Evaluation of the National Science Foundation's Integrative Graduate Education and Research Traineeship Program (IGERT): Follow-up Study of IGERT Graduates

Final Report

Contract # GS-10F-0086K
Order No. NSFDACS06D1412

February 2011

Prepared for
National Science Foundation
4201 Wilson Blvd.
Arlington, VA 22230

Prepared by
Jennifer Carney, Project Director
Alina Martinez, Interim Project Director
John Dreier
Kristen Neishi
Amanda Parsad

Assisted by
Beth Gamse, Project Quality Advisor
Meredith Beck
Grace Chang
Daphne Garcia
Barbara Lovitts
Tom McCall
Jan Nicholson
Satyendra Patrabansh
Mylene San Gabriel
Jonathan Spader
Chris Rodgers
Daniel Smith

Executive Summary

In 1995, the National Academy of Science's Committee on Science, Engineering, and Public Policy (COSEPUP) issued a report titled *Reshaping the Graduate Education of Scientists and Engineers.* That report, and subsequent studies of graduate education, called for American doctoral programs to engage students in interdisciplinary work and to provide professional training to better prepare students (and ultimately graduates) for a wide range of scientific careers and research opportunities. In particular, the COSEPUP report argued that the traditional paradigm of graduate education—in which students work within a single department, apprentice to a single professor, and engage in narrowly focused research—yields students so specialized that they are not suitably prepared for entry-level jobs, are unable to adapt to non-academic settings, and lack an understanding of the increasingly global nature of STEM research.

The National Science Foundation's Integrative Graduate Education and Research Traineeship (IGERT) program supports students in science, technology, engineering, and mathematics (STEM) fields who participate in university-developed interdisciplinary graduate training experiences. Faculty members at each IGERT site develop a series of education and research activities in which students and faculty from multiple departments participate. Activities are centered on an interdisciplinary theme and commonly include multidisciplinary research collaborations, cross-departmental lab rotations, interdisciplinary seminars, team-taught courses, and/or off-campus internships. Most IGERT students enroll in a single-discipline PhD program and participate in IGERT in addition to their regular departmental experiences. Between 1998 and 2007, the IGERT program has supported the graduate training of over 4,000 doctoral students, and has graduated over 800 doctoral students.

There is distinct alignment between the components of the IGERT program and the earlier calls for reform in STEM graduate education that emphasized versatility and interdisciplinary graduate training. Reformers encouraged universities to increase the career preparedness of PhD candidates through training in skills commonly required in the private sector (e.g., business and industry settings), including teamwork and managerial skills and participation in internships, supplemented with broader types of career assistance and job placement. Reformers also argued that graduate education should require more interdisciplinary work, not solely in support of wider career options but also to encourage "adventuresome research."

This report presents the findings from the *IGERT Graduates Follow-up Study*, which was designed to investigate the short-term professional outcomes of IGERT graduates and to assess whether IGERT-funded graduate students are prepared for successful STEM-related careers and have developed the requisite research, teaching, and leadership capacities. It also explores how IGERT graduates have fared in their early careers, one to eight years postgraduation, relative to their counterparts trained through more traditional single-discipline programs. The findings from this study illustrate the interdisciplinary environment in which STEM graduates currently work, the alignment between IGERT graduate training and the STEM workforce, and the role IGERT graduates are playing in advancing a more interdisciplinary approach to research and in training the next generation of STEM scholars and researchers.

IGERT Graduates Follow-up Study

This evaluation was designed with two purposes: to *describe* the short-term career trajectories and outcomes of IGERT PhD graduates along with their preparation for their career responsibilities, and to

compare the short-term career trajectories and outcomes of IGERT graduates with national data on STEM graduate students and with data collected from a sample of non-IGERT PhD graduates. Each of these purposes was addressed in one of two separate sub-studies, as follows. Although some IGERT graduates were enrolled as master's students or left with master's degrees, this study is focused only on the outcomes of PhD graduates, as the primary intention of the IGERT program is to enhance STEM doctoral training programs.

Descriptive Sub-Study

The first component of this evaluation was designed to provide NSF with comprehensive descriptive data on the postgraduation outcomes of all IGERT PhD graduates. However, because IGERT PhD graduates were in the workforce for eight or fewer years when this study collected data, the career outcomes presented in this study can only reflect these graduates' *short-term* career activities and achievements. Research questions included:

- What are the career interests, motivations, and demographic characteristics of IGERT graduates?
- To what extent and in how much time do IGERT graduates complete their doctoral degrees?
- What are the early career outcomes and job responsibilities of IGERT graduates?
- What are the perceived effects of IGERT training on graduates' enrollment, dissertation research, degree completion, ability to obtain jobs, and career preparedness?

To answer these questions, all IGERT PhD graduates as of 2007 who received funding from one of the 125 IGERT projects funded between 1998 and 2003 were invited to complete an online survey. Survey data were collected in two waves (Spring 2008, Spring 2009). Responses were received from 645 of the 869 IGERT PhD graduates, resulting in a response rate of 74 percent. The study also analyzed data from the IGERT Program Distance Monitoring System (DMS), an annual Web-based survey of all IGERT Principal Investigators and trainees, to examine IGERT trainees' demographic characteristics and doctoral degree completion rates, and interviews were conducted with IGERT trainees who left their institutions without completing their PhD degrees.

Comparative Sub-Study

The second component of this evaluation was designed to compare the short-term career trajectories and outcomes of IGERT PhD graduates and comparable non-IGERT PhD graduates. Research questions included:

- How do IGERT and non-IGERT graduates compare with regard to their decisions to enroll in graduate school, likelihood of completing their degrees, and time taken to complete their degrees?
- How competitive and successful are IGERT graduates in entering the STEM workforce as compared to non-IGERT graduates?
- How do IGERT and non-IGERT graduates compare in the range of careers entered and diversity of responsibilities assumed?

- How do IGERT and non-IGERT graduates compare in their perceptions of how well their graduate training prepared them for the workforce?

A subsample of IGERT graduates was matched with a sample of non-IGERT graduates from similar departments. Two sources were used to identify the comparison departments: a) IGERT department chairs' self-identified competitor departments and b) U.S. News & World Report Rankings of doctoral programs by field of study. Data were collected during Spring 2008 using an online survey. Responses were received from 261 of 396 IGERT graduates, resulting in a response rate of 66 percent; 436 of 827 non-IGERT graduates completed the survey, resulting in a response rate of 52 percent. Where appropriate, information from national data collections was also presented to provide context for the IGERT findings.

Major Findings

In the first nine years of the IGERT program, over 800 PhD students graduated from IGERT projects and entered the workforce. These students demonstrate engagement in interdisciplinary work both in their initial graduate school interests as well as when completing their doctoral theses. We found no evidence that participating in IGERT detracts from students' ability to graduate or lengthens the time it takes students to complete their degrees. Specifically:

- Most IGERT graduates (83 percent) reported that they were already interested in an interdisciplinary education or research training experience when they applied to graduate school.

- Four in five IGERT graduates (81 percent) reported drawing upon at least two distinct, broad disciplines for their dissertation research, even though most IGERT students received their degrees in a single discipline.

- Within 10 years of beginning their graduate studies, 54 percent of IGERT trainees had graduated with PhDs, 3 percent were still enrolled, 21 percent had graduated after receiving master's degrees, and 22 percent had withdrawn from their institutions without receiving any degrees.

- The median time to degree for all IGERT graduates was 5.2 years.

- Over the IGERT program's first nine years, women have composed 36 percent of IGERT graduates and underrepresented minorities (URM) have represented 7 percent of all IGERT graduates. When compared to national data, the proportion of women or URM among IGERT graduates in a given discipline was sometimes greater than, sometimes on par with, and sometimes below the national average among all STEM PhD recipients. Sixty-six percent of the IGERT graduates surveyed indicated that they are the first in their immediate family to have obtained a PhD in a STEM field.

- Ninety-six percent of IGERT graduates reported that their IGERT experience positively contributed to their ability to complete their PhDs. The traineeship's financial support was the most valuable factor cited (86 percent), followed by the project's focus on an interdisciplinary theme (57 percent), the freedom to pursue students' own research interests (56 percent), and access provided to resources, equipment, and technology (56 percent).

IGERT PhD graduates reported that they were prepared, upon graduation, to work as researchers across multiple employment sectors, including academia, industry, and government. Thirty-two percent of IGERT graduates were in postdoctoral appointments at the time of this study's data collection, primarily in academic settings. Sixty-eight percent of IGERT graduates were employed at the workforce. Nearly half of these employed IGERT graduates were working at colleges or universities; one-third were employed in industry or business and the remaining individuals were working in government or other organizations, including nonprofits, research institutions, nongovernmental laboratories, or self-employed entrepreneurial endeavors. We found that:

- IGERT graduates considered a broad range of careers upon graduation; 69 percent considered at least two employment sectors (academia, industry, government, etc.) when applying for jobs, including 39 percent who considered three or more sectors.
- IGERT graduates overwhelmingly reported that their graduate preparation gave them a competitive edge when applying for positions in the workforce (93 percent) and that their IGERT experience specifically helped them obtain a position (94 percent).
- IGERT graduates credited their interdisciplinary experiences as influential in securing employment, whether through interdisciplinary exposure (72 percent), training (59 percent), or research conducted (52 percent).

Employed IGERT graduates reported various professional responsibilities in their positions, however most were engaged in research (82 percent) or teaching (46 percent). Evaluation data suggest that IGERT graduates have continued to engage in interdisciplinary work in their current positions.

- Overall, 35 percent of employed IGERT graduates were in positions involving only research; 51 percent were in positions involving research and other responsibilities; and 14 percent were in positions involving responsibilities other than research.
- IGERT graduates conducting research were engaged in a mix of basic research, applied research, and development work.

The IGERT PhD graduates examined in this evaluation have all begun their careers recently, within the past eight years. Nonetheless, they are active scientists who are establishing professional identities. Recent IGERT graduates are beginning to exhibit the qualities that characterize STEM leaders of the future, including engaging in interdisciplinary research and education, demonstrating global awareness of STEM research, and taking on leadership roles in their current positions.

- Most IGERT graduates reported using multiple disciplines in their current work; over three-quarters (79 percent) reported using two or more disciplines, including 34 percent who reported using four or more disciplines.
- Forty-nine percent of IGERT graduates employed in the workforce reported that their current professional responsibilities required them to draw upon new disciplines they did not use in their dissertation research.

- A large majority of employed IGERT graduates (86 percent) described working on scientific or technical projects that required integration of multiple disciplines.

- Eighty-four percent of employed IGERT graduates who were teaching in higher education settings reported that they had begun training the next generation of interdisciplinary STEM researchers through fostering interdisciplinary collaborations, courses, or research experiences for students.

- Almost all employed IGERT graduates (91 percent) reported being aware of the relevance of international research to their own work, and 40 percent worked with colleagues outside the US.

- Many employed IGERT graduates had already assumed leadership roles, including directing projects or programs (75 percent), revising academic curricula (71 percent of those in academic positions), and directing the technical or scientific agenda of their organizations (42 percent).

In general, IGERT graduates reported that their graduate program prepared them well for their current responsibilities, including those that transcend disciplinary boundaries such as explaining their research to colleagues in other disciplines and working and networking with colleagues in other disciplines. Nearly all (94 percent) would recommend their IGERT-related graduate program to prospective students interested in pursuing similar career paths.

We conducted exploratory analyses comparing IGERT graduates with non-IGERT graduates from other departments. IGERT and non-IGERT graduates reported no significant differences in securing employment by the time they graduated with their PhD degrees and obtaining a position in their most desired employment sector (academia, industry, etc.). Academic institutions were the most frequent employers of both groups, followed by industry or business, and then government. However, there are observed differences between the two groups in terms of their interests, interdisciplinary engagement, and job responsibilities. They also differed in their perceptions of how well their graduate program aided their entry into the workforce and prepared them for their job responsibilities. All of these differences were found to be significant at the $p<.05$ level. Specifically:

- IGERT graduates reported having greater interest in an interdisciplinary education or research training experience when they applied to graduate school than non-IGERT graduates (85 versus 75 percent). IGERT graduates were also significantly more likely than non-IGERT graduates to pursue a career in STEM for the intellectual challenge (83 versus 75 percent) and in order to create new knowledge (42 versus 33 percent).

- The dissertations produced by IGERT graduates were more interdisciplinary than those produced by non-IGERT graduates: for example, IGERT graduates' dissertations drew upon an average of three broad disciplines and non-IGERT graduates' dissertation only drew upon an average of two broad disciplines.

- IGERT students earned their degrees nearly five months sooner than non-IGERT students in similar departments, on average (5.63 years versus 6.04 years).

- IGERT graduates were more likely than non-IGERT graduates to report that their graduate program had prepared them well for research faculty positions at universities (62 percent of

IGERT graduates agreed and 27 somewhat agreed while 51 percent of non-IGERT graduates agreed and 32 percent somewhat agreed).

- Both IGERT and non-IGERT graduates considered employment in a variety of sectors, but IGERT graduates considered fewer sectors (2.39 sectors considered by non-IGERT graduates versus 2.10 sectors considered by IGERT graduates).

- IGERT graduates reported having less difficulty than non-IGERT graduates when obtaining their post-degree positions (1.75 versus 2.02 on a scale of 1 [not difficult] to 5 [very difficult]) and were more likely than non-IGERT graduates to believe that their graduate preparation gave them a competitive edge when applying for positions in the workforce (95 versus 91 percent).

- IGERT graduates were more likely to list research as their primary job responsibility (75 versus 63 percent), while non-IGERT graduates were more likely to list teaching or training as their primary responsibility (17 versus 24 percent).

- Both groups reported that they drew upon multiple disciplines in their research; however, IGERT graduates were more likely to be integrating multiple disciplines (84 versus 73 percent).

- Among graduates with teaching responsibilities, both groups reported that they engaged in team-teaching with colleagues in other departments or advising students from other departments; however, IGERT graduates were more likely to be teaching courses that required them to integrate two or more disciplines (63 versus 50 percent).

Findings from this evaluation suggest that IGERT training programs attracted students with different interests and motivations than non-IGERT students—students who produced more interdisciplinary dissertations and subsequently engaged in more interdisciplinary integration upon entering the workforce. IGERT students were more likely than non-IGERT students to report that their IGERT training facilitated their job search process and prepared them well for their current job responsibilities.

This evaluation provides the National Science Foundation with a first look at the career outcomes of IGERT graduates. The greatest limitation of this study is the potential for selection bias in its comparison group. We cannot conclusively determine, from this study, whether the IGERT graduate experience led to the outcomes observed. It is possible that the differences observed between IGERT and non-IGERT students reflect underlying differences in students' personal interests, abilities, and motivations, and not the IGERT training they received. Because we did not have any specific hypotheses about what kinds of differences we would expect in early career outcomes, the findings in this report should be viewed as exploratory rather than confirmatory. Future studies could be designed to test whether it is indeed the IGERT training that is causing any observed differences, by using a more rigorous design that explicitly models the selection of students into IGERT.

As with any research, this study answered some questions while raising others. Future research efforts could address the following types of questions about longer term follow up (to learn about subsequent career activities of IGERT graduates, specifically), and could potentially employ more rigorous study designs—perhaps in a subset of projects where feasible (to make stronger causal statements about the impact of the IGERT program).

- Are IGERT graduates drawn to employment environments that emphasize interdisciplinary collaboration?

- What strategies are used by IGERT projects to successfully recruit and retain women and/or underrepresented minorities?

- What IGERT project characteristics are associated with graduates' career outcomes? For example, do graduates from IGERT projects that received an international supplement have more broad global perspectives than graduates from other projects? Are graduates who participated in an IGERT-sponsored internship in industry more likely to pursue careers in industry than IGERT graduates who did not participate in such internships?

- What are the longer term career outcomes of IGERT graduates? For example, does the interdisciplinary focus of IGERT graduates working in universities hinder their ability to obtain tenure within a single-discipline academic department when compared to single-discipline peers?

- How productive are IGERT graduates, as measured by publications and presentations, when compared to non-IGERT peers? Do IGERT graduates publish in a wider span of disciplinary journals as compared to non-IGERT peers? Are they more likely to collaborate on research with colleagues in other disciplines?

- Does the increased interdisciplinary nature of IGERT students' dissertations have any effect on the degree requirements or dissertation guidelines of participating departments when compared to departments without IGERT students?

As the IGERT program continues to support the graduate training of STEM PhD students, evaluation of these and other questions will deepen the NSF's understanding of its investment as well as contribute to the national dialogue over the appropriate directions for graduate STEM education in this country.

Table of Contents

List of Exhibits

Chapter 1: Introduction and Methods

The National Science Foundation's (NSF) Integrative Graduate Education and Research Traineeship (IGERT) program funds universities for the purpose of establishing interdisciplinary graduate training for students in the fields of science, technology, engineering, and mathematics (STEM). The IGERT program represents a considerable investment by NSF in graduate education. It has trained more than 4,000 graduate students in less than a decade. As such, it is important to know what happened to those graduate students who received IGERT training and whether they were prepared for their careers after graduation.

In 2006, NSF contracted with Abt Associates Inc. and subcontractor RelyOn Media to conduct an external evaluation of the IGERT program investigating the short-term professional outcomes of IGERT graduates. The evaluation's primary purpose was to investigate whether and to understand how the IGERT program prepared its graduate student participants for successful STEM-related careers. This evaluation also investigated how IGERT graduates have fared in their early careers relative to their counterparts trained through more traditional programs. This report presents the findings from the *IGERT Follow-up Study*.

The current evaluation continues the monitoring and evaluation efforts in place for 9 years. The IGERT Distance Monitoring System (DMS) has collected annual descriptive information on the characteristics of IGERT projects and their individual participants since 1999.[1] In 2001, Abt Associates and subcontractor WestEd launched a multiyear, cross-site study of the IGERT program that investigated project implementation, including aspects of project management and leadership, the educational experiences of and outcomes for students and faculty involved in the IGERT projects, and the institutional contexts in which IGERT projects operated.[2] Abt Associates subsequently conducted a second evaluation of the IGERT program that employed a matched comparison group to examine program impacts during graduate school, including student recruitment, graduate training experiences, faculty engagement in interdisciplinary teaching and research, and advancing interdisciplinary graduate education within host institutions.[3]

This evaluation extends these earlier studies by exploring the early career outcomes of IGERT graduates and provides the first comprehensive review of postgraduation career trajectories and outcomes of IGERT students since the IGERT program began. The evaluation investigates trainees' reasons for pursuing graduate degrees, the influence of the IGERT program on their entry into the workforce, the relevance of their graduate training to their responsibilities and activities in the workforce, and the characteristics of their current work responsibilities. It also compares outcomes for IGERT graduates with those in a matched comparison group of non-IGERT graduates.

In this report, we begin by reviewing the broad landscape of STEM education reform before turning to the details of this current evaluation. This chapter provides information on key study features; later chapters describe findings in more detail.

Landscape of STEM Graduate Education Reforms

Doctoral-trained professionals in STEM play a significant role in the nation's capacity for scientific and technological innovation, in job creation, and in economic competitiveness. They produce knowledge, ideas, information, and technology that lead to the development of new products, new businesses, new jobs, and solutions to pressing social, economic, environmental, and health problems. Throughout much of the 20th century, the United States was a leader in STEM research and development, based in large

part on the quality of its STEM research and education programs. Although American institutions of higher education still rank among the best in the world, other countries have increasingly invested more heavily in STEM higher education, research, and development, and the United States now competes with other nations for students, for preeminence in STEM, and for global economic dominance.[4] [5]

These international pressures, combined with predictions that the nation's demand for STEM workers will exceed supply in all sectors for the foreseeable future, have motivated US leaders to examine the state of the nation's STEM research and education enterprise.[6] [7] The National Academy of Sciences' Committee on Science, Engineering, and Public Policy (COSEPUP) Report of 1995, *Reshaping the Graduate Education of Scientists and Engineers*, helped catalyze and responded to a national discussion about doctoral education focused on two interrelated issues: meeting the demand for graduate-level STEM professionals and reforming the structure and process of graduate education. The report also challenged American institutions of higher education to reshape graduate education by offering a broader range of academic areas that would better prepare graduate students for the needs and realities of a wide variety of careers and research opportunities. In particular, the report argued that the traditional paradigm of graduate education—in which students work within a single department, apprentice to a single professor, and engage in narrowly focused course work and research—yields students so specialized that they are not suitably prepared for entry-level jobs, are unable to adapt to non-academic settings, and lack an understanding of the increasingly global nature of STEM research.[8]

The national discussion about doctoral education has since been informed by four different major studies of doctoral education. Maresi Nerad and Joseph Cerny's *PhDs: 10 Years Later Study* (1996) explored the career trajectories of PhDs 10 years after degree completion and the role of their graduate training in those careers.[9] Jody Nyquist's *Re-Envisioning the PhD to Meet the Needs of the 21st Century* (2000) focused on the perspectives of nine different stakeholder groups and provided a compendium of more than 300 "best practices" and innovative strategies at participating institutions.[10] Chris Golde and Timothy Dore's *At Cross Purposes* (2001) used the experiences of graduate students who were in their third year of graduate study and beyond to identify aspects of the doctoral training system that were and were not working.[11] Finally, the *Responsive PhD* program (2006), supported by the Woodrow Wilson National Fellowship Foundation, used findings from several major studies and projects on doctoral education to sharpen the recommendations for change.[12]

Despite their diverse perspectives, the findings and recommendations across these studies were remarkably similar to each other and to those of the COSEPUP report. All four reports emphasized the importance of two features, versatility and interdisciplinary work, as follows:

- Graduate education should increase the versatility and career options of PhD candidates through (1) training in skills commonly required in business, industry, and the private sector, including teamwork and managerial skills, (2) participation in internships, and (3) more career assistance and job placement; and

- Graduate education should require more interdisciplinary work, not solely in support of wider career options but also to encourage "adventuresome research."

Other suggested programmatic improvements included inculcating values and ethics training, increasing exposure to technology, and incorporating understanding of the global economy and environment.

These and other more recent studies (e.g., *Carnegie Initiative on the Doctorate*) have motivated reform initiatives within departments and universities across the country.[13] In addition, larger-scale initiatives, such as the *PhD Completion Project*, supported by associations, foundations, and the federal government, have also been spurred on by this national dialogue.[14]

The IGERT Program

The National Science Foundation created the Integrative Graduate Education and Research Traineeship (IGERT) program in 1997, demonstrating its substantial response to the challenges articulated in the COSEPUP and subsequent reports about graduate training. The IGERT program funds university-based projects that alter the traditional paradigm for graduate education by establishing interdisciplinary education and research training programs for doctoral students. The IGERT program was established to:

- Educate US PhD scientists and engineers who will pursue careers in research and education, providing them with the interdisciplinary backgrounds, deep knowledge in chosen disciplines, and technical, professional, and personal skills to become leaders and creative agents for change.

- Catalyze a cultural change in graduate education for students, faculty, and institutions by establishing innovative models for graduate education and training in a fertile environment for collaborative research, which transcends traditional disciplinary boundaries.

- Facilitate diversity in student participation and preparation and contribute to the development of a diverse, globally engaged science and engineering workforce.[15]

There is direct alignment of IGERT expectations with the recommendations embedded in the reports discussed above.

IGERT aims to increase the versatility, and therefore the career options, of PhD candidates through:

- Attention to the development of personal and professional skills (e.g., communication, teamwork, mentoring, leadership), and
- Opportunities for career development, such as internships and mentoring in various settings (e.g., industry, national labs, academic institutions, non-US institutions).

IGERT encourages interdisciplinary work by requiring projects to:

- Adopt a comprehensive interdisciplinary theme that serves as a foundation for traineeship activities, and
- Integrate interdisciplinary research with innovative graduate education and training mechanisms, and create other educational features that foster strong interactions between participating students and faculty within and across disciplines.

IGERT supports other programmatic improvements for students, including:

- Exposure to broad-based state-of-the-art research and educational tools and methodologies,
- Instruction in ethics and responsible conduct of research, and
- Development of students' international perspective.

While all IGERT projects share these goals in a broad sense for their students, individual projects vary widely in design and scope. Most IGERT projects supplement departmental disciplinary training and requirements with their own project-specific IGERT requirements, while a handful have developed new interdisciplinary degrees. All IGERT projects involve faculty and students from diverse disciplinary backgrounds. The number of departments and research units involved ranges from one to more than ten; and about a quarter of projects have arrangements with industry or other partners that contribute facilities and resources.[16]

After over a decade of program activity, the IGERT program has demonstrably promoted interdisciplinary training and research for students and faculty within institutions.[17] As a result, its success was recognized in the 2007 America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education and Science (America COMPETES) Act, which explicitly legislated the expansion of innovation in graduate student research and education through the IGERT program.[18]

Study Design

The purposes of this study were to describe the degree completion and postgraduation outcomes of IGERT students and to compare those outcomes with those of other STEM doctoral students. Although some IGERT graduates were enrolled as master's students or left their institutions after receiving master's degrees, this study focused only on the outcomes of PhD graduates, as enhancing doctoral training is the primary goal of the IGERT program.

To fulfill these purposes, this evaluation was designed with two components, a Descriptive Sub-study, and a Comparative Sub-study.

- The Descriptive Sub-study documented the short-term career trajectories and outcomes of IGERT PhD graduates by following them one to eight years beyond graduation, gathering information about their early career activities and achievements and their preparation for their career responsibilities.[19]

- The Comparative Sub-study assessed the influence of the IGERT model of interdisciplinary education on degree completion by comparing data collected from IGERT students with national data on STEM graduate students on such factors as demographic profiles and degree completion rates. It also compared postgraduation outcomes for samples of IGERT graduates and non-IGERT graduates, including their reasons for pursuing graduate degrees, their experiences related to workforce entry, the relevance of their graduate training to current positions, and the characteristics of their current work responsibilities.

Conceptual Framework

Abt Associates' *Evaluation of the Initial Impacts of the National Science Foundation's Integrative Graduate Education and Research Traineeship Program* (2006) suggests that IGERT projects attract a "different breed" of graduate student for whom traditional measures of achievement might not fit completely and who may hold themselves to diverse standards of success. Thus, it was important for this study to measure both traditional academic research as well as alternative pathways (e.g., entrepreneurial ventures, industry or government research and development, and public policy development).

This study was grounded in the assumption that the IGERT training experience is but one of multiple factors that might influence the outcomes observed among graduates. Other interrelated factors that might influence individuals' career outcomes include:

- Background characteristics,
- Personal attitudes, beliefs, and value characteristics,
- Graduate program characteristics and experiences (including IGERT),
- Academic progression and success factors, and
- Career choices, progression, accomplishments, and current situation.

We collected data on some of the background characteristics and personal values hypothesized to influence the career outcomes observed in our study. We note however, that this evaluation cannot control for all of the factors outlined above.

Study Methodology: Descriptive Sub-Study

Below, we describe the methods used in the descriptive portion of this evaluation, including the research questions, data sources, study samples, and analytic approach.

