

SRI International

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EVALUATION OF NSF SUPPORT FOR UNDERGRADUATE RESEARCH OPPORTUNITIES Survey of SBES Graduates

Draft Final Report

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Disclaimer

Any opinions, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the United States Government.

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The SRI Project Team

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EXECUTIVE SUMMARY

INTRODUCTION

This report is one of several prepared by SRI International (SRI) under a contract to the National Science Foundation (NSF) to conduct a broad-based, nationwide evaluative study of NSF's support for undergraduate research. The purpose of the study was to understand better the demographic and academic characteristics of undergraduates who participate in undergraduate research opportunities (UROs) nationwide, why individuals choose to participate, the characteristics and components of UROs, and UROs' effects on students' academic and career decisions.

The major components of the study are:

- An inventory of UROs provided by public and private institutions in the United States.
- Site visits to selected research institutions that provide UROs.
- A survey of student and faculty participants in UROs funded by NSF.
- A survey of individuals ages 22 to 35 who have received a bachelor's degree in the so-called "hard" sciences, technology, engineering, or mathematics (STEM).
- A survey of individuals ages 22 to 35 who have received a bachelor's degree in the social, behavioral, or economic sciences (SBES).
- A follow-up survey of the undergraduate respondents to the NSF-program participant survey.

This executive summary describes the major results of the SBES graduates survey, which included approximately 3,200 individuals. The objective of both this survey and that of STEM graduates was to provide a longer-term and broader perspective on the academic and career effects of undergraduate research, relative to the surveys that focused on UROs funded by NSF. SBES graduates were asked whether they had participated in any UROs; if so, the nature of those experiences; and the effects of those experiences on their decisions about careers and academic degrees. To facilitate comparisons, many of the questions were identical across the four surveys.

SURVEY METHODS

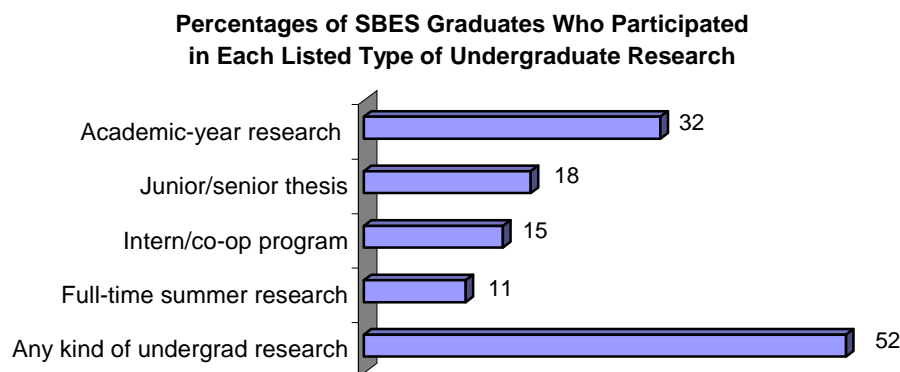
SRI subcontracted with TNS NFO (NFO) to provide the sample and do the data collection. NFO selected the survey sample from its Interactive Panel, which comprises 1.2 million households and 3.6 million individuals. The starting sample for this study was adults age 22 to 35 with a bachelor's degree or higher. To ensure that the sample was representative, the sample was balanced to U.S. Census profiles for adults of the specified age and education, with an added oversample of Hispanics/Latinos and blacks. Survey sample members were screened to confirm that they met the age and education requirements. SBES graduates were identified as those who indicated that they had received their bachelor's degree in an SBES field, as listed in the questionnaire. Only those who met all eligibility criteria are included in the final data file. The survey response rate was 40%; analyses are based on a total of 3,197 respondents.

MAJOR SURVEY FINDINGS

Research Participation

About half of SBES graduates participated in research activities as undergraduates.

The most common type of undergraduate research was working with a professor or researcher during the academic year (32% of SBES graduates did so). Many students participated in more than one type of research.



Source: SRI International SBES graduates survey, 2004.

Those who did not participate in research were much more likely to have chosen not to participate than to have been unable to participate.

About three-fourths of non-researchers indicated that they chose not to participate in research (e.g., were not interested, didn't have time); 4 in 10 indicated that they were unable to participate, either because research opportunities were not available or because the student applied but was turned down.

It is also noteworthy that the percentage who selected "it never occurred to me [to participate in research]" decreased over time, from 31% of those who graduated between 1989 and 1992, to 20% of those who graduated between 1998 and 2004. (Correspondingly, the actual participation rate increased slightly over time, from 49% of 1989-1992 graduates to 55% of 1998-2004 graduates.)

Among racial/ethnic groups, blacks were slightly more likely than others to have participated in research; there was no difference in the participation rates of men and women.

Nine percent of undergraduate SBES researchers reported that they participated in research sponsored by NSF, NASA, or NIH.

Thirty-eight percent of researchers said that none of these agencies supported any of their research, and 52% said they had no idea if any of these agencies supported them. The percentages who reported sponsorship by each organization were as follows: NSF 7%, NIH 2%, and NASA 1%.

Sponsored and non-sponsored researchers¹ experiences were different in a number of ways, including the following:

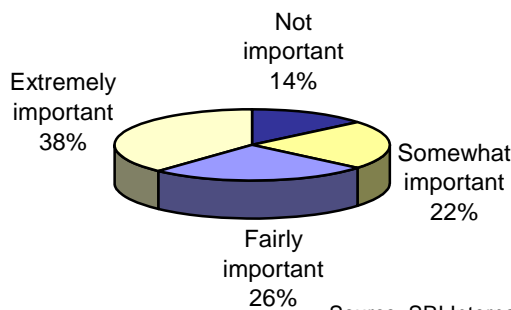
- Sponsored researchers were far more likely than non-sponsored researchers to have participated in high school math/science fairs (64% vs. 25%).
- Summer research was far more common among sponsored researchers than among their non-sponsored counterparts (52% vs. 18%, respectively).
- Sponsored researchers spent more time on undergraduate research: they reported an average of 12 months of research experience (not necessarily all sponsored by NSF, NASA, or NIH), compared with 8 months for non-sponsored researchers.

Research Experience Effects

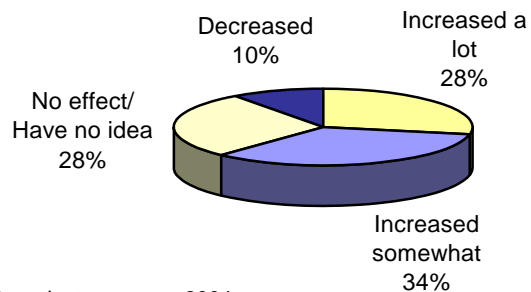
Many respondents reported that their undergraduate research experiences were important in shaping their career decisions and interests.

About 4 in 10 respondents reported that their undergraduate research was extremely important to their career decision, and about 6 in 10 said that their interest in an SBES career increased somewhat or a lot as a result of their undergraduate research experiences.

Perceived Importance of Undergraduate Research to SBES Researchers' Career Decisions



Effects of Undergraduate Research on SBES Researchers' Interest in a Career in the Social/Behavioral Sciences



Source: SRI International SBES graduates survey, 2004.

Effects were stronger among sponsored researchers than among non-sponsored researchers.

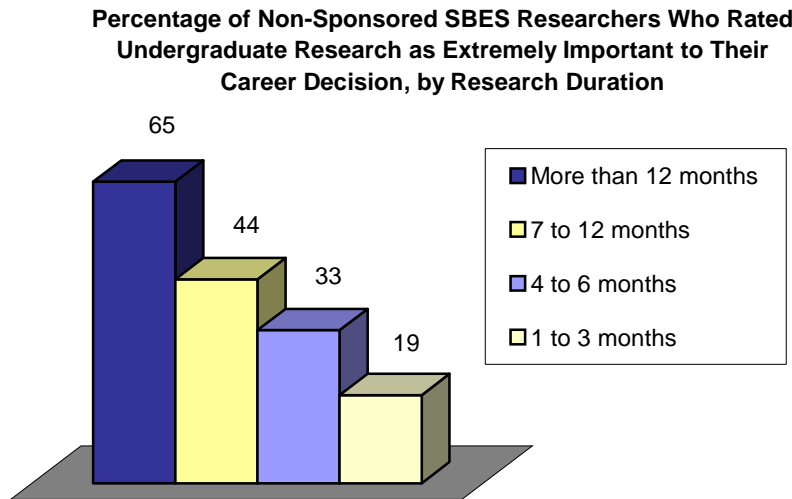
- Sponsored researchers were more likely than non-sponsored researchers to be “high gainers” in confidence, understanding, and awareness² as a result of their experiences.
- Sponsored students rated research as more influential in their career decisions and interests than did non-sponsored students. For example, 62% of sponsored researchers rated their research as extremely important to their career decision, compared with 36% of non-sponsored researchers.

¹ By “sponsored-researchers,” we mean those who reported that at least some of their undergraduate research was sponsored by NSF, NASA, or NIH. Note that “non-sponsored researchers” may well have been sponsored by organizations other than NSF, NASA, or NIH.

² Confidence, understanding, and awareness were indices derived from three or more attitude items asking the extent to which the respondent’s undergraduate research experiences increased their confidence, understanding, and awareness on various dimensions. “High gainers” on each index were those who scored in approximately the top quartile of that index.

Among non-sponsored researchers, those with more than 12 months of research experiences (“high-experience researchers”) reported stronger research effects in most areas than did those with less experience.

- High-experience researchers reported stronger gains in confidence, understanding, and awareness than did those with less research experience.
- High-experience researchers rated research as more influential in their career decision than did researchers with less experience.



Source: SRI International SBES graduates survey, 2004.

Research-experience effects tended to be strongest among Hispanics/Latinos and weakest among non-Hispanic whites, but most racial/ethnic group differences were quite small.

There were no appreciable differences between men and women in their perceived gains from their research experiences.

Students who were highly academically motivated were more likely than less motivated students to pursue undergraduate research opportunities.

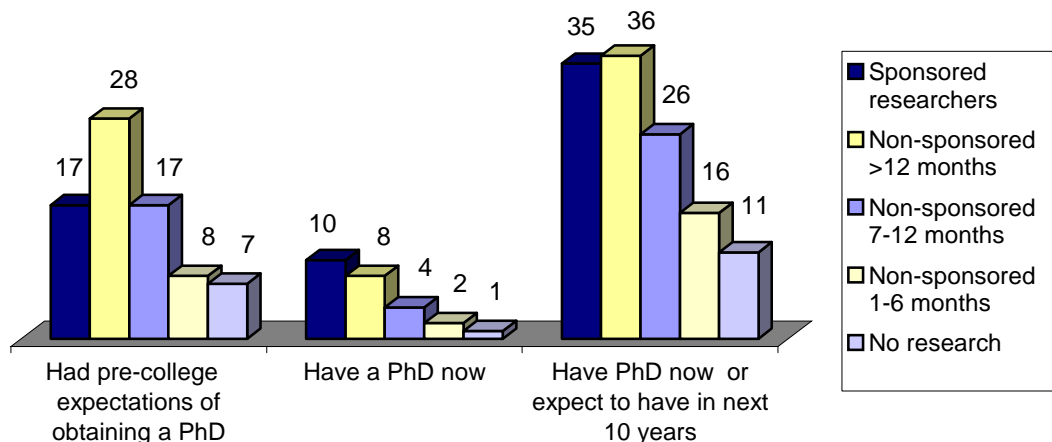
Fourteen percent of SBES graduates who participated in research had pre-college expectations of obtaining a PhD, compared with 7% of those who did not participate in research. Sponsored researchers were not appreciably more likely than non-sponsored researchers to have such expectations.

Undergraduate research, especially sponsored research, seemed to motivate/encourage undergraduates to pursue a PhD.

At the time of the survey, twice as many researchers as non-researchers had obtained a PhD or expected one in the next 10 years, and twice as many also had *new* PhD expectations.³ The percentages of sponsored and high-experience non-sponsored researchers with PhDs or expectations thereof were especially high.

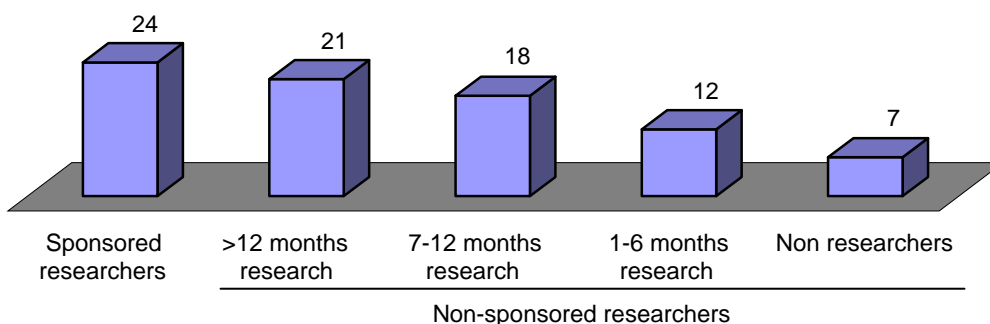
³ By “new PhD expectations,” we mean that the respondents did not have pre-college expectations of obtaining a PhD, but at the time of the survey they either had a PhD or expected to obtain one in the next 10 years.

Percentages of Each Specified Group of SBES Graduates Who Expected/Attained a PhD



Source: SRI International SBES graduates survey, 2004.

Percentage of Each Specified Group of SBES Graduates With "New" PhD Expectations

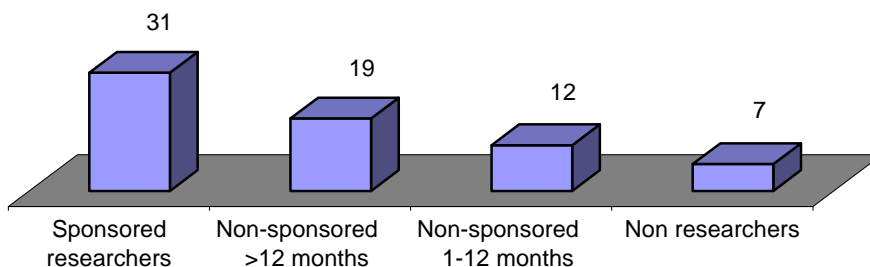


Source: SRI International SBES graduates survey, 2004.

Researchers were more likely than non-researchers to be employed in academia.

Researchers were twice as likely as non-researchers to be currently employed by a college or university (14% vs. 7%, respectively). Sponsored researchers and high-experience non-sponsored researchers were especially likely to be employed in academia.

Percentage of SBES Graduates Currently Employed in Academia, by Research Sponsorship and Duration of Research



Source: SRI International SBES graduates survey, 2004.

Similarities and Differences Between SBES and STEM Findings

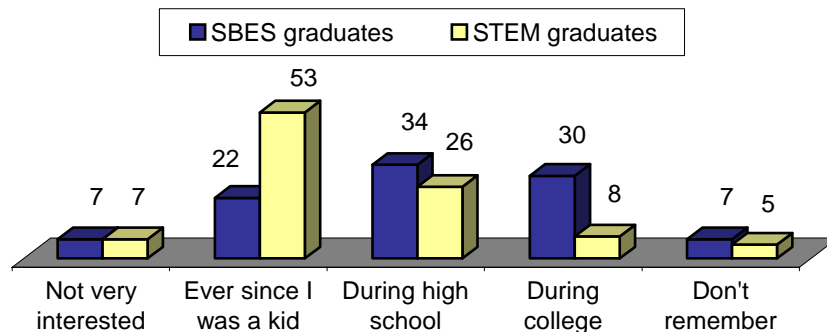
Major areas of similarity between the two surveys:

- SBES and STEM graduates had almost identical overall research participation rates.
- Similar percentages of SBES and STEM researchers participated in the various kinds of research activities covered in the survey.
- Similar percentages of SBES and STEM researchers felt that their research affected their career decisions and interests.
- Most of the variables that correlated highly with perceived gains and degree expectations were the same in the two surveys.

