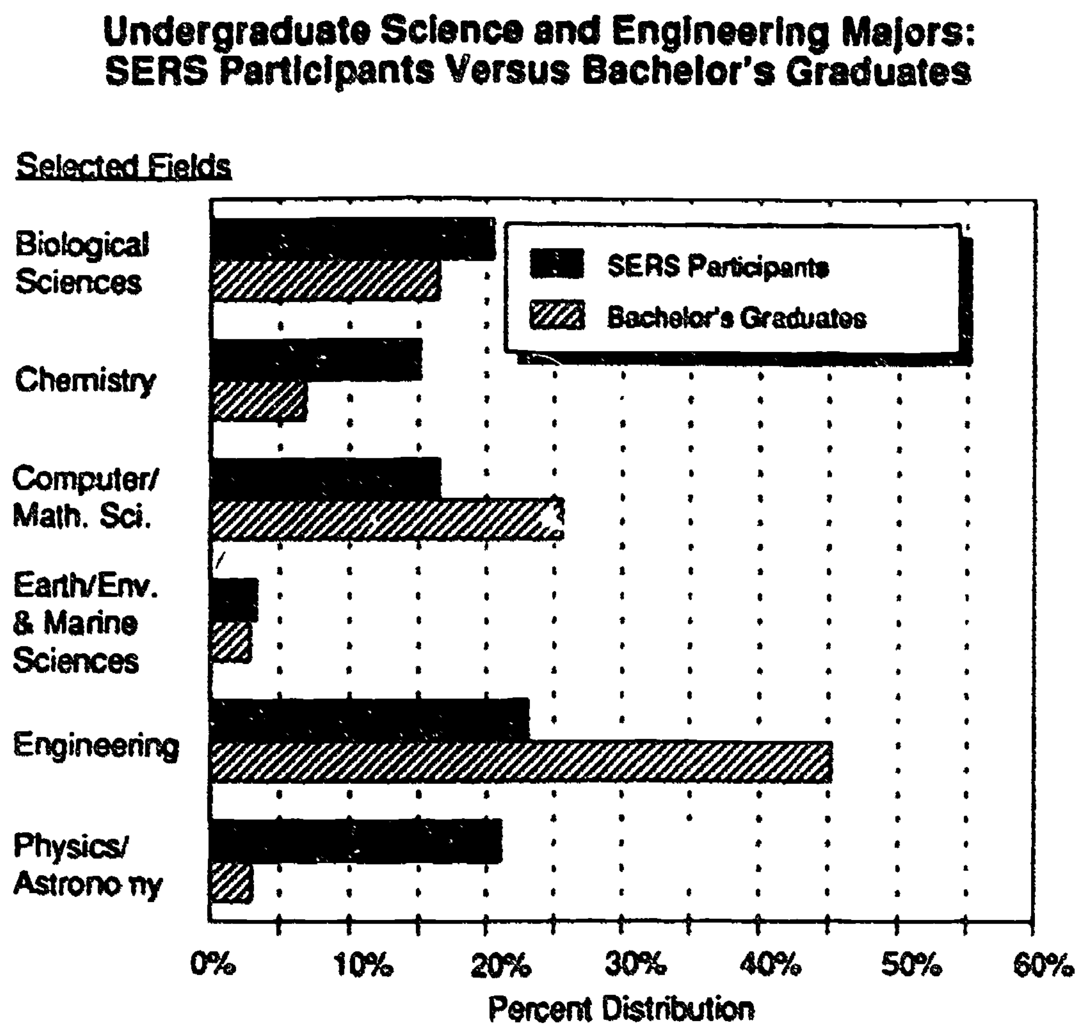
Source: SERS follow-up survey of participants during academic year 1987-1988 through Fall 1989.



Source: 1988 NSF New Entrants Survey.

Source: *U.S. Department of Energy Science and Engineering Research Semester: Profile and Survey of 1987-1990 SERS Participants*, July 1991, p. 18.

Figure 10. Example of More Definitive Comparison Groups: Undergraduate Majors



Note: These data have been restricted to include only engineering and physical, biological, and computer/mathematical sciences. The figure represents distribution across these selected fields.

SERS participants include those for academic years 1987-1988 through 1989-1990.

Bachelor's graduates data were from the 1988 New Entrants Survey for those who received degrees in the academic year 1986-1987.

Source: *U.S. Department of Energy Science and Engineering Research Semester: Profile and Survey of 1987-1990 SERS Participants*, July 1991, p. 13.