Research Questions for the Descriptive Sub-Study

The descriptive sub-study was designed to answer questions about the degree completion and post-degree outcomes of IGERT PhD students. It focused both on the outcomes observed and on IGERT graduates' perceptions of how their IGERT experience influenced their success. Research questions included:

- What are the career interests, motivations, and demographic characteristics of IGERT graduates?
- To what extent and in how much time do IGERT graduates complete their doctoral degrees?
- What are the early career outcomes and job responsibilities of IGERT graduates?
- What are the perceived effects of IGERT training on graduates' enrollment, dissertation research, degree completion, ability to obtain jobs, and career preparedness?

Sources of Data for the Descriptive Sub-Study

Data for the descriptive study were drawn from a combination of original data sets and existing data collection efforts. Primary source data for the descriptive study were collected via:

- Online surveys of IGERT graduates
- Telephone interviews with IGERT doctoral degree non-completers

Existing national data were used to contextualize IGERT graduates' characteristics, experiences, and outcomes. These sources included:

- Survey of Earned Doctorates
- Survey of Doctoral Recipients
- PhD Completion Project

The core data source was an online survey completed by IGERT graduates about their graduate experiences, career choices, and current professional responsibilities. The survey also asked how their IGERT experience influenced their academic and career progression. The survey was initially administered in Spring 2008; it reopened in Spring 2009 to collect additional responses and achieve a higher response rate.

In addition, phone interviews were conducted with individuals who had left their IGERT institutions without completing their PhDs. These interviews gathered data on respondents' graduate school experiences, reasons for leaving their respective IGERT-related institutions, additional education opportunities, and current employment situations.

A final data source on IGERT participants was the IGERT Program Distance Monitoring System (DMS), which contains data from annual Web-based surveys of all IGERT PIs and trainees across all IGERT sites. From the DMS, we extracted information data on trends in IGERT participation, IGERT trainees' demographic characteristics, and doctoral degree completion rates.

Samples for the Descriptive Sub-Study

Our primary sample, which we call the *Full IGERT Sample*, consists of students who participated in the first six cohorts of IGERT between 1998 and 2003 and who had graduated with their PhDs by December 2007. In addition, we identified a group of IGERT trainees who had not completed their PhD degrees at their IGERT institutions, called the *IGERT Non-Completer Sample*. We describe each of these samples below.

Full IGERT Sample

The Full IGERT Sample was drawn from the 125 projects funded between 1998 and 2003. All students funded by these projects between 1998 and 2006 who graduated from their IGERT institutions by December 2007 were included in the Full IGERT Sample, resulting in a total of 869 IGERT PhD graduates (Exhibit 1.2). We used all information that was available for each individual, attempting to contact each one through e-mail, telephone, and/or paper mail. In addition, we conducted Internet searches and contacted students' PIs, home departments, and/or former faculty advisers in an effort to identify the current whereabouts of each IGERT graduate. Once we obtained a working e-mail address, we sent notification of our study and confirmed that we reached the appropriate respondent. Details on the methods used to identify and locate individuals in the Full IGERT Sample are contained in Appendix A.

Exhibit 1.2

Final Sample Size and Response Rates for Full IGERT Sample

	IGERT PhD Respondents
a. Targeted sample	881
b. Final survey sample [a]	869
c. Located/invited [b]	810
d. Number of completed surveys [c]	645
	Percent
e. Response rate (d/b)	74%
f. Cooperation rate (d/c)	80%

[a] We excluded 12 individuals who had erroneously been categorized as having completed a PhD (non-completers (n=4), still enrolled (n=6), already had PhD/ postdoctoral fellows (n=2). Note that postdoctoral fellows had been funded through IGERT in prior years, the IGERT program no longer allows funding for postdoctoral appointments.

[b] We were unable to find a workable e-mail address for 59 individuals in the targeted sample, for whom no valid contact information could be obtained or because the email invitation to complete the survey "bounced back" as undeliverable or misidentified. These individuals therefore did not receive a survey invitation. They are included in the denominator of the response rate calculation and excluded from the denominator of the cooperation rate as per recent guidelines issued by APPOR.[20]

[c] There were 51 IGERT respondents who started, but did not complete, surveys. Six of these respondents' surveys are included in the analyses in this report because they had completed at least 40 percent of the questions; the remaining individuals were dropped and are not included in this table as a "completed survey."

We ultimately achieved a 74 percent response rate, meaning that 74 percent of the originally targeted sample (minus ineligibles) completed the survey. Because of the nature of an online survey, it is not possible to know how many of the remaining 26 percent received the survey invitation but declined to participate or never received the invitation because it was filtered to a "junk mail" folder, blocked by a "spam filter," or sent to an unused e-mail account. We do know that the survey invitations for 59 of the 224 nonresponding individuals "bounced back" to us as undeliverable, thus it is possible that the proportion of individuals who actually received the survey and responded is higher than 74 percent.

IGERT Non-Completer Sample

As of the 2005–2006 academic year, 242 IGERT trainees were identified in the IGERT Distance Monitoring System as having left their IGERT institutions without completing their doctoral degrees. E-mail addresses were available for 124 of these IGERT trainees. All 124 of these individuals were invited via e-mail to participate in a phone interview and 38 did so. Ten were subsequently excluded from analyses because they either reported they had since earned PhD degrees (N=6) or had actually been IGERT postdoctoral fellows and not graduate students (N=4). Overall, 25 percent of IGERT trainees identified as leaving their graduate programs without degrees for whom we had contact information participated in phone interviews. Exhibit 1.3 shows our final sample of IGERT trainees who were identified as having left their IGERT institutions before completing their doctoral degrees.

Exhibit 1.3

Final Sample Size and Response Rates for Interviews of IGERT Trainees Leaving Their Graduate Programs Without Their Doctoral Degrees

	IGERT (N)
a. Targeted interview sample	242
b. Interview sample [a]	232
c. Located/invited	114
d. Number of completed interviews	28
	Percent
e. Response rate (d/b)	12%
f. Cooperation rate (d/c)	25%

[a] Ten trainees were deemed ineligible post hoc because they received IGERT funding only in postdoctoral appointments (n=4) or actually received their PhDs from their IGERT institutions (n=6).

Analytic Approach for the Descriptive Sub-Study

To answer the descriptive study's research questions, we conducted descriptive analyses of data from IGERT graduates. In most cases, all graduates were analyzed together. However, in some cases we also examined outcomes for selected subgroups of IGERT graduates, such as men versus women or individuals belonging to racial or ethnic groups underrepresented in STEM. Where appropriate, information from national data collections was presented to provide context for the IGERT findings. It is important to note that—while such extant data can provide useful benchmarks and contexts—there are multiple differences between these existing data sources and the data collected for this evaluation that render statistical comparisons inappropriate, including years of national data available, differences in racial/ethnic classifications, and inclusion of various citizenship statuses in national analytic data. Thus no statistical tests of differences between IGERT and national data were conducted.

Data for the Full IGERT Sample were collected in two waves of data collection, as discussed in detail in Appendix A. Comparison of the demographics of survey responders and nonresponders indicated that the two groups did not differ on gender or racial/ethnic status, however, the distribution across STEM disciplines did differ. As a result, the final survey data responses for the Full IGERT Sample presented in Chapters 2, 3, and 4 are weighted by the STEM disciplines of IGERT graduates' home departments. In these chapters, we present unweighted Ns and weighted percentages.

Study Methodology: Quasi-Experimental Comparative Sub-Study

This section presents an overview of the methods used in the quasi-experimental component of the evaluation, including the research questions, data sources, study samples, and analytic approach. A more detailed discussion of the methods used for this comparative study is presented in Chapter 5 and in Appendix A. This portion of our evaluation was designed to compare the short-term postgraduation outcomes of IGERT PhD graduates with those of non-IGERT PhD graduates. This method contrasts the IGERT interdisciplinary experience with the single department options otherwise available to students. The comparison is interdisciplinary against single department education, with IGERT as the exemplar of interdisciplinary.

Research Questions for the Comparative Sub-Study

The quasi-experimental study addressed the following research questions:

- How do IGERT and non-IGERT graduates compare with regard to their decisions to enroll in graduate schools, likelihood of completing their degrees, and time taken to complete degrees?
- How competitive and successful are IGERT graduates in entering the STEM workforce as compared to non-IGERT graduates?
- How do IGERT and non-IGERT graduates compare in the range of careers entered and diversity of responsibilities assumed?
- How do IGERT and non-IGERT graduates compare in their perceptions of how well their graduate training prepared them for the workforce?

Sources of Data for the Comparative Sub-Study

The primary data sources for this component of the evaluation were online surveys completed by IGERT and non-IGERT graduates. These surveys were designed to provide data on respondents' graduate experiences, career choices, and current professional responsibilities.

Samples for the Comparative Sub-Study

The quasi-experimental comparison evaluation analyzed data from two samples:

- *IGERT Subsample*, a selected subsample of the Full IGERT Sample surveyed in the descriptive study, and
- *Non-IGERT Subsample*, a matched comparison sample for the IGERT Subsample.

IGERT Subsample

In order to compare participants of the IGERT model of interdisciplinary education and the traditional model of STEM graduate education, we selected a subset of individuals from our Full IGERT Sample to form an analytic subsample that would be matched to a comparison group. This subset was restricted to IGERT graduates who were: a) PhD graduates; b) trainees in one of the 77 projects funded between 1998 and 2001; c) graduates from a department with three or more IGERT doctoral graduates; and d) graduates between January 2001 and December 2006. Overall, 61 IGERT projects and 89 unique departments had graduates that met these criteria.[21] The final IGERT analytic subsample includes 401 PhD graduates from 56 IGERT projects and 85 unique departments. Appendix B provides a side-by-side summary of the data for the IGERT Subsample and the Full IGERT Sample for each item where we present data comparing IGERT and non-IGERT graduates.

Non-IGERT Subsample

We constructed a matched comparison group for the IGERT Subsample by matching institutional departments based on academic quality and selecting graduates from these departments. Once we identified a comparison department for each department represented in the IGERT Subsample, we invited the comparison department chairs to participate in the study. We ultimately recruited a comparison department match for 85 of the 89 IGERT departments in our analytic sample. Participating department chairs were asked for a list of all PhD graduates from their respective departments between 2001 and 2006. We then drew a matched sample of non-IGERT graduates for each IGERT department,

constructed to detect a minimum effect size of 0.3 in outcomes between the IGERT Subsample and Non-IGERT Subsample. Exhibit 1.4 shows the final sample sizes and response rates for the IGERT and Non-IGERT survey subsamples. For further information on the methods used to match departments or the sampling strategies and power calculations used to construct the Non-IGERT Subsample, see Appendix A.

Exhibit 1.4

Final Sample Sizes and Response Rates for IGERT and Non-IGERT Subsamples

	IGERT Subsample (N)	Non-IGERT Subsample (N)
a. Targeted sample [a]	401	834
b. Final survey sample [b]	396	827
c. Located/invited [c]	349	636
d. Number of completed surveys [d]	261	436
	Percent	**Percent**
e. Response rate (d/b)	66%	52%
f. Cooperation rate (d/c)	75%	69%

[a] We targeted twice as many non-IGERT as IGERT respondents because we assumed a lower find rate and lower participation rate from the non-IGERT individuals and wanted to ensure sufficient power in our analyses.

[b] We excluded 5 IGERT Subsample individuals because status classified post hoc made them ineligible for our sample. For the following reasons, we excluded 7 non-IGERT individuals from the subsample: a) degree status classified post hoc made them ineligible for our sample (n=4); b) duplicate record (n=1); and c) tragic event (n=2).

[c] We were unable to find workable e-mail addresses for 47 IGERT Subsample and 191 non-IGERT individuals in the targeted sample, either because we never obtained an individual's e-mail address or because the invitation "bounced back" as undeliverable or misidentified. These individuals therefore did not receive a survey invitation. They are included in the denominator of the response rate calculation and excluded from the denominator of the cooperation rate as per recent guidelines issued by APPOR.[22]

[d] We decided to classify 2 IGERT and 8 non-IGERT partially completed respondents as having submitted a survey because they had completed at least 40 percent of the questions.

Analytic Approach for the Comparative Sub-Study

To answer the research questions posed by the comparative study, we employed a quasi-experimental design with a one-to-many matched comparison group. This type of matching means that each treatment unit may have multiple matched controls.[23] To improve statistical power each IGERT graduate was matched with one or more non-IGERT graduates based on degree program, graduation year, and citizenship status. To compare outcomes for IGERT and non-IGERT graduates, we used a variety of statistical tests, including least squares regression models, t-tests, and chi-square tests, and made adjustments, where necessary, to account for the unbalanced sample sizes of the two groups. Descriptive statistics, consisting primarily of means, medians, standard deviations, minimums, maximums, and frequency distributions, are presented. Where controls for individual characteristics were included in estimating the difference between IGERT and non-IGERT graduates on outcome domains, the following least square regression model was used:

$$Y = \beta_0 + \beta_1(TrtDummy) + \sum_m \beta_{1+m} + \varepsilon$$

where:

Y = the outcome of interest

$\hat{\beta}_0$ = the covariate-adjusted mean outcome for non-IGERT graduates

$\hat{\beta}_1$ = the covariate-adjusted mean outcome for IGERT graduates

The difference in the outcome between IGERT and non-IGERT graduates, holding all other factors constant, is then calculated as the difference of $\hat{\beta}_1 - \hat{\beta}_0$. As with any quasi-experimental study, caution is necessary in interpreting the differences between IGERT and non-IGERT graduates.

These analyses identify areas where differences may exist between IGERT graduates and their non-IGERT counterparts. Because the analyses reported here are exploratory in nature, results should be regarded as preliminary until they can be rigorously tested and replicated in future studies. In accordance with standard social science methods, we deliberately limited the number of statistical tests conducted by focusing on key research questions and using as few tests as possible to answer these questions.[24] However, as this study represents the first time that an evaluation of the postgraduation outcomes of IGERT graduates has been examined, we took an exploratory rather than confirmatory approach to our design, and for this report conducted a total of 68 hypothesis tests. With this many tests, we would expect to see approximately four statistically significant results (at the 5 percent significance level) that are due to chance alone. Since our study is exploratory, we did not apply any statistical adjustment for multiple testing, so caution is necessary in interpreting significant findings. It is also important to note that our choice of comparison group does not account for potential selection bias. For example, our design does not make it possible to disentangle the effects of the IGERT program from effects that may result from IGERT participants' tendencies to seek interdisciplinary interactions. This issue is discussed more in Chapter 5.

Organization of this Report

The remainder of the report presents findings on IGERT graduates' demographic backgrounds, motivations, degree completion rates, entrance into the STEM workforce, and roles as STEM leaders. Chapters 2, 3, and 4 present data from the Descriptive Sub-study, as follows: Chapter 2 illustrates the educational achievements of IGERT graduates and references IGERT graduates' degree completion relative to national data. Chapter 3 describes IGERT PhD graduates' entry into the workforce, including careers considered and chosen and current job responsibilities. Chapter 4 describes IGERT PhD graduates' perceptions of the contribution of their IGERT training to their job preparedness. Chapter 5 presents findings from the Comparative Sub-study of IGERT and non-IGERT graduates. Chapter 6 summarizes the study's findings and implications.

Five appendices are included with this report: Appendix A describes our methods for sample selection, post-stratification weighting, and data collection. Appendix B provides a side-by-side summary of the data for the IGERT Subsample and the Full IGERT Sample for each of the data items examined in the Comparative Sub-study where we presented data comparing IGERT and non-IGERT graduates. Appendix C explains how we mapped specific departments listed by IGERT and non-IGERT graduates to a set of broad disciplinary fields for analysis purposes. Appendix D contains the survey instrument used with IGERT and non-IGERT graduates. Appendix E contains the interview protocol used with IGERT non-completers.

[1] The IGERT Distance Monitoring System is operated by ORC Macro, formerly Quantum Research Corporation (QRC).

[2] A. Martinez, et al. 2006. *Contractor Annual Report and Summary of Cross-Site Monitoring of the NSF Integrative Graduate Education and Research Traineeships (IGERT) Program.* Prepared for the National Science Foundation. Cambridge, Mass.: Abt Associates.

[3] J. G. Carney, et al. 2006. *Evaluation of the Initial Impacts of the National Science Foundation's Integrative Graduate Education and Research Traineeships (IGERT) Program*. Prepared for the National Science Foundation. Cambridge, Mass.: Abt Associates. Full report available at http://www.nsf.gov/pubs/2006/nsf0617/index.jsp.

[4] Thirty-six of the top 50 universities worldwide are located in the United States. (Center for World-Class Universities (2009). *Academic Rankings of World Universities*. Shanghai, China: Shanghai Jiao Tong University. http://www.arwu.org/ARWU2009.jsp (accessed December 20, 2009).

[5] Committee on Prospering in the Global Economy of the 21st Century. 2007. *Rising above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. Washington, D.C.: National Academies Press.

[6] National Science Board. 2008. *Science and Engineering Indicators 2008*. (volume 1, NSB 08-01; volume 2, NSB 08-01A). Arlington, Va: National Science Foundation, 3-1.

[7] Committee on Prospering in the Global Economy of the 21st Century. 2007. *Rising above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. Washington, D.C.: National Academies Press.

[8] Committee on Science, Engineering, and Public Policy (COSEPUP). 1995. *Reshaping the Graduate Education of Scientists and Engineers*. Washington, D.C.: National Academies Press.

[9] Nerad and Cerny's study surveyed nearly 6,000 PhDs who completed their graduate education in six disciplines between 1983 and 1985. M. Nerad and J. Cerny. 1996. *Ph.D.s—Ten Years Later*. Seattle, Wash.: Center for Innovation and Research in Graduate Education. http://depts.washington.edu/cirgeweb/c/research/Ph.D.s—ten-years-later (accessed December 18, 2009).

[10] Nyquist's compendium highlights the movement toward innovative strategies and actions for change within the academy (www.grad.washington.edu/envision/practices/index.html (accessed December 18, 2009). J. D. Nyquist and Bettina J. Woodford. 2000. *Re-envisioning the Ph.D.: What Concerns Do We Have?* Seattle, Wash.: Center for Instructional Development and Research and University of Washington. www.grad.washington.edu/envision/project_resources/concerns.html (accessed December 18, 2009).

[11] C. M. Golde and T. M. Dore. 2001. *At Cross Purposes: What the Experiences of Doctoral Students Reveal about Doctoral Education*. Philadelphia: A Report Prepared for the Pew Charitable Trusts. http://www.Ph.D.-survey.org (accessed December 18, 2009).

[12] According to their Web site (www.woodrow.org/responsivePh.D.), the Woodrow Wilson National Fellowship Foundation received a beginning grant from the Pew Charitable Trusts. Between 2000 and 2006, they worked with 14 PhD-granting universities to test and develop a model for innovation and change.

[13] G. Walker, et al. 2008. *The Formation of Scholars: Rethinking Doctoral Education for the Twenty-First Century.* San Francisco: Jossey-Bass.

[14] Council of Graduate Schools. *PhD Completion Project*. http://www.phdcompletion.org/ (accessed December 2009).

[15] Integrative Graduate Education and Research Traineeship (IGERT) Program Solicitation, NSF 08-540.

[16] A. Martinez, et al. 2006. *Contractor Annual Report and Summary of Cross-Site Monitoring of the NSF Integrative Graduate Education and Research Traineeships (IGERT) Program.* Prepared for the National Science Foundation. Cambridge, Mass.: Abt Associates.

[17] J. G. Carney, et al. 2006. *Evaluation of the Initial Impacts of the National Science Foundation's Integrative Graduate Education and Research Traineeships (IGERT) Program*. Prepared for the National Science Foundation. Cambridge, Mass.: Abt Associates. Full report available at http://www.nsf.gov/pubs/2006/nsf0617/index.jsp.

[18] America COMPETES Act 2007. Public Law 110-69. Section 4003.

[19] Trainees' long-term career trajectories and outcomes were not included as outcomes in this evaluation because too few IGERT graduates have been in the labor force long enough to provide valid or reliable data on these longer-term outcomes.

[20] See American Association for Public Opinion Research Standard Definitions Report. http://www.aapor.org/Standard_Definitions/1481.htm (accessed September 23, 2009).

[21] One project was excluded because its structure did not fit the sampling framework of the study—it draws individual students and faculty from a number of different universities instead of from within one or two institutions; and four projects were excluded because we were unable to find adequate comparison matches.

[22] See American Association for Public Opinion Research Standard Definitions Report. http://www.aapor.org/Standard_Definitions/1481.htm (accessed on September 23, 2009).

[23] E. Bergstralh, et al. 1996. "Software for Optimal Matching in Observational Studies." *Epidemiology* 7: 331–332; P. R. Rosenbaum. 1995. *Observational Studies*. New York: Springer-Verlag.

[24] P. Z. Schochet. 2008. *Guidelines for Multiple Testing in Experimental Evaluations of Educational Interventions, Final Report*. Prepared for the Institute of Education Sciences. Princeton, N.J.: Mathematica Policy Research Inc.

Chapter 2: Characteristics of IGERT PhD Graduates

In its first nine years, the IGERT program supported the graduate training of over 4,000 doctoral students and graduated more than 800 doctoral students. In this chapter, we explore the reasons these individuals initially pursued an interdisciplinary graduate program and the extent to which they were able to incorporate multiple disciplines into their doctoral theses. We also present descriptive statistics on the individuals who have graduated from IGERT training programs since the program's inception, including their graduation rates, time to degree, and demographic make-up. Finally, we explore the extent to which IGERT graduates report that their IGERT training experience helped or hindered their degree completion. This chapter answers the following questions:

- What draws IGERT graduates to pursue interdisciplinary training?
- Does IGERT influence students' decision to enroll in STEM graduate programs at institutions they might not otherwise have chosen?
- How interdisciplinary are the dissertations of IGERT graduates?
- How many IGERT trainees complete graduate degrees?
- How long does it take IGERT graduates to complete their PhD degrees?
- To what extent have IGERT projects graduated a diverse body of PhD graduates (i.e., by including more women and individuals from underrepresented racial and ethnic groups)?
- Does the IGERT experience help or hinder students' ability to complete their degrees?

Findings in this chapter are based on data from the Distance Monitoring System of IGERT trainees, which includes all IGERT PhD graduates (N=869) and our survey of the Full IGERT Sample of IGERT PhD graduates as of December 2007 (N=645). When reporting data on the degree completion of IGERT participants, we include all individuals who were IGERT trainees between 1998 and 2007 (N=4,080).

Key Findings

- Most IGERT graduates (83 percent) reported that they were already interested in an interdisciplinary education or research training experience when they applied to graduate school, for both intellectual and practical reasons. For example, some were intellectually drawn to interdisciplinary research problems, some described the nature of modern science as requiring interdisciplinary thought, and some believed that studying interdisciplinary research would best prepare them for a scientific career.
- Four in five IGERT graduates (81 percent) reported drawing upon at least two distinct, separate disciplines for their dissertation research, even though most IGERT graduates received their degrees in a single discipline.
- There were no patterns in the combinations of disciplines used by IGERT graduates in their dissertations: 521 survey respondents reported 245 different distinct combinations of fields, and 30 percent reported four or more disciplines.
- Between 1998 and 2007, 869 IGERT trainees received doctoral degrees.
  Sixty-six percent of the IGERT graduates surveyed indicated that they were the first in their immediate family to have obtained a PhD in a STEM field.

Key Findings

- Participation in IGERT was not associated with a decrease in students' likelihood of graduating, nor an increase in the amount of time it took them to complete their PhD degrees, when compared to national norms.
- Within 10 years of beginning their graduate studies, 54 percent of IGERT students had graduated with PhDs, 3 percent were still enrolled, 21 percent had left after receiving master's degrees, and 22 percent had withdrawn from their institutions without receiving degrees. The median time to degree for IGERT graduates was 5.2 years.
- Over the IGERT program's first decade, women have composed 36 percent of IGERT graduates. This compares to 45 percent of US STEM PhD graduates nationwide throughout 1998–2006. Underrepresented minorities represented 7 percent of all IGERT graduates, compared with 10 percent nationwide. The proportion of women or minorities graduating from IGERT projects remained fairly consistent from year to year.
- Ninety-six percent of IGERT graduates reported that their IGERT experience positively contributed to their ability to complete their PhDs. The traineeship's financial support was the most valuable factor cited (86 percent), followed by the project's focus on an interdisciplinary theme (57 percent), the freedom to pursue students' own research interests (56 percent), and access provided to resources, equipment, and technology (56 percent).

Pursuit of an Interdisciplinary Graduate Experience

According to the program solicitation, IGERT projects are expected to adopt a "comprehensive interdisciplinary theme" that serves as the foundation for traineeship activities and is based on transformative interdisciplinary research in science, technology, engineering, or mathematics. IGERT projects have, for example, designed interdisciplinary themes related to sustainability, bioinformatics, neurosciences, computational science and engineering, and nanoscience.[1] Project faculty members are encouraged to integrate their theme with "innovative graduate education and training mechanisms, curricula enhancement, and other educational features that foster strong interactions among participating students and faculty and develop an appreciation for the global nature and context of the proposed interdisciplinary theme."[2] In this section, we assess the extent to which the interdisciplinary nature of the IGERT graduate experience attracted students to enroll. We then describe how IGERT students sustained the interdisciplinary nature of their graduate education during their doctoral thesis research.

IGERT Students Are Attracted to Interdisciplinary Studies

Some IGERT projects recruited new students directly to their programs while other IGERT projects drew in students currently at their universities. As a result, it was difficult to ascertain the degree to which the IGERT program affected the initial enrollment of students in graduate programs. However, there is evidence that IGERT played a role in drawing a small number of students to their graduate programs, as 12 percent of IGERT graduates (N=78) indicated they *would not have enrolled* at their

institution without the IGERT training program. The remainder said they still would have enrolled at their institution (45 percent) or that they were not aware of IGERT before enrolling (43 percent).[3]

Most IGERT graduates were already interested in interdisciplinary training when they joined IGERT: 83 percent of IGERT graduates reported having had an interest in interdisciplinary education or research training experience when they initially applied to graduate school.[4] Those who did not have an interest in interdisciplinary education also participated in IGERT, presumably developing an interest in interdisciplinary work along the way. One such individual explained, "I was not particularly interested when I enrolled, but it became extremely important to me while I was in graduate school. My current work is VERY interdisciplinary, so this was a valuable experience."

> "Interdisciplinary programs are more interesting to me than traditional programs because they incorporate a variety of topics to solve problems. As the problems in engineering and science become more and more complex, it is necessary for individuals to draw upon an expanded knowledge and experience base."
>
> – IGERT graduate

IGERT graduates reported a variety of reasons for their initial interest in interdisciplinary graduate programs (Exhibit 2.1). Some of the graduates indicated their reasons were intellectual: they did not want to be confined to one discipline but were interested in studying multiple areas (39 percent) or they desired to learn how to use multiple research methods to address research questions (21 percent). For example, one IGERT graduate wrote, "I am fascinated by the under-explored niches of science that exist at the interfaces between disciplines."