Major areas of difference between the two surveys:

- SBES researchers averaged less research experience than STEM researchers but their average perceived gains were higher.
- The differences between sponsored and non-sponsored researchers were less consistent among SBES graduates than among STEM graduates.
- STEM graduates were most likely to have been interested in STEM since childhood; SBES graduates were most likely to have become interested in SBES while they were in high school or college.

Percentages of SBES and STEM Graduates Who Became Interested in SBES/STEM at Each Specified Time



Sources: SRI International SBES graduates survey, 2004, and STEM graduates survey, 2003.

SUMMARY

Half of SBES graduates over the past 15 years reported that they had at least some hands-on research experiences as undergraduates; 9% participated in research sponsored by NSF, NASA, or NIH (“sponsored research”). A large majority of those who did not participate in research chose not to do so; the absence of opportunities for research was a much less commonly reported reason for not participating. There were no differences among racial/ethnic groups or between men and women in overall research participation rates, but men, Asians, and Hispanics/Latinos were more likely than their female, black, and non-Hispanic white counterparts to participate in sponsored research. Undergraduate research tended to attract students who already expected to obtain an advanced degree, but it—and especially sponsored research—also helped encourage

them to pursue a doctorate and was positively correlated with current employment in academia. Overall, the findings with regard to SBES graduates paralleled those found for STEM graduates. One interesting difference between the two groups was that STEM graduates were much more likely than SBES graduates to have been interested in their field since childhood.

I. INTRODUCTION

This report is one of several prepared by SRI International (SRI) under a contract to the National Science Foundation (NSF) to conduct a broad-based, nationwide evaluative study of NSF's support for undergraduate research. The purpose of the study is to understand better the demographic and academic characteristics of undergraduates who participate in undergraduate research opportunities (UROs) nationwide, why individuals choose to participate, the characteristics and components of UROs, and UROs' effects on students' academic and career decisions.

MAJOR STUDY COMPONENTS

The major components of this study are:

- An inventory of UROs provided by public and private institutions in the United States.
- Site visits to selected research institutions that provide UROs.
- A survey of student and faculty participants in UROs funded by NSF.
- A survey of individuals ages 22 to 35 who have received a bachelor's degree in ("hard") science, technology, engineering, or mathematics (STEM).
- A survey of individuals ages 22 to 35 who have received a bachelor's degree in a social, behavioral, or economic science (SBES).
- A follow-up survey of NSF student participants, 2 years after the initial survey.

The focus of this report is on the SBES graduates survey. Reports on the inventory, the site visits, the NSF-program participant survey, and the STEM graduates survey have been prepared and submitted to NSF previously. A report on the follow-up student survey will be prepared later in 2005. Each of the study components is described briefly below.

Inventory of UROs

The first major task of the study was the compilation of an inventory of the kinds of UROs that are supported by NSF and other government and non-government entities in the United States.⁴ The primary focus of the inventory was on undergraduate research in STEM, particularly the disciplines that are supported by NSF. The focus was also on programs and organizations that themselves fund UROs, as opposed to programs and organizations that provide such experiences for undergraduates with funding from other sources. The inventory is organized first by type of sponsoring organization: NSF, other federal agencies, foundations, and industry. Each organization's list is ordered by the amount of funding it provides for undergraduate research, insofar as it is possible to determine, and according to how specifically and/or determinably the programs provide an actual research experience. Finally, there is a cross-cutting element that distinguishes those programs that are generic (open to all groups) from

⁴ C.A. Ailes *et al.*, "Evaluation of NSF Support for Undergraduate Research Opportunities: Inventory of Undergraduate Research Opportunities," report to the National Science Foundation. December 2003. Arlington, VA: SRI International.

those that are targeted, sometimes geographically, but generally to racial/ethnic groups that are underrepresented in science and engineering careers.

Site Visits

Primarily to help guide development of the survey questionnaires, SRI conducted site visits to 20 institutions that provide research opportunities for undergraduates.⁵ Institutions were selected to provide diversity in terms of types of students served, academic field of research, geographic location, and types of NSF awards supporting undergraduate research. To include both summer and academic-year (fall to spring) participants, some visits were conducted during the summer and others were conducted during the regular academic terms. Interviews and focus groups were conducted with principal investigators (PIs), other faculty mentors, graduate student mentors, and undergraduates currently participating in research. For the most part, individual interviews were conducted with faculty, and group interviews were conducted with undergraduates and graduate students.

NSF-Program Participant Survey

Conducted mostly through Web-based questionnaires, the NSF-program participant survey included more than 4,500 undergraduates, 800 graduate student/postdoc mentors, and 2,200 principal investigators (PIs) and other faculty mentors who participated in over 1,000 active NSF awards between June 2002 and May 2003.⁶ The overall response rate was 79%, ranging from 76% of the undergraduates to 95% of the PIs. Respondents were asked about the undergraduate research experiences they had during either the 2002 summer or the 2002-2003 academic year (fall through spring). Undergraduates were asked about their reasons for participating, the kinds of activities in which they engaged, areas of satisfaction and dissatisfaction with the research experience, and perceived effects of the experiences. Graduate students, PIs, and faculty mentors were asked questions that paralleled many of those asked of the undergraduates as well as questions about their attitudes about involving undergraduates in research and undergraduate mentoring needs.

STEM Graduates Survey

The STEM graduates survey involved a nationwide sample of approximately 3,400 individuals ages 22 to 35 who have received a STEM bachelor's degree. Respondents were asked whether they had participated in any UROs; if so, about the nature of those experiences and the effects of those experiences on their decisions about careers and academic degrees.

The overall purpose of this survey was to provide a longer-term and broader perspective on the academic and career effects of undergraduate research than could be provided from a survey

⁵ C.A. Ailes *et al.*, "Evaluation of NSF Support for Undergraduate Research Opportunities: Site Visit Report," report to the National Science Foundation. October 2003. Arlington, VA: SRI International. The institutions visited were Arizona State University, Georgetown University, George Washington University, Georgia Institute of Technology, Hampton University, Haverford College, Hope College, Howard University, IBM Almaden Research Center, Jackson State University, Johns Hopkins University, National Institute of Standards & Technology, Southern University, Southwest Indian Polytechnic Institute, Stanford University, University of California at Irvine (California AMP Symposium), University of Colorado, University of Maryland, University of South Carolina, and University of Wisconsin.

⁶ S.H. Russell, "Evaluation of NSF Support for Undergraduate Research Opportunities: 2003 NSF-Program Participant Survey," report to the National Science Foundation. February 2004. Arlington, VA: SRI International.

limited to current URO participants and to UROs sponsored by NSF. A sample derived from award- or institution-based lists of past participants in UROs was considered and rejected because of the difficulty/high cost of locating individuals and, especially, because those who are located in such efforts tend to be disproportionately in academia. In a study of the effects of UROs on career and academic decisions, such a bias would have seriously damaged the validity of the results.

SBES Graduates Survey

The SBES graduates survey is the focus of this report. This survey is analogous in scope and size to the STEM graduates survey. The questionnaire is virtually identical to that used in the STEM survey, with the exception of changes in terminology to specify survey items' focus on the "social, behavioral, and economic sciences" rather than "science, math, or engineering."

NSF Student Follow-up Survey

As of July 2005, a follow-up survey of all undergraduate respondents to the 2003 NSF program survey is underway. This survey focuses on tracking outcomes of the students' 2002-2003 research experiences and will compare these outcomes with expectations that students reported in the 2003 survey. To facilitate comparisons, many of the survey questions are identical across the four surveys.

SBES GRADUATES SURVEY: STUDY METHODS

Sample Design and Data Collection

From a sampling perspective, the objective of this survey was to obtain a nationally representative sample of individuals ages 22 to 35 who had received a bachelor's degree in an SBES field. Because it would have been prohibitively expensive to obtain such a sample "from scratch" (for example, using random digit dialing techniques to contact households and then screening for the desired subset of individuals), SRI subcontracted with TNS NFO (NFO) to provide the sample and do the data collection.

The NFO interactive panel comprises 3.6 million individuals in 1.2 million U.S. households. Panel members are recruited through random gathering of e-mail addresses. When individuals join the panel, they provide complete demographic information about themselves and their households, thereby providing the basis for selecting population subsets for subsequent surveys. (For more information about NFO, go to <http://www.tns-global.com>.)

The starting sample for this survey was adults age 22 to 35 with a bachelor's degree or higher. Both age and educational attainment are pre-identified demographics in NFO's MySurvey Community (interactive panel). To ensure that the sample was representative, the sample was balanced to U.S. Census profiles for adults of the specified age and education on the following demographics: geographic location, market size, age, household income, household size and race. Hispanics/Latinos and blacks were oversampled to obtain sufficient numbers of respondents for analyses.⁷ NFO sent survey participation requests to a total of 62,400 individuals; of these, 25,183 (40%) logged into the survey. Screening questions were used to

⁷ NSF also considers persons with disabilities to be an underrepresented group, the inclusion of which is encouraged in all NSF-supported activities. Disability status was not included in this survey because previous SRI surveys have found that self-reports of disabilities are unreliable.

confirm that respondents met the survey's age and education requirements and that they had received their bachelor's degree in an SBES field⁸ from an institution in the United States.

Data Cleaning and Weighting

NFO sent a total of 4,455 completed questionnaires to SRI. A review of the responses to the academic-major question showed that 1,125 respondents had specified a major that was not an SBES field. (Most of these were in the "other social/behavioral science—please specify" response category; they included such fields as business, English, nursing, history, etc.). These responses were deleted from the file. Another four were deleted because they answered fewer than half of the survey questions. Additionally, the number of respondents who selected the "linguistics" category was much larger than expected, given the distribution of 2000-2001 academic majors reported by the U.S. Department of Education (ED).⁹ (A total of 129 respondents selected this category; ED statistics suggested that there should have been about 13 linguistics majors, given our survey sample size.) Write-in comments by several in this group led us to believe that many of these "linguists" were language majors (and thus not social scientists); we suspected that they selected the linguistics category because it was the closest category on the list to "languages." It was not feasible to follow up on individual respondents to make a positive categorization, so all linguistics majors except three individuals whose comments indicated that they were indeed linguists were deleted from the file. The final survey file includes 3,197 respondents.

For analysis purposes, respondents who selected two or more SBES fields were included in the "interdisciplinary" group; respondents who selected one SBES field and specified one or more non-SBES fields were included in the SBES field that they selected.¹⁰ Survey responses were then weighted by academic major, separately for men and women, to correspond with ED statistics for the 2000-2001 academic year.¹¹ The interdisciplinary majors group was treated as self-weighting because this category is not included in the ED tables.

The demographic profiles of survey respondents were compared with NFO population estimates with regard to sex, race, ethnicity, household income, household size and composition, and geographic region. The comparisons showed that the two groups were within a few percentage points of one another on all variables, so no weighting on demographic variables was done.

Data cleaning also was done with regard to the assignment of respondents into "research" or "no research" categories. A total of 109 respondents who indicated that they had engaged in

⁸ As listed in the questionnaire, the fields included in the survey were: archeology; anthropology; criminology; economics, including econometrics; geography; linguistics; political science; psychology (including clinical, cognitive, comparative, counseling, child/developmental, experimental, industrial/organizational, physiological/psychobiology, social, etc.); social work; social sciences (general); sociology; urban affairs/studies; other social or behavioral sciences (*please specify*); interdisciplinary major involving a combination of two or more of the above categories; interdisciplinary or double major involving any of the above and some other field(s) not listed here (*please specify*).

⁹ U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, "Completions" survey (NCES IPEDS). See <http://nces.ed.gov/programs/digest/>

¹⁰ For example, a respondent who selected "economics" and "psychology" was included in the "interdisciplinary SBES" group, whereas a respondent who selected "economics" and specified that he also majored in business was included in the "economics" group.

¹¹ IPEDS "Completions" survey, as above.

some form of “hands-on” undergraduate research (question 16)¹² were recoded as not having done research for the following reasons:

- They reported having done none of the 14 research-related activities listed in question 30 (74 respondents).
- Of the listed activities in question 30, they had done only “little or nothing that seemed to me like real research” (30 respondents).
- The only research they reported was in the “other” category on question 16, and the activities they described were not research (they were subjects in psychology experiment, student teachers, etc.) (5 respondents).

REPORT ORGANIZATION

The remainder of this report is organized in a generally chronological sequence. We begin with profiles of the SBES graduates and a discussion of undergraduate research participation rates. We then move from students’ motivations to participate (or not) in undergraduate research, to the research activities, to perceptions of effects of the experiences—what has been learned/gained, interest in various careers—to academic degree expectations. This report parallels a just-completed report on recent graduates in “hard” science, technology, engineering, and mathematics (STEM), referenced above. To provide a context for SBES findings, we often cite comparable findings from the STEM survey.

Following the body of report are two appendices: Appendix A is the survey questionnaire, and Appendix B comprises survey responses broken out by major study variables.

A note on the reporting of group differences: all group differences reported here are statistically reliable at the .05 level. (That is, the odds are less than 5 in 100 that the difference occurred only by chance.)

¹² See Appendix A for the wording of question 16 and its response categories.

II. PROFILE OF SBES GRADUATES

This chapter provides a broad description of the academic and demographic characteristics of individuals ages 22 to 35 who received bachelor's degrees in a social, behavioral, or economic science (SBES) field. The survey data presented here are based on information provided by a total of 3,197 respondents.

ACADEMIC CHARACTERISTICS

Academic Major

A respondent's inclusion in the study as an SBES major was based on his/her selection of one or more of the SBES majors listed in the questionnaire (see Appendix A). For analysis purposes, respondents were divided into the eight mutually exclusive categories listed in Table II-1. As noted in Chapter I, except for interdisciplinary SBES majors, the categories were weighted to parallel U.S. Department of Education (ED) statistics. There are no interdisciplinary majors in ED statistics (each graduate is required to have a single primary major), so interdisciplinary majors in the survey were treated as self-weighting (that is, they were given a weight of 1.0).

Considerably the largest field was psychology, which comprised 31% of SBES graduates. The next largest fields were interdisciplinary SBES (17%), political science (12%), and sociology (11%).

	Number of respondents	Weighted Percentage
Criminology (including criminal justice)	194	7
Economics (including econometrics)	458	8
Political science (including government and international relations)	398	12
Psychology (including clinical, cognitive, comparative, counseling, child/developmental, experimental, industrial/organizational, physiological/psychobiology, social, etc.)	929	31
Social work	109	6
Sociology	212	11
Other SBES (including anthropology, archeology, geography, linguistics, general social sciences, and urban affairs/studies)	367	9
Interdisciplinary (interdisciplinary or double major involving two or more of the above categories)	530	16
TOTAL	3,197	100

Notes: Percentages were weighted to parallel the 2000-2001 distribution of graduates across SBES majors as reported by the U.S. Department of Education National Center for Education Statistics, Integrated Postsecondary Education Data System (NCES IPEDS), "Completions" survey. The interdisciplinary category is not included in the NCES IPEDS tables; respondents in this category have a weight of 1.

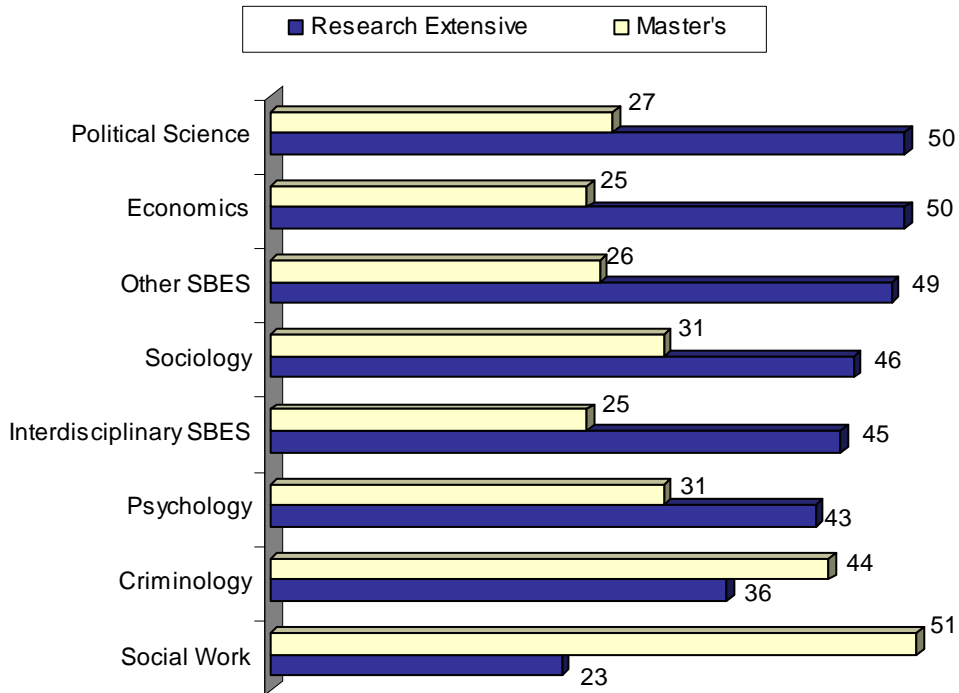
Sources: SRI International SBES graduates survey, 2004; NCES IPEDS

Type of School

Slightly over half (54%) of SBES graduates received their bachelor's degree from a research university—44% from an institution categorized by the Carnegie classification as research extensive and 10% from a research intensive institution. Another 31% graduated from a master's institution, 13% graduated from a baccalaureate institution, 1% graduated from a specialized institution, and 1% did not report their alma mater. This distribution is virtually identical to that reported for STEM graduates.

The percentages of respondents in each academic major who graduated from the two largest categories of institutions—research extensive and master's—are shown in Figure II-1.

Figure II-1
Percentages of SBES Graduates Who Received Their Bachelor's Degree from a Research Extensive or Master's Institution, by Academic Major



Source: SRI International SBES graduates survey, 2004.

Economics, political science, and “other SBES” majors were the most likely to have graduated from a research extensive institution. Majors from the two most applied fields—criminology/criminal justice and social work—were the most likely to have graduated from a master's institution.

Attendance at a 2-Year College

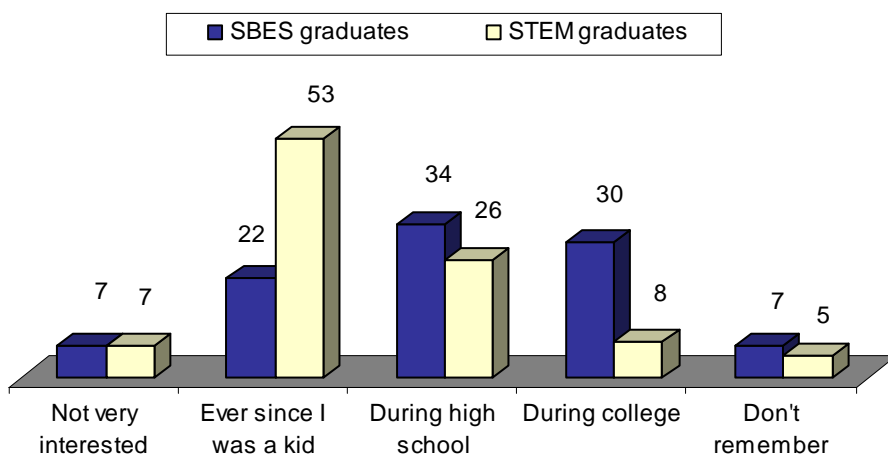
About one in six SBES graduates (18%) reported having started their undergraduate education at a 2-year college. Students who graduated from master's or research intensive institutions were more likely than average to have done so (25% and 24%, respectively); those who graduated from research extensive and baccalaureate institutions were least likely to have done so (14% and 10%). Across academic majors, those in political science were the least likely

to have gone to a 2-year college (10% did so), and criminology/criminal justice majors (25%) were more likely than average to have done so. Among racial/ethnic groups, blacks had the lowest 2-year college attendance rate (11%). There were no appreciable differences between men and women on this item.

Origins of Interest in SBES

SBES majors were about equally likely to become interested in SBES during high school or college (34% and 30%, respectively), and only 22% reported that they had been interested in SBES “ever since I was a kid.” In contrast, about half of STEM majors became interested in STEM as children, and only 8% became interested in college; 26% became interested when they were in high school (Figure II-2).

Figure II-2
Percentages of SBES and STEM Graduates Who Became Interested in SBES/STEM at Each Specified Time



Sources: SRI International SBES graduates survey, 2004, and STEM graduates survey, 2003.

We suspect that the percentage interested in SBES/STEM since childhood is lower for SBES majors than for STEM majors in part because SBES topics are less likely than STEM topics to be covered in elementary school, so awareness of SBES among elementary school students is relatively low. The low percentage of STEM majors who became interested in college also may reflect the steep learning curve required (or at least perceived to be required) of someone who waits until college to take up a STEM field.

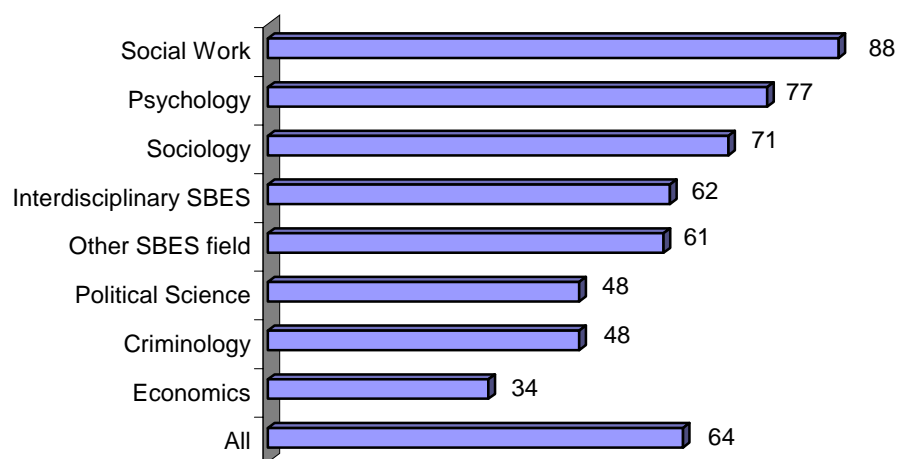
DEMOGRAPHIC CHARACTERISTICS

Sex and Race/Ethnicity

Overall, across all SBES fields, women outnumbered men by almost two to one: 64% to 36%. (In contrast, women and men were equally represented among STEM majors.) Women outnumbered men in each of the SBES fields except economics¹³, criminology/criminal justice, and political science (Figure II-3). Women were especially dominant in social work (88%), but

¹³ Men are similarly dominant in mathematics, a field on which much of economics relies heavily.

**Figure II-3
Percentage of SBES Graduates Who Were Women,
by Academic Major**



Source: National Center for Education Statistics, Integrated Postsecondary Education Data System (NCES IPEDS), "Completions" survey, 2001.

they also comprised over three-fourths of the psychology majors and about 7 in 10 sociology majors.¹⁴

Eight in 10 respondents (79%) were non-Hispanic whites, 7% were Asian, 6% were black, 6% were Hispanic/Latino, and 2% belonged to more than one race. There were few appreciable differences among the various academic majors in the distribution of racial/ethnic groups. The most notable exceptions were that Asians comprised 15% of economics majors (vs. 7% overall) and Hispanics/Latinos comprised 11% of criminology/criminal justice majors (vs. 6% overall).

Household Income

As was the case with STEM graduates, the household income levels of SBES graduates reflected the typical income advantage that college graduates have over those who have not gone to college. The median income across all U.S. households in 2003, as reported by the U.S. Census Bureau, was \$43,300.¹⁵ In contrast, 82% of SBES graduates had household incomes of \$40,000 or more, and 39% had incomes of \$90,000 or more. Graduates who majored in economics (50%) and political science (46%) were more likely than average to have incomes over \$90,000.

Employment Status and Type of Employer

Eighty-five percent of SBES graduates reported that they were employed either full-time (75%) or part-time (10%), and 10% were still in school. Among those who were employed, by far the largest group (51%) reported that they were employed by a for-profit company. Fourteen percent were employed by a non-profit company, 13% by the government (excluding military),

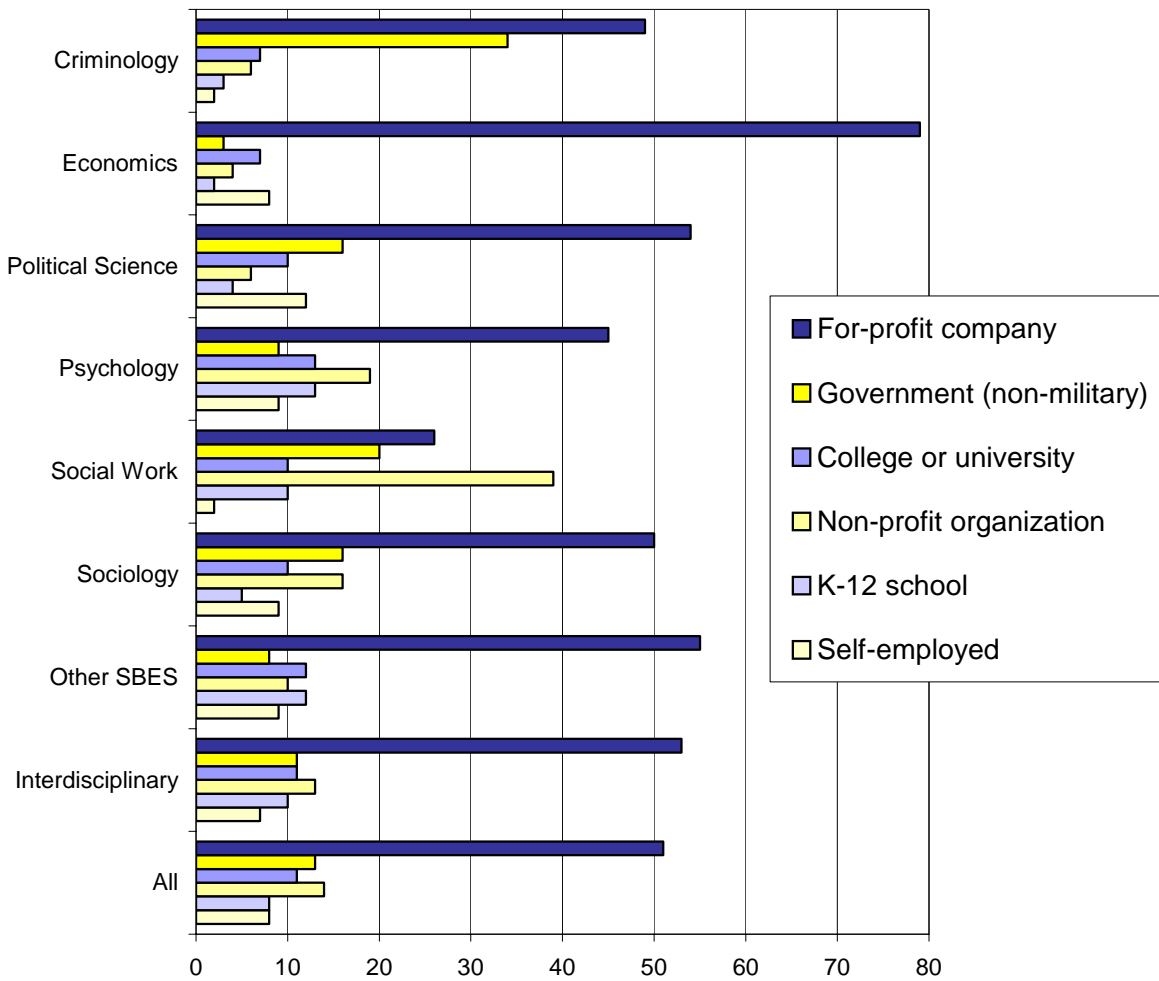
¹⁴ As reported in Chapter I, our survey responses were weighted by academic major, separately for men and women, to correspond with statistics provided by the NCES-IPEDS 2001 "Completions" survey; accordingly, the percentages reported in this paragraph are those reported by NCES.

¹⁵ DeNavas-Walt, Carmen, et al., U.S. Census Bureau, Current Population Reports, P60-226, *Income, Poverty, and Health Insurance Coverage in the United States, 2003*. U.S. Government Printing Office, Washington, DC, 2004.

11% by a college or university, and 8% by an elementary/secondary school. Compared to their STEM counterparts, SBES graduates were less likely to be employed by a for-profit company (51% vs. 60%, respectively) and slightly more likely to be employed by government (13% vs. 8%) or a non-profit organization (14% vs. 11%).

Employment sector varied considerably by academic major (Figure II-4). For example, among those employed, economics majors were the most likely to be in the for-profit sector (79%) and among the least likely to be in the non-profit sector (4%), whereas the pattern for social work majors was the opposite, with 39% in the non-profit sector and 26% in the for-profit sector. Predictably, criminology/criminal justice majors were the most likely to be in government (34%).

Figure II-4
Employment Sector of SBES Graduates, by Academic Major
 (Base: Those Employed Full- or Part-Time)



Source: SRI International SBES graduates survey, 2004.

OVERVIEW OF SBES GRADUATES

Surveyed in 2004, Americans ages 22 to 35 who had received bachelor's degrees in an SBES field were predominantly non-Hispanic white women. Women were especially dominant in social work, psychology, and sociology, whereas men predominated in economics, political science, and criminology/criminal justice. One notable difference between SBES and STEM graduates was that a higher percentage of SBES graduates were women. Also, SBES graduates were most likely to have become interested in SBES in high school or college, whereas STEM graduates were most likely to have been interested in STEM ever since childhood.

III. UNDERGRADUATE RESEARCH PARTICIPATION RATES AND SPONSORSHIP

This chapter describes who participated in undergraduate research, when they did so, and whether any of their research was sponsored by NSF, NIH, or NASA.

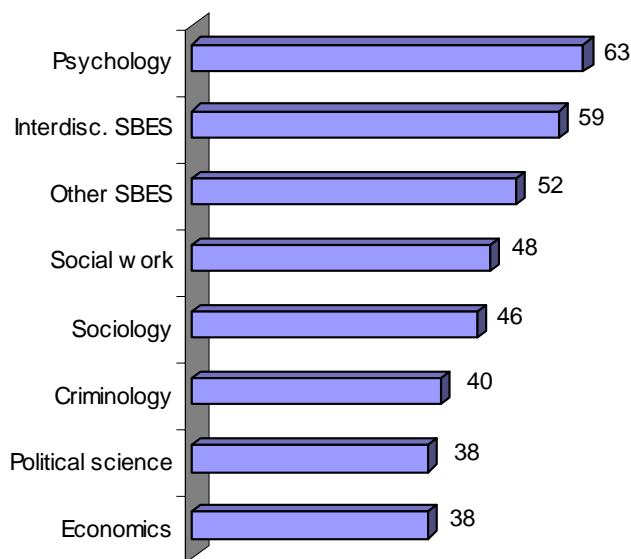
RESEARCH PARTICIPATION RATES

Figure III-1
Percentage of SBES Graduates Who Participated in Research During Each Academic Year



Source: SRI International SBES graduates survey, 2004.

Figure III-2
Percentage of SBES Graduates Who Participated in Undergraduate Research, by Academic Major



Source: SRI International SBES graduates survey, 2004.