Exhibit 2.1

Reasons for IGERT Graduates' Pursuit of Interdisciplinary Graduate Degrees

Coded responses to the open-ended question, *"Why were you interested in interdisciplinary graduate programs?"*	Percent [a]
Interested in multiple disciplines or intersection of disciplines	39%
Interested in using or applying a broad array of research methods	21
Interdisciplinary research advances scientific developments and problem solving in science and society	21
Chosen field of study is inherently interdisciplinary	19
Prior study was interdisciplinary or included multiple fields	11
Enhanced career opportunities	10
Opportunities for collaboration	7
Prior interdisciplinary work experience	2
Other	2

Exhibit reads: 39 percent of IGERT graduates reported having pursued an interdisciplinary graduate degree because of a personal interest in multiple disciplines or an intersection of disciplines.

Includes IGERT PhD graduates: N=645; Missing=193.

[a] Percents sum to more than 100 because respondents could report multiple responses.

Source: IGERT Follow-up Survey, 2008. (Item A5).

Other graduates noted that they pursued interdisciplinary studies because their chosen field of study was inherently interdisciplinary (19 percent) or because scientists must use interdisciplinary research to solve problems in society (21 percent). The comments of these graduates included statements such as, "I'm especially passionate about science that addresses environmental problems, and much of that science is by necessity interdisciplinary"; "The real world is interdisciplinary"; and "This is the forefront of science. The overlap of highly technical fields is where new discoveries, insights, and knowledge can be obtained."

Seven percent of graduates were interested in the collaboration opportunities provided by interdisciplinary study. Finally, a few graduates indicated that an interdisciplinary graduate experience provided them with enhanced career opportunities (10 percent) or that their prior work training or experience had already been interdisciplinary (2 percent).

IGERT Graduates Complete Multidisciplinary Doctoral Theses

> "The major challenge that I faced was in returning back to my discipline after all of this creative intellectual explanation in order to complete a dissertation that would be of sufficient depth to meet the requirements of a dissertation 'product' within my own discipline…. I found the process of completing a disciplinary PhD after being trained as an interdisciplinary scholar the most challenging aspect of the entire process."
>
> – IGERT graduate

Abt Associates' 2006 evaluation of the IGERT program found that only 23 percent of IGERT awards created new certificate or degree programs.[5] Thus the majority of IGERT students earned their PhD degrees from a single disciplinary department while also fulfilling additional IGERT requirements such as participating in IGERT-related courses, seminars, and research experiences. Not surprisingly, IGERT trainees reported having more interdisciplinary experiences and training than non-IGERT students, including greater interaction with faculty and students in other disciplines and involvement with inter- and multidisciplinary research experiences. IGERT training activities typically occurred during students' first few years of graduate school, after which students focused on their dissertation research. The previous evaluation documented that the course work and training received by IGERT students in these early years was more interdisciplinary than that received by non-IGERT students but did not examine the influence of the IGERT-related interdisciplinary training experiences on PhD students' ultimate graduate research experience: the doctoral dissertation. Once they entered this final stage of doctoral training, did IGERT students continue to engage in interdisciplinary work and produce theses that were multidisciplinary or interdisciplinary in some fashion? Or, when they were back within the organizational structure of their home departments, did they produce single-discipline degrees?

> "[IGERT] allowed me to design, conduct, and complete an interdisciplinary dissertation." – IGERT graduate

Data from the current study indicated that the majority of IGERT graduates continued to draw upon multiple fields when completing their dissertation research, even though their degrees were often being granted from a single department. We asked IGERT graduates to identify broad disciplinary categories they used in their dissertation research from the following list:

- Agricultural Sciences / Natural Resources
- Astronomy
- Atmospheric Science and Meteorology
- Biological / Biomedical Sciences
- Chemistry
- Communications
- Computer and Information Sciences
- Education
- Engineering
- Geological and Earth Sciences
- Health Sciences
- Humanities
- Mathematics
- Ocean / Marine Sciences
- Physics
- Professional Fields / Business Management / Administration
- Psychology
- Social Sciences
- Other

Of this list, 81 percent of IGERT graduates reported that they drew on at least two disciplines in their dissertation research (Exhibit 2.2). Engineering students were most likely to incorporate multiple disciplines and social science students were least likely to do so (although two-thirds of social science students still reported doing so).

Exhibit 2.2

Extent to Which IGERT Graduates Used Multiple Disciplines in Their Dissertation Research, Overall and by Home Discipline [a]

	Percent of IGERT graduates who used two or more disciplines in their dissertations
ALL IGERT GRADUATES [b]	81%
By home discipline: [c]	
Computer Sciences	85%
Engineering	92
Life Sciences	77
Mathematics	86
Physical Sciences	80
Social Sciences	68

Exhibit reads: 81 percent of all IGERT PhD graduates reported using two or more main disciplines in their dissertation research. Eighty-five percent of IGERT PhD graduates in computer sciences reported using two or more main disciplines in their dissertation research.

[a] *Home discipline* was coded from the department of enrollment as reported by a trainee in the Distance Monitoring System.

[b] Includes IGERT PhD graduates: N=645; Missing=0.

[c] Includes IGERT PhD graduates: N=33 (computer sciences), 147 (engineering), 177 (life sciences), 29 (math), 164 (physical sciences), 90 (social sciences); Missing=0. Five graduates from "other" home disciplines were not included in the "by home discipline" figures in this exhibit.

Source: IGERT Follow-up Survey, 2008. (Item B9).

What disciplines did IGERT graduates use in their doctoral thesis research? The disciplines used in IGERT graduates' dissertations are presented in Exhibit 2.3, overall and for graduates within various home disciplines. It is immediately apparent that there was no "one size fits all" combination of disciplines. In fact, only 16 of 108 possible disciplinary combinations displayed were not reported by

any graduates. The diversity observed reflects the range of interdisciplinary topics around which funded IGERT projects have organized their training opportunities, which is only natural given that IGERT is a cross-agency program spanning all NSF Directorates.

Exhibit 2.3

Disciplines Used in IGERT Graduates' Dissertation Research, by Home Discipline of Graduate

Disciplines used in thesis research:	*IGERT Graduates' Home Discipline* [a]						
	All	Computer Sciences	Engi-neering	Life Sciences	Math	Physical Sciences	Social Sciences
Biological and/or Biomedical Sciences	51%	45%	41%	89%	62%	34%	26%
Engineering	41	15	97	13	10	40	7
Chemistry	35	9	42	24	7	68	3
Mathematics	33	42	44	28	100	26	16
Physics	32	9	44	10	28	62	4
Computer and Information Sciences	26	94	23	27	34	15	17
Social Sciences	15	9	6	10	0	1	80
Agricultural Sciences and/or Natural Resources	12	0	6	29	14	5	8
Psychology	9	21	1	8	0	1	36
Geological and/or Earth Sciences	9	0	5	14	3	11	4
Health Sciences	8	12	9	11	3	4	8
Atmospheric Science and Meteorology	5	0	7	6	7	5	2
Ocean and/or Marine Sciences	4	0	1	5	3	7	2
Education	3	0	2	0	3	3	9
Communications	2	6	3	0	3	1	4
Professional Fields/ Business Management/ Administration	2	6	1	0	0	1	6
Humanities	2	3	0	1	0	1	13
Astronomy	1	0	1	1	0	2	0

Exhibit reads: 51 percent of all IGERT PhD graduates and 45 percent of all computer sciences IGERT graduates reported using biological and/or biomedical sciences in their dissertation research.

Includes IGERT PhD graduates: N=645 (All Graduates), 33 (computer sciences), 147 (engineering), 177 (life sciences), 29 (math), 164 (physical sciences), 90 (social sciences); Missing=0. Five graduates from "other" home disciplines are included in the "All" total, but excluded from the rest of the table.

Note: Percents sum to more than 100 because respondents could report multiple disciplines.

[a] *Home discipline* was coded from the department of enrollment as reported by trainees in the Distance Monitoring System.

Source: IGERT Follow-up Survey, 2008. (Item B9).

The use of multiple and varied disciplines reported by IGERT graduates is observed across all graduates as well as within specific home disciplines. For example, IGERT graduates receiving their PhDs in engineering reported also using biology (41 percent), chemistry (42 percent), mathematics (44 percent), physics (44 percent), or computer and information sciences (23 percent) in their dissertation research.

Exhibit 2.3 illustrates the extent to which IGERT graduates drew upon various disciplines in their dissertation research, but it does not capture the extent to which individuals reported drawing upon more than two disciplines. As shown in Exhibit 2.4, the majority of IGERT graduates reported using two or three broad disciplines—and 30 percent reported using four or more disciplines in their dissertation research. On average, IGERT graduates reported using three broad disciplines in their dissertations.[6]

Exhibit 2.4

Number of Broad Disciplines IGERT Graduates Used in Dissertation Research

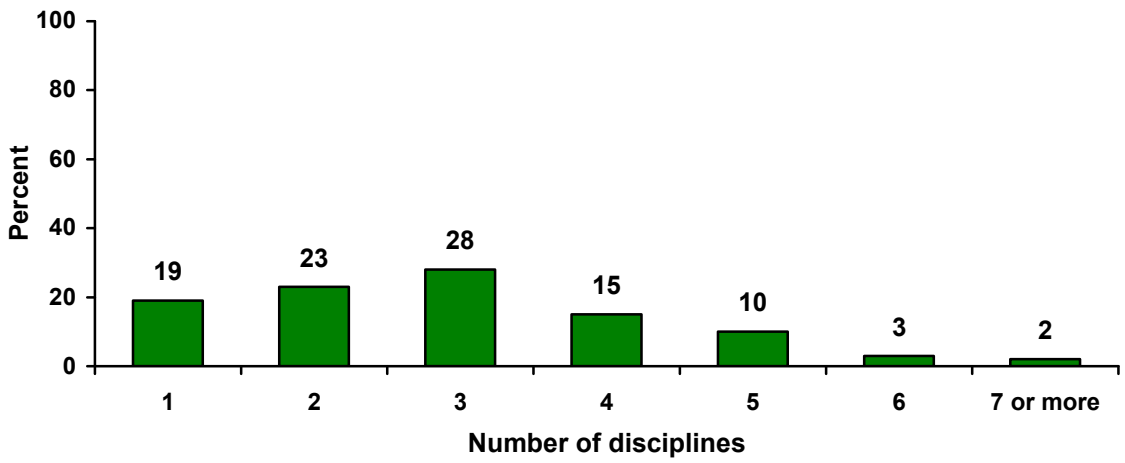

Exhibit reads: 19 percent of all IGERT PhD graduates used only one and 23 percent reported using two disciplines in their dissertation research.

Includes IGERT PhD graduates: (N=645); Missing=0.

Source: IGERT Follow-up Survey, 2008. (Item B9).

Which broad disciplines were most likely to be combined by IGERT graduates when completing their dissertations? It turns out there was no one answer to that question. We examined all possible combinations among the 19 broad disciplines and found that each unique combination was reported by 4 percent or fewer graduates—out of 645 responding individuals. The 521 IGERT graduates using two or more disciplines in their dissertation reported 245 different combinations of disciplines, 172 of which were reported only by a single respondent.

For each broad discipline respondents reported using in their dissertation, respondents could further specify the detailed disciplines used. Exhibit 2.5 provides an illustration of this; the full list of the 230 detailed disciplines can be found in the survey instrument in Appendix D. On average, IGERT graduates reported drawing from seven detailed disciplines in their dissertations.[7] Several IGERT respondents explicitly commented that while they only checked off 1 of the main 19 broad disciplines, their work was still "interdisciplinary" because within that category, they were combining content or methods from

multiple detailed disciplines. For example, within the broad discipline of chemistry, one individual reported drawing upon analytical chemistry, inorganic chemistry, organic chemistry, physical chemistry, and polymer chemistry for his/her dissertation research. Of the 19 percent of IGERT graduates who reported using only one broad discipline for their dissertations, 59 percent reported using more than one detailed discipline.[8]

Exhibit 2.5

Examples of Detailed Disciplines That Map to Broad Disciplines Used in Survey

Broad Discipline	Examples of Detailed Disciplines	
Biological/Biomedical Sciences	Biochemistry Bioinformatics Plant Physiology Evolutionary Biology	Ecology Neurosciences Toxicology etc.
Engineering	Bioengineering & Biomedical Engineering Chemical Engineering Civil Engineering Engineering Physics	Environmental Health Engineering Mechanical Engineering Ocean Engineering etc.

For a complete list of the detailed disciplines contained within each broad discipline, see the survey instrument in Appendix D.

Degree Completion

An IGERT graduate education experience typically includes both a series of interdisciplinary courses and research experiences, followed by students' creation of an original research dissertation. Does the interdisciplinary nature of the IGERT experience inhibit students' degree-completion ability? Does completing an IGERT PhD degree require more time than a traditional, single-discipline degree? We found no evidence that participating in IGERT prevents or slows down students' ability to complete their degrees. IGERT graduates completed their PhD degrees at rates equal to national norms, and in equal (or less) time. Individuals leaving their institutions without completing their PhDs reported that IGERT had nothing to do with their departure, and most IGERT graduates credited aspects of their IGERT experience with helping them complete their degrees.

Number of Degrees Granted

Essential to creating a diverse science and engineering workforce for the future is ensuring that graduate students persist to degree completion. Between 1998 and 2007, 869 IGERT trainees received doctoral degrees. Sixty-six percent of the IGERT graduates indicated that they were the only ones in their immediate families to have obtained PhDs in a STEM field.[9] The number of graduates grew annually, as more IGERT projects matured and students had time to progress through their degree programs (Exhibit 2.6). Exhibits 2.7, 2.8, and 2.9 illustrate the diversity of IGERT graduates by gender, race/ethnicity, and STEM discipline.

Exhibit 2.6

Number of IGERT PhD Graduates, by Year

Academic Year	Number per Year	Cumulative Number
1999–2000	10	10
2000–2001	14	24
2001–2002	38	62
2002–2003	75	137
2003–2004	112	249
2004–2005	162	411
2005–2006	176	587
2006–2007	200	787
2007–2008	82	869

Exhibit reads: 10 IGERT graduates completed their PhDs in the 1999–2000 academic year and 14 completed their PhDs in the 2000–2001 academic year.

Includes IGERT PhD graduates: N=869; Missing=0.

Source: IGERT Distance Monitoring System, 2007.

Exhibit 2.7

Number of IGERT PhD Graduates, by Gender and Year

Academic Year	Men	Women
1999–2000	7	2
2000–2001	9	5
2001–2002	20	15
2002–2003	54	20
2003–2004	70	42
2004–2005	101	57
2005–2006	116	55
2006–2007	124	75
2007–2008	48	34
Total, all years	549	305

Exhibit reads: 7 men and 2 women IGERT graduates completed their PhDs in the 1999–2000 academic year.

Includes IGERT PhD graduates: N=869 (All Graduates), 549 (Men), 305 (Women); Missing or not reported=15.

Source: IGERT Distance Monitoring System, 2007.

Exhibit 2.8

Number of IGERT PhD Graduates, by Race/Ethnicity and Year

Academic Year	Underrepresented Minority [a]	White, Asian
1999–2000	0	10
2000–2001	1	10
2001–2002	4	29
2002–2003	6	63
2003–2004	7	98
2004–2005	10	135
2005–2006	16	144
2006–2007	9	170
2007–2008	10	69
Total, all years	63	728

Exhibit reads: All 10 of the IGERT graduates who completed their PhDs in the 1999–2000 academic year were White or Asian.

Includes IGERT PhD graduates: N=869 (All Graduates), 63 (Underrepresented Minority), 728 (White or Asian); Missing or not reported=78.

[a] Underrepresented Minority defined as Hispanic, African American, Native American, or Pacific Islander.

Source: IGERT Distance Monitoring System, 2007.

Exhibit 2.9

Number of IGERT PhD Graduates, by Home Discipline and Year

Academic Year	IGERT Graduates' Home Discipline [a]						
	All	Computer Sciences	Engi-neering	Life Sciences	Math	Physical Sciences	Social Sciences
1999–2000	10	0	4	2	1	1	2
2000–2001	14	1	7	0	0	3	3
2001–2002	38	2	11	4	0	16	5
2002–2003	75	4	16	19	5	24	7
2003–2004	112	4	30	39	4	27	8
2004–2005	162	7	47	43	5	40	19
2005–2006	176	12	46	45	5	40	28
2006–2007	200	9	51	54	9	51	23
2007–2008	82	6	16	20	4	17	17
Total, all years	869	45	228	226	33	219	112

Exhibit reads: Among the 10 IGERT graduates who completed their PhDs in the 1999–2000 academic year, 4 earned degrees in engineering, 2 in life sciences, 1 in math, 1 in physical science, and 2 in social sciences.

Includes IGERT PhD graduates: N=869 (All Graduates), 45 (computer sciences), 228 (engineering), 226 (life sciences), 33 (math), 219 (physical sciences), 112 (social sciences); Missing=0. Six graduates from "other" home disciplines are not included in this exhibit.

[a] *Home discipline* was coded from the department of enrollment as reported by trainees in the Distance Monitoring System.

Source: IGERT Distance Monitoring System, 2007.

Degree Completion Rates

The path to completing a STEM PhD is marked by extensive time dedicated to course work, research, and teaching.[10] Even though nationally representative data on PhD completion rates do not currently exist, the Council of Graduate Schools' PhD Completion Project recently estimated that STEM doctoral degree completion rates for a small sample of institutions ranged from 55 to 64 percent of students graduating within 10 years, with moderate variation among STEM disciplines.[11] The doctoral degree completion rates for IGERT trainees fell within these national ranges and varied by field of study. Exhibit 2.10 displays the IGERT completion rates alongside persistence and attrition rates by discipline of study.

The table presents the percent of IGERT students who had completed their PhD degrees, were still enrolled in their PhD programs, had left their institutions after completing master's degrees, or had withdrawn without graduating at four time points—three, five, seven, and ten years after enrollment. Very few IGERT trainees (2 percent) finished their doctoral degrees by the end of their third year of graduate study, as most (84 percent) were still working toward their doctoral degrees. By the end of the tenth year of graduate school, however, more than half of IGERT trainees (54 percent) completed their PhD degrees, and the percent of trainees still enrolled in their degree programs had diminished to 3 percent. At the end of ten years, PhD degree completion rates were highest in the life and physical sciences (63 and 60 percent, respectively) and lowest in engineering (45 percent).

IGERT Trainees Who Leave without Completing Their Degrees

Forty-three percent of IGERT students left their institution without completing their PhD degrees within ten years of enrollment. This rate of departure was consistent with other studies, which often cited departure rates around 40 percent.[12] To learn more about why IGERT trainees withdrew from doctoral study at their IGERT institutions and to investigate whether the IGERT experience played a role in their departure, we interviewed 28 former trainees whose PIs reported they had left without completing their PhD degrees.[13] As the number of respondents was small, the following discussion presents counts rather than percents. Two-thirds of these individuals (N=18) reported transferring to another institution to pursue their doctorates; the remaining third did not.

The former IGERT trainees who were interviewed reported leaving their IGERT degree program for a variety of reasons, including personal reasons, realizing their research interests were not met in their IGERT degree programs, or moving with their faculty advisers who were relocating to other institutions. Twenty of the 28 respondents indicated that their IGERT experience had no bearing on their decision to leave their institution. These individuals reported that the time devoted to their IGERT program did not affect their research or course work progress and that the combined workload of participating in IGERT and fulfilling their other graduate school responsibilities was manageable. Eight of the 28 respondents said that IGERT did influence their decision to leave for academic reasons (N=5), as a result of losing IGERT funding (N=2), or for other reasons (N=1). Nearly all 28 interviewees reported that their faculty advisers were supportive of their participation in IGERT.

Exhibit 2.10

Degree Completion and Enrollment Status of IGERT PhD Trainees as of 2007, by Home Discipline

	IGERT Degree Completion and Enrollment Status [a]															
	Years Since Initial Enrollment															
	3 Years				5 Years				7 Years				10 Years			
Home Discipline [b]	Completed PhD	Still Enrolled in PhD	Left after receiving master's degree	Left without completing degree	Completed PhD	Still Enrolled in PhD	Left after receiving master's degree	Left without completing degree	Completed PhD	Still Enrolled in PhD	Left after receiving master's degree	Left without completing degree	Completed PhD	Still Enrolled in PhD	Left after receiving master's degree	Left without completing degree
Computer Sciences	3%	85%	2%	10%	15%	59%	8%	17%	40%	22%	12%	26%	51%	3%	15%	31%
Engineering	2	81	10	7	17	53	18	11	38	19	27	16	45	4	32	19
Life Sciences	1	88	3	8	16	66	6	12	49	24	9	18	63	4	11	21
Math	2	80	9	8	21	52	14	13	47	16	22	16	56	0	26	18
Physical Sciences	2	87	4	7	20	60	9	11	50	17	14	18	60	1	17	22
Social Sciences	1	87	6	5	16	65	10	9	41	31	15	13	58	7	19	16
TOTAL [c]	2	84	6	8	17	59	11	13	43	21	17	19	54	3	21	22

Exhibit reads: After three years of enrollment, 3 percent of IGERT trainees enrolled in computer sciences had completed their PhDs, while 85 percent were still enrolled, 2 percent withdrew after receiving master's degrees, and 10 percent withdrew without completing any degree. After five years of enrollment, 15 percent of IGERT trainees enrolled in computer sciences had completed their PhDs (including those who completed a PhD in the first three years), while 59 percent were still enrolled, 8 percent withdrew after receiving master's degrees (including those who withdrew after receiving master's degrees in the first three years), and 17 percent withdrew without completing any degree (including those who withdrew without receiving any degree in the first three years).

[a] Percent of IGERT trainees who had completed PhDs, were still enrolled in their degree program, left after receiving master's degrees, and left without receiving any degrees after each specific number of years since starting their IGERT-related graduate program.

[b] *Home discipline* was coded from the department of enrollment as reported by trainees in the Distance Monitoring System. Includes only IGERT trainees who had completed their degree, withdrew, or were still enrolled as of the third year of their doctoral program:

Computer Sciences: 168 (3 years); 118 (5 years); 82 (7 years); 68 (10 years).

Engineering: 1,086 (3 years); 742 (5 years); 512 (7 years); 440 (10 years).

Life Sciences: 749 (3 years); 541 (5 years); 376 (7 years); 317 (10 years).

Mathematics: 96 (3 years); 63 (5 years); 45 (7 years); 39 (10 years).

Physical Sciences: 754 (3 years); 542 (5 years); 341 (7 years); 294 (10 years).

Social Sciences: 410 (3 years); 283 (5 years); 205 (7 years); 164 (10 years).

[c] Total includes IGERT PhD trainees in "other" fields (N=62), who are not otherwise reported in this table.

Total: 3,325 (3 years); 2,343 (5 years); 1,609 (7 years); 1,363 (10 years).

Source: IGERT Distance Monitoring System, 2007.

Time to Degree

The average length of time that doctoral students spend in graduate school before completing their degrees has increased over the past three decades.[14] Many aspects of graduate education have an impact on time to degree, including degree requirements, time dedicated to course work instead of research or teaching, and students' ability to conduct their own research.[15] We investigated the time that IGERT graduates spent in their graduate programs and found the median time to degree for IGERT students who

graduated with their PhDs between 1999 and 2007 was 5.2 years, calculated as the time elapsed between initial graduate enrollment at the IGERT institution and graduation with the PhD. Exhibit 2.11 displays the median time to degree by broad STEM discipline for IGERT graduates from 1999 to 2007 and for all US citizen STEM graduates in 2006. The median time to degree within broad disciplines for IGERT graduates appears lower than the national median time to degree for US citizen STEM graduates nationwide in 2006 (Exhibit 2.11). The national data displayed in Exhibit 2.11 provide useful context; a direct comparison between IGERT graduates and all graduates nationally on time to degree is less informative, as national data on number of years between enrollment and graduation include time spent at multiple institutions, whereas data on IGERT graduates is based solely on the number of years within the IGERT institutions. .

Exhibit 2.11

Median Time to Degree for IGERT and STEM PhD Recipients, by Home Discipline [a]

Home Discipline [b]	IGERT PhD Graduates in 1999–2007 [c] *Years between enrollment in and graduation from PhD program*	National STEM PhD Graduates in 2006 [d] *Years between initial enrollment in graduate school (any degree) and graduation from PhD program*
Engineering	5.0	6.3
Life Sciences	5.3	6.7
Physical Sciences	5.2	6.0
Mathematics	*5.2*	-
Computer Sciences	*5.7*	-
Physical Sciences (excluding Mathematics and Computer Sciences)	*5.1*	-
Social Sciences	5.7	7.9

Exhibit reads: The median number of years for IGERT graduates to complete their engineering doctoral degrees was 5.0 years, and the median number of years for US STEM doctorates to complete their engineering doctoral degrees was 6.3 years.

[a] The median graduate time to degree for IGERT PhD graduates was based on the time elapsed from when they enrolled in their IGERT graduate program until receiving PhDs. National data from the Survey of Earned Doctorates calculated graduate time to degree based on time elapsed from initial enrollment in any graduate program until receiving a PhD, which could include time spent in other graduate degrees unrelated to the doctoral degree. The total across disciplines was not reported in this exhibit because the distribution of IGERT graduates across broad disciplines differs considerably from the distribution of STEM PhD recipients nationally.

[b] *Home discipline* was coded from the department of enrollment as reported by trainees in the Distance Monitoring System. *Life sciences* includes health sciences for only national data. *Physical sciences* includes mathematics and computer sciences to match publicly available national data.

[c] Includes IGERT PhD graduates: N=147 (engineering), 177 (life sciences), 226 (physical sciences (N=164), including math (N=29) and computer sciences (N=33)), 90 (social sciences); Missing=1.

[d] Includes National (US citizen) STEM PhD graduates, who received their doctoral degrees in 2006 only: N=2,072 (engineering), 5,761 (life sciences), 3,186 (physical sciences, including math and computer sciences), 4,555 (social sciences).

Sources: IGERT Follow-up Survey, 2008. (Items B1 and B5). Survey of Earned Doctorates, 2006.

The time to degree estimates for IGERT graduates presented in Exhibit 2.11 incorporate all individuals who had graduated as of December 2007. Many IGERT students were still enrolled at this time, some of whom presumably will graduate at a later date. As such, the numbers presented in this exhibit may underestimate the actual time to degree of IGERT students. To measure the true time to degree for IGERT students would require waiting until all IGERT students had graduated or left their institutions,

which is not feasible for this study. To closely estimate this calculation, we computed the time to degree for all IGERT graduates who initially enrolled in their graduate program in 2000 or earlier. Only 418 IGERT graduates met this criterion; the median time to degree for those individuals was 5.7 years, or one-half year longer than the original estimate.[16]

We also examined the median time to degree for IGERT graduates by whether or not they had received master's degrees prior to enrolling in their PhD programs. The median time to degree for the 183 IGERT graduates who held master's degrees prior to enrolling in their PhD programs was 4.9 years; the median time to degree for the remaining 461 IGERT graduates who did not have prior master's degrees was 5.3 years.