The percentage of SBES graduates who participated in research as undergraduates or in high school was essentially the same as that for STEM graduates: 52% and 53%, respectively. By far the most common academic years for undergraduate research participation were students' junior and senior years (or the preceding summers).¹⁶ For each of these years, slightly more than a fourth of SBES graduates reported that they participated in research (Figure III-1). Only about 1 in 10 did research as sophomores, and only 1 in 20 did so as freshmen.

We reviewed differences in research participation rates by academic major, type of school, whether the respondent started at a 2-year college, year of graduation, participation in high school math/science fairs, when the respondent first became interested in SBES, and the respondent's sex and race/ethnicity. We also compared SBES findings on each of these dimensions with those from the STEM graduates survey. Findings are summarized below.

The percentage of graduates in each academic major who participated in research ranged from a low of 38% to 40% of majors in criminology/criminal justice, economics, and political science to slightly over 60% of psychology majors (Figure III-2). This 25-percentage-point range is considerably smaller than the 40-point range among STEM majors (from 34% of mathematics majors to 74% of chemistry majors).

¹⁶ This question was not asked of STEM graduates.

There were no statistically reliable differences in overall research participation rates across types of schools or between those who started at a 2-year college and those who did not. However, graduates of baccalaureate schools were more likely than average to participate in junior/senior thesis work that involved hands-on research as its main component (31% of baccalaureate school graduates vs. 18% overall).

Consistent with the gradual increase in undergraduate research opportunities, the percentage of SBES majors who participated in research increased from 49% of those who graduated between 1989 and 1992 to 55% of those who graduated since 1998. These percentages are virtually identical to those for STEM majors.

High school math/science fairs tend to focus much more on the “hard” sciences than on SBES. Nevertheless, SBES researchers were twice as likely as non-researchers to have participated in such fairs (29% vs. 15%, respectively).¹⁷ Researchers also were somewhat more likely than non-researchers to have been interested in SBES “ever since I was a kid” (26% vs. 18%).

The percentages of male and female SBES majors who participated in research were not reliably different. Among the racial/ethnic groups, blacks were slightly more likely than others to have participated in research (60% did so, vs. 52% overall). For STEM majors, there were similarly small differences between the sexes and among the racial/ethnic groups.

RESEARCH SPONSORSHIP

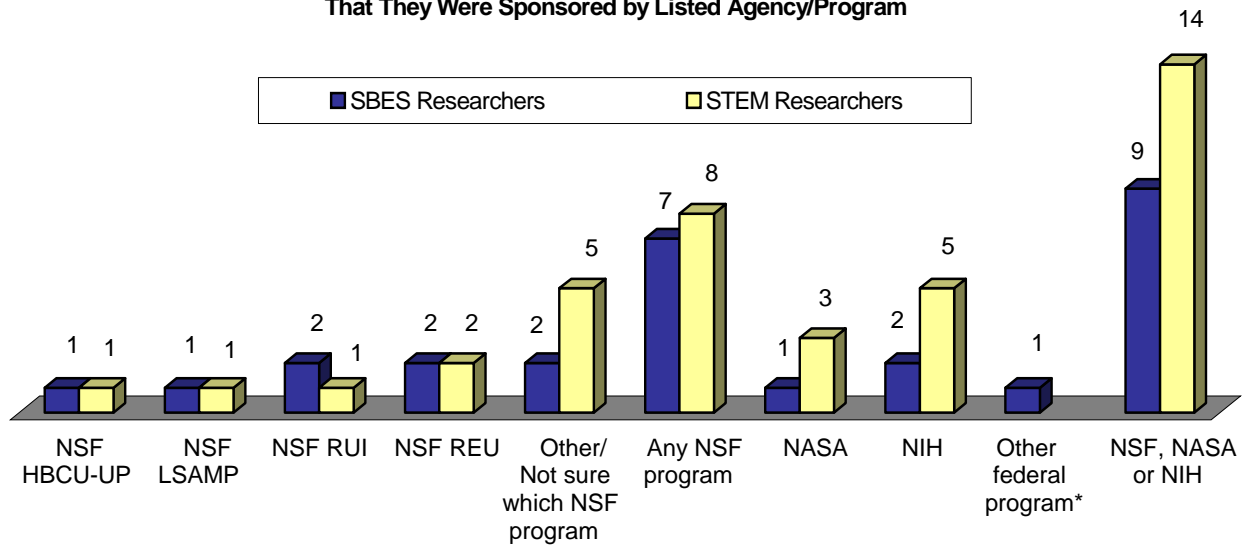
Many SBES graduates who participated in undergraduate research were unaware of who sponsored it. Asked if any of several listed federal government programs/agencies sponsored any of their research, about half (52%) said they had no idea. Another 38% said no, and 10% answered in the affirmative. Among the federal sponsors, NSF was by far the most common, reported as a sponsor by 7% of respondents.

Men were considerably more likely than women to have been supported by NSF (11% vs. 4%). Among the racial/ethnic groups, Asians and Hispanics/Latinos were more likely than blacks or non-Hispanic whites to report NSF support (17% and 15% vs. 4% and 5%, respectively). Among the academic majors and types of schools, economics majors, interdisciplinary SBES majors, and research-extensive universities were the most likely to have NSF-supported research: 13% to 15% of researchers in each of these groups reported NSF support.

As shown in Figure III-3, the percentages of SBES and STEM researchers supported by NSF were about the same, as were the percentages who had no idea who sponsored their research. Not surprisingly, however, STEM researchers were more likely than SBES researchers to be supported by NASA and NIH, and these greater percentages led to a higher percentage overall supported by NSF, NASA, or NIH (14% of STEM researchers vs. 9% of SBES researchers). In the remainder of this report, we will refer to researchers who were supported by NSF, NASA, or NIH as “sponsored researchers.”

¹⁷ The corresponding percentages among STEM graduates were 40% and 22%.

Figure III-3
Percentages of STEM and SBES Undergraduate Researchers Who Reported
That They Were Sponsored by Listed Agency/Program



*This category was not included in the STEM survey.

Sources: SRI International STEM graduates survey, 2003, and SBES graduates survey, 2004.

OVERVIEW OF RESEARCH PARTICIPATION

Overall, about half of SBES majors participated in undergraduate research, and a large majority did so during their junior and/or senior year. The highest research participation rates were among psychology and interdisciplinary SBES majors; the lowest were among economics and political science majors. Graduates who had participated in high school math/science fairs and those who had been interested in SBES since childhood had higher participation rates than their counterparts. Participation rates increased slightly over the 15-year period covered by the survey. There were small differences among racial/ethnic groups (blacks were more likely than others to participate), but there were no statistically reliable differences in participation rates between men and women or across types of schools. For the most part, these data paralleled those for STEM graduates. The percentages of STEM and SBES researchers who reported being supported by NSF were also about the same, though the percentage who reported being sponsored by NASA and NIH was higher for STEM than for SBES.

IV. REASONS FOR PARTICIPATING OR NOT PARTICIPATING IN UNDERGRADUATE RESEARCH

REASONS FOR PARTICIPATING IN UNDERGRADUATE RESEARCH ACTIVITIES

Respondents who participated in research were asked to rate the importance of each of nine potential reasons for doing so. They used a four-point scale where 1 = not important, 2 = somewhat important, 3 = fairly important, and 4 = extremely important. As shown in Table IV-I, the ratings reflected diverse motivations for research participation, ranging from a desire for fun to being required to participate. With the mean rating as the metric, the top three reasons overall were “I wanted hands-on experiences to reinforce what I learned in class,” “I thought it would be fun,” and “I needed/wanted the academic credit I could get from doing research.”

Table IV-1					
SBES Researchers' Motivations for Participating in Research					
(Listed in descending order of mean rating)					
Number of respondents: 1622					
	Mean	Doesn't Apply/Not Important	Somewhat Important	Fairly Important	Extremely Important
I wanted hands-on experiences to reinforce what I learned in class.	3.15	9%	14%	31%	46%
I thought it would be fun.	2.99	10	18	36	37
I needed/wanted the academic credit I could get from doing research.	2.91	18	15	25	42
I thought it would help me get into graduate/law/business school or get a job.	2.85	20	16	24	41
I wanted to know if a social/behavioral science was for me.	2.75	19	19	32	31
I wanted to learn more about what it's like to be a researcher.	2.72	19	20	30	31
I wanted to know if going to grad school in a social/behavioral science was for me.	2.65	24	18	28	31
I needed to fulfill my school's/my scholarship's requirements for research.	2.30	43	12	17	28
Doing research was more appealing than other kinds of jobs.	2.28	41	14	22	24
<p>This table shows, for example, that 9% of SBES graduates who participated in undergraduate research reported that “I wanted hands-on experiences to reinforce what I learned in class” was not important or did not apply to them as a reason for participating in research.</p> <p>Note: Mean is calculated on a 4-point scale where 1 = not at all important/doesn't apply, 2 = somewhat important, 3 = fairly important, and 4 = extremely important.</p> <p>Source: SRI International SBES graduates survey, 2004.</p>					

To facilitate analyses of the relationships between motivations and other study variables and comparisons between the STEM and SBES surveys, we used factor analysis and correlation matrices to identify three clusters of items with similar response patterns. We termed the clusters

“help with a career/academic decision,” “personal interest,” and “meet requirements.” The items comprising each cluster are as follows:

Help with a career/academic decision

I wanted to know if social/behavioral science was for me.

I wanted to learn more about what it’s like to be a researcher.

I wanted to know if going to grad school in a social/behavioral science was for me.

Personal interest

I wanted hands-on experiences to reinforce what I learned in class.

I thought it would be fun.

Meet requirements

I needed to fulfill my school’s/my scholarship’s requirements for research.

I needed/wanted the academic credit I could get from doing research.

Each cluster comprises an index, with respondents divided into four groups on the basis of their mean rating on items in that index.¹⁸ Overall, “personal interest” was the most important motivation for SBES graduates, with a mean of 3.1. “Help with decisions” and “meet requirements” had means of 2.7 and 2.6, respectively.

We reviewed differences in motivations by research sponsorship, academic major, type of school, sex, and race/ethnicity. The largest differences were by research sponsorship and academic major. Sponsored researchers (that is, those who reported that at least some of their research was supported by NSF, NASA, or NIH) tended to have higher scores than did non-sponsored researchers on the “help with decisions” index. For example, 43% of sponsored researchers said that wanting “to know if going to grad school in a social/behavioral science was for me” was extremely important in their decision to do research, compared with 29% of non-sponsored researchers.

With regard to differences in motivations among academic majors, graduates in the two most “applied” majors—criminology/criminal justice and social work—were the most distinctive. For example, obtaining academic credit was an especially important motivation to these two majors: 63% and 59%, respectively, of these groups rated this as extremely important, compared with 42% overall. These two groups were also the least likely to have said that wanting “to learn more about what it’s like to be a researcher” was an extremely important motivator (19% vs. 31% overall).

SBES graduates as a whole were more likely than STEM graduates to have high scores on both the “help with decisions” and “meet requirements” indices. On the former index, 34% of SBES graduates and 22% of STEM graduates were in the top quartile; on the latter index, the corresponding percentages were 29% and 19%. There were no statistically reliable differences between SBES and STEM graduates on the “personal interest” index.

¹⁸ Indices were developed with the STEM data. We attempted to divide respondents into quartiles, but because many respondents had the same scores, this was not possible. Accordingly, the top group of each index was defined by the following ratings: “help with decisions,” 3.5 to 4.0; “personal interest,” 4.0; and “meet requirements,” 3.1 to 4.0. To facilitate comparisons of the STEM and SBES surveys, we used not only the same indices for the two surveys but also the same break-points for the four groups.

REASONS FOR NOT PARTICIPATING IN UNDERGRADUATE RESEARCH ACTIVITIES

Respondents who indicated that they had not participated in research (n = 1,575) were asked, “Which of the following help to describe why you did not participate in any hands-on research activities when you were in high school or a college undergraduate?” The response options are listed below, in descending order of the percentages of respondents who selected them.

(1) Research opportunities were not available to me (or I didn't know about them)	38%
(2) I didn't have time.....	34
(3) I was not interested in doing research	32
(4) It never occurred to me to do research	23
(5) The research opportunities that were available to me weren't interesting	8
(6) It didn't pay well enough (or at all).....	7
(7) Faculty did not conduct research at the school I attended.....	7
(8) My grades were not good enough.....	2
(9) I applied/asked about doing research but was turned down	1
(10) Other reasons	<1

Overall, it was much more common for students to *choose* not to participate in research than to be *unable* to participate (that is, unable either because research opportunities were not available or because the respondent was turned down): 73% of respondents selected one or more of the “choice” options (options 2,3,4,5,6), and 44% selected one or more of the “unable” options (options 1,7,8,9). These percentages were similar to those found in the STEM survey.

The rationales for non-participation that produced the largest differences among subgroups were “research opportunities were not available to me” and “I didn't have time.”

- Women were more likely than men to report that research opportunities were not available (42% vs. 31%) but less likely to report that they didn't have time for research (31% vs. 39%).
- Master's institutions graduates were the most likely and research-extensive university graduates the least likely to report that research opportunities were not available (46% vs. 32%); the percentages were essentially reversed for those who didn't have time for research (28% vs. 40%).
- Non-Hispanic whites were less likely than others to report that they didn't have time for research (32% of non-Hispanic whites, 39% of Asians, 46% of blacks, and 45% of Hispanics/Latinos)
- Blacks were the least likely and non-Hispanic whites the most likely to report that research opportunities were not available to them (27% of blacks, 31% of Hispanics/Latinos, 36% of Asians, and 40% of non-Hispanic whites).

Interestingly, the perception of availability of research opportunities did not increase appreciably over the 15 years covered by the survey, but the awareness of research as a personal option did: the percentage who selected “it never occurred to me” decreased over time: 31% of those who graduated between 1989 and 1992, 24% of those who graduated between 1993 and 1997, and 20% of those who graduated between 1998 and 2004. In the STEM survey, a parallel trend was observed, but the percentages were slightly smaller.

OVERVIEW OF REASONS FOR PARTICIPATING OR NOT

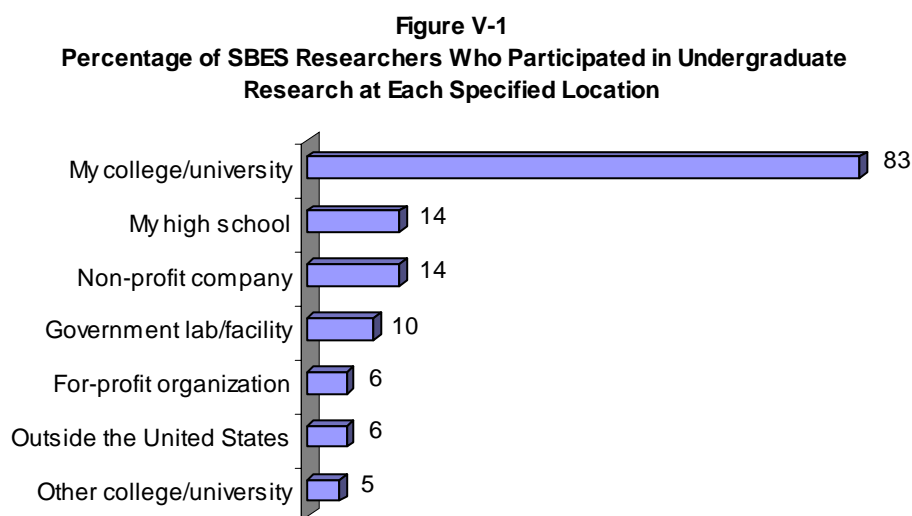
The most highly rated reasons for participating in undergraduate research reflected both personal interest in research and a need to meet academic requirements. Sponsored researchers stood out as being considerably more likely than their non-sponsored counterparts to use research to help them make career and academic decisions. Among SBES graduates who did not participate in research, *choosing* not to participate (for example, because “I didn’t have time” or “I wasn’t interested”) was much more common than being unable to participate (for example, because of the unavailability of research opportunities).

V. CHARACTERISTICS AND ACTIVITIES OF UNDERGRADUATE RESEARCH EXPERIENCES

In this chapter we describe the characteristics of undergraduate research experiences and the activities that comprised those experiences. The relationships between research activities/ characteristics and respondents' perceptions of the effects of their research experiences are discussed in Chapter VI.

LOCATION OF RESEARCH EXPERIENCES

Among those who participated in research, the vast majority (83%) did so at their own college or university; the next most common locations were the respondent's high school (14%) and a non-profit company (14%) (Figure V-1). STEM and SBES research-location percentages



Source: SRI International SBES graduates survey, 2004.

were very similar except that the percentages at non-profit and for-profit companies were reversed. Among STEM researchers, 15% did research at for-profits, and 8% did research at non-profits.

Not surprisingly given the predominance of research at one's own school, students whose school provided undergraduate research opportunities were much

more likely to have participated in research than were students at schools where there were no research opportunities (69% vs. 34%).

Subgroups who were more likely than their counterparts to have done research at particular locations are summarized below. (Note that all percentages are based on those who participated in research.)

- *High school*: sponsored researchers (28%), Hispanics (23%), men (19%).
- *Non-profit company*: social work majors (32%).
- *Government lab or facility*: criminology/criminal justice majors (33%).
- *For-profit company*: economics majors (19%), sponsored researchers (13%).
- *Outside the United States*: sponsored researchers (23%), "other SBES" majors (13%), economics majors (12%), and interdisciplinary SBES majors (11%) majors.
- *Other college/university*: sponsored researchers (13%)

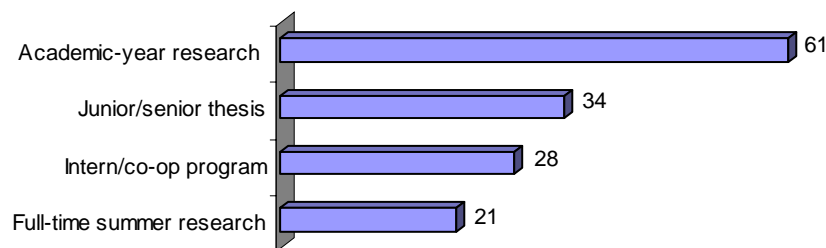
TYPES OF RESEARCH EXPERIENCES

Respondents were asked, “Which kinds of hands-on research activities (if any) did you participate in with a teacher, professor, or researcher, either during high school or while you were an undergraduate in college?” They selected from the following response options:

- Hands-on research with a professor during one or more academic terms, while attending classes.
- Intern or co-op program that involved hands-on research as its main component. Usually, a company or other organization pays you for working on a research project at their site. Sometimes you receive academic credit at your school for this research. May happen any time of year.
- A junior or senior thesis that involves hands-on research (other than library research) as its main component.
- Summer research, other than intern or co-op program. A full-time hands-on research project for the summer with a professor or researcher.
- Other kinds of hands-on research experiences with a teacher, professor, or researcher, in high school or as an undergraduate in college.

The most common type of undergraduate research was working with a professor or researcher during the academic year, reported by 61% of SBES researchers (Figure V-2). Least

Figure V-2
Percentage of SBES Researchers Who Participated
in Each Listed Type of Undergraduate Research



Source: SRI International SBES graduates survey, 2004.

common was full-time summer research, reported by 21% of researchers. The percentages who did each type of research are similar to those reported by STEM majors.

Summer research was far more common among sponsored researchers than among their non-sponsored counterparts (52% vs. 18%, respectively). Academic-

year research also was more common among sponsored than non-sponsored researchers, but the difference was relatively small (69% vs. 60%). Asians and Hispanics/Latinos were more likely than blacks and non-Hispanic whites, and men were more likely women, to have participated in summer research, paralleling the relatively large percentages of these Asians, Hispanics/Latinos, and men who participated in sponsored research.

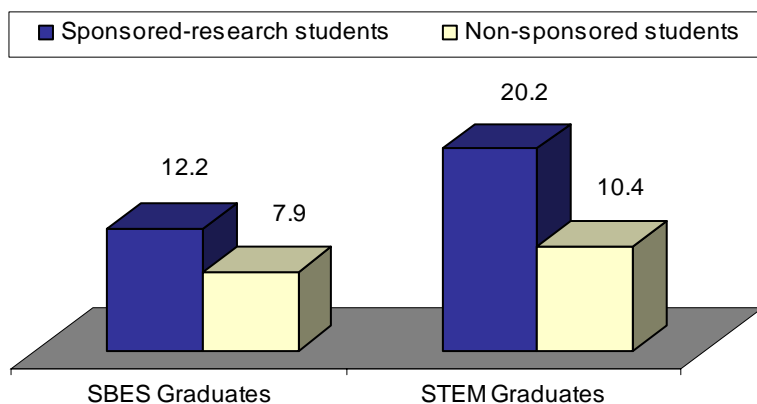
DURATION OF RESEARCH EXPERIENCES

Among those who engaged in each type of research, SBES graduates reported spending averages of approximately 6 months each on academic-year research, thesis research, and research-related intern/co-op programs, and 3.8 months on summer research. Overall, the

average number of months of research was 8.3.¹⁹ In each type of research, SBES graduates averaged fewer months than did STEM graduates. For example, STEM graduates averaged 9.0 months of academic-year research and 11.8 months of research in total.

As was the case with STEM graduates, the dimensions that showed the largest differences in overall research duration among SBES graduates were research sponsorship and academic major, but the differences among SBES graduates on both these dimensions were much smaller than those among STEM graduates. For SBES graduates, sponsored researchers reported an average of 12.2 months of research experience, compared with 7.9 months for non-sponsored researchers—a 4.3-month difference; the comparable durations for STEM graduates were 20.2 and 10.4—a 9.8-month difference (Figure V-3). Among SBES academic majors, research

Figure V-3
Mean Research Duration (in Months) for SBES and STEM Graduates,
by Research Sponsorship



Sources: SRI International STEM graduates survey, 2003, and SBES graduates survey, 2004.

duration ranged from a low of 6.4 months among criminology/criminal justice majors to a high of 9.6 months among “other SBES” majors—a 3.2 month difference. In contrast, the range for STEM graduates was from 7.9 months (mathematics majors) to 19.4 months (chemistry majors)—an 11.5 month difference.

Research duration differences among the major types of schools were small, and there were no statistically reliable differences on this measure between men and women, by race/ethnicity, or by year of degree.

RESEARCH ACTIVITIES

The questionnaire asked whether respondents did each of 17 activities as part of any of their undergraduate research experiences:

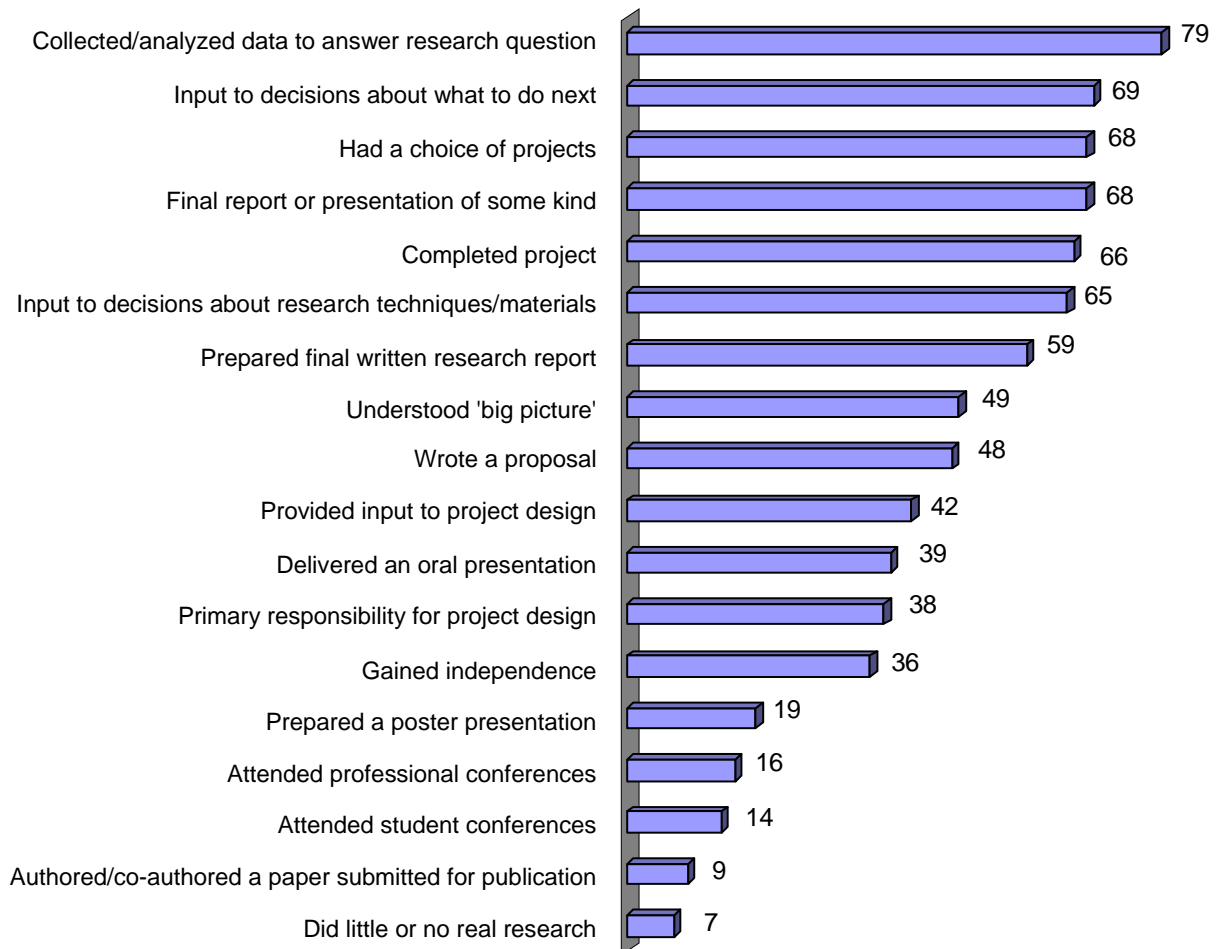
- Had a choice of projects to work on
- Had primary responsibility for designing the project that they worked on
- Provided input to designing their project (someone else had primary responsibility)
- Wrote a proposal describing the research they planned to do
- Had input to or responsibility for decisions about research techniques/materials
- Had input to or responsibility for decisions about what to do next

¹⁹ Note that this is a very crude measure of the amount of research conducted, because there was undoubtedly considerable variation in the hours spent on research over the duration of the research experience. For example, in SRI’s survey of NSF program participants, we found that summer programs averaged 37 hours per week of research-related activities, whereas the average hours per week for academic year programs was 15.

- Collected and/or analyzed data or information to try to answer a research question
- Did little or nothing that seemed to be real research
- Gained increasing independence over the course of the research
- Were able to complete their project
- Understood how their work contributed to the “bigger picture” of research in that field
- Attended student conference(s) that included students from other colleges
- Attended professional conference(s) (conferences not specifically for students)
- Prepared a poster presentation describing their research and results
- Prepared a final written research report describing their research and results
- Delivered an oral presentation describing their research and results
- Authored or co-authored a paper that was submitted for publication in a professional journal.

Figure V-4 lists the activities in abbreviated form and shows the percentages who reported engaging in each. Most common was the quintessential research activity, collecting/analyzing

Figure V-4
Percentage of SBES Researchers Who Reported Engaging in Each Listed Undergraduate Research Activity



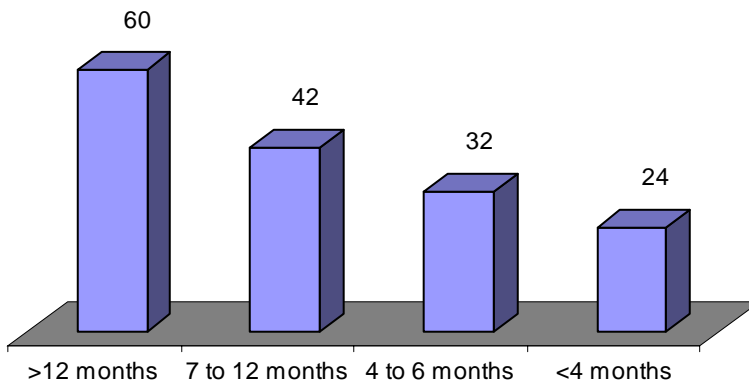
Source: SRI International SBES graduates survey, 2004.

data to try to answer a research question, which was done by 79% of researchers. Of the 16 activities (excluding “did little or nothing that seemed to be real research”), SBES undergraduate researchers participated in an average of 7.0. Only 7% felt that they did little or nothing that seemed to be real research.

The average number of activities and the percentages who did each activity were all quite similar to those reported by STEM researchers. The activity with the largest difference between the two groups was “understood how my work contributed to the ‘bigger picture’ of research in that field,” reported by 59% of STEM researchers and 49% of SBES researchers.

Not surprisingly, the longer a student participated in research, the greater the likelihood that s/he participated in any given activity. For example, only 24% of those who participated in research for less than 4 months gained increasing independence, whereas 60% of those who did research for more than 12 months gained increasing independence (Figure V-5).

Figure V-5
Percentage of SBES Researchers Who Gained Increasing Independence, by Duration of Undergraduate Research



Source: SRI International SBES graduates survey, 2004.

Correspondingly, the mean total number of activities ranged from 5.8 among those with less than 4 months experience to 8.9 for those with more than 12 months experience. (Henceforth, we refer to those with more than 12 months of research experience as “high-experience” researchers.)

Unlike the findings for STEM researchers, SBES sponsored researchers did not tend to participate in a greater number of activities than did

non-sponsored researchers. (This is at least partly because, as shown in Figure V-3, the difference between sponsored and non-sponsored researchers in research duration was much smaller for SBES than for STEM.) Moreover, a comparison of participation rates for individual activities showed that for three of the five activities with the largest differences, non-sponsored researchers had *higher* participation than did sponsored researchers. Non-sponsored researchers were more likely than their sponsored counterparts to have collected/analyzed data to try to answer a research question (81% vs. 61%, respectively), to have been able to complete their project (67% vs. 51%), and to have prepared a final report (60% vs. 47%). Also notably, only half as many non-sponsored as sponsored researchers said that they did no real research (6% vs. 13%). On the other hand, non-sponsored researchers were less likely than sponsored researchers to have had input to project design (41% vs. 53%) and to decisions about what techniques and materials to use (63% vs. 76%).