Trainees from Groups Underrepresented in STEM

According to the 2008 program solicitation, the IGERT program is designed to "facilitate diversity in student participation and preparation, and to contribute to a world-class, broadly inclusive, and globally engaged science and engineering workforce."[17] NSF encourages projects to "include strategies for recruitment, mentoring, and retention aimed at members of groups underrepresented in science and engineering, including women [and] racial and ethnic minorities." As seen in Exhibit 2.12, the majority of IGERT graduates and national STEM PhD graduates were white, non-Hispanic males in life science, physical science, or engineering disciplines.

Exhibit 2.12

IGERT PhD Graduates and National STEM PhD Graduates Descriptive Characteristics

	IGERT PhD Graduates [a]	National STEM PhD Graduates [b]
Gender		
Male	64%	55%
Female	36	45
Race/ethnicity[c]		
Non-URM	80%	87%
Chose not to report or unknown	13	3
URM	7	10
Home Discipline of study in doctoral program		
Life Sciences	26%	34%
Engineering	26	14
Physical Sciences	25	14
Social Sciences	13	32
Computer Sciences	4	3
Mathematics	1	3

Exhibit reads: 64 percent of all IGERT graduates are men, and 55 percent of national STEM PhD graduates are men.

[a] Includes IGERT PhD graduates: N=869 (All Graduates); Missing is 0 for all variables except for gender (N=15).

[b] Includes National (US citizen and permanent resident) STEM PhD graduates, who received doctoral degrees in academic years 1998–1999 through 2005–2006. N=140,493. Missing=5.

[c] IGERT URM includes: Hispanic, American Indian, Alaskan Native, Black, Native Hawaiian, or Pacific Islander. National data on URM includes: Hispanic, American Indian, Alaskan Native, or Black. National data reports Native Hawaiian or Pacific Islander within Other/Unknown category.

Sources: IGERT Distance Monitoring System, 2007. IGERT Follow-up Survey, 2008. (Items P2, P3, and P4). NSF/SRS, Survey of Earned Doctorate, 2006. Integrated Science and Engineering Resources Data System (WebCASPAR), http://webcaspar.nsf.gov.

Female Graduates

Women represent a large pool of potential talent for STEM fields, and the IGERT program encourages IGERT projects to employ strategies to recruit and retain both men and women. Between 1999 and 2008, 36 percent of IGERT graduates were women, although the proportion has ranged, year to year, from between 22 to 43 percent (Exhibit 2.13).[18] Note, however, that these numbers are not a direct measure of whether IGERT projects are increasing the participation of women in STEM graduate programs, because some IGERT projects recruit students who are already enrolled in degree programs.

Exhibit 2.13

IGERT PhD Graduates, by Gender and Year of Graduation

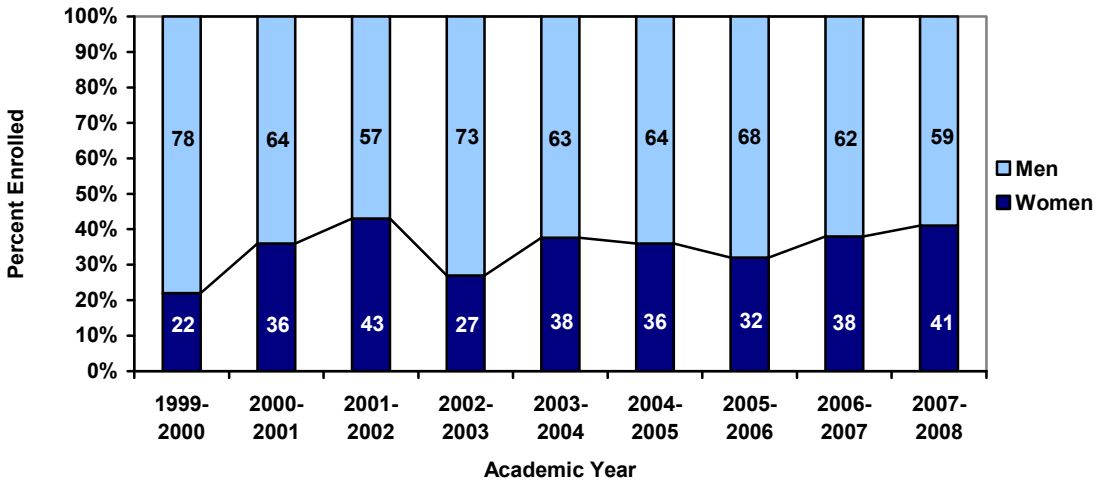

Exhibit reads: In 1999–2000, 78 percent of IGERT graduates were men and 22 percent were women.

Includes IGERT PhD graduates: N=869; Missing=15.

Source: IGERT Distance Monitoring System, 2007.

The proportion of IGERT graduates who were female varied by STEM discipline. Compared to national data, the proportion of female IGERT graduates in some disciplines was slightly higher than female doctoral recipients nationwide (e.g., engineering) whereas for other disciplines (e.g., math and social sciences), the proportion of female IGERT graduates was lower than those of women doctoral recipients nationally (Appendix B, Exhibit 2.14).

Similar proportions of male and female IGERT students earned their PhD degrees over time. By the end of the tenth year of graduate school, equal percentages of men and women (57 percent) had completed their PhDs (Appendix B, Exhibit 2.15). The PhD Completion Project has estimated that 55 percent of women STEM doctoral students at a sample of institutions completed their degrees within 10 years of beginning their studies in 1992–1993 or 1994–1995.[19]

Graduates from Racial/Ethnic Groups Underrepresented in Science

In addition to encouraging the participation of women in IGERT doctoral programs, NSF also encourages projects to actively recruit individuals from racial and ethnic groups traditionally underrepresented in STEM disciplines (Hispanic, American Indian, Alaskan Native, Black, Native Hawaiian, or Pacific Islander). As of 2008, 63 IGERT trainees from underrepresented racial and ethnic groups had completed their doctoral degrees, including 26 African American, 29 Hispanic, 2 Native American, and 6 multiracial IGERT trainees. Exhibit 2.16 displays the percentage of IGERT graduates who identified themselves with a racial/ethnic group underrepresented in STEM since the program's inception. Between 1999 and 2008 the representation of IGERT PhD graduates identifying with a racial/ethnic group underrepresented in STEM ranged from 0 to 12 percent.

Exhibit 2.16

IGERT PhD Graduates, by Race/Ethnicity and Year of Graduation [a]

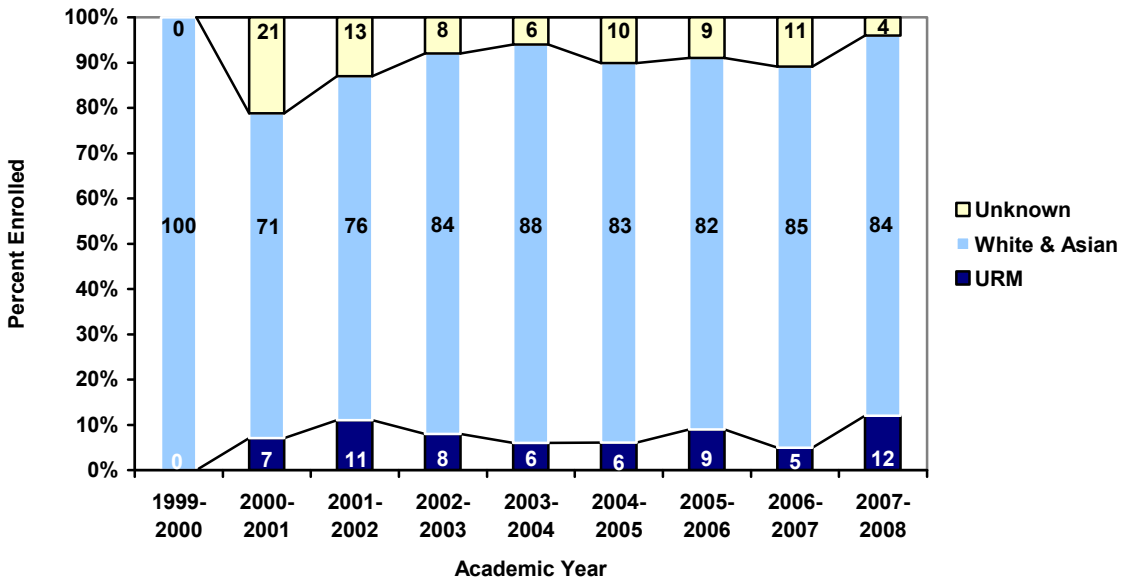

Exhibit reads: Among the IGERT PhD graduates receiving doctoral degrees in 2007-2008, 84 percent identified themselves as White or Asian, 4 percent identified with a racial/ethnic group underrepresented in STEM, and 12 percent did not report their race/ethnicity.

Includes IGERT PhD graduates: N=869; Missing=0.

[a] URM is composed of the following: Hispanic, American Indian, Alaskan Native, Black, Native Hawaiian, or Pacific Islander. Unknown includes individuals who chose not to identify or did not answer these race and ethnicity questions.

Sources: IGERT Distance Monitoring System, 2007. IGERT Follow-up Survey, 2008. (Items P2 and P3)

Averaging across all years, 7 percent of IGERT graduates self-identified as being members of racial/ethnic group underrepresented in STEM, and 80 percent identified themselves as White or Asian. Thirteen percent did not report their racial/ethnic identity. Compared to national data, the proportion of URM IGERT graduates in a given discipline was roughly similar to national averages of URM STEM doctoral recipients (Appendix B, Exhibit 2.17).

Degree completion of IGERT students who identified with a racial/ethnic group underrepresented in STEM varied by discipline (Appendix B, Exhibit 2.18). Thirty-seven percent of IGERT trainees who identified themselves with a URM group completed their doctoral degree by the end of the tenth year of graduate school. After 10 years, completion rates for URM were highest in social sciences (58 percent) and life sciences (48 percent). National estimates conducted by the PhD Completion Project reported that 43 percent of African American and 54 percent of Hispanic American STEM doctoral students completed their PhDs within 10 years of their initial enrollment in 1992–1993 or 1994–1995.[20] The majority of IGERT trainees who identified themselves as White or Asian had completed their degree within ten years of graduate school (60 percent) with ten year completion rates highest in life and physical sciences.

The Role of IGERT in Degree Completion

IGERT graduates viewed the IGERT experience as playing a positive role in their ability to complete their degrees. Only 4 percent of IGERT graduates reported that their IGERT experience did not contribute to degree completion, while just over one-third reported that IGERT contributed "a little" (10 percent) or "to some extent" (26 percent) (Exhibit 2.19). The majority of IGERT graduates reported that their IGERT experience contributed "quite a bit" (36 percent) or "a great deal" (24 percent).

Exhibit 2.19

Extent IGERT Contributed to Graduates' Ability to Complete Their Degrees

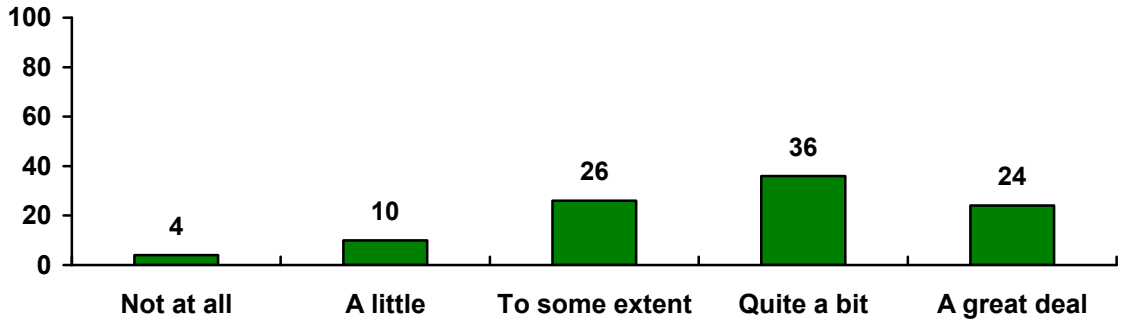

Exhibit reads: 24 percent of IGERT graduates reported that their IGERT experience contributed a great deal to their ability to complete their doctoral degrees.

Includes IGERT PhD graduates: N=645; Missing=6.

Source: IGERT Follow-up Survey, 2008. (Item B11).

Graduates indicated that IGERT had helped them progress toward degree completion in a variety of ways (Exhibit 2.20). Nearly all agreed that having IGERT financial support contributed to their ability to complete their degrees. Quotations from selected IGERT graduates highlight various ways the financial support led to their research and degree completion:

> My IGERT funding was critical for completing my degree. It gave me resources to have a year to pursue research, which I would not normally have been able to pursue; it gave me the ability to collaborate with outside researchers; it gave me the ability to be trained outside my area; it gave me the ability to have a fantastic scientific community in [my field of study].

> My IGERT experience played a significant role in helping me to complete my degree. First, the financial support allowed me to focus on a challenging, interdisciplinary research topic that was new in my adviser's laboratory. I would have struggled if I had been required to teach and try to pursue this challenging project.

A little over half the respondents indicated that the interdisciplinary theme of their IGERT program (57 percent) contributed to their degree completion. As one respondent commented:

> I was able to receive interdisciplinary training [through IGERT] in computer science, mathematics, neurobiology, and biology. In addition, I was conducting research alongside

> faculty, postdocs, and students who were studying problems at the intersection of all of these disciplines. All of these factors contributed to my graduate training.

In addition, at least half of IGERT graduates reported that having the freedom to pursue their own research interests (56 percent), having access to resources, equipment, and technology (56 percent), or increased time to conduct research (50 percent) were aspects of the IGERT program that contributed to their degree completion. The comments from two IGERT graduates described the positive role IGERT played in their own degree completion.

> My IGERT [program] had a very positive influence on the completion of my degree as it funded my research and allowed me to focus on developing my research ideas as well as to explore avenues I would otherwise not have had the time or resources to explore.

> IGERT provided me with the essential tools and resources to complete my degree (i.e., human, laboratory, and monetary). Without [these] tools and resources, my thesis would not have been as well rounded scientifically from my point of view.

Elements of the IGERT program cited less frequently as influential in degree completion included having two faculty advisers (17 percent) and experience working in multiple labs (21 percent). Only 32 of the 645 IGERT graduates commented that their IGERT experience in some way played a negative role in their degree completion, citing the burden of additional requirements, lack of cohesion in the interdisciplinary training experience, and funding that stopped after two years.[21] Thus for the vast majority of participating trainees, the IGERT experience contributed to degree completion.

Exhibit 2.20

Elements of IGERT That Contribute to Graduates' Ability to Complete Their Degrees

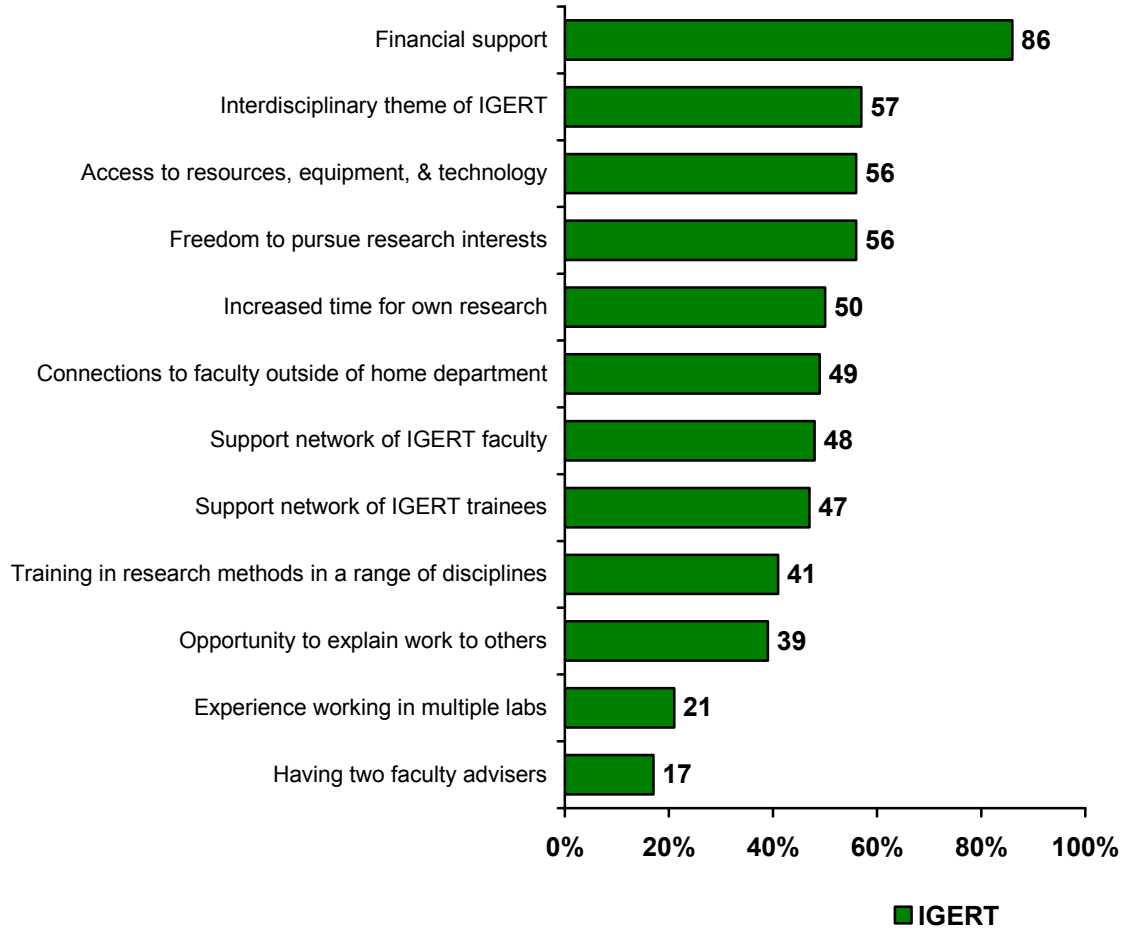

Exhibit reads: 86 percent of IGERT graduates reported that the IGERT-related financial support contributed to their ability to complete their doctoral degrees.

Includes IGERT PhD graduates: N=645; Missing=6.

Note: Percents sum to more than 100 because respondents could select multiple responses.

Source: IGERT Follow-up Survey, 2008. (Item B12).

Summary

Students reported that it was the interdisciplinary focus that drew them to IGERT projects —83 percent of IGERT graduates reported having an interest in interdisciplinary education or research training experience when they applied to graduate school, and 12 percent of IGERT graduates reported that they would not have enrolled at their specific institutions without the opportunity to participate in their IGERT training program. More graduates were motivated by their own intellectual interest in interdisciplinary research than by practical reasons such as believing it would help them get a job. Once enrolled, students participated in cross-disciplinary and interdisciplinary training experiences while funded as an IGERT trainee. Even after their traineeships ended, IGERT graduates continued to engage

in interdisciplinary work by combining multiple disciplines in their final PhD theses. IGERT graduates on average reported using three broad disciplines in their dissertations, and 30 percent reported using four or more disciplines in their dissertation research. Graduates from all home disciplines reported a wide range of various disciplinary combinations.

IGERT graduates completed their PhD degrees at rates equal to national norms and in equal (or less) time. Participating in IGERT does not appear to negatively influence students' ability to complete their degrees or the time it takes them to do so. By the end of their tenth year, 54 percent of IGERT trainees have completed their PhD degrees. Degree completion rates were highest in life and physical sciences, and lowest in engineering. The median time to degree for IGERT students who graduated with their PhDs between 1999 and 2007 was 5.2 years. Approximately 305 women and 63 underrepresented minority individuals graduated with IGERT PhDs since 1998. Only 43 percent of IGERT students leave their institutions without completing their degrees. A subsample of these individuals reported that IGERT did not have any influence on their decision to leave. Nearly all IGERT graduates credited aspects of their IGERT experience with helping them complete their degrees. The IGERT traineeship's financial support was highly valued by graduates, as was the accompanying interdisciplinary focus, access to resources, equipment, and technology, and freedom to pursue independent research interests.

---

[1] S. Brown and J. Giordan. 2008. *Integrative Graduate Education and Research Traineeship (IGERT): 2006–2007 Annual Report*. Arlington, Va.: National Science Foundation. Information also available through the NSF Award Search at http://www.nsf.gov/awardsearch.

[2] Integrative Graduate Education and Research Traineeship (IGERT) Program, Program Solicitation, NSF 08-540. 2008. Arlington, Va.: National Science Foundation.

[3] *IGERT Follow-up Study Survey, 2008. Item A6.* Includes IGERT PhD graduates: N=645; Missing=0.

[4] *IGERT Follow-up Study Survey, 2008. Item A4.* Includes IGERT PhD graduates: N=645; Missing=68 IGERT were set to missing because they responded "I don't remember" to this question.

[5] J. G. Carney, et al. (2006). *Evaluation of the Initial Impacts of the National Science Foundation's Integrative Graduate Education and Research Traineeship program*. Cambridge, Mass.: Abt Associates, Inc. Full report available at http://www.nsf.gov/pubs/2006/nsf0617/index.jsp.

[6] *IGERT Follow-up Survey, 2008. Item B9.* Includes IGERT PhD graduates: N=645; Missing=0.

[7] *IGERT Follow-up Survey, 2008. Item B9.* Includes IGERT PhD graduates: N=645; Missing=0.

[8] *IGERT Follow-up Survey, 2008. Item B9.* Includes IGERT PhD graduates who only selected one broad discipline used in their dissertation research: N=124; Missing=0.

[9] *IGERT Follow-up Study Survey, 2008. Item P6.* Includes IGERT PhD graduates: N=645; Missing=6.

[10] M. T. Nettles and C. M. Millett. 2006. *Three Magic Letters: Getting to PhD*. Baltimore, MD: Johns Hopkins University Press. National Research Council. 1996. *The Path to the PhD: Measuring Graduate Attrition in the Sciences and Humanities*. Washington, D.C.: National Academy Press.

[11] PhD Completion rate range based on different STEM disciplines. Council of Graduate Schools. 2007. *PhD Completion and Attrition: Analysis of Baseline Program Data from the PhD Completion Project*. Washington, D.C.: Council of Graduate Schools. http://www.PhDcompletion.org/quantitative/book1_quant.asp (accessed on December 18, 2009).

[12] The following studies have cited an estimated attrition rate of 40 percent. E. M. Benkin. 1984. "Where Have All the Doctoral Students Gone? A Study of Doctoral Student Attrition at UCLA. *Dissertation Abstracts International*, 45A, 2770; B. Berlson. 1960. *Graduate Education in the United States*. New York: McGraw-Hill; P. Jacks, et al. 1983. "The ABCs of ABD: A Study of Incomplete Doctorates." *Improving College and University Teaching* 31: 74–81; A. Tucker. 1964. *Factors Related to Attrition among Doctoral Students*. Washington, D.C.; K. M. Wilson. 1965. *Of Time and the Doctorate: Report of an Inquiry into the Duration of Doctoral Study*. Atlanta, Ga.

[13] Initially, 38 former IGERT trainees were interviewed. These individuals were selected at convenience from a list of "non-completing PhD students" provided by IGERT PIs in the Distance Monitoring System. However, upon interview, four former trainees indicated they had been postdoctoral fellows (not graduate students) while receiving IGERT funding. Six more of the interviewees indicated that they had received degrees from their institutions. These may have left the IGERT program but remained at their university, or have been

inaccurately tracked by the project in the IGERT Distance Monitoring System. These 10 individuals were excluded from this analysis, thus resulting in a final sample size of 28.

[14] National Science Board. 2006. *Science and Engineering Indicators 2006.* (volume 1, NSB 06-01; volume 2, NSB 06-01A). Arlington, Va.: National Science Foundation, pp. 2–8.

[15] M. T. Nettles and C. M. Millett. 2006. *Three Magic Letters: Getting to PhD.* Baltimore, Md.: Johns Hopkins University Press.

[16] *IGERT Follow-up Survey, 2008. Item B9.* Includes IGERT PhD graduates who initially enrolled in their IGERT related graduate doctoral degree programs between 1990 and 2000: N=124; Missing=0.

[17] Integrative Graduate Education and Research Traineeship (IGERT) Program, Program Solicitation, NSF 08-540. (2008). Arlington, Va.: National Science Foundation.

[18] *IGERT Distance Monitoring System, 2007.* Percentages of IGERT trainees count participants during the academic year in which trainee graduated with a doctoral degree.

[19] Council of Graduate Schools. 2007. *PhD Completion and Attrition: Analysis of Baseline Program Data from the PhD Completion Project*. Washington, D.C.: Council of Graduate Schools. http://www.phdcompletion.org/quantitative/PhDC_Program_Completion_Data_Demographic.pdf.

[20] Council of Graduate Schools. 2007. *PhD Completion and Attrition: Analysis of Baseline Program Data from the PhD Completion Project*. Washington, D.C.: Council of Graduate Schools. http://www.phdcompletion.org/quantitative/PhDC_Program_Completion_Data_Demographic.pdf.

[21] *IGERT Follow-up Survey, 2008. Item B13.* Includes IGERT PhD graduates: N=645; Missing=31.

Chapter 3: Entering the Workforce

We provide evidence in Chapter 2 that IGERT students are inherently interested in interdisciplinary work from the beginning of their graduate studies, and that most complete an interdisciplinary dissertation even when earning their degrees from a single disciplinary department. What happens to IGERT graduates after graduation? How easily do they find employment, and where do they end up working? What role does their IGERT training play in helping or hindering them in finding a job? In this chapter, we explore the entry of IGERT graduates into the workforce, including careers they consider, characteristics of their current positions, and factors they deem important in choosing their current positions. We also describe IGERT graduates' perceptions about their competitiveness in entering the job market and the role IGERT played in preparing them for various career options. This chapter examines the following research questions:

- How prepared do IGERT graduates report they feel for a broad range of career options?
- To what extent do IGERT graduates consider a broad range of career options, including careers in academia, government, and the private sector?
- What positions do IGERT graduates enter upon graduation, and why do they choose those positions?
- How do IGERT graduates describe the role of their IGERT training in preparing them for the job market?

Data for this chapter come from our survey of the Full IGERT Sample of IGERT PhD graduates (N=645). Most findings are based on responses from the 628 IGERT graduates who reported that they were currently employed either full- or part-time (N=607, N=21, respectively), although some findings are reported separately for individuals who were employed in the workforce and those who held postdoctoral appointments (N=427 and N=201, respectively). Unless otherwise indicated, all responses about current employment status reflect respondents' current status at the time of data collection in either 2008 or 2009.

Key Findings

- IGERT PhD graduates reported that they were prepared, upon graduation, to work as researchers across multiple employment sectors, including academia, industry, and government.
- IGERT graduates considered a broad range of careers upon graduation: 69 percent considered at least two employment sectors (academia, industry, government, etc.) when applying for jobs, including 39 percent who considered three or more sectors.
- IGERT graduates overwhelmingly reported that their graduate preparation gave them a competitive edge when applying for positions in the workforce (93 percent) and that their IGERT experience specifically helped them obtain positions in the workforce (94 percent).