The differences in research activities by type of school paralleled those found for STEM students. Students at research-extensive universities were less likely than average to have been involved in 11 of the 16 types of experiences/activities listed. In contrast, students at baccalaureate colleges were more likely than average to have been involved in 9 of the 16

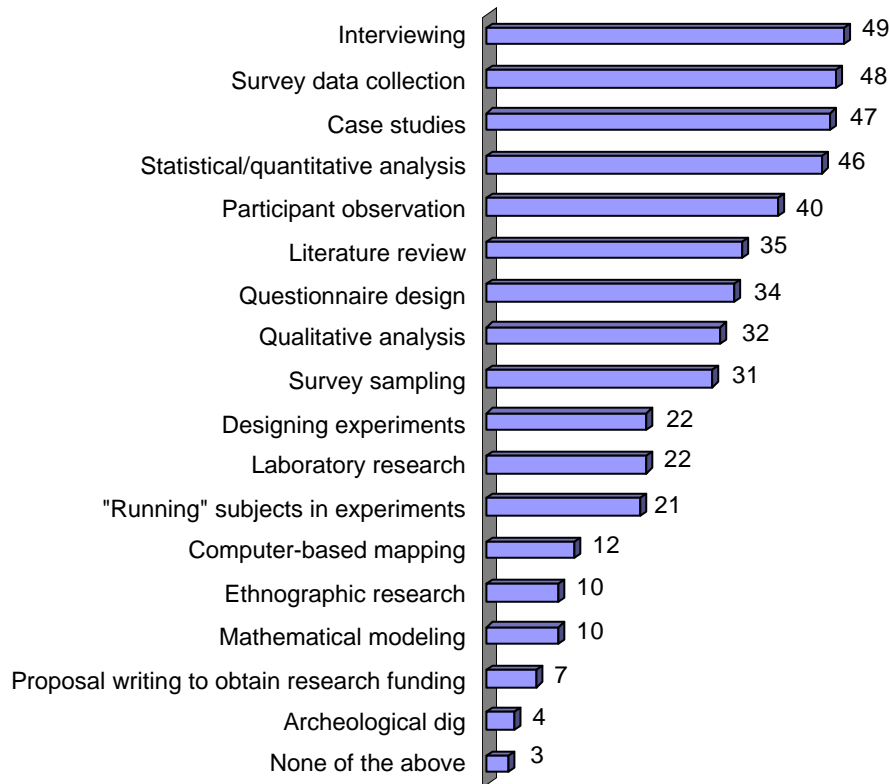
activities, and they were not lower than average on any activities. For example, SBES undergraduates in baccalaureate colleges were the most likely, and those in research extensive universities the least likely to have had a choice of projects/research topics to work on, to have been involved in project design and other project decisions, and to have gained increasing independence over the course of the research.

Research activities showed few appreciable differences and no discernable patterns of differences between men and women, among the racial/ethnic groups, or among academic majors.

RESEARCH METHODS AND APPROACHES

SBES researchers were asked to indicate which of 17 types of research they had engaged in as undergraduates (Figure V-6). The top four choices showed a mixture of qualitative and quantitative methods: interviewing, survey data collection, case studies, and statistical/quantitative analysis. Predictably, percentages varied substantially by major, but only two of the methods were not engaged in at all by some majors (no criminology or social work major participated in any archeological digs, and no social work major did any lab research). Also, the two most common methods overall—interviewing and survey data collection—were among the most common activities of majors in every SBES field.

Figure V-6
Percentage of SBES Researchers Who Reported
Engaging in Each Listed Type/Aspect of Research



Source: SRI International SBES graduates survey, 2004.

ACADEMIC CREDIT AND PAY FOR UNDERGRADUATE RESEARCH

SBES students were slightly more likely than STEM students to have received academic credit for at least some of their undergraduate research activities (77% vs. 70%, respectively). However, they were quite a bit less likely to have received pay (22% vs. 41%).

As was the case with STEM students, SBES sponsored researchers were much more likely than their non-sponsored counterparts to have received pay (53% vs. 19%), and some of the groups with relatively high percentages of sponsored researchers (Asians, students in research-intensive universities, and economics majors) also had relatively high percentages who received pay. Note that receipt of pay is largely a function of participation in a summer program.

The dimension that showed the largest differences in the percentages who received academic credit for their research activities was academic major. Majors in criminology/criminal justice and social work were the most likely to have received credit (89% and 88%, respectively), whereas economics majors were the least likely to have done so (61%).

RELATIONSHIP BETWEEN RESEARCH AND COURSEWORK

Almost all SBES researchers reported that most of their research was in the same academic field as their major (87%) and at least somewhat related to the courses they took in their major (90%—49% “closely related,” 41% “somewhat related.”) These percentages are almost identical to those for STEM majors. Academic fields with relatively high correspondence between research and coursework were psychology and social work; those with relatively low correspondence were interdisciplinary SBES and economics. For instance, the percentages of each of these majors who reported that most of their research was in their major field were: psychology, 93%; social work, 98%, economics 74%, and interdisciplinary SBES, 80%. Women were slightly more likely than men to have conducted research in the same field as their major (91% vs. 82%), and their research was more likely to be closely related to their coursework (54% vs. 39%). These male/female differences reflected women’s predominance among psychology and social work majors and men’s predominance among economics majors.

OVERVIEW OF UNDERGRADUATE RESEARCH CHARACTERISTICS AND ACTIVITIES

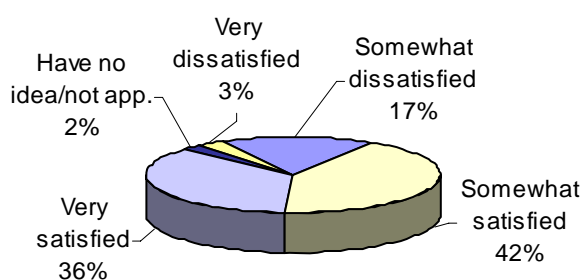
The vast majority of undergraduate research was done at one’s own school, was in the same field as one’s major, and was at least somewhat related to one’s coursework. About three-fourths of researchers received academic credit for at least some of their research, but only about a fifth received pay for any of it. Research was most commonly conducted with a professor or researcher during the academic year. Overall, only about a fifth of researchers participated in summer programs, but half of sponsored researchers did so. On average, SBES researchers spent a total of 8.3 months doing research, 3.5 months less than the average for STEM researchers. Eight in 10 SBES researchers collected/analyzed data to try to answer a research question, most prepared some kind of final report or presentation, and most had at least some input to project decisions. Sponsored and non-sponsored researchers were not appreciably different in the numbers of research activities in which they engaged, nor did either group hold a consistent advantage over the other in their rate of participation in the various individual activities. Predictably given the diversity of majors, the research methods used were diverse and reflected both quantitative and qualitative approaches. Interviewing and survey data collection were among the most common methods in every SBES major.

VI. PARTICIPANTS' PERCEPTIONS OF UNDERGRADUATE RESEARCH

Respondents who participated in undergraduate research were asked a variety of attitudinal questions about their experiences, including their satisfaction with various aspects of their undergraduate research opportunities (UROs) and their perceptions of the effects that the UROs had on them. The kinds of effects covered included gains students believed that they had made on various dimensions as a result of their undergraduate research experiences, perceived effects of research on respondents' career decisions, and increased or decreased interest in several related career areas.

SATISFACTION WITH OPPORTUNITIES FOR UNDERGRADUATE RESEARCH²⁰

Figure VI-1
Satisfaction of SBES Researchers with the Variety of Opportunities at Their College/University to Do Research

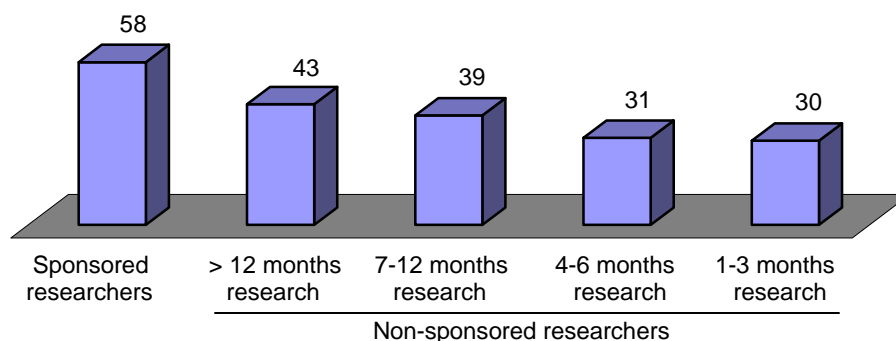


Source: SRI International SBES graduates survey, 2004.

SBES undergraduate researchers were asked how satisfied they were with several aspects of UROs at their college/university: how well they were informed about the UROs, the variety of UROs, and the UROs' relevance to the respondent's interests. Response distributions to the three questions were very similar. For instance, respondents were far more likely to be satisfied than dissatisfied with the variety of UROs at their school (78% vs. 20%), but only about a third were very satisfied (Figure VI-1). The dimensions that showed the greatest differences among subgroups were research sponsorship and duration: the percentage who

were very satisfied with the variety of their UROs ranged from 58% of sponsored researchers to 30% of non-sponsored researchers who had done less than 4 months of research (Figure VI-2).

Figure VI-2
Percentage of SBES Researchers Very Satisfied with the Variety of Opportunities at Their College/University to Do Research, by Research Sponsorship and Duration of Undergraduate Research



Source: SRI International SBES graduates survey, 2004.

²⁰ Questions about satisfaction with UROs were not asked of STEM graduates.

There were no appreciable differences between men and women in their responses to the three satisfaction questions, and differences on other dimensions—race/ethnicity, type of school, and academic major—tended to be quite small.

SBES researchers also were asked if they felt they had done about the right amount of research as an undergraduate or if they now wished they had done more or less research. Respondents were split almost equally between those who felt they had done about the right amount (48%) and those who wish they had done more (49%). Almost no one wished s/he had done less (2%). As with the satisfaction issues, breakouts by sponsorship and duration produced the greatest subgroup differences, although the differences on this issue were not very large. Percentages who wished they had done more research ranged from highs of about 50% among non-sponsored researchers with 12 months or less research experience to about 40% of sponsored and high-experience non-sponsored researchers.²¹

PERCEPTIONS OF GAINS IN UNDERSTANDING, CONFIDENCE, AND AWARENESS

Respondents were asked to rate the extent to which their undergraduate research experiences had increased their understanding, skills, confidence, etc. on various dimensions. They used a 4-point scale on which 1 = not at all, 2 = somewhat, 3 = a fair amount, and 4 = a great deal. Table VI-1 shows the individual items asked and the percentage distributions of responses.

Ninety percent or more of respondents indicated increases of at least “somewhat” on all except one of the dimensions listed. Dimensions that showed the greatest impact were understanding of how to conduct a research project (84% reported increases of a fair amount or a great deal), skills/abilities in working independently (83%), and understanding how to plan a research project (81%). The dimension that produced the least impact (with 53% reporting increases of a fair amount or a great deal) was awareness of what graduate school is like.

Factor analyses of the items showed that most fell into one of three clusters:

Increased understanding:

- How to formulate a research question
- How to plan a research project
- How to conduct a research project
- How to deal with setbacks, “negative results,” etc.
- How scientific knowledge is built

Increased confidence:

- Confidence in your research skills generally
- Confidence in your ability to succeed in grad school
- Qualifications for jobs in related fields

²¹The average research duration among high-experience non-sponsored researchers was 22.8 months, almost twice as long as the 12.2-month average duration for sponsored researchers. Given this differential, it is surprising that the percentages who wished that they had done more were the same.

Table VI-1
SBES Researchers' Perceptions of Gains on Various Dimensions
as a Result of Undergraduate Research Experiences
(Listed in descending order of mean rating)

Number of respondents: 1600

	Mean	How Much Each Increased:				
		Not At All	Some-what	A Fair Amount	A Great Deal	Have No Idea
Your understanding of how to conduct a research project (U)	3.31	3%	12%	35%	49%	< 1%
Your skills/abilities in working independently	3.30	3	13	35	48	1
Your understanding of how to plan a research project(U)	3.23	4	15	35	46	< 1
Your understanding of the nature of the job of a researcher	3.17	4	17	38	41	1
Your skills/abilities in working collaboratively with others	3.16	5	17	34	43	1
Your confidence in your research skills generally (C)	3.14	3	18	40	38	1
Your understanding of how to formulate a research question (U)	3.13	5	18	35	41	1
Your understanding of how scientific knowledge is built (U)	3.06	6	19	37	37	1
Your awareness of career paths of the faculty you worked with (how they got to where they were when you worked with them) (A)	3.05	7	18	35	38	2
Your awareness of the variety of problems/issues that researchers in your major investigate [not asked in STEM survey]	3.05	5	20	38	36	< 1
Your understanding of how to deal with setbacks, "negative results," etc. (U)	3.02	7	19	38	35	1
Your confidence in your ability to succeed in grad school (C)	2.92	10	20	37	32	2
Your qualifications for jobs in related fields (C)	2.89	10	22	37	30	2
Your awareness of the variety of social/behavioral science fields you could specialize in (A)	2.84	10	24	38	28	1
Your awareness of career options in social/behavioral sciences (A)	2.84	10	24	38	28	< 1
Your awareness of what graduate school is like (A)	2.58	18	28	31	22	2

This table shows, for example, that 3% of SBES graduates who participated in undergraduate research indicated that their understanding of how to conduct a research project were "not at all" increased by their research experience.

Notes: Mean is calculated on a 4-point scale where 1 = not at all, 2 = somewhat, 3 = a fair amount, and 4 = a great deal.

(U) = part of the "understanding" index

(C) = part of the "confidence" index

(A) = part of the "awareness" index.

Source: SRI International SBES graduates survey, 2004.

Increased awareness:

Career paths of the faculty in the program (how they got to where they are now)

What graduate school is like

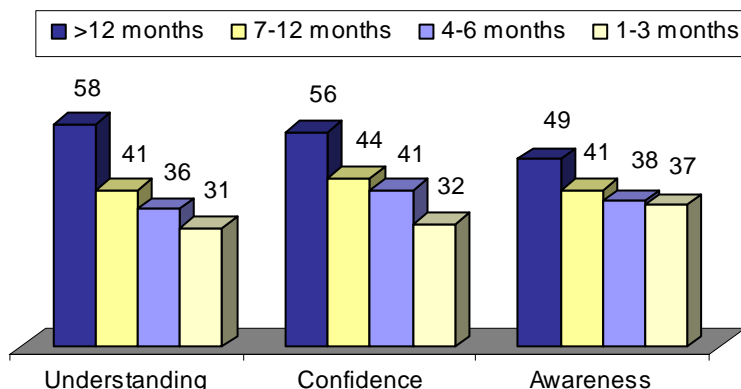
The variety of SBES fields you could specialize in

Career options in SBES

Each cluster of variables comprises an index,²² the score of which was calculated as the mean of the respondent's responses to each item in the index. Respondents whose scores are in the top quartile²³ of each index are termed "high gainers." For the most part, subgroup comparisons are based on comparisons of the percentages who are high gainers. This is a less precise measure than mean scores, but it is more intuitive.

Dimensions for which subgroup comparisons were made included those for which other findings have been reported: research duration and sponsorship, sex, race/ethnicity, academic major, and type of school. In addition, we looked at the relationship between gains and many other study variables, including motivations for participating in research, undergraduate grade point average (GPA), when the respondent became interested in SBES, participation in high school math/science fairs, importance of research to one's career decision, whether academic credit and/or pay was received for research activities, relationship to coursework, and specific research activities. Findings from these analyses are reported below, first for the "basic" analysis variables and then for the additional ones.

Figure VI-3
Percentages of SBES Researchers Who Were "High Gainers"
in Understanding, Confidence, and Awareness,
by Duration of Undergraduate Research



Source: SRI International SBES graduates survey, 2004.

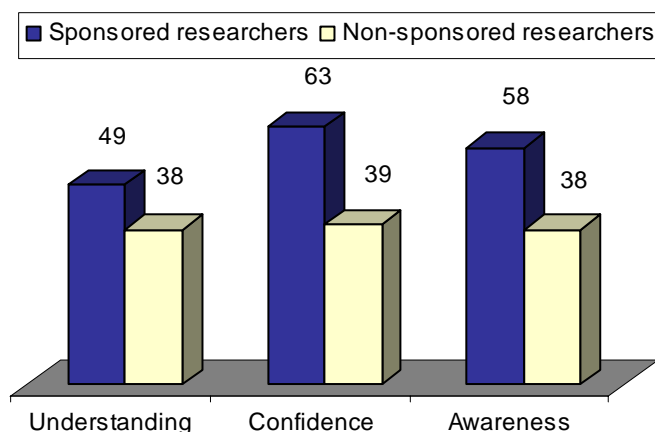
Predictably, high-experience researchers were considerably more likely to be high gainers than were those with less research experience (Figure VI-3). The differences were greatest with regard to gains in understanding: here, the percentage of high gainers ranged from 31% among those with 1 to 3 months of research experience to 58% among high-experience researchers.