Key Findings (cont.)

- IGERT graduates credited their interdisciplinary experiences as influential in securing employment, whether through interdisciplinary exposure (72 percent), training (59 percent), or research conducted (52 percent).
- Thirty-two percent of IGERT graduates (N=201) were in postdoctoral appointments at the time of the study's data collection while 68 percent of IGERT graduates (N=427) were employed in the workforce.
- Overall, nearly half of IGERT graduates in the workforce were employed at colleges or universities and one-third were employed in industry or business. The remaining individuals were working in government or other organizations, including nonprofits, research institutions, or nongovernmental laboratories, and a few were self-employed or engaged in entrepreneurial endeavors.

Preparing to Enter the Workforce

IGERT PhD graduates reported that they were equally prepared for research careers in academic, government, or industry settings at the time of graduation. They did not solely seek out academic employment. Most IGERT graduates reported that they considered postdoctoral appointments or employment in the workforce in at least two settings (academic, government, industry, etc.), and one-quarter of graduates entering the workforce sought exclusively nonacademic employment.

IGERT Prepares Graduates for a Variety of Careers

The IGERT program is designed to expand graduate training to better prepare students for a broad range of career options in academic, industry, government, and nonprofit settings. To achieve this goal, IGERT projects create opportunities for IGERT trainees to work on research projects with individuals from a range of occupations (industry, other universities, government laboratories); receive training in areas of professional development (such as grant writing); and conduct internships or work off-campus in other environments.[1] These activities are intended to ensure that IGERT trainees graduate from their PhD programs prepared not only to become faculty members at universities but also to pursue other options as well.

We asked IGERT graduates the extent to which they felt prepared for the following positions at the time they graduated:

- Faculty member at a university with teaching and research responsibilities
- Faculty member at a university with only research responsibilities
- Researcher at a government lab or research institution
- Researcher or developer in industry/business
- Non-research policy or planning position in government or nonprofit

Data indicate that IGERT PhD graduates felt prepared for both university faculty and other careers upon graduation. On average, IGERT graduates agreed that they were prepared to work in four of the five

types of positions listed above, suggesting that IGERT graduates' training during graduate school could be applied across a broad range of career options.[2] Nearly all IGERT graduates agreed or somewhat agreed that they were prepared to be researchers at government labs, research institutions, or universities (reporting the combined value of the first two columns of Exhibit 3.1). In addition, three-quarters of IGERT graduates agreed or somewhat agreed that they were prepared for positions that involved research in industry, or faculty positions that involved both research and teaching. More than half agreed that they were prepared for non-research positions in government or the nonprofit organization.

> "Prior to defending my dissertation, I had 3 job offers. A postdoc in a government department, and two teaching positions…. My IGERT experience made me feel confident that I could choose any of these jobs and succeed. I was prepared to do research at a government organization (due to my exposure to current research techniques while in IGERT). I was also prepared to teach at an academic institution (due to a teaching internship that I acquired while an IGERT student)."
>
> – IGERT graduate

Exhibit 3.1

IGERT Graduates' Perception upon Graduation of Their Preparedness for Various Positions

	All IGERT Graduates		
"I felt prepared for the following types of jobs…"	**Agree**	**Somewhat Agree**	**Somewhat Disagree or Disagree**
Researcher at a government lab or research institution	76%	19%	5%
Faculty member at a university with only research responsibilities	61	28	11
Research/developer in industry/business	54	28	18
Faculty member at a university with teaching and research responsibilities	48	35	17
Non-research policy or planning position in government or nonprofit	27	31	42

Exhibit reads: 76 percent of IGERT PhD graduates agreed, 19 percent somewhat agreed, and 5 percent somewhat disagreed or disagreed that they felt prepared for a researcher job at a government laboratory or research institution.

Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in paid positions: N=628; Missing=4-75. "I don't know" responses were set to missing.

Source: IGERT Follow-up Survey 2008. (Item C7).

IGERT Graduates Consider Multiple Career Options

IGERT graduates' preparedness for a broad range of careers was also reflected in the types of careers they considered when entering the workforce after graduation (Exhibit 3.2). Overall, IGERT graduates were most likely to pursue positions in colleges or universities; just under half also reported that they had pursued careers in industry or the public sector. Only 31 percent limited their search to one sector; 30 percent considered two sectors, and 39 percent considered three or more sectors.

Exhibit 3.2

Employment Sectors IGERT Graduates Considered for First Postgraduation Position (Including Postdoctoral Appointments)

	All IGERT Graduates	
	Considered	Most desired
Employment Sectors		
College or university	83%	61%
Industry or business	46	19
Government	45	11
Non-government lab, research institution, or think tank	27	5
Other nonprofit organization or private foundation	14	1
Entrepreneur or self-employed	9	3
K–12 school	2	0
Number of sectors pursued		
One	31%	
Two	30	
Three or more	39	

Exhibit reads: 83 percent of IGERT graduates reported that they considered working in college or university settings for their first position after completing graduate school and 61 percent indicated that it was their most desired setting to work.

Includes IGERT PhD graduates who were not enrolled in degree programs and were in postdoctoral appointments or employed in the workforce: N=628; Missing=0.

Note: "Considered" percents in the "Employment Sectors" section of this exhibit do not sum to 100 because respondents could check multiple responses.

Source: IGERT Follow-up Survey, 2008. (Item C11).

Obtaining a Position after Graduation

IGERT graduates indicated that they were prepared for and subsequently considered careers in a broad range of sectors. Yet, perceptions of preparedness may or may not translate into immediate success in obtaining desired employment positions. Do IGERT graduates experience difficulty finding positions that match their interests given their interdisciplinary background and training? Which careers do they end up selecting? In this section, we discuss IGERT graduates' success in obtaining postgraduation positions, the careers they chose, their reasons for choosing those careers, and their perceptions of the role their IGERT training played in helping them obtain their positions.

Obtaining a Position

Most IGERT graduates successfully and easily obtained postgraduation employment in either a postdoctoral appointment or a position in the workforce. Eighty-seven percent of IGERT PhD graduates reported that they were already working or had a job offer in hand by the time they graduated.[3] IGERT graduates were also successful in obtaining a post-degree position in their most desired job sector (76 percent).[4]

Just over half of IGERT PhD graduates reported having had "no difficulty" at all obtaining their first paid positions, whether the position was a postdoctoral appointment or not (Exhibit 3.3). Thirty-nine percent encountered "a little" or "moderate" level of difficulty and 7 percent reported that obtaining their first paid position was "difficult" or "very difficult."

Exhibit 3.3

IGERT Graduates' Perceptions of Difficulty Obtaining First Paid Postgraduation Position

"How difficult was it to obtain your first paid position in the workforce after graduating?"	All IGERT Graduates
Not difficult at all	53%
A little difficult	24
Moderately difficult	15
Difficult	4
Very difficult	3

Exhibit reads: 53 percent of IGERT graduates reported that it was not difficult at all to obtain their first paid postgraduation positions in the workforce.

Includes IGERT PhD graduates who were not enrolled in degree programs and were in postdoctoral appointments or employed in the workforce: N=628; Missing=0.

Source: IGERT Follow-up Survey, 2008. (Item C5).

The employment rate for IGERT graduates was 98 percent at the time of our survey.[5] The employment rate of IGERT PhD graduates was higher than the overall employment rate in the country at that time (94 percent) but on par with college-educated individuals 25 years or older nationwide (97 percent).[6] Among the 2 percent of IGERT graduates (N=11) who were unemployed at the time of our survey, 4 IGERT graduates were searching for jobs, and the remaining 7 had chosen not to work for various personal and professional reasons.[7]

Reasons for Choosing Current Position

The majority of IGERT graduates reported that their main motivation for choosing their current positions was intellectual challenge, followed by the independence associated with the position, compensation, and the opportunity to follow their passions (Exhibit 3.4). Reasons differed for those in postdoctoral appointments from those in the workforce: a greater proportion of postdoctoral appointees reported that the opportunity to learn new skills was a motivating reason, and a higher proportion of those in the workforce were motivated by salary/benefits.

Exhibit 3.4

Reasons for Choosing Current Position

	All IGERT Graduates	Graduates in Postdoctoral Appointments	Graduates in the Workforce
Intellectual challenge	59%	66%	56%
Degree of independence	33	30	35
Salary/benefits	32	19	37
Opportunity to follow my passion	29	33	27
Opportunity to contribute to society	25	17	28
Opportunity to create new knowledge / make decisions	23	24	22
Opportunities for advancement	22	24	22
Opportunity to learn new skills	16	33	9
Job security	15	6	19
Level of responsibility	9	6	11

Exhibit reads: 59 percent of IGERT graduates identified intellectual challenge as 1 of the 3 most important factors to them when choosing their current positions.

Includes IGERT PhD graduates who were not enrolled in degree programs and were in postdoctoral appointments or employed in paid positions: N=628 (All IGERT), 201 (Graduates in Postdoctoral Positions), 427 (Graduates in the Workforce); Missing N=0.

Note: Percents total more than 100 because respondents could check multiple responses.

Source: IGERT Follow-up Survey, 2008. (Item C12).

Contribution of IGERT to Graduates' Success in Obtaining Positions as Postdoctoral Appointees or in the Workforce

IGERT graduates (in both postdoctoral positions and the workforce) overwhelmingly reported that their graduate preparation gave them a competitive edge when applying for postdoctoral or professional positions in the workforce (93 percent).[8] Many also noted that their IGERT experience, specifically, helped them obtain employment (94 percent); the extent of this influence ranged from "a great deal" (15 percent) to "quite a bit" (30 percent), "to some extent" (32 percent), and "a little" (17 percent).[9] IGERT graduates most often attributed value to the interdisciplinary nature of their IGERT training experience; some graduates also commented on IGERT's contribution to their communication skills or to expanding their professional networks. We discuss these three areas below.

The Interdisciplinary Nature of IGERT

The most common aspect of the IGERT experience that graduates cited as contributing to their job acquisition was IGERT's interdisciplinary focus (Exhibit 3.5). Eighty percent of graduates credited one or more aspects of the IGERT interdisciplinary experience as having been helpful in their employment searches. The comments in the box at right illustrate two graduates' experiences.

"I was hired because I am a computer programmer that is fluent in biology. People like this, who really can cross between the disciplines and can actually appreciate the subtle, yet very significant, differences in how different groups think about problems and data, are very rare. My boss appreciates this." – IGERT graduate

"My IGERT experience played a very important role in obtaining my current position ... because of the unique multidisciplinary theme of my research and the program in general. My current employers were very impressed with my working knowledge of several traditionally disparate areas, giving the impression that, 'this person can do two jobs!'" – IGERT graduate

Exhibit 3.5

Interdisciplinary Aspects of IGERT Training That Contributed to IGERT Graduates' Ability to Obtain Positions in the Workforce

Did any of the following contribute to your ability to obtain a position in the workforce?	All IGERT Graduates
Exposure to multi/interdisciplinary research	72%
Interdisciplinary research training	59
Interdisciplinary research conducted	52
Selected at least one of the above three items:	***80***

Exhibit reads: 72 percent of IGERT graduates reported that the exposure to multi/interdisciplinary research they gained through IGERT contributed to their ability to obtain positions in the workforce.

Includes IGERT PhD graduates who were not enrolled in degree programs and were in postdoctoral appointments or employed in the workforce: N=628; Missing=0.

Source: IGERT Follow-up Survey, 2008. (Item C9).

Developing Graduates' Communication Skills

IGERT projects provide multiple avenues through which students can present their own research, including opportunities to present their research at professional conferences or to other IGERT students. Forty-eight percent of IGERT graduates reported that these experiences developed their abilities to communicate in ways that benefited them during job interviews (Exhibit 3.6).

"I believe my extensive experience in giving presentations and communicating results to colleagues led to the development of my communication skills and helped me obtain a position." – IGERT graduate

Exhibit 3.6

Opportunities to Communicate Own Research That Contributed to IGERT Graduates' Ability to Obtain Positions in the Workforce

Did any of the following contribute to your ability to obtain a position in the workforce?	All IGERT Graduates
Opportunities to present work at professional conferences	40%
Opportunities to present work to other students	27
Selected at least one of the above two items:	***48***

Exhibit reads: 40 percent of IGERT graduates reported that opportunities to present their work at professional conferences gained through IGERT contributed to their ability to obtain positions in the workforce.

Includes IGERT PhD graduates who were not enrolled in degree programs and were in postdoctoral appointments or employed in the workforce: N=628; Missing=0.

Source: IGERT Follow-up Survey, 2008. (Item C9).

IGERT Expands Graduates' Professional Networks

Developing a community of IGERT students and faculty who interact about their respective IGERT project's integrated interdisciplinary theme is a core objective for IGERT projects. Graduates from IGERT projects reported that interactions with IGERT faculty members and researchers in other disciplines played a distinct role in assisting them in obtaining positions after graduation. IGERT projects also connect students with researchers and career settings outside of campus. For example, the 2006 IGERT program evaluation found that 29 percent of IGERT trainees participated in off-campus internships.[10] Graduates cited the connections made through their IGERT internships and their exposure to non-academic job opportunities as having contributed to obtaining a job. In total, 52 percent of IGERT graduates reported that some aspect of networking provided through their IGERT experience contributed to their ability to obtain positions in the workforce (Exhibit 3.7).

"IGERT provided me the opportunity to take an internship in industry. This industrial experience was likely a large positive on my resume when applying for a full-time position." – IGERT graduate

"I work in industry research…. Being in an IGERT program gave me experience and exposure to this kind of workplace. It allowed me to articulate my experience and describe how I would integrate into a corporate research team when I was interviewing. By networking through the other faculty and staff, I made some connections at my future employer." – IGERT graduate

"I think the interdisciplinary knowledge I acquired through courses and the interactions with experts in other fields made finding my first job somewhat easy. Participating in international conferences to present my work and to network with other researchers was also important. Finally, the locally organized IGERT conferences and retreats also provided excellent opportunities to present my work and network with faculty, both internal and external to [my university]. Those experiences helped me build confidence and prepare me in a way for my first job search. The IGERT fellowship made possible all those opportunities." – IGERT graduate

Exhibit 3.7

Networking Connections That Contributed to IGERT Graduates' Securing Employment

Did any of the following contribute to your ability to obtain a position in the workforce?	All IGERT Graduates
Networking with IGERT faculty	29%
Networking outside home institution	28
Networking outside home discipline	24
Connections made from IGERT internships	16
Exposure to non-academic job opportunities	16
Selected at least one of the above five items:	***52***

Exhibit reads: 29 percent of IGERT graduates reported that opportunities to network with IGERT faculty contributed to their ability to obtain positions in the workforce.

Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in paid positions: N=628; Missing=0.

Source: IGERT Follow-up Survey, 2008. (Item C9).

Graduates Perceive No Negative Effects of IGERT Training on Job Market Entry

Ninety-four percent of IGERT graduates reported that their IGERT training contributed to their job acquisition in some way; only 6 percent reported that IGERT features had not contributed to their employment. Furthermore, only 14 IGERT graduates reported that their IGERT experience may have played a negative role in their job search.[11] Some of these graduates reported that prospective employers may perceive interdisciplinary training as less comprehensive in graduates' home discipline. For example,

> "I was also not considered for some jobs because of my diverse background. I don't think it is the fault of IGERT, just some departments have not embraced interdisciplinary research for faculty."

> "Not all employers think an interdisciplinary background is valuable. It is sometimes difficult to portray myself as an expert in any one field and balance my experience across disciplines."

However, given that only 14 IGERT graduates (3 percent) reported any negative effects, we conclude that the interdisciplinary experiences associated with IGERT training were helpful, rather than harmful, to their job prospects.

Current Employment of IGERT Graduates

Where do recent IGERT PhD graduates end up being employed? At the time of this study's data collection, the IGERT graduates surveyed were between one and eight years out from graduation. At this early stage of their careers, 68 percent (N=427) of IGERT graduates were employed in the workforce; 32 percent (N=201) were in postdoctoral appointments.[12] Overall, more than half of all IGERT graduates were situated at colleges or universities, including 24 percent in postdoctoral appointments and 27 percent in faculty positions. One-quarter of graduates were employed in industry or business, and the remainder were working in government or other private sector organizations (Exhibit 3.8).

Employment sector differed by home discipline (Exhibit 3.8). Graduates from mathematics, social sciences, and life sciences were most likely to be working for a college or university, while those from engineering, physical sciences, and computer sciences were more evenly divided between academic and industry/business positions. Graduates from mathematics and life sciences were also more likely to be in postdoctoral positions than graduates from other disciplines.

Exhibit 3.8

Current Employers and Positions of IGERT Graduates, Overall and by Home Discipline of Graduate

		IGERT Graduates' Home Discipline [a]					
	All	Computer Sciences	Engi-neering	Life Sciences	Math	Physical Sciences	Social Sciences
College or university	**56%**	**52%**	**39%**	**67%**	**83%**	**44%**	**83%**
US faculty position	27	36	19	26	28	17	59
Postdoctoral appointment	24	15	15	38	48	20	15
Other college or university position [b]	5	0	4	3	7	6	9
Industry or business	**23%**	**30%**	**38%**	**10%**	**7%**	**32%**	**2%**
Non-postdoctoral position	22	27	37	9	7	32	2
Postdoctoral appointment	1	3	1	1	0	0	0
Government	**13%**	**6%**	**16%**	**12%**	**10%**	**15%**	**7%**
Non-postdoctoral position	8	3	10	8	10	10	6
Postdoctoral appointment	4	3	6	5	0	5	1
Other private sector [c]	**9%**	**12%**	**7%**	**11%**	**0%**	**9%**	**8%**
Non-postdoctoral position	6	3	6	8	0	6	6
Postdoctoral appointment	3	9	1	4	0	4	2

Exhibit reads: 56 percent of all IGERT graduates were employed at colleges or universities at the time of this study's data collection, including 27 percent in faculty positions, 24 percent in postdoctoral appointments, and 5 percent in other college or university positions. 52 percent of all computer sciences IGERT graduates were employed in colleges or universities.

Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in postdoctoral positions or employed in the workforce: N=628 (All); 33 (computer sciences), 142 (engineering), 172 (life sciences), 29 (math), 160 (physical sciences), 87 (social sciences); Missing=0-2. Five graduates from other home disciplines are included in the "All" total, but excluded from the rest of the table.

[a] *Home discipline* is coded from the department of enrollment as reported by trainees in the Distance Monitoring System.

[b] "Other college or university position" includes US nonfaculty and foreign institution positions.

[c] "Other private sector" includes nongovernmental lab, research institution, think tank, private foundation, nonprofit organization, entrepreneur, or self-employed.

Note: Sums do not add up to individual percents due to rounding.

Source: IGERT Follow-up Survey, 2008. (Items C4, C13, F2).

In the remainder of this chapter we examine the employment characteristics of IGERT PhD graduates in more detail. We begin with a brief description of IGERT graduates who were completing postdoctoral appointments at the time of this study's data collection. We then describe the positions held by IGERT graduates who had completed their training (PhD or postdoctoral training) and were employed in the workforce. We examine these two groups separately—those in postdoctoral positions and those in the workforce—because the postdoctoral fellowship represents the final stage of training in many scientific disciplines and these individuals ultimately may seek employment in a variety of sectors.

IGERT Graduates in Postdoctoral Appointments

Overall, 32 percent (N=201) of IGERT graduates were in postdoctoral appointments at the time of the study's data collection. Three-quarters of these individuals held appointments in academic (college or university) settings, with the rest obtaining their postdoctoral training from the government or the private sector (Exhibit 3.9). Among the postdoctoral appointees in academia, 81 percent held postdoctoral appointments at US PhD institutions, 4 percent were employed in other US non-PhD granting institutions, including community or junior colleges, and 15 percent held appointments in foreign colleges or universities.

Exhibit 3.9

Current Employers of IGERT Graduates in Postdoctoral Positions

	IGERT Graduates in Postdoctoral Positions
College or university	74%
Government	14
Other private sector [a]	9
Industry or business	3

Exhibit reads: 74 percent of IGERT graduates in postdoctoral positions were situated at colleges or universities at the time of this study's data collection.

Includes IGERT PhD graduates who were not enrolled in degree programs and were in postdoctoral positions: N=201; Missing=0.

[a] "Other private sector" includes nongovernmental lab, research institution, think tank, private foundation, nonprofit organization, entrepreneur, or self-employed.

Source: IGERT Follow-up Survey, 2008. (Item C13).

IGERT Graduates in the Workforce

Sixty-eight percent (N=427) of IGERT graduates were employed in the workforce in non-postdoctoral positions. Nearly half of employed IGERT graduates were working for colleges or universities, one-third were working in industry or business, and the remaining individuals were employed by the government or the private sector (Exhibit 3.10). While most IGERT graduates were employed at established companies, 7 percent of IGERT graduates were working for companies that had been newly established within the previous five years.[13] In this section we describe the employment characteristics of these IGERT graduates (to whom we refer as "employed IGERT graduates") in more detail. These findings represent the first look at the career trajectories of employed IGERT graduates. As these individuals were between one and eight years postgraduation, these findings may not reflect the ultimate career trajectories of IGERT graduates.

Exhibit 3.10

Current Employers of Employed IGERT Graduates

	Employed IGERT Graduates
College or university	47%
Industry or business	32
Government	12
Other private sector [a]	9

Exhibit reads: 47 percent of employed IGERT graduates were employed at colleges or universities at the time of this study's data collection.

Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in the workforce; excludes individuals in postdoctoral appointments: N=427; Missing=0.

[a] "Other private sector" includes nongovernmental lab, research institution, think tank, private foundation, nonprofit organization, entrepreneur, or self-employed.

Source: IGERT Follow-up Survey, 2008. (Item C13).

IGERT Graduates Employed within Educational Institutions

Forty-seven percent (N=206) of employed IGERT graduates reported that they were employed at colleges or universities. Of these individuals, 64 percent were working within the United States higher education system, primarily at PhD-granting institutions, and 36 percent were employed in other education-related institutions or at foreign institutions (Exhibit 3.11). Eighty percent of the 206 IGERT graduates working in academia were junior faculty members, primarily assistant professors; fewer were in the more senior ranks as associate professors or full professors. The remaining individuals held a mix of instructor, lecturer, or other positions. Although it is early in their careers, 4 percent of IGERT graduates in tenure-track faculty positions had already obtained tenure.[14]

Exhibit 3.11

Institution Type and Position of IGERT Graduates Working in Academia (Excluding Postdoctoral Appointees)

	IGERT Graduates Working in Academia
Type of Institution: [a]	
US PhD granting institution	64%
US non-PhD granting institution (e.g., masters' or baccalaureate granting institutions)	26
US junior or community college or technical institute	2
Foreign college or university	6
Other education-related institutions [b]	2
Position:	
Assistant Professor	80%
Associate Professor	7
Full Professor	1
Other, faculty	5
Other, nonfaculty	8

Exhibit reads: 64 percent of IGERT graduates who were employed at colleges or universities were working at US PhD granting institutions.

[a] Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in college or university settings (excludes postdoctoral positions): N=206; Missing=0.

[b] "Other institutions" include medical college and law school.

[c] Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in US higher education settings (excludes postdoctoral positions): N=190; Missing=2.

Source: IGERT Follow-up Survey, 2008. (Item F1, F3).

IGERT Graduates Employed within Industry or Business

Thirty-two percent of employed IGERT graduates in full- or part-time positions (N=131) reported that they were working in industry or business, spanning a variety of goods-producing and service-providing sectors. Among these individuals, 23 percent reported that they provided professional, scientific, and business services and 22 percent reported that they produced biotechnological products. The remaining 55 percent were spread across various sectors, producing a variety of goods (computer products, pharmaceuticals, energy, etc.) and services (information, communications, media, finance and banking, etc.) (Exhibit 3.12).

Exhibit 3.12

Employment Sector of IGERT Graduates Working in Industry or Business (Excluding Postdoctoral Appointees)

Most Frequently Reported Sectors	IGERT Graduates Working in Industry or Business
Goods-Producing:	
Biotechnological products	22%
Computer and electronic products	15
Chemical products	14
Pharmaceutical	13
Other manufacturing	11
Energy/Fuels	9
Electrical equipment, appliance, and components	6
Other goods-producing sectors [a]	9
Service-Providing:	
Professional, scientific, and business	23
Information, communications, media	6
Other service providing sectors [b]	10

Exhibit reads: 22 percent of IGERT graduates who were working in industry or business reported that they produced biotechnological products.

Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in the industry or business sector (excludes postdoctoral positions): N=131; Missing=0.

[a] Additional goods-producing sectors included: mineral and metals products (3 percent), transportation (2 percent), food, beverage, and tobacco products (1 percent), wood products, paper products, printing (1 percent), agriculture, forestry, fishing and hunting (1 percent), mining (1 percent), and textiles and apparel (1 percent). Sum does not add up to individual percents due to rounding.

[b] Additional service-providing sectors included: finance and banking (4 percent), health and health care–related (2 percent), other services (3 percent), education services (1 percent), and public administration (1 percent). Sum does not add up to individual percents due to rounding.

Note: Percents total more than 100 because respondents could check multiple responses.

Source: IGERT Follow-up Survey, 2008. (Item D1).

IGERT Graduates Employed within Government

Twelve percent (N=52) of employed IGERT graduates reported that they were currently working for the government. Of these individuals, 57 percent reported working in a US federal government laboratory. The remaining individuals reported being employed at US federal agencies or departments (27 percent), state or local governments (11 percent) and foreign governments (4 percent), or other government entities (2 percent).[15]

IGERT Graduates Employed within Other Private Sectors

Six percent (N=25) of IGERT graduates employed in the workforce reported working for other private-sector organizations; of those, 64 percent were at non-governmental research laboratories, followed by

19 percent at non-governmental organizations, and 17 percent were in consulting organizations, private foundations, or other private sector entities.[16]

The remaining 3 percent (N=13) of employed IGERT graduates indicated that they were engaged in entrepreneurial endeavors or self-employment, 10 of whom reported that their business was based on self-developed proprietary intellectual property, and 7 of whom employed at least one other person in their line of work.[17]

Summary

Upon graduation, IGERT graduates reported feeling prepared for research positions in a variety of settings, including universities, government laboratories, industry, business, or other research institutions. Whether seeking a postdoctoral or professional position, two out of three IGERT graduates considered positions in multiple sectors (academic, government, industry, etc). When job hunting, most IGERT graduates already had a job offer in hand when they graduated, usually in their most desired job sector. Half of IGERT graduates indicated having no difficulty obtaining their first position; most of the other half had only moderate or "a little" difficulty. As a result, the employment rate for IGERT graduates at the time of our survey was 98 percent, which was on par with that of college-educated individuals in the United States. When choosing their current positions, IGERT graduates were most motivated by intellectual challenge and the opportunity to follow their passions. Nearly all IGERT graduates reported that their graduate preparation—especially their IGERT-related interdisciplinary experiences—gave them a competitive edge when applying for positions in the workforce. One to eight years after graduation, one-third of IGERT graduates were in postdoctoral positions. The remaining two-thirds were employed in the workforce, either in higher education (47 percent), industry or business (32 percent), government (12 percent), or in other private sector settings such as research institutions or non-governmental organizations (9 percent).

[1] J. G. Carney, et al. 2006. *Evaluation of the Initial Impacts of the National Science Foundation's Integrative Graduate Education and Research Traineeship Program.* Prepared for the National Science Foundation. Cambridge, Mass.: Abt Associates. http://www.nsf.gov/pubs/2006/nsf0617/index.jsp. A. Martinez, et al. 2006. *Contractor Annual Report and Summary of Cross-Site Monitoring of the NSF Integrative Graduate Education and Research Traineeships (IGERT) Program.* Prepared for the National Science Foundation. Cambridge, Mass.: Abt Associates. S. Brown and J. Giordan. 2008. *IGERT 2006–2007 Annual Report.* (NSF08-40). National Science Foundation. Washington, D.C.

[2] We classified respondents as in agreement if they responded that they *agreed* or *somewhat agreed* to the statements that they were prepared for positions in the five job categories. Other response options were *somewhat disagree*, *disagree*, or *I don't know*.

[3] *IGERT Follow-up Survey 2008. Item C1.* Includes IGERT PhD graduates who were not enrolled in degree programs and sought employment at the time of graduation: N=615; Missing=0.

[4] *IGERT Follow-up Survey 2008. Combined variable created from Items C11 and C13.* Includes IGERT PhD graduates (N=607) who were not enrolled in degree programs, had sought employment at the time of graduation, and were in postdoctoral appointments or employed in the workforce.

[5] *IGERT Follow-up Survey, 2008. Item C3.* Includes IGERT PhD graduates not enrolled in degree programs: N=645; Missing=6.

[6] Bureau of Labor Statistics online data tool: http://www.bls.gov/data/#unemployment. Data are not available for PhD-level graduates, only all college graduates.

[7] *IGERT Follow-up Survey, 2008. Item N1.* Includes IGERT PhD graduates who were not enrolled in degree programs and unemployed: N=11; Missing=0.

[8] *IGERT Follow-up Survey 2008. Item C6.* Includes IGERT PhD graduates who were not enrolled in degree programs, had sought employment at the time of graduation, and either currently in postdoctoral appointments or employed in the workforce or had been employed since leaving their institutions: N=628; Missing=24. Responses of "I don't know" to this item were set to missing.

[9] *IGERT Follow-up Survey, 2008. Item C8.* Includes IGERT PhD graduates who were not enrolled in degree programs and were in postdoctoral appointments or employed in the workforce: N=628; Missing=0.

[10] J. G. Carney, et al. 2006. *Evaluation of the Initial Impacts of the National Science Foundation's Integrative Graduate Education and Research Traineeships (IGERT) Program*. Prepared for the National Science Foundation. Cambridge, Mass.: Abt Associates. Full report available at http://www.nsf.gov/pubs/2006/nsf0617/index.jsp.

[11] *IGERT Follow-up Study Survey, 2008. Item C10.* Includes IGERT PhD graduates who were not enrolled in degree programs and were currently in postdoctoral appointments or employed in the workforce: N=628; Missing=87.

[12] *IGERT Follow-up Survey, 2008. Item C4.* Includes IGERT PhD graduates who were not enrolled in degree programs and were in postdoctoral appointments or employed in the workforce (excludes postdoctoral appointments): N=628; Missing=0.

[13] *IGERT Follow-up Survey 2008. Items C13, D2, G2, H3.* Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in the workforce (excludes postdoctoral appointments): N=427; Missing=0.

[14] *IGERT Follow-up Survey, 2008. Item F4.* Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in US higher education settings (excludes postdoctoral appointments): N=190; Missing=2.

[15] *IGERT Follow-up Survey, 2008. Item E1.* Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in government positions (excludes postdoctoral appointments): N=52.

[16] *IGERT Follow-up Survey, 2008. Item G1.* Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in other private sector organizations including nongovernment laboratories, research institutions, think tanks, private foundations, or nonprofit organizations (excludes postdoctoral appointments): N=25; Missing=0.

[17] *IGERT Follow-up Survey, 2008. Items H5* and *H6.* Includes IGERT PhD graduates who were not enrolled in degree programs and engaged in entrepreneurial endeavors or were self-employed (excludes postdoctoral appointments): N=14.

Chapter 4: Responsibilities and Activities of IGERT Graduates in the Workforce

"The [IGERT] graduate experience should contribute to the professional development of the students and equip them to understand and integrate scientific, technical, business, social, ethical, policy and global issues to confront the challenging problems of the future."
– IGERT Program Solicitation

Addressing cutting-edge, complex scientific and social problems in a technologically advanced society requires scientists to engage with multiple disciplinary fields, recognize the global nature of STEM research, and encourage the development of the next generation of interdisciplinary researchers. The IGERT program responds to these multifaceted demands by funding IGERT graduate programs to "meet the challenges of educating U.S. PhD scientists and engineers who will pursue careers in research and education with the interdisciplinary backgrounds, deep knowledge in chosen disciplines, and technical, professional, and personal skills to become, in their own careers, leaders and creative agents for change."[1]

The IGERT PhD graduates examined in this evaluation have begun their careers within the past eight years. Nevertheless, they are active scientists who are establishing professional identities. In this chapter, we explore whether currently employed IGERT graduates are exhibiting the qualities that characterize the STEM leaders of the future as defined by the IGERT program framework. Specifically, we examine IGERT graduates' involvement in conducting interdisciplinary research, educating the next generation of interdisciplinary researchers, demonstrating global awareness of STEM research through engaging in global interactions, and serving as leaders in their current professional arenas. This chapter addresses the following research questions:

- What are the current job responsibilities of IGERT graduates?
- Do IGERT graduates engage in interdisciplinary work?
- Are IGERT graduates beginning to prepare the next generation of interdisciplinary scientists?
- Do IGERT graduates demonstrate global awareness of STEM research and engage in global interactions?
- Have IGERT graduates assumed leadership responsibilities within their current positions?
- How do IGERT graduates perceive that their graduate training prepared them for the workforce?

Data for this chapter come from our survey of the Full IGERT Sample of IGERT PhD graduates (N=645). Most data represent responses from the 628 IGERT graduates who reported that they were currently employed either full-time (N=607) or part-time (N=21) at the time of the survey.

Key Findings

- One-third of all IGERT graduates were postdoctoral fellows at the time of this study's data collection. Nearly all these individuals were conducting research during their postdoctoral appointments (98 percent); 44 percent of those at universities were also teaching. The majority were drawing on more than one discipline in their postdoctoral research (73 percent), and 30 percent reported working in at least one new field that was not part of their dissertation research.
- IGERT graduates employed in the workforce reported various professional responsibilities, including research (82 percent) and/or teaching (46 percent). Overall, 35 percent of employed IGERT graduates were in positions involving *only research*; 51 percent were in positions involving *research and other responsibilities*; and 14 percent were in positions involving *responsibilities other than research*.
- In their current work, 51 percent of IGERT graduates employed in the workforce drew upon disciplines they used in their dissertation research; 49 percent were using new field(s).
- Employed IGERT graduates continued to engage in interdisciplinary work in their current positions. A large majority of employed IGERT graduates (86 percent) described working on scientific or technical projects that required integration of multiple disciplines. On average, employed IGERT graduates reported using three broad and nine detailed disciplines in their current work.
- Employed graduates with teaching responsibilities were primarily employed in universities or colleges. Eighty-four percent of IGERT graduates who were teaching in higher education settings were involved in some form of interdisciplinary education, by way of fostering interdisciplinary collaborations, courses, or research experiences for students.
- Almost all employed IGERT graduates (98 percent) who were responsible for some form of research and development, manufacturing, or technical services reported knowing whether scientists in other countries were doing work that was relevant to their own work, and 40 percent worked with colleagues outside the United States.
- Many employed IGERT graduates had already assumed leadership roles, including leading projects or programs (75 percent), revising academic curricula (71 percent of those in academic positions), and directing the technical or scientific agenda of their organizations (42 percent).
- In general, IGERT graduates reported that their graduate programs prepared them well for their current responsibilities, and nearly all would recommend their IGERT-related graduate programs to prospective students interested in pursuing similar career paths.

Responsibilities and Interdisciplinary Engagement of IGERT Graduates in Postdoctoral Appointments

As discussed in Chapter 3, 32 percent of all IGERT graduates (N=201) were postdoctoral fellows at the time of this study's data collection, working primarily at colleges or universities (74 percent) followed by government (14 percent), other private sectors (9 percent), and business or industry (3 percent). Nearly all these individuals (98 percent) reported having research responsibilities; the remaining 2 percent (4 individuals) reported having administration/management (N=2), teaching or training (N=1), and/or other responsibilities including policy, advocacy, or lobbying (N=2). Three-quarters of graduates in postdoctoral positions reported that their postdoctoral research drew on more than one discipline (73

percent) and 30 percent reported working in at least one new field that was not part of their dissertation research. Among IGERT graduates in postdoctoral appointments at colleges or universities, 44 percent reported having teaching responsibilities, and 10 percent reported that they had helped to develop a new interdisciplinary course at their institutions.

IGERT Graduates Employed in the Workforce

Sixty-eight percent of IGERT graduates (N=427) were employed in the workforce at the time of this study's data collection, working in academia (47 percent), industry or business (32 percent), government (12 percent), or other private sector entities (9 percent). Although the professional responsibilities of these IGERT graduates varied, most were engaged in research or teaching. As shown in Exhibit 4.1, 82 percent of IGERT graduates in the workforce were involved in research, development, or technology, and 46 percent were involved in teaching or training. When collapsing these responses, we find that overall, 35 percent of employed IGERT graduates were in positions involving *only research*; 51 percent were in positions involving *research and other responsibilities*; and 14 percent were in positions involving *responsibilities other than research*.

Exhibit 4.1

Work Responsibilities for IGERT Graduates Employed in the Workforce

	Employed IGERT Graduates
Detailed responsibilities	
Research, development, and/or technology	82%
Teaching or training	46
Technical services or technical support	14
Administration or management	14
Manufacturing	7
Media or journalism	3
Policy, advocacy, or lobbying	3
Other	4
Broad responsibilities [a]	
Research only	35
Research and non-research responsibilities	51
Non-research responsibilities only	14

Exhibit reads: 82 percent of all employed IGERT graduates employed in the workforce reported research, development, or technology as either their primary or secondary work responsibility.

Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in the workforce. Excludes graduates in postdoctoral positions: N=427; Missing=4.

[a] Research responsibilities are defined as those engaged in the following categories listed in "Detailed responsibilities": Research, development, and/or technology; Technical services or technical support; or Manufacturing. Non-research responsibilities include all other aspects listed in "Detailed responsibilities": Teaching or training; Administration or management; Media or journalism; Policy, advocacy, or lobbying; or Other.

Note: Percents total more than 100 because respondents could indicate up to two areas of responsibility.

Source: IGERT Follow-up Survey, 2008. (Item I2).

Examination of employed IGERT graduates' work responsibilities by their graduate degree home disciplines reveals similar responsibilities across the disciplines (Exhibit 4.2). Within each home discipline, the majority of IGERT graduates were in positions involving *only research* or *research and*

other responsibilities (80–100 percent), and a minority (0–20 percent) were in positions that involved only non-research responsibilities. Thus, at least in their recent positions after graduation, employed IGERT graduates have focused primarily on research. In the remainder of this section, we provide more specific details on the work responsibilities of employed IGERT graduates.

Exhibit 4.2

Work Responsibilities for Employed IGERT Graduates by Graduates' Home Discipline

	IGERT Graduates' Home Discipline [a]					
	Computer Sciences	Engi-neering	Life Sciences	Math	Physical Sciences	Social Sciences
Detailed responsibilities						
Research, development, and/or technology	100%	81%	77%	87%	82%	81%
Teaching or training	43	37	48	67	32	73
Technical services or technical support	13	17	12	13	20	0
Administration or management	4	17	14	0	16	10
Manufacturing	0	13	0	0	11	0
Media or journalism	4	2	7	0	4	0
Policy, advocacy, or lobbying	0	2	6	0	1	7
Other	0	3	7	0	2	1
Broad responsibilities						
Research only [b]	48	44	26	33	46	9
Research and non-research responsibilities [b]	52	46	54	53	39	73
Non-research responsibilities	0	9	20	13	15	19

Exhibit reads: 100 percent of IGERT graduates who were currently employed and had earned doctoral degrees in Computer Sciences reported "research, development, and/or technology" as either their primary or secondary work responsibility in their current job.

Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in the workforce. Excludes graduates in postdoctoral positions: N=427 (all); 23 (computer sciences), 108 (engineering), 92 (life sciences), 15 (math), 114 (physical sciences), 71 (social sciences); Missing=4 (all), 2 (engineering), 1 (life sciences), and 1 (social sciences). Five graduates from "other" home disciplines are excluded from this table.

[a] *Home discipline* is coded from the department of enrollment as reported by trainees in the Distance Monitoring System.

[b] Research responsibilities are defined as those engaged in the following categories listed in "Detailed responsibilities": Research, development, and/or technology; Technical services or technical support; or Manufacturing. Non-research responsibilities include all other aspects listed in "Detailed responsibilities" such as: Teaching or training; Administration or management; Media or journalism; Policy, advocacy, or lobbying; or Other.

Note: Percents for the detailed responsibilities total more than 100 because respondents could indicate up to two areas of responsibility. Percents for some of the broad categories do not sum to 100 due to rounding.

Source: IGERT Follow-up Survey, 2008. (Item I2).

Research or Development

Those employed IGERT graduates in a non-postdoctoral position who indicated that their current work focuses on research (86 percent) reported engaging in multiple research activities (Exhibit 4.3). Three-quarters of these respondents characterized their responsibilities as relating to basic research, half were working on applied research, and two-fifths reported their job responsibilities were more closely associated with development, such as using knowledge gained from research for the production of goods.

Exhibit 4.3

Current Research or Development Responsibilities of IGERT Graduates

Types of Research	IGERT Graduates Engaged in Research
Applied research	75%
Basic research	53
Development	41
Computer applications, programming, systems development	22
Design of equipment, processes, structures, or models	21
Production, operations, or manufacturing	12
Technical services or technical support	9

Exhibit reads: 75 percent of employed IGERT graduates with research-oriented responsibilities reported that they engaged in applied research as part of their employment.

Includes IGERT PhD graduates employed in the workforce whose primary or secondary work responsibilities involved research, development, technology, manufacturing, and/or technical services/support. Excludes graduates in postdoctoral positions: N=361; Missing=0.

Note: Percents total more than 100 because respondents could check more than one response.

Source: IGERT Follow-up Survey, 2008. (Item J1).

Teaching or Training

Forty-six percent of employed IGERT graduates had teaching or training responsibilities. Of those, most teaching activities took place in universities or colleges (92 percent). Only a handful of IGERT graduates with teaching or training responsibilities were working in industry (4 percent) or government (2 percent).[2]

Administration or Management

Fourteen percent of employed IGERT graduates reported that they currently had administrative or managerial responsibilities, including supervising individuals responsible for research and/or development; teaching or training; or safety, environment, or health (59, 13, and 11 percent, respectively).[3] Employed IGERT graduates with managerial responsibilities reported supervising either professional personnel (55 percent), both professional and nonprofessional personnel (32 percent), primarily nonprofessional personnel (11 percent) or students and faculty (2 percent).[4]

Engagement in Interdisciplinary Work

The ability to address complex scientific problems at the interface of disciplines requires scientists to engage in cutting-edge interdisciplinary work. Employed IGERT graduates extended the interdisciplinary nature of their graduate school experiences by continuing to conduct interdisciplinary work and drawing from multiple disciplines in their careers. To determine the extent to which IGERT graduates engaged in inter- or multidisciplinary research, we asked them to identify the disciplines they used in their current work. As with describing their dissertation research (see Chapter 2), respondents were presented with a list of 19 broad disciplines and asked to identify those that they used in their current work:

- Agricultural Sciences / Natural Resources
- Astronomy
- Atmospheric Science and Meteorology
- Biological / Biomedical Sciences
- Chemistry
- Communications
- Computer and Information Sciences
- Education
- Engineering
- Geological and Earth Sciences
- Health Sciences
- Humanities
- Mathematics
- Ocean / Marine Sciences
- Physics
- Professional Fields / Business Management / Administration
- Psychology
- Social Sciences
- Other

Over three-quarters (79 percent) of employed IGERT graduates reported using two or more disciplines in their work, and 34 percent reported that they used four or more disciplines (Exhibit 4.4). Within each of the broad disciplines listed above, respondents could indicate the detailed fields in which they worked (for example, in engineering they might be using mechanical engineering, electrical engineering, or civic engineering). IGERT graduates reported using multiple detailed disciplines in their work. Some graduates reported using 1 to 5 detailed disciplines (40 percent) or 6 to 10 detailed disciplines (30 percent), and 30 percent reported using 11 or more detailed disciplines in their work. On average, employed IGERT graduates drew from 3 broad and 9 detailed disciplines in their current work.[5]

"Without IGERT's interdisciplinary training, I would not be able to conduct the research I do. My training allows me to integrate formal, mathematical, and computer science methods with the experimental techniques of applied psychology. If I had attended a traditional graduate program I would have a subset of these skills, and I would not know how to truly integrate them."

– IGERT graduate

Exhibit 4.4

Number of Disciplines Employed IGERT Graduates Use in Their Current Work

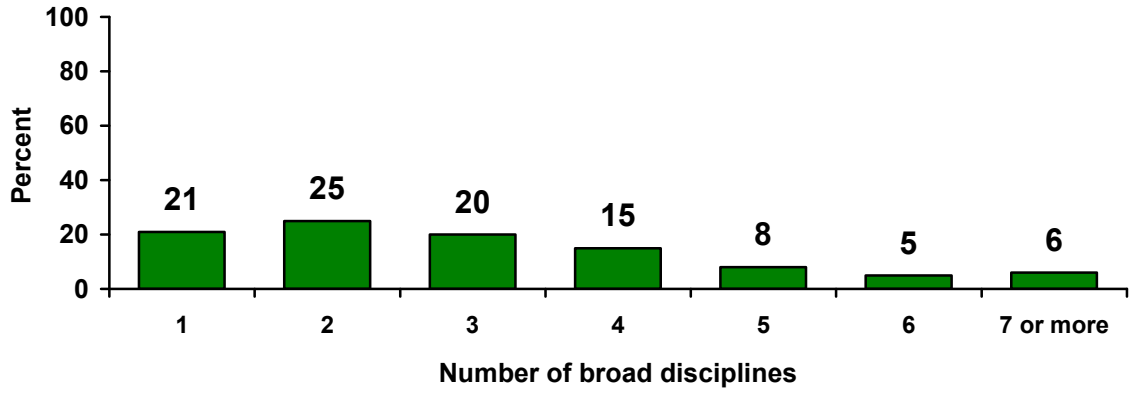

Exhibit reads: 21 percent of employed IGERT graduates use one broad discipline in their current work; 25 percent of employed IGERT graduates use two broad disciplines in their current work.

Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in the workforce. Excludes graduates in postdoctoral positions: N=427; Missing=4.

Source: IGERT Follow-up Survey, 2008. (Item I1).

Nearly half of IGERT graduates employed in the workforce reported using engineering (45 percent) or biology or biomedical sciences (41 percent) in their current work and roughly one-third reported that their current work involved mathematics or chemistry (Exhibit 4.5). IGERT graduates reported working in multiple areas and using a variety of disciplines beyond their home graduate degree disciplines. For example, although 96 percent of IGERT Computer Sciences graduates continued to use computer sciences in their professional work, 30 percent indicated that their work also involved biological or biomedical sciences.

Exhibit 4.5

Disciplines Used in IGERT Graduates' Current Work, by Home Discipline of Graduate

Disciplines used in current work:	Employed IGERT Graduates' Home Discipline [a]						
	All	Computer Sciences	Engi-neering	Life Sciences	Math	Physical Sciences	Social Sciences
Engineering	45%	13%	90%	17%	13%	53%	6%
Biological and/or Biomedical Sciences	41	30	33	81	67	33	20
Mathematics	35	43	43	19	93	40	19
Chemistry	32	4	34	21	0	65	1
Physics	27	13	32	9	7	54	3
Computer and Information Sciences	25	96	23	17	47	20	16
Social Sciences	21	22	6	20	0	4	87
Agricultural Sciences and/or Natural Resources	13	0	7	39	20	5	11
Education	10	0	8	10	7	9	20
Health Sciences	13	9	8	26	7	4	24
Geological and/or Earth Sciences	6	0	3	11	0	10	6
Professional Fields and/or Business Management and Administration	10	13	10	8	0	9	11
Psychology	6	17	0	1	0	1	29
Atmospheric Science and Meteorology	5	0	5	7	7	5	6
Ocean and/or Marine Sciences	4	0	1	12	7	4	3
Communication	6	13	5	8	0	5	4
Humanities	4	4	0	6	0	1	13
Astronomy	2	0	2	0	0	4	1

Exhibit reads: 45 percent of IGERT PhD graduates, and 13 percent of Computer Sciences graduates employed in the workforce, reported using engineering in their current work.

Includes IGERT graduates who were not enrolled in degree programs and were employed in the workforce: N=627 (all); 23 (computer sciences), 108 (engineering), 91 (life sciences), 15 (math), 114 (physical sciences), 71 (social sciences); Missing=4 (all), 2 (engineering), 1 (life sciences), and 1 (social sciences). Exhibit excludes five graduates from "other" home disciplines.

[a] *Home discipline* is coded from the department of enrollment as reported by trainees in the Distance Monitoring System.

Note: Percents sum to more than 100 because respondents could report multiple disciplines.

Source: IGERT Follow-up Survey. 2008. (Item I1)

To what extent was the interdisciplinary work IGERT graduates completed during graduate school relevant to the work IGERT graduates conducted in their employed positions? All employed IGERT graduates were using at least some of their dissertation disciplines in their current work. However, the interdisciplinary nature of the work currently conducted by IGERT graduates required not only training in a broad range of fields but also the ability to adapt and draw from new disciplines. Thus, while 51 percent of IGERT graduates were only drawing upon disciplines they used in their dissertation research, 49 percent of IGERT graduates were also using some new fields (Exhibit 4.6), which demonstrates that these graduates are capable of connecting with new disciplines.

Exhibit 4.6

Congruence between Disciplines Used in Graduates' Theses and Current Work among IGERT Graduates Now Employed in the Workforce

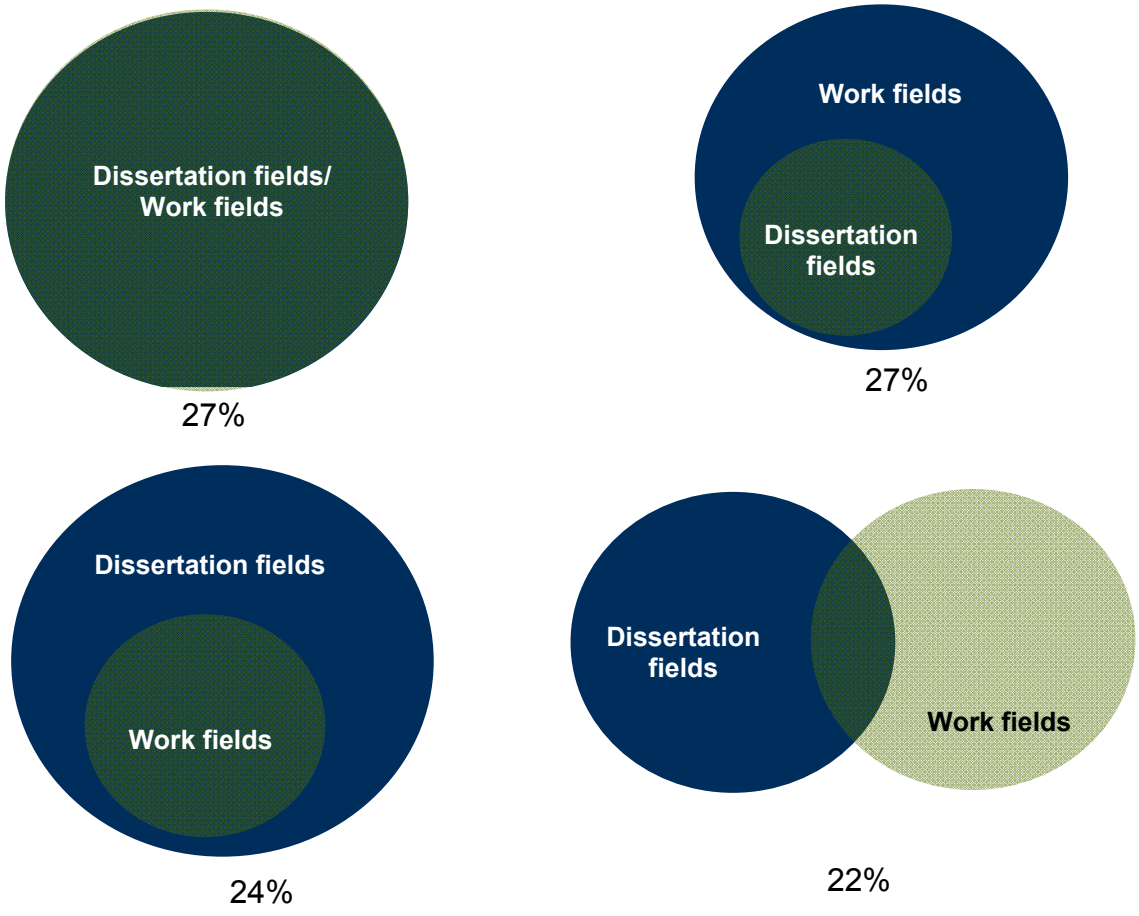

Exhibit reads: 27 percent of employed IGERT graduates were using the same disciplines from their dissertation research in their current work. Twenty-seven percent of employed IGERT graduates were using all the disciplines from their dissertation research along with some new disciplines in their current work. Twenty-four percent of employed IGERT graduates were using some of the disciplines from their dissertation research and no new disciplines in their current work. Twenty-two percent of employed IGERT graduates were using some disciplines from their dissertation research and some new disciplines in their current work.

Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in the workforce: N=437; Missing=4.

Source: IGERT Follow-up Survey, 2008. (Items B9, B10, I1)

Of those IGERT graduates employed with research responsibilities, a large majority (86 percent) described working on scientific or technical projects that required the integration of two or more disciplines and 86 percent have collaborated with individuals outside their disciplines.[6]

Regardless of their current responsibilities, IGERT graduates overwhelmingly reported that their graduate program prepared them for cross-disciplinary activities (Exhibit 4.7). Nearly all IGERT graduates reported that their graduate program prepared them "well" or "very well" to explain their own work or research to scientists or technologists in other disciplines (96 percent) and to work and network with scientists or technologists in other disciplines (94 percent). In fact, as shown in Exhibit 4.8, these represent two of the top three benefits of graduate training that IGERT graduates reported.

> "Working across the disciplines in my IGERT was the best job training I received in graduate school, for work outside the academic world. I knew much more about environmental policy from my IGERT than I learned in any other part of graduate school. I also learned how to speak about climate change science in a way that is comprehensible to more of the public than most scientists learn to do. I also learned how to think outside my own discipline in my IGERT, an experience which has proven invaluable in a job where my greatest assets are being flexible and knowledgeable across many different fields."
>
> – IGERT graduate

Exhibit 4.7

Graduate Preparation and Current Job Activities Related to Research and Interdisciplinary Collaboration

Job Activities	*Graduate Program Preparation* Very Well	Well	Not Well	Regularly Engage In
Explain my own work or research to scientists or technologists in other disciplines	63%	33%	4%	81%
Publish research, technical findings, and/or reports	62	33	5	76
Work and network with scientists or technologists in other disciplines	57	37	6	80
Develop own technical or scientific agenda	45	46	9	82
Present my own or my organization's research or work to nontechnical audiences	39	43	18	64
Obtain funding for research or project work [a]	21	46	33	77
Develop and/or commercialize a service or product	10	26	64	35

Exhibit reads: 81 percent of IGERT graduates employed in the workforce reported that they regularly explained their own work or research to scientists or technologists in other disciplines. As for the preparation for this activity, 63 percent indicated their graduate program prepared them "very well," 33 percent indicated it prepared them "well," and 4 percent indicated that it did not prepare them well.

Includes only IGERT graduates who were not enrolled in degree programs and were employed in the workforce: N=427; Missing=2-6.

[a] Includes only IGERT graduates who were not enrolled in degree programs and were employed in the workforce except in industry/business: N=296; Missing=3.

Source: IGERT Follow-up Survey, 2008. (Items D7, E6, F10, G7,and H12)

IGERT graduates also reported equal levels of preparedness with respect to more traditional research areas, such as publishing research or developing their own technical or scientific agendas. Indeed, the third item in the top three areas of preparedness was the ability to publish research, technical findings, and/or reports, described by 95 percent of graduates. This may indicate that, in the eyes of IGERT graduates, their interdisciplinary training did not come at the expense of more preparation as a scientist.

Educating the Next Generation of Interdisciplinary Researchers

Since IGERT is meant to be a catalyst for changing the way that STEM graduates are prepared, we would expect the influence of IGERT to extend beyond individual IGERT projects. Indeed, there is evidence that IGERT graduates, particularly those now involved in training a subsequent generation of scientists, were employing methods advocated by the IGERT program for training interdisciplinary researchers.

> "The IGERT-funded seminar exposed me to a great deal of mathematical biology, which is the basis of the course I am [now] developing and teaching."
>
> – IGERT graduate

Eighty-four percent of IGERT graduates who indicated that they taught in higher education settings reported educating the next generation of interdisciplinary researchers in some fashion, either through fostering interdisciplinary collaborations, training experiences, or research in their teaching practices. For example, 55 percent of IGERT graduates at universities had supervised an interdisciplinary undergraduate or graduate level research project within the past year, and 43 percent indicated that they had involved a student from another discipline or department in their own research (Exhibit 4.8). Although they are only at the beginning of their careers, 38 percent of IGERT graduates who were teaching in higher education settings had already helped develop a new interdisciplinary course at their universities, and 13 percent had developed an entirely new interdisciplinary program of study. The development of new interdisciplinary educational offerings may reflect the typical pattern of new faculty members introducing courses and programs that reflect their expertise—in this case, IGERT graduates bringing their interdisciplinary training into the offerings of their new institutions.

> "The IGERT program aided my ability to reach across the social science/natural science divide. I feel close connections at my current job with faculty in geology, chemistry, and biology as well as anthropology, which is of great value at a small undergraduate teaching institution. My cross-disciplinary work helps me show my students and advisees the value of making these connections as well."
>
> – IGERT graduate

Exhibit 4.8

Percent of IGERT Graduates Employed in Higher Education with Teaching Responsibilities Who Had Engaged in Interdisciplinary Education Activities within the Past Year

Interdisciplinary Activities	IGERT Graduates with University Teaching Responsibilities
Supervised an interdisciplinary undergraduate or graduate level research project	55%
Had an undergraduate or graduate student from another discipline work on IGERT graduates' own research projects	43
Helped develop a new interdisciplinary course	38
Served on a dissertation committee of a graduate student from another department or discipline	31
Team-taught a course with colleague(s) from another discipline	19
Helped develop a new interdisciplinary undergraduate or graduate program of study	13
None of the above [a]	16

Exhibit reads: 55 percent of IGERT graduates working within higher education who had teaching responsibilities indicated that they had supervised an interdisciplinary undergraduate or graduate level research project within the year prior to completing the survey.

Includes only IGERT PhD graduates who were not enrolled in degree programs and were employed in the workforce with teaching responsibilities in the higher education system: N=167; Missing=0. Excludes graduates in postdoctoral positions.

Note: Percents will total greater than 100 because respondents could check more than one response item.

[a] Approximately 50 respondents to the survey were not presented with this option. Thus, the percent choosing "none of the above" may be an underestimate, and the other percents may be overestimates (as approximately 50 respondents were forced to choose at least one of the other options).

Source: IGERT Follow-up Survey 2008. (Item K5).

Global Awareness and Engagement

> "The single greatest contribution to my graduate education was the International IGERT supplement that provided the opportunity for me to work in a lab in [another country] and experience a different culture."
>
> – IGERT graduate

Because the STEM enterprise transcends geopolitical boundaries, remaining at the forefront of advances in STEM requires a globally aware workforce. As a result, the IGERT program requests that projects make students aware of the global dimensions of their STEM fields. We found that nearly all IGERT graduates were aware of the global nature of STEM research in their disciplines, regardless of whether their jobs required them to engage in global scientific conversations or interactions. For example, almost all IGERT graduates (91 percent) who had research and development, technology, manufacturing, or technical services and support responsibilities indicated that they knew whether scientists in other countries were engaged in work relevant to their current research.[7]

IGERT graduates employed in the workforce have engaged in global interactions as part of their current responsibilities in various ways. IGERT graduates (employed across any sector and job) reported that their job required them to be informed of research in other countries (60 percent) and that they regularly searched or used international databases or citations (47 percent). Roughly 40 percent of IGERT graduates

reported working on a team with colleagues who were located abroad or attending professional conferences outside the US, and 34 percent had traveled to other countries for work-related purposes.[8] Among those who were teaching undergraduate or graduate students in universities (N=167), 23 percent had discussed the international nature of the scientific enterprise in a course.[9] Smaller proportions of IGERT graduates had applied or been recruited for a position outside the US (11 percent) or worked abroad (11 percent) and a handful had learned a foreign language on behalf of their career (6 percent).[10]

> "The IGERT program provided me with the ability to work on high-quality research individually or in teams. It made me open to work with scientists from different backgrounds and developed my [verbal] and leadership skills."
>
> – IGERT graduate

Demonstrating Leadership

The IGERT program is intended to play a role in developing the next generation of STEM leaders. We asked respondents whether they regularly engaged in various leadership activities as part of their current job responsibilities (Exhibit 4.9). Three-quarters of IGERT graduates reported that they regularly led projects or programs. Nearly three-quarters of those in university settings had participated in revising or developing new curricula (71 percent), and about half of those in non-university settings had responsibility for delegating and making assignments (56 percent).

Over 200 IGERT graduates reported that they were employed in the workforce outside of universities, in government, industry or business, or other organizations. Of these 271 individuals, 3 percent reported they are already top level executives (e.g., president, CEO, or vice president) within their respective organizations, and 11 percent indicated that they were first line supervisors, administrators, or managers (e.g., director or department/division heads). [11]

One component of leadership is the ability to work well with others. As shown in Exhibit 4.10, most IGERT graduates reported that their program prepared them "well" or "very well" to work as part of a team or to lead projects (89 and 83 percent, respectively). They also believed their program prepared them well to serve as mentors to other individuals (80 percent), and nearly all reported leaving their programs capable of balancing the demands of multiple projects (89 percent). This latter may reflect the nature of IGERT training programs, which often require students to balance the requirements and activities of their home departments with those of the IGERT training experience.[12]

> "The greatest single contribution that IGERT has given me is the ability to successfully communicate and collaborate with a wide range of individuals . . . from university accountants to wildlife ecologists to Guyanese government leaders to Amerindian hunters."
>
> – IGERT graduate

Exhibit 4.9

Percent of IGERT PhD Graduates Engaged in Leadership Activities in Their Current Positions

Employed IGERT Graduates [a]	Percent
Lead projects or programs	75%
Play a significant role in the development, implementation, and execution of policies, procedures, and standards	47
Direct or participate in developing and/or implementing the vision and strategic direction of the organization	43
Develop or direct the technical or scientific agenda of the organization	42
Employed Graduates at Universities [b]	
Participate in revising or developing curricula	71%
Develop new degree programs	22
Employed Graduates at Non-Universities [c]	
Delegate responsibilities and assignments	56%
Develop and oversee budget and/or profit and loss statements	21

Exhibit Reads: 75 percent of IGERT graduates in the workforce led projects or programs as part of their current positions. Forty-six percent of IGERT graduates working in an academic setting participated in revising or developing curricula as part of their current positions. Fifty-six percent of IGERT graduates working in a non-academic setting delegated responsibilities and assignments as part of their current positions.

[a] Includes only IGERT graduates who were not enrolled in degree programs and were employed in the workforce: N=427; Missing=2.

[b] Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in the workforce in colleges or universities: N=206; Missing=0.

[c] Includes IGERT PhD graduates who were currently employed in the workforce but not working in college or university settings: N=221; Missing=2.

Source: IGERT Follow-up Survey, 2008. (Items D6, D7, E5, E6, F9, F10, G6, G7, H11, and H12).

Exhibit 4.10

IGERT Graduates' Graduate Preparation and Current Job Activities Related to Leadership

	Graduate Program Preparation			
Job Activities	Very Well	Well	Not Well	Regularly Engage In
Work as part of a team	47%	42%	11%	90%
Balance the demands of multiple projects	40	49	11	94
Lead projects or programs	34	49	17	75
Serve as a mentor	33	47	21	72

Exhibit reads: 90 percent of IGERT graduates employed in the workforce reported that they regularly work as part of a team in their current jobs. As for their level of preparation for working on a team, 47 percent reported that their graduate programs prepared them "very well," 42 percent reported they were prepared "well," and 11 percent reported that their graduate programs did not prepare them well for this.

Includes only IGERT graduates who were not enrolled in degree programs and were employed in the workforce: N=427; Missing=2-4.

Source: IGERT Follow-up Survey, 2008. (Items D7, E6, F10, G7, and H12).

Alignment of Graduate Training with STEM Workforce Demands

The training that students receive during graduate school is the primary mechanism through which they acquire the knowledge, skills, and abilities necessary to fulfill the job responsibilities they will assume in professional STEM positions. To what extent does the graduate training received by IGERT graduates align with the workforce demands they face? We examined the level of alignment between graduate training and current job activities for IGERT graduates by forming a dichotomous measure using information about job activities and level of preparation for such activities. We considered graduate training to be "aligned" with current activities if respondents had reported
(a) regularly engaging in an activity and their training had prepared them "well" or "very well," or
(b) not regularly engaging in the activity and their graduate training had prepared them "not well."
Respondents' graduate training was defined as "not aligned" if they reported (a) regularly engaging in the activity and their graduate training prepared them "not well" or (b) did not regularly engage in the activity and their graduate training prepared them "well" or "very well."

As shown in Exhibit 4.11, at least two-thirds of graduates reported alignment in each of the outcomes examined, particularly balancing the demands of multiple projects and developing their own technical and scientific agendas. The fact that balancing the demands of multiple projects came up with the highest degree of alignment again may reflect graduates' reports that the IGERT experience had developed their multitasking abilities.

Exhibit 4.11

Percent of IGERT Graduates Reporting Alignment between Current Work Activities and Graduate Training

Job Activities	IGERT Graduates
Balance the demands of multiple projects	88%
Develop own technical or scientific agenda	84
Work as part of a team	84
Explain my work or research to scientists or technologists in other disciplines	81
Work and network with scientists or technologists in other disciplines	80
Publish research, technical findings, and/or reports	79
Lead projects or programs	77
Serve as a mentor	74
Develop and/or commercialize a service or product	70
Obtain funding for research or project work [a]	69
Present my or my organization's research or work to nontechnical audiences	67
Be informed of research in other countries	66

Exhibit reads: An estimated 88 percent of IGERT graduates employed in the workforce received training during graduate school that was relevant to their current job activity of balancing multiple projects.

Includes only IGERT graduates who were not enrolled in degree programs and were employed in the workforce: N=427; Missing=2-6.

[a] Includes only IGERT graduates who were not enrolled in degree programs and were employed in the workforce except those employed in industry/business: N=296; Missing=3.

Source: IGERT Follow-up Survey, 2008. (Items D7, E6, F10, G7, and H12).

Reflecting satisfaction with their graduate training now that they are employed in the workforce, nearly all IGERT graduates (94 percent) reported that they would recommend their (IGERT-related) graduate programs to prospective students interested in pursuing careers similar to their own.[13]

Summary

Recent IGERT graduates are beginning to exhibit the qualities that characterize STEM leaders of the future, including engaging in interdisciplinary research and education, demonstrating global awareness of STEM research, and taking on leadership roles in their current positions. IGERT graduates reported drawing upon various disciplines in their work and integrated multiple disciplines on scientific and technical projects. Forty-nine percent of employed IGERT graduates had broadened their interdisciplinary focus to include new disciplines in their current work that were not used in their dissertation research, reflecting their ability not just to work in fields they were trained in, but to branch out to new fields as well. IGERT graduates reported that their graduate programs had well prepared them for their current responsibilities including those that transcend disciplinary boundaries, such as explaining their research to colleagues in other disciplines and working and networking with colleagues in other disciplines. Eighty-four percent of IGERT graduates with teaching responsibilities in universities had begun training the next generation of interdisciplinary STEM researchers through fostering interdisciplinary collaborations, courses, or research experiences for students. Almost all IGERT graduates were aware of whether scientists in other countries were conducting research relevant to their own work, and two in five employed graduates reported working on teams with colleagues who were located abroad. Even though they were just starting their postgraduate careers, many IGERT graduates had already begun taking on leadership roles directing projects or programs, and some had already revised academic curricula or were responsible for directing the technical or scientific agenda of their organizations.

[1] Integrative Graduate Education and Research Traineeship (IGERT) Program, Program Solicitation, NSF 08-540. (2008). Arlington, Va.: National Science Foundation.

[2] *IGERT Follow-up Survey, 2008. Items C13 and I2*. Includes IGERT PhD graduates () who were not enrolled in degree programs and were employed in the workforce: N=427; Missing=0.

[3] *IGERT Follow-up Survey, 2008. Item L2*. Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in the workforce with job responsibilities involving administration or management: N=57; Missing=1.

[4] *IGERT Follow-up Survey, 2008. Item L3*. Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in the workforce with job responsibilities involving administration or management: N=57; Missing=1.

[5] *IGERT Follow-up Survey, 2008. Items J3 and J2*. Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in the workforce with job responsibilities involving research, development, and/or technology, manufacturing, or technical services/support: N=362; Missing=1.

[6] *IGERT Follow-up Survey, 2008. Items J3 and J2*. Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in the workforce with job responsibilities involving research, development, and/or technology, manufacturing, or technical services/support: N=362; Missing=1.

[7] *IGERT Follow-up Survey, 2008. Item J4*. Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in the workforce with job responsibilities involving research, development, and/or technology, manufacturing, or technical services/support: N=362; Missing=2.

[8] *IGERT Follow-up Survey, 2008. Items D7, E6, F10, G7, H12, D8, E7, F11, G8 and H13*. Includes IGERT PhD graduates (N=427) who were not enrolled in degree programs and were employed in the workforce: N=427; Missing=3-4.

[9] *IGERT Follow-up Survey, 2008. Item K5*. Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in the workforce, with work responsibilities involving teaching/training in higher education institutions, and were currently providing instruction to undergraduate or graduate students: N=167; Missing=0.

[10] *IGERT Follow-up Survey, 2008. Items D8, E7, F11, G8 and H13*. Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in the workforce: N=427; Missing=4.

[11] *IGERT Follow-up Survey, 2008. Items D5, E4, G5 and H10.* Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in the workforce except for those working in colleges or universities: N=271; Missing=2.

[12] J. G. Carney, et al. 2006. *Evaluation of the Initial Impacts of the National Science Foundation's Integrative Graduate Education and Research Traineeship program*. Cambridge, Mass.: Abt Associates, Inc. Full report available at http://www.nsf.gov/pubs/2006/nsf0617/index.jsp.

[13] *IGERT Follow-up Survey, 2008. Item O3*. Includes IGERT PhD graduates who were not enrolled in degree programs and were employed in the workforce: N=427; Missing=0.

Chapter 5: Comparing IGERT and Non-IGERT Graduates

Chapters 2 through 4 described the experiences and early career outcomes of IGERT PhD graduates. These evaluation data revealed that IGERT graduates reported consistent interest in interdisciplinary work, completion of interdisciplinary dissertations, and pursuit of jobs in a variety of employment sectors. Further, IGERT graduates reported that their professional activities enabled them to engage in research and teaching activities that are often interdisciplinary in nature. IGERT graduates reported being well or very well prepared for their current work responsibilities. There is evidence that there is a high degree of alignment between what IGERT graduates were trained to do and what they are now doing.

How do these training and career outcomes compare to other PhD students who graduate without an IGERT experience? Is there any evidence that participating in IGERT better prepares graduates for their chosen STEM careers than single-discipline PhD programs? Do IGERT graduates pursue a broader range of career opportunities than other PhD graduates? To assess the influence of the IGERT experience on the degree completion and postgraduation career outcomes of recent graduates, we compared survey responses from a sample of IGERT graduates and a comparison group of recent graduates from single-discipline PhD programs. IGERT and non-IGERT graduates were compared in the following areas:

- decision to enroll in graduate school;
- likelihood of completing degree;
- time taken to complete degree;
- competitiveness upon entry to the job market;
- success in obtaining a desired position in the job market;
- breadth of careers entered;
- diversity of career responsibilities assumed; and
- preparedness for careers.

The counterfactual in this sub-study (described in detail below) was the single-discipline doctoral experience IGERT graduates might have had if they had not participated in IGERT. This comparison was quasi-experimental: a constructed comparison group was used to represent the experiences that IGERT graduates might have had if they had not received IGERT training. Because of the selection bias inherent in any quasi-experimental comparison group, it is possible that the differences observed between IGERT and non-IGERT graduates are due to factors other than the IGERT training experience. This chapter describes the methods used in the comparative analysis and presents the findings from survey data of the IGERT Subsample (N=261) and the Non-IGERT Subsample (N=436). Most findings about respondents' specific employment outcomes were based on PhD graduates who reported that they were employed at the time of the survey (N=255 IGERT Subsample and N=415 Non-IGERT Subsample). Because this is the first examination of IGERT PhD graduates' postgraduation outcomes, the study did not have specific hypotheses (about such outcomes) it was planning to test. As discussed in Chapter 1, as the number of hypothesis tests (e.g., the hypotheses that IGERT and non-IGERT graduates differ on particular outcomes) increases, the likelihood of false discoveries also increases; by limiting the number of tests, we can limit the likelihood of such false discoveries. We did not adjust the p-values to account for the statistical tests reported below. Thus, we do not know whether the observed differences between IGERT and non-IGERT graduates reflect underlying and substantively meaningful differences, simply because some of these differences are likely due to chance.

Key Findings

We present here key findings from the comparative sub-study. Findings that highlight a difference between IGERT and non-IGERT respondents were found to be significant at the p<.05 level.

- There is evidence that IGERT training programs attract students with different interests and motivations than non-IGERT programs. IGERT graduates reported having greater interest in an interdisciplinary education or research training experience when they applied to graduate school than non-IGERT graduates. IGERT graduates were also significantly more likely than non-IGERT graduates to pursue a career in STEM for the intellectual challenge and in order to create new knowledge.
- The dissertations produced by IGERT graduates were more interdisciplinary than those produced by non-IGERT graduates; IGERT graduates' dissertations were more likely to draw from two disciplines or more than those of non-IGERT graduates.
- IGERT students earned their degrees one-half year sooner than non-IGERT students in similar departments, on average.
- IGERT graduates were more likely than non-IGERT graduates to report that their graduate programs had well prepared them for research faculty positions at universities and were also more likely to report being prepared for other types of positions.
- Both IGERT and non-IGERT graduates considered employment in a variety of sectors, but IGERT graduates considered fewer sectors.
- IGERT training may have provided a competitive boost to IGERT graduates' job obtainment. IGERT graduates reported having *less difficulty* than non-IGERT graduates obtaining their post-degree positions and were more likely than non-IGERT graduates to believe that their graduate preparation gave them a competitive edge when applying for positions in the workforce.
- IGERT and non-IGERT graduates reported no significant differences in securing employment by the time they graduate with their PhD degrees and obtaining a position in their most desired employment sector (academia, industry, etc.). Academic institutions were the most frequent employers of both groups, followed by industry or business, then government.
- IGERT graduates were more likely to list research as their primary job responsibility, while non-IGERT graduates were more likely to list teaching or training as their primary responsibility.
- Both groups reported that they drew upon multiple disciplines in their research; however, IGERT graduates were more likely to be integrating multiple disciplines.
- Among graduates with teaching responsibilities, both groups reported that they engaged in team-teaching with colleagues in other departments or advising students from other departments; however, IGERT graduates were more likely to be teaching courses that required them to integrate two or more disciplines.
- IGERT and non-IGERT graduates were equally likely to demonstrate awareness of the global nature of science and to engage in leadership activities in their current positions.
- IGERT graduates were more likely to have received relevant training in working and networking with scientists or technologists in other disciplines and developing their own technical and scientific agenda than non-IGERT graduates. However, IGERT and non-IGERT graduates were equally likely to have received graduate training aligned to their other current job activities.

Comparative Study Methods

Measuring the impacts of the IGERT program required that we compare what we actually observed for IGERT graduates to what we would have observed from the same graduates had they not participated in the IGERT—the counterfactual. The most rigorous comparison study design would involve a random assignment study, where a pool of equally eligible potential IGERT applicants would be randomly assigned to either participate in or not participate in the IGERT training experience. As IGERT grants are competitively awarded to institutions, and institutions' selection processes are quite variable, a random assignment study of impacts was not feasible.

Thus, we used a quasi-experimental design. We identified a comparison group of students from similar departments at other universities and controlling during sample selection and afterward in analysis for factors that might influence the outcomes of interest. Ideally, in order to minimize differences between the two groups before they had exposure to activities likely to affect the outcomes of difference, we would have created a comparison group of non-IGERT students at the time that both groups of students initially enrolled in their graduate programs. Such a comparison was not possible in this study, given that the evaluation only began after the respondents of interest had graduated. In this component of the evaluation, outcomes for a subsample of IGERT graduates were compared with outcomes for a sample of non-IGERT graduates from a matched set of departments. The sample construction is described in Appendix A along with information on the final survey samples. Findings from these comparisons follow.

IGERT Subsample

We selected a subset of IGERT graduates from all IGERT graduates who graduated with PhDs between January 2001 and December 2006 from a department with three or more IGERT doctoral graduates. The final IGERT Subsample included 401 PhD graduates from 56 IGERT projects and 85 unique departments.

Comparison Subsample

The matched comparison group was constructed by identifying comparison departments based on academic quality and selecting graduates from these departments. We chose to identify matched comparison departments using two methods: a) self-identified IGERT competitor departments and b) U.S. News & World Report Rankings of doctoral programs by field of study. We obtained a list of recent PhD graduates from each department and then matched non-IGERT graduates with the subsample of IGERT graduates. We matched graduates in each IGERT department with non-IGERT graduates as closely as possible on citizenship status and graduation year. To account for an anticipated lower find and response rate among the comparison respondents, we over-sampled; our final sample contained 834 non-IGERT graduates.

Strengths and Limitations of Comparison Approach

The comparison approach was designed to address the question of what is gained (or lost) by offering students an interdisciplinary component to their education, as compared with the traditional single-discipline model. The comparison was across-department (interdisciplinary) against single-department education, with IGERT representing interdisciplinary education. By matching IGERT graduates to non-IGERT graduates from similar academic programs, the selected comparison approach accounts for institutional and departmental characteristics that may affect the outcomes of interest. It also accounts for national trends for scientists to engage in joint work across disciplines that might influence the cross-disciplinary activities offered by both IGERT and non-IGERT departments.

The limitation of this approach is that our comparison group does not account for potential selection bias among participating individuals. It is possible that the outcomes for participants reflect their inherent predisposition to seek interdisciplinary interactions rather than reflecting the effect of IGERT funding. Our design does not allow us to disentangle the effects of the IGERT program from the effects that may be a result of the IGERT participants' tendencies to seek interdisciplinary interactions. We attempted to address this limitation by collecting data from non-IGERT graduates on their motivations and their desire to engage in interdisciplinary education and research.

Final Sample Sizes, Response Rates, and Characteristics

Exhibit 5.1 shows the final sample sizes and response rates for the IGERT and Non-IGERT Subsamples.

Exhibit 5.1

Final Sample Size and Response Rates for IGERT Subsample and Non-IGERT Subsample

	IGERT Subsample	Non-IGERT Subsample
a. Targeted sample [a]	401	834
b. Final survey sample [b]	396	827
c. Located/invited [c]	349	636
d. Number of completed surveys [d]	261	436
	Percent	**Percent**
e. Response rate (d/b)	66%	52%
f. Cooperation rate (d/c)	75%	69%

[a] We targeted twice as many non-IGERT as IGERT respondents because we assumed a lower find rate and lower participation rate from the non-IGERT individuals and wanted to ensure sufficient power in our analyses.

[b] We excluded 5 IGERT Subsample individuals because status classified post hoc made them ineligible for our sample. For the following reasons we excluded 7 non-IGERT individuals from the subsample: a) degree status classified post hoc made them ineligible for our sample (n=4); b) duplicate record (n=1); and c) tragic event (n=2).

[c] We were unable to find a workable e-mail address for 47 IGERT Subsample and 191 Non-IGERT Subsample individuals in the targeted sample, either because we never obtained an individual's e-mail address or because the invitation "bounced back" as undeliverable or misidentified. These individuals therefore did not receive a survey invitation. They were included in the denominator of the response rate calculation and excluded from the denominator of the cooperation rate as per recent guidelines issued by APPOR.[1]

[d] We decided to classify 2 IGERT and 8 non-IGERT partially completed respondents as having submitted a survey because they had completed at least 40 percent of the questions.