²² Four items were not included in an index. Three of them—your skills/abilities in working independently, your skills/abilities in working collaboratively with others, and understanding the nature of the job of a researcher—did not correlate highly with any of the other items nor with each other. A fourth item—awareness of the variety of problems/issues that researchers in your major investigate—was included in only the SBES survey.

²³ The quartiles were established using the STEM survey results. Because many respondents had the same index score, defining precise quartiles was not possible. The top quartile of the awareness index comprised those with ratings of 3.2 to 4.0, the top quartile of the understanding index comprised those with ratings of 3.6 to 4.0, and the top quartile of the confidence index comprised those with ratings of 3.1 to 4.0.

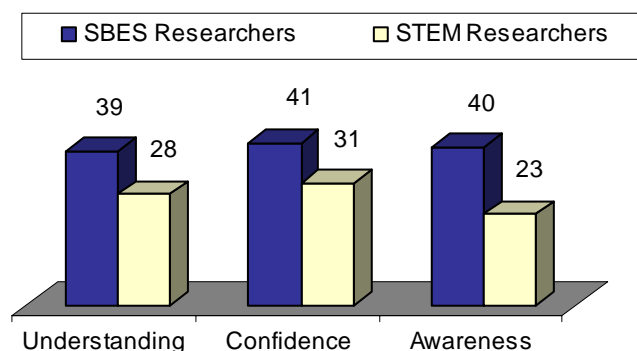
Sponsored researchers were more likely than their non-sponsored counterparts to be high gainers (Figure VI-4). Interestingly, the *smallest* differences between these two groups were on the

Figure VI-4
Percentages of SBES Researchers Who Were "High Gainers" in Understanding, Confidence, and Awareness, by Research Sponsorship



Source: SRI International SBES graduates survey, 2004.

Figure VI-5
Percentages of SBES and STEM Researchers Who Were "High Gainers" in Understanding, Confidence, and Awareness



Source: SRI International SBES graduates survey, 2004.

understanding index. The relatively large differences between sponsored and non-sponsored students on awareness and confidence suggest that formal programs like REU may place a greater emphasis on preparing students for graduate school and careers than do other research opportunities.

The findings that SBES researchers tended to have less research experience than STEM researchers (averaging 8.3 and 11.8 months, respectively) and were somewhat less likely to be sponsored researchers (9% vs. 14%) led us to expect that SBES gains would be smaller than STEM gains. In fact, however, SBES researchers tended to have higher perceived gains than did STEM researchers on all three indices (Figure VI-5). This was true for the overall SBES and STEM groups, as well as for sponsored researchers, non-sponsored researchers, and each research-duration subgroup. The reasons for these differences are unclear.

On the dimensions of sex, race/ethnicity, academic major, and type of school, differences in perceived gains were small and variable across the three indices, as summarized below.

- Men gained slightly more than women in awareness and confidence but slightly less in understanding.
- Hispanics'/Latinos' gains in awareness and confidence were higher than average and non-Hispanic whites' were lower than average, whereas blacks had higher than average gains in understanding.
- Interdisciplinary SBES and "other SBES" majors had higher than average gains in awareness and confidence, criminology/criminal justice majors had lower than average gains in confidence and understanding, sociology majors had lower than average gains in awareness, and psychology majors had lower than average gains in confidence.

- On the awareness index, graduates of research-extensive universities had higher than average scores and masters institution graduates had lower than average scores, but the differences were very small, and there were no statistically reliable differences on the understanding and confidence indices. Baccalaureate college graduates' above-average rates of participation in various research activities (see pages 22 and 23, above) did not translate into above-average gains.

In reviewing the relationships between the gains indices and other study variables, we found that, for the most part, variables that were related to one of the gains indices also were related to the others at a similar level. To simplify reporting, we limit our discussion to correlates of the confidence index.

Many of the study variables that had strong relationships with gains in confidence measured intensity of interest/involvement in the research process: duration of undergraduate research (discussed above), the importance of undergraduate research to one's career decision, number of research activities, and the importance of various reasons for participating in research.²⁴ Other variables that had strong relationships with confidence gains were undergraduate GPA (which might be considered a measure of involvement with academics in general) and research activities that bring students into the research community: authoring articles for professional journals and attending student/professional conferences.

Table VI-2 lists each of the variables noted above. It illustrates the relationship between each variable and the index of increased confidence by showing, for contrasting groups, the percentages who were high gainers on the confidence index. For instance, the table shows that 61% of students who said their undergraduate research was extremely important to their career decision were high gainers on the confidence index, compared with only 15% of those for whom undergraduate research was not important to their decision.

²⁴ It is interesting that feeling strongly about a reason for participating in research tended to be related to confidence gains. We suspect that these relationships reflect enthusiasm (or lack thereof) about the research experience that was generalized to both the antecedents and outcomes of the experience. That is, respondents who thought they gained a lot from their research experiences felt strongly about why they participated, whereas those who didn't think research taught them much did not ascribe much significance to their reasons for participation. It is also interesting that participating in research to meet academic requirements did not correlate nearly as strongly with perceived gains as did participating because of personal interest or to help make an academic/career decision. We interpret this finding as suggesting that research participation is most likely to be an effective motivator when it is done voluntarily.

Table VI-2
Selected Correlates of Perceived Increases in SBES Researchers' Confidence

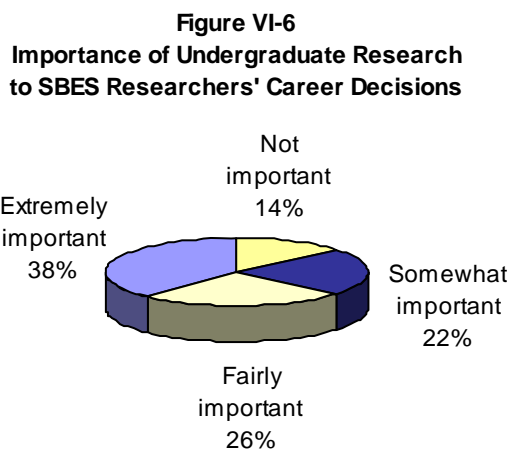
	Group with the Largest Percentage of High Confidence Gainers		Group with the Smallest Percentage of High Confidence Gainers	
Importance of undergraduate research to career decision	Extremely important	61%	Not important	15%
Why participate in research: needed help with a career/academic decision (index)	Very important	62	Not important	18
Why participate in research: doing research was more appealing than other kinds of jobs	Very important	64	Not important	30
Why participate in research: personal interest (index)	Very important	60	Not important	26
Why participate in research: thought it would help me get into graduate/medical school or get a job	Very important	53	Not important	24
Number of research activities	10+	58	< 5	30
Undergraduate grade point average	3.90+	56	< 3.0	31
Authored/co-authored professional journal article	Yes	61	No	39
Attended student conferences	Yes	59	No	38
Attended professional conferences	Yes	58	No	38

This table shows, for example, that 61% of SBES researchers who said their undergraduate research was extremely important to their career decision were high gainers on the confidence index, vs. only 15% of those for whom undergraduate research was not important to their decision.

Note: "High confidence gainers" are those whose mean ratings on the index of increased confidence were between 3.1 and 4.0.

Source: SRI International SBES graduates survey, 2004.

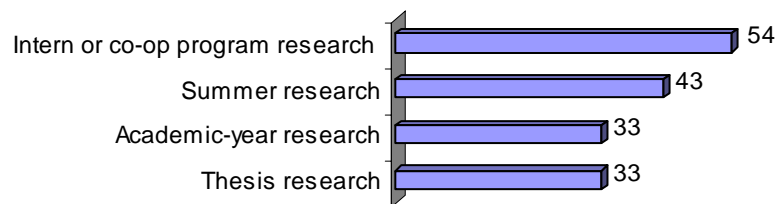
EFFECT OF RESEARCH EXPERIENCES ON RESPONDENTS' CAREER DECISIONS



Source: SRI International SBES graduates survey, 2004.

Respondents were asked to rate the importance of each type of research that they engaged in to their career decision. On a 4-point scale where 1 = not important, 2 = somewhat important, 3 = fairly important, and 4 = extremely important, about 4 in 10 respondents reported that at least one of the types of research they engaged in was extremely important to their career decision (Figure VI-6). Only 14% said research was not important. The overall mean rating was 2.89. Research in an intern or co-op program tended to be the most influential. Of those who participated in such a program, 54% rated it as extremely important (Figure VI-7). All these percentages were very similar to those of STEM graduates.

Figure VI-7
Percentage of SBES Participants In Each Type of Research Program Who Rated That Research as Extremely Important to Their Career Decision



Source: SRI International SBES graduates survey, 2004.

Sponsored students rated all types of research as more influential than did non-sponsored students. Overall, 62% of sponsored students and 36% of non-sponsored students rated their undergraduate research as extremely important. However, ratings of high-experience non-sponsored researchers were virtually identical to those of sponsored students.

Among racial/ethnic groups, Hispanics'/Latinos' influence ratings were higher than those of other groups (mean rating = 3.22; 52% rated their research as extremely important, compared with 38% overall). There were no appreciable differences in influence ratings between men and women or by type of school or academic major.

EFFECT OF RESEARCH EXPERIENCES ON INTEREST IN VARIOUS CAREERS

Respondents who participated in research were asked to rate the extent to which their interest in various types of careers had increased or decreased as a result of their undergraduate research experiences. The types of careers listed were: social/behavioral sciences, research, teaching, medicine, law, business, public policy, and social work. Respondents provided their ratings on a 5-point scale where 1 = decreased a lot, 2 = decreased somewhat, 3 = no effect, 4 = increased somewhat, and 5 = increased a lot. A "have no idea" response option was also provided. Table VI-3 summarizes responses to these questions.

About 6 in 10 graduates said that their interest in careers in social/behavioral sciences was increased somewhat or a lot, and 28% said that their interest increased a lot. As expected, the careers least influenced were those the least likely to be related to SBES research: business, law, and medicine. For careers asked about in both STEM and SBES surveys (SBES/STEM, teaching, research, and medicine), the mean responses by the two groups of respondents were very similar.

For the most part, increased interest in the various career areas was positively related to research sponsorship and duration. The differences were especially large with regard to interest in a career in research. Sponsored students' mean rating of changed interest in a research career was 4.01, compared with a means of 3.49 for high-experience non-sponsored students and 3.32 for non-sponsored students overall; the percentages of each group who reported their interest increased were 76%, 54%, and 45%, respectively.

Predictably, there were sizable differences across the various academic majors in the effects of research on interest in the various types of careers—especially those careers that tended to be related to specific majors. For example, social work majors were the most likely to report that their interest in a career in social work increased as a result of their research; political science, interdisciplinary SBES, and economics majors were the most likely to have increased interest in a career in public policy; and economics and interdisciplinary SBES majors were the most likely to have increased interest in a career in business (Table VI-4).

Table VI-3
Effect of Undergraduate Research Experiences
on SBES Researchers' Interest in Careers in Various Areas
(Listed in descending order of mean rating)

Career in:	Mean	Decreased	No effect/ Have no idea	Increased somewhat	Increased a lot
Social/behavioral sciences	3.78	10%	28%	34%	28%
Social work	3.49	11	43	26	19
Teaching	3.46	12	45	25	18
Public policy	3.40	8	55	23	14
Research	3.39	22	30	29	19
Business	3.32	10	60	18	13
Law	3.28	10	61	17	12
Medicine	3.22	10	64	16	10

This table shows, for example, that 10% of SBES graduates reported that their interest in a career in social/behavioral sciences had decreased as a result of all their research experiences.

Note: Mean is calculated on a 5-point scale where 1 = decreased a lot, 2 = decreased somewhat, 3 = no effect,/have no idea, 4 = increased somewhat, and 5 = increased a lot.

Source: SRI International SBES graduates survey, 2004.

Table VI-4
Effect of Undergraduate Research on Interest in Different Types of Careers,
for Selected SBES Academic Majors

Career in:	Above-Average Effect		Below-Average Effect	
	Academic Major	Mean	Academic Major	Mean
Social/behavioral sciences	Sociology	4.04	Economics	3.55
			Political science	3.58
Social work	Social work	4.07	Political science	3.15
			Other SBES	3.21
Teaching	Interdisciplinary SBES	3.67	[none]	
Public policy	Political science	3.82	Psychology	3.21
	Interdisciplinary SBES	3.65		
	Economics	3.59		
Research	Economics	3.59	Social work	2.97
	Interdisciplinary SBES	3.57	Psychology	3.29
Business	Economics	4.13	Social work	3.01
	Interdisciplinary SBES	3.52	Psychology	3.17
Law	Criminology	3.97	Other SBES	2.99
	Interdisciplinary SBES	3.51	Psychology	3.11
	Political Science	3.51		
Medicine	Psychology	3.30	Political science	2.95
			Criminology	3.04

This table shows, for example, that sociology majors reported above-average increases in interest in a career in social/behavioral sciences as a result of their undergraduate research experiences (mean rating = 4.04).

Note: Mean is calculated on a 5-point scale where 1 = decreased a lot, 2 = decreased somewhat, 3 = no effect,/have no idea, 4 = increased somewhat, and 5 = increased a lot.

Source: SRI International SBES graduates survey, 2004.

Among the racial/ethnic groups, non-Hispanic whites had lower than average mean ratings for all career areas except social/behavioral sciences. Hispanic/Latinos and Asians tended to have higher than average means. The only appreciable differences between men and women were with regard to a career in business (mean ratings of 3.55 for men and 3.19 for women); these differences reflect at least in part the much greater proportion of men than women who were economics majors. There were only very small differences by degree year and type of school.

OVERVIEW OF PERCEPTIONS OF UNDERGRADUATE RESEARCH

Undergraduate SBES researchers had very positive perceptions of their research experiences:

- Almost all felt that they had gained at least somewhat on all dimensions of understanding, confidence, and awareness that were covered in the questionnaire.
- About two-thirds said their research was extremely or fairly important to their career decision and that their interest in a career in social/behavioral sciences had increased at least somewhat as a result of their research experiences.
- About 8 in 10 said that they were somewhat or very satisfied with the variety of opportunities for research at their school, how well informed they were about them, and the opportunities' relevance to the respondent's interests.

Research duration and sponsorship were positively related to all these variables. Other dimensions that were related to perceived gains included needing help with an academic or career decision as a reason to participate in research, personal interest as a reason to participate in research, undergraduate GPA, authorship of professional journal articles, and attendance at student or professional conferences. Study findings on these issues tended to be very similar to those for STEM researchers, except that SBES researchers tended to have markedly higher perceived gains in understanding, confidence, and awareness than did STEM researchers.

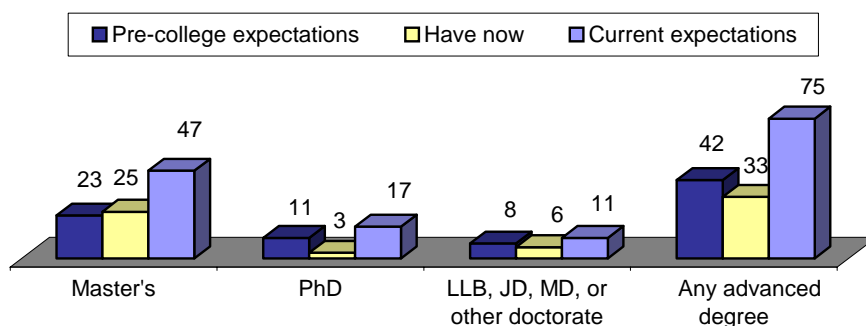
VII. ACADEMIC DEGREES AND EMPLOYMENT IN ACADEMIA

One of the major objectives of undergraduate research—or at least that of most of the sponsored programs—is to increase the number of students who pursue a PhD and a career in the scientific/academic community. In this chapter, we discuss findings regarding respondents’ highest degree expectations before they started college,²⁵ the highest degree they had completed at the time of the survey, and the highest degree they expected to have 10 years in the future.²⁶ We also report on the percentages currently employed in academia.