The IGERT and non-IGERT respondents were similar on most demographic characteristics (Exhibit 5.2). Visual examination of the data suggested that the two groups have similar proportions of men and women and of underrepresented minority students. Nearly two-thirds of each group reported being the first in their family to earn a PhD degree in a STEM discipline, and they studied similar fields while enrolled in their PhD programs. We tested the significance of the difference observed between the IGERT Subsample and the Non-IGERT Subsample on the items in Exhibit 5.2. Two items were significant at the $p < .05$ level: gender and citizenship. Males were slightly more represented among the IGERT respondents, while individuals choosing not to report their gender were slightly more represented among the non-IGERT respondents. Regarding citizenship, all IGERT students were required to be US citizens, compared to 85 percent of the non-IGERT respondents. The non-IGERT noncitizens primarily studied engineering and computer science disciplines. We did not exclude noncitizens from the analyses presented in this chapter, nor did we examine differences within discipline groupings.

Exhibit 5.2

IGERT and Non-IGERT Respondent Descriptive Characteristics

	IGERT Subsample Respondents	Non-IGERT Subsample Respondents
Gender *		
Male	64%	61%
Female	35	34
Chose not to report	1	5
Race/ethnicity		
White, Non-Hispanic	70	68
Asian	8	14
Hispanic or Latino	4	5
Black or African American	3	2
Multiple Races, Non-Hispanic	3	1
American Indian, Alaska Native, Pacific Islander	<1	<1
Chose not to report	11	10
Citizenship *		
US Citizen	99	85
Non-US Citizen	1 [a]	15
Family education history		
First in family to earn a PhD in STEM field	66	61
Discipline of study in doctoral program		
Life Sciences	31	32
Physical Sciences	24	21
Engineering	18	20
Social Sciences	15	14
Computer Sciences	6	8
Mathematics	5	6

Exhibit reads: 64 percent of IGERT Subsample respondents and 61 percent of Non-IGERT Subsample respondents were men.

* $p < .05$

Includes PhD graduates:

Gender: N=261 (IGERT Subsample) and 436 (Non-IGERT Subsample); Missing=1 (IGERT Subsample) and 8 (Non-IGERT Subsample).

Race/Ethnicity: N=261 (IGERT Subsample) and 436 (Non-IGERT Subsample); Missing= 2 (IGERT Subsample) and 8 (Non-IGERT Subsample).

Citizenship: N=261 (IGERT Subsample) and 436 (Non-IGERT Subsample); Missing= 7 (IGERT Subsample) and 3 (Non-IGERT Subsample).

Family history: N=261 (IGERT Subsample) and 436 (Non-IGERT Subsample); Missing= 2 (IGERT Subsample) and 8 (Non-IGERT Subsample).

Discipline of study: N=261 (IGERT Subsample) and 436 (Non-IGERT Subsample); Missing= 0 (IGERT Subsample) and 0 (Non-IGERT Subsample).

[a] To receive an IGERT traineeship, students are required to be US citizens. Two IGERT graduates reported that they are not US citizens. They may have been incorrectly identified by their PI as receiving IGERT funding, or may have received IGERT funding when they should not have. We do not have further information on these respondents.

Note: IGERT and Non-IGERT graduates' characteristics in this table were reported for descriptive purposes only; statistical tests were not conducted to determine significance of these characteristic-related data.

Sources: IGERT Follow-up Survey, 2008. IGERT Distance Monitoring System, 2007.

Analysis

To test for significance of the difference observed between the IGERT Subsample and the Non-IGERT Subsample we used t-tests, chi-squares, and ordinary least squares (OLS) regressions. We followed standard statistical procedures in selecting a test appropriate for the outcomes being examined, according to whether those outcomes were categorical or continuous. T-tests were used to examine the difference in the mean on a continuous variable (such as employment rates, measured from 0 to 100 percent); chi-square tests were used to examine the differences on categorical/binary outcomes (such as current employment sector); OLS regressions were used to control for characteristics while examining these differences (such as controlling for a prior master's degree when examining time to degree). We used control variables (such as background characteristics) in some models to help explain the differences between the two groups. Although students in our samples were nested within departments and institutions, we did not use HLM models because there were no significant institution or department effects. Assuming a two-sided hypothesis test using a $p<0.05$ alpha level and a desired level of power of 80 percent, and given that for the subsample our final respondent counts were IGERT (N=261) and Non-IGERT (N=436), the minimum detectable effect size for these analyses was 0.22.

Comparative Study Findings

Engagement in Interdisciplinary Education

There is evidence that IGERT training programs attract a "different breed" of student than traditional STEM departments. More IGERT graduates than non-IGERT graduates reported interest in having interdisciplinary education or research training experiences when they applied to graduate school (85 versus 75 percent, p=.01).[2] [3] IGERT students followed through on this interest when completing their dissertations: 75 percent of IGERT graduates drew on at least two disciplines in their dissertation research (Exhibit 5.3) compared with 61 percent of non-IGERT graduates.[4] On average, IGERT graduates reported using an average of three major disciplines in their dissertations; non-IGERT graduates reported using two disciplines, on average ($p<0.001$).[5]

Time to Degree

We compared time to degree for IGERT and non-IGERT graduates. For individuals who graduate, the additional experiences associated with IGERT traineeships do not lengthen the amount of time it takes IGERT trainees to obtain their PhD degrees. Graduates in the IGERT subsample took less time to complete their degrees as compared to the non-IGERT graduates; nearly half a year less (5.63 versus 6.04 years, respectively); this difference was statistically significant (Exhibit 5.4).

Exhibit 5.3

Number of Disciplines IGERT and Non-IGERT Graduates Used in Dissertation Research

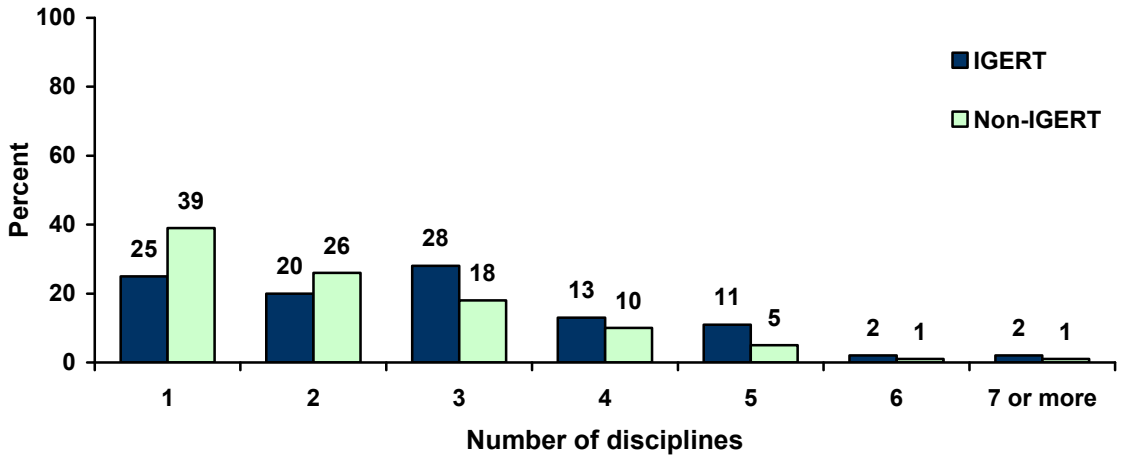

Exhibit reads: 25 percent of IGERT graduates and 39 percent of non-IGERT graduates reported using only one discipline in their dissertation research.

Includes PhD graduates: N=261 (IGERT Subsample) and 436 (Non-IGERT Subsample). Missing=0 (IGERT Subsample) and 0 (Non-IGERT Subsample).

Note: IGERT and Non-IGERT graduates' number of disciplines used in their dissertation research in this table were reported for descriptive purposes only; statistical tests were not conducted to determine significance of these findings since a t-test was conducted on the average number of disciplines used in their dissertation research.

Source: IGERT Follow-up Survey, 2008. (Item B9).

Exhibit 5.4

Estimate Difference between IGERT and Non-IGERT Graduates on Average Time to Degree [a]

Outcome	Covariate-Adjusted Mean [b] IGERT	Non-IGERT	Estimate Differences	p-value
Time to degree	5.63	6.04	-0.41	<0.001

Exhibit reads: On average, IGERT graduates completed their doctoral degrees in 5.63 years, and non-IGERT graduates completed their doctoral degrees in 6.04 years. This estimated difference of 0.41 year was statistically significant.

[a] Time to degree was calculated in years as the time between initial enrollment in graduate program until doctoral degree completion.

[b] Values shown were regression-adjusted estimates controlling for field of study and having a prior master's degree. We controlled for these two variables as we hypothesized that students' time to degree is in part a function of their home discipline and whether they already had master's degrees when they began their doctoral programs.

Includes PhD graduates: N=261 (IGERT Subsample) and 436 (Non-IGERT Subsample); Missing=0 (IGERT Subsample) and 1 (Non-IGERT Subsample).

Source: IGERT Follow-up Survey, 2008. (Items B1 and B5).

Career Motivations

Various factors influence PhD graduates' career choices, including students' personal motivations and graduate training experiences. IGERT graduates differ from non-IGERT graduates both in the factors

they reported as motivating them to pursue careers in STEM and in the degree to which they reported their graduate experiences prepared them for various careers.

IGERT graduates were significantly more likely than non-IGERT graduates to pursue a career in STEM for the intellectual challenge (83 versus 75 percent) and the opportunity to create new knowledge or make decisions (42 versus 33 percent) (Exhibit 5.5). A greater proportion of non-IGERT graduates were motivated to pursue a career in STEM because of the opportunity for advancement than IGERT graduates (9 versus 5 percent). There were no other statistically significant differences. However, we observed that higher percentages of IGERT graduates valued independence and the ability to contribute to society, and higher percentages of non-IGERT graduates valued the opportunity to follow their passions.

Exhibit 5.5

Most Important Factors in Choosing a Career for IGERT and Non-IGERT Graduates

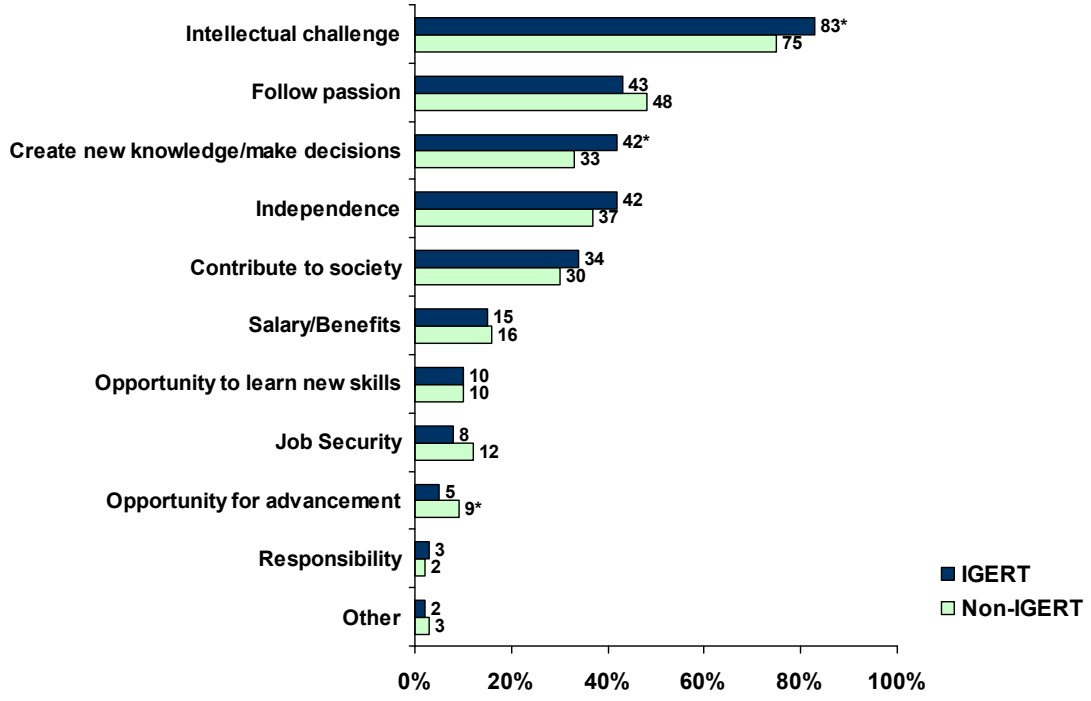

Exhibit reads: 83 percent of IGERT graduates and 75 percent of non-IGERT graduates indicated that intellectual challenge was one of the most important factors in choosing a career. This difference of 8 percentage points was statistically significant.

* p< .05

Includes PhD graduates: N=261 (IGERT Subsample) and 436 (Non-IGERT Subsample); Missing=0 (IGERT Subsample) and 1 (Non-IGERT Subsample).

Note: Percents total more than 100 because respondents could select up to three responses.

Source: IGERT Follow-up Survey, 2008. (Item A2).

Career Preparation

By design, IGERT projects provide graduate students with the technical and professional skills necessary to succeed in a broad range of career options, to allow PhD graduates to pursue careers with a mix of research, teaching, and policy/planning responsibilities. We observed only one difference between IGERT and non-IGERT graduates in their perceptions of how prepared they were for various careers at the time of graduation: IGERT graduates were more likely to report that they felt well prepared for a faculty position with research-only responsibilities. Otherwise, the majority of IGERT and non-IGERT graduates agreed that they were well prepared upon graduation for research positions outside of academia, whether in industry, government laboratories, or other research institutions; for faculty positions with research and teaching responsibilities; and (to a lesser extent) for non-research policy positions (Exhibit 5.6). [6]

Exhibit 5.6

IGERT and Non-IGERT Graduates' Preparedness for Various Positions

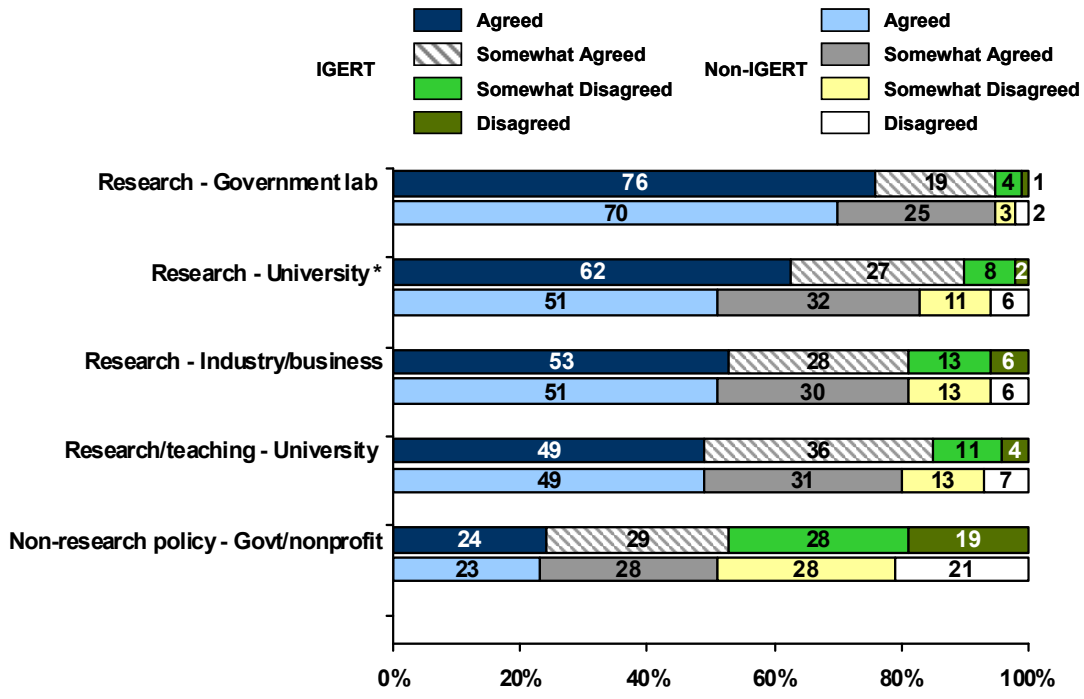

Exhibit reads: 76 percent of IGERT graduates agreed, 19 percent somewhat agreed, 4 percent somewhat disagreed, and 1 percent disagreed that they were prepared for a job as a researcher at a government lab or research institution upon completing their degrees; whereas 70 percent of non-IGERT graduates agreed, 25 percent somewhat agreed, 3 percent somewhat disagreed, and 2 percent disagreed that they were prepared for this type of job. The difference is not statistically significant.

* $p<.05$

Includes PhD graduates who were not enrolled in degree programs and were in postdoctoral positions or employed in the workforce: N= 255 (IGERT Subsample) and 415 (Non-IGERT Subsample); Missing=2-34 (IGERT Subsample) and 4-56 (Non-IGERT Subsample). "I do not know" responses were set to missing.

Source: IGERT Follow-up Survey, 2008. (Item C7).

Careers Considered

The employment sectors considered by non-IGERT graduates were similar to those considered by IGERT graduates, with one exception. IGERT graduates were statistically *less* likely than non-IGERT graduates to consider positions in a "non-government lab, research institution, or think tank" (24 versus 33 percent, p=.01, Exhibit 5.7). Most IGERT and non-IGERT graduates considered employment in more than one job sector. Non-IGERT graduates were more likely to report that, on average, they considered a slightly higher number of job sectors than IGERT graduates (2.39 versus 2.10, p<.01).[7]

Exhibit 5.7

Employment Sectors Considered by IGERT and Non-IGERT Graduates

	IGERT	Non-IGERT
College or university	84%	85%
Industry or business	42	49
Government	41	47
Non-government lab, research institution, or think tank	24	33 *
Other nonprofit organization or private foundation	12	13
Entrepreneur or self-employed	5	8
K–12 school	2	4

Exhibit reads: 84 percent of IGERT and 85 percent of non-IGERT PhD graduates considered employment at colleges or universities. This difference was not significant.

* p<.05

Includes PhD graduates who were not enrolled in degree programs and were in postdoctoral positions or employed in the workforce: N= 255 (IGERT Subsample) and 415 (Non-IGERT Subsample); Missing=0 (IGERT Subsample) and 0 (Non-IGERT Subsample).

Note: Percents total more than 100 because respondents could check more than one response.

Source: IGERT Follow-up Survey, 2008. (Item C11).

Success in Obtaining a Position in the Workforce

IGERT and non-IGERT PhD graduates reported equal success in securing employment by the time they graduate; roughly 87 percent of graduates in both groups reported having obtained a paid position either before or when they completed their doctoral degrees.[8] These job acquisition rates appeared slightly higher than national estimates of postgraduation plans for recent PhD graduates; based on data from the Survey of Earned Doctorates, slightly less than three-quarters of PhD recipients in 2006 had definite plans for employment (or postdoctoral positions) at the time they were surveyed.[9] IGERT graduates reported having *less difficulty* than non-IGERT graduates in obtaining their first jobs (1.75 versus 2.02 on a scale of 1 [not at all difficult] to 5 [very difficult], p =.001).[10] IGERT graduates also were significantly more likely than non-IGERT graduates to believe that their graduate preparation gave them a competitive edge when applying for positions in the workforce (95 versus 91 percent, p=.03).[11]

Overall Employment Rates

The employment rates for both IGERT and non-IGERT graduates mirrored the national employment trends of recent PhD recipients; recent national data estimate that 98 percent of recent PhD recipients are

employed on a part- or full-time basis.[12] At the time of our survey (Summer 2008), the employment rates for IGERT and non-IGERT graduates were 98 and 97 percent, respectively.[13]

Positions Obtained

At this early stage of their careers, IGERT and non-IGERT graduates reported working in similar employment sectors. Academic institutions were the most frequent employers of both groups, followed by industry or business, then government (Exhibit 5.8). Similar proportions of IGERT and non-IGERT graduates were holding postdoctoral appointments (29 versus 25 percent).[14]

The concentration of these graduates in academia was slightly higher than the national trend among PhD graduates. According to data from the Survey of Earned Doctorates, nationwide employment trends from 1986 through 2006 indicated that roughly half of PhD recipients pursued employment in academia for their first post-PhD positions (49–53 percent). However, PhD recipients nationwide in the physical sciences or engineering fields had higher rates of pursuing employment outside of academia, particularly in industry. From 1986 to 2006, between 49 and 60 percent of recent PhD recipients in physical science and mathematics-related fields and 55 to 76 percent of recent PhD recipients in engineering obtained positions in industry.[15]

Exhibit 5.8

Current Employer of IGERT and Non-IGERT Graduates

	IGERT	Non-IGERT
College or university	62%	60%
Industry or business	20	19
Government	9	11
Non-governmental lab, research institution, think tank, private foundation, or nonprofit organization	6	8
Entrepreneur or self-employed	3	2
K–12 school	0	1

Exhibit reads: 62 percent of IGERT and 60 percent of non-IGERT PhD graduates were working in colleges or universities. This difference is not significant.

Includes PhD graduates who were not enrolled in degree programs and were in postdoctoral positions or employed in the workforce: N=255 (IGERT Subsample) and 415 (Non-IGERT Subsample); Missing=0 (IGERT Subsample) and 0 (Non-IGERT Subsample).

Source: IGERT Follow-up Survey, 2008. (Item C13).

More than three-quarters of both IGERT and non-IGERT graduates reported that they were working in the job sector that was their most desired upon graduation (81 versus 76 percent).[16] This difference was not significant.

Reasons for Choosing Current Position

There are many factors involved in the decision to pursue and select a job, and we explored the most important factors for graduates in selecting their current position. We asked respondents to select up to three factors that were the most important to them in choosing their current positions (Exhibit 5.9). IGERT graduates were more likely than non-IGERT graduates to select their current positions for the intellectual challenge (63 versus 55 percent, p=.037). Otherwise, IGERT and non-IGERT graduates

reported that they were motivated by similar factors, including degree of independence and the opportunity to follow their passions.

Exhibit 5.9

Factors Important to IGERT and Non-IGERT Graduates When Choosing Their Current Position

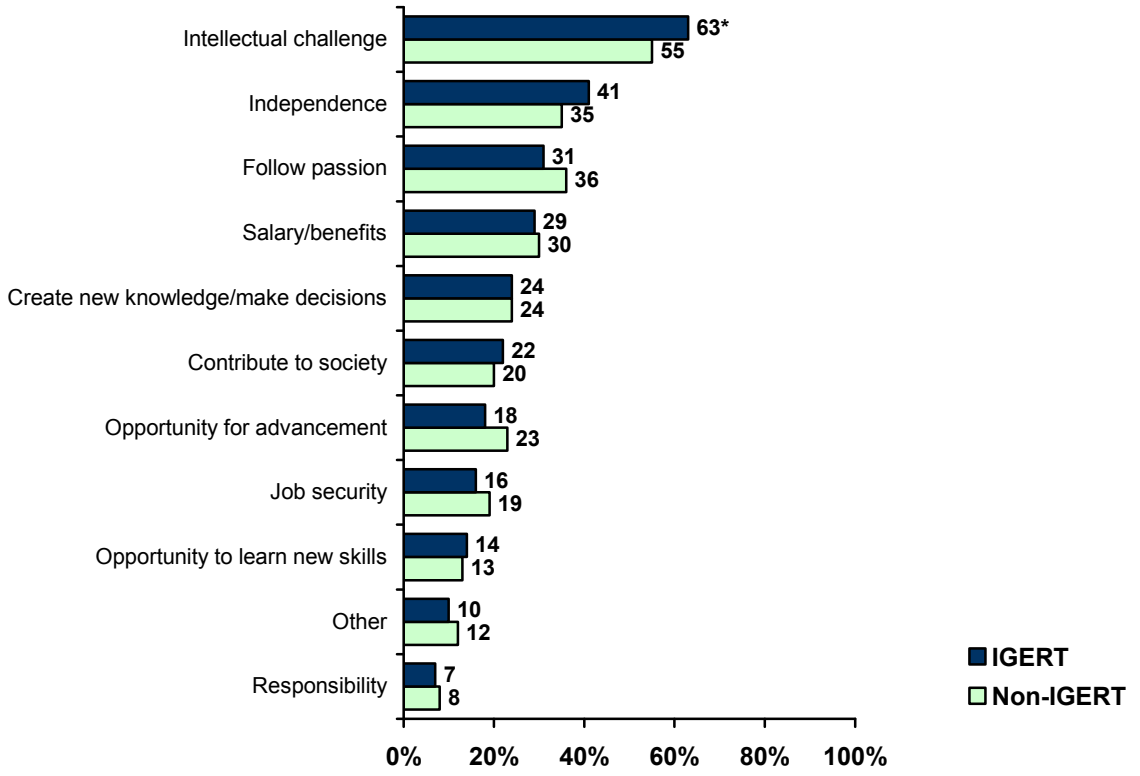

Exhibit reads: 63 percent of IGERT and 55 percent of non-IGERT graduates identified intellectual challenge as one of the three most important factors to them when choosing their current positions. This difference of 8 percentage points was statistically significant. * $p < .05$.

Includes PhD graduates who were not enrolled in degree programs and were in postdoctoral positions or employed in the workforce: N=255 (IGERT Subsample) and 415 (Non-IGERT Subsample); Missing=0 (IGERT Subsample) and 0 (Non-IGERT Subsample).

Note: Percents total more than 100 because respondents could check more than one response.

Source: IGERT Follow-up Survey, 2008. (Item C12).

Employment Responsibilities

Similar proportions of IGERT and non-IGERT graduates were involved to some extent in research as well as teaching and training. However, when asked to identify their *primary* job responsibility, IGERT graduates were more likely to list research, while non-IGERT graduates were more likely to list teaching or training (Exhibit 5.10). Less than 15 percent of IGERT Subsample and Non-IGERT Subsample

graduates reported having responsibilities in manufacturing, technical services, administration or management, media, or policy.

Exhibit 5.10

Difference between IGERT and Non-IGERT Graduates' *Primary* Responsibilities in Their Current Positions

Outcome	Percent [a]		Estimated Differences	p-value
	IGERT	Non-IGERT		
Research, development, and/or technology	75%	63%	12%	.002
Teaching or training	17	24	7	.02

Exhibit reads: 75 percent of IGERT subsample graduates and 63 percent of non-IGERT graduates reported that "research, development, and/or technology" was their *primary* job responsibility. This difference was statistically significant.

Includes PhD graduates who were not enrolled in degree programs and were in postdoctoral positions or employed in the workforce: N=255 (IGERT Subsample) and 415 (Non-IGERT Subsample). Missing=2 (IGERT Subsample) and 4 (Non-IGERT Subsample).

Source: IGERT Follow-up Survey, 2008. (Item I2).

Interdisciplinary Research and Teaching

Reflecting the multidisciplinary nature of modern-day scientific research, most IGERT and non-IGERT graduates reported that their current work involved more than one scientific discipline. Both groups reported, on average, drawing from three disciplinary areas and 8 specific disciplines in their current work.[17] Such multidisciplinary work requires not only training in a broad range of fields but also the ability to adapt and draw from new disciplines. Similar proportions of IGERT (43 percent) and non-IGERT graduates (47 percent) reported that they used a discipline that they did not draw upon in their dissertation research in their current line of work.[18] IGERT and non-IGERT graduates were equally likely to report that they currently collaborated with individuals outside their disciplines (83 and 81 percent, respectively).[19] A large majority of both groups reported that they worked on scientific or technical projects that required the integration of two or more disciplines; however, the proportion was