ACADEMIC DEGREE EXPECTATIONS AND ATTAINMENT

About half of the survey respondents reported that before they started college they expected to obtain an advanced degree (master’s or doctorate). At the time of the survey, a third reported that they had obtained an advanced degree, and three-fourths expected that they would have an advanced degree 10 years from now (Figure VII-1). Thus, the college experience in general tended to raise students’ degree expectations, although many had not yet achieved those expectations. Even among the earlier graduates in the group (those who graduated between 1989

Figure VII-1
Percentages of SBES Graduates Who Expected/Attained Advanced Degrees



Source: SRI International SBES graduates survey, 2004.

and 1992), there was a sizeable number whose academic expectations had not yet been achieved. For example, 16% of the 1989-1992 graduates reported that they expected to have a PhD in the next 10 years (that is, by 2014), but, 12-plus years after obtaining their bachelor’s degree, only 5% had yet obtained one.

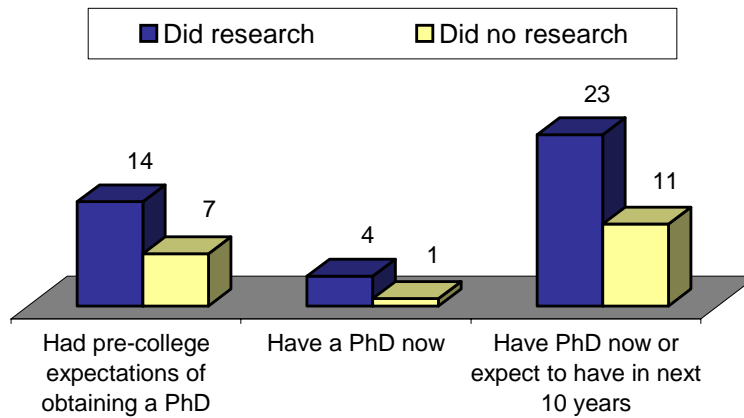
Undergraduate research was positively related to both expectations and attainment of a PhD. Compared with those who did not participate in undergraduate research, SBES graduates who participated in research were more likely to have pre-college degree expectations of obtaining a PhD, to have completed a PhD at the time of the survey, and to expect to obtain a PhD in the

²⁵ Respondents who had participated in undergraduate research were asked, “Before you participated in any undergraduate research, what was the highest degree you expected to receive?”

²⁶ We noted in the questionnaire, “This may be a degree you have already completed.”

future. For each measure, the percentage of researchers who expected/attained a PhD was at least double the corresponding percentage of non-researchers (Figure VII-2). Most strikingly, 23% of researchers either had completed a PhD at the time of the survey or expected to complete one in the next 10 years,²⁷ compared with 11% of non-researchers.

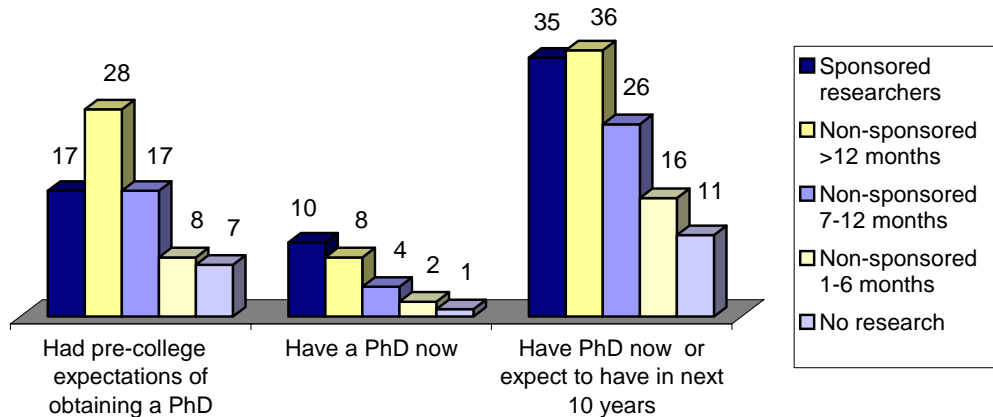
Figure VII-2
Percentages of SBES Graduates Who Expected/Obtained a PhD,
by Whether the Respondent Participated in Undergraduate Research



Source: SRI International SBES graduates survey, 2004.

Sponsored and high-experience non-sponsored researchers had even more impressive percentages: 17% of sponsored researchers and 28% of high-experience non-sponsored researchers had pre-college expectations of obtaining a PhD, and 35% to 36% of these two groups either had a PhD at the time of the survey or expected to obtain one in the next 10 years (Figure VII-3).

Figure VII-3
Percentages of Each Specified Group of SBES Graduates
Who Expected/Attained a PhD

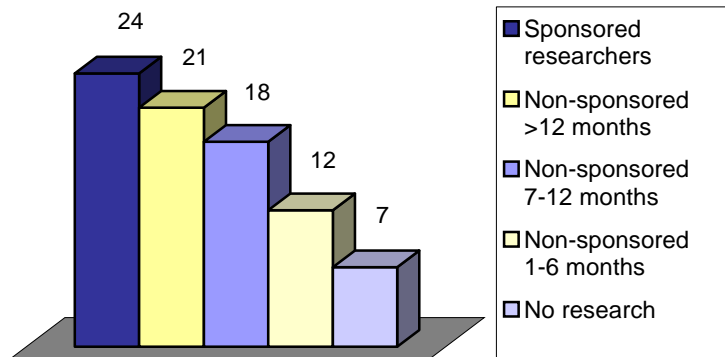


Source: SRI International SBES graduates survey, 2004.

²⁷ Expectations of a PhD include those who expected to obtain *either* an MD or PhD (not sure which one) and those who expected to *obtain* both an MD *and* a PhD.

We also found that students who participated in research were twice as likely as those who did not do so to have “new” expectations of obtaining a PhD:²⁸ 15% vs. 7%, respectively. Sponsored and high-experience non-sponsored researchers were especially likely to have new expectations of obtaining a PhD (Figure VII-4). These findings suggest that undergraduate

Figure VII-4
Percentage of Each Specified Group of SBES Graduates Who Had "New" PhD Expectations (Did Not Have Pre-College Expectations of Obtaining a PhD but Have/Expect One Now)



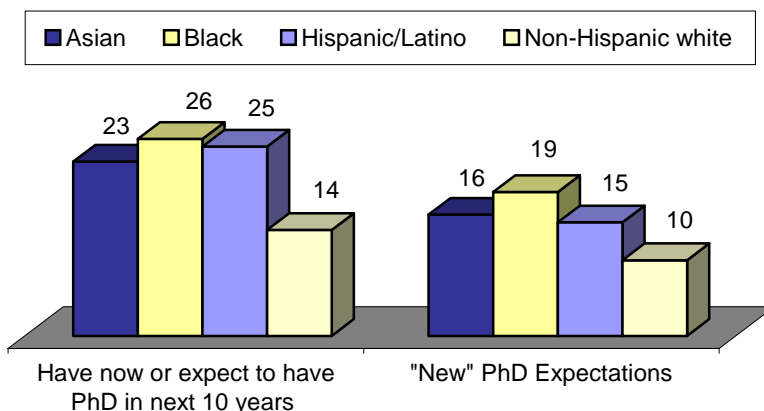
Source: SRI International SBES graduates survey, 2004.

research tends to attract those who are already highly academically motivated, but it also helps to encourage even those who were not originally motivated to obtain a PhD to do so.

These findings are similar to those found for STEM graduates, except that among STEM graduates, sponsored researchers had consistently higher expectation and attainment percentages than did non-sponsored high-experience researchers. This difference between the two surveys may reflect research duration differences. Among STEM

graduates, sponsored and non-sponsored high-experience researchers averaged quite similar durations: 20 and 24 months, respectively. In contrast, among SBES graduates, sponsored researchers averaged only about half as much research as their high-experience non-sponsored counterparts: 12 and 23 months, respectively. Given the much shorter amount of time the SBES sponsored group spent on research than did the SBES non-sponsored high-experience group, the strength of the research effect on them is particularly impressive.

Figure VII-5
PhD Expectations of SBES Graduates, by Race/Ethnicity



Source: SRI International SBES graduates survey, 2004.

Among the racial/ethnic groups, non-Hispanic whites were less likely than others to have new expectations of a PhD and to expect to have a PhD 10 years from now (Figure VII-5). There were no differences among the racial/ethnic groups in the percentages who had pre-college expectations of a PhD or who had completed a PhD at the time of the survey.

Among academic majors, graduates in psychology were considerably the most likely to

²⁸ By “new” expectations, we mean those who did not have pre-college expectations of obtaining a PhD, but at the time of the survey they had either obtained a PhD or expected to do so in the next 10 years.

have pre-college expectations of obtaining a PhD (19%); those in criminology/criminal justice were the least likely (1%). Percentages of graduates in other fields who had pre-college PhD expectations ranged between 5% and 11%. Psychology majors also were more likely than average to have completed a PhD at the time of the survey (5%) and to expect to have a PhD in the next 10 years (23%), but the percentage with new expectations of a PhD (13%) was average. The only other group besides psychology majors with above-average percentages on any of these measures was the interdisciplinary SBES group, who were notable for their percentages who expected a PhD in the next 10 years (21%) and had new expectations of a PhD (15%).

There were only small differences on measures of PhD expectations and attainment between men and women and by type of school.

Among researchers, those who expected/attained a PhD tended to have higher gains in confidence, understanding and awareness than those who did not have these expectations/attainments, although the relationship was not as strong as one might have expected. For instance, 30% of those in the top quartile on the confidence gains index had a PhD or expected one in the next 10 years, compared with 17% of those in the bottom quartile. For the most part, other study variables that had strong positive relationships to PhD expectations or attainment were also related to gains in confidence. They are summarized below.

- *Undergraduate GPA.* (Base: all respondents) Positively related to all measures of PhD expectations and attainment.

	Undergraduate GPA		
	<3.0	3.5 to 3.69	3.9+
Had pre-college expectations of a PhD	4%	16%	19%
Completed PhD at time of survey	<1	3	11
Have now or expect PhD in 10 years	10	20	38
New expectations of a PhD	9	11	24

(This table shows, for example, that 4% of respondents with GPAs of less than 3.0 had pre-college expectations of obtaining a PhD.)

- *Authored or co-authored a paper submitted for publication in a professional journal.* (Base: those who participated in research) Positively related to all measures of PhD expectations, but not to current attainment of a PhD.

	Authored paper?	
	No	Yes
Had pre-college expectations of a PhD	13%	25%
Have now or expect PhD in 10 years	20	47
New expectations of a PhD	14	28

- *Attended student/professional conferences as part of undergraduate research experiences.* (Base: those who participated in research) Positively related to current expectations and attainment.

	Attended conferences?	
	No	Yes
Completed PhD at time of survey	3%	8%
Have now or expect PhD in 10 years	18	38
New expectations of a PhD	12	26

- *Perceived importance of research experiences to one's career decision.* (Base: those who participated in research) Positively related to all measures of PhD expectations and attainment.

	Importance of undergraduate research to your career decision			
	Not	Somewhat	Fairly	Extremely
Had pre-college expectations of a PhD	10%	9%	14%	18%
Completed PhD at time of survey	1	2	3	7
Have now or expect PhD in 10 years	13	16	20	32
New expectations of a PhD	8	12	13	23

- *Needing help with academic/career decisions as a reason to participate in undergraduate research.* (Base: those who participated in research) Positively related to all measures of PhD expectations and attainment.

	Index: need help with decisions	
	Bottom quartile	Top quartile
Had pre-college expectations of a PhD	9%	18%
Completed PhD at time of survey	2	6
Have now or expect PhD in 10 years	14	34
New expectations of a PhD	10	24

- *Number of research activities.* (Base: those who participated in research) Positively related to all measures of PhD expectations and attainment.

	Number of research activities	
	Fewer than 10	10 or more
Had pre-college expectations of a PhD	12%	21%
Completed PhD at time of survey	3	7
Have now or expect PhD in 10 years	19	33
New expectations of a PhD	14	21

- *When became interested in SBES.* (Base: all respondents) Positively related to all measures of PhD expectations, but not to current attainment of a PhD.

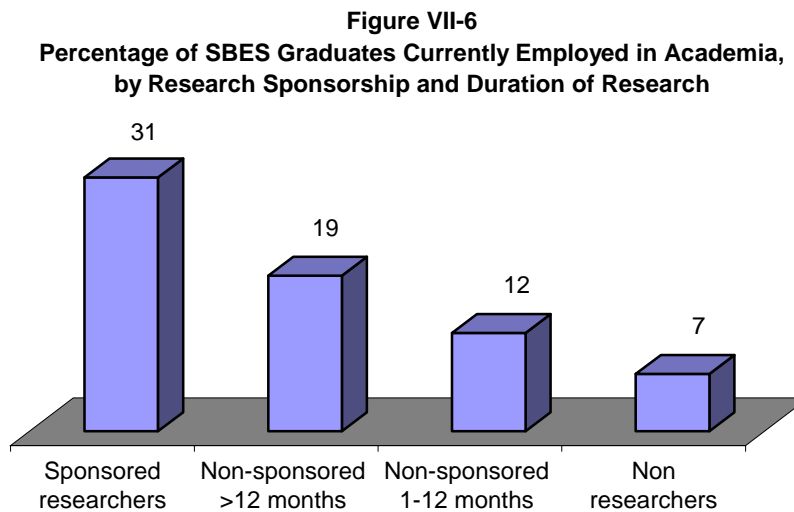
	When became interested in SBES		
	Childhood	High school	College
Had pre-college expectations of a PhD	14%	13%	9%
Have now or expect PhD in 10 years	23	18	15
New expectations of a PhD	16	13	10

- *Starting college at a 2-year school.* (Base: all respondents) Negatively related to pre-college expectations of obtaining a PhD. However, the two groups had virtually identical percentages on the other PhD expectation/attainment measures.

	Started college at a 2-year school?	
	Yes	No
Had pre-college expectations of a PhD	7%	12%

CURRENT EMPLOYMENT IN ACADEMIA

Perhaps reflecting their higher likelihood of obtaining a PhD, researchers were twice as likely as non-researchers to be currently employed by a college or university (14% vs. 7%, respectively). Sponsored researchers were especially likely to be employed in academia (Figure VII-6). These findings roughly paralleled those for STEM graduates.



Source: SRI International SBES graduates survey, 2004.

OVERVIEW OF ACADEMIC DEGREES AND EMPLOYMENT IN ACADEMIA

Undergraduate research—by both SBES and STEM graduates—tends to attract those who want to obtain a PhD but it also encourages those who did not originally have PhD expectations. Researchers—especially sponsored and high-experience non-sponsored researchers—were more

likely than non-researchers to have obtained a PhD at the time of the survey, to have had pre-college expectations of obtaining one, and to have current expectations of obtaining one. Most compelling, researchers were twice as likely as non-researchers to have new expectations of a PhD and to be employed in academia. Sponsored and high-experience non-sponsored researchers were especially likely to have new expectations of a PhD and to be employed in academia. Among undergraduate researchers, likely precursors of PhD expectations/attainment included attending student/professional conferences, obtaining an undergraduate GPA of 3.9 or higher, authoring papers submitted to professional journals, and needing help with an academic/career decision as an important reason for participating in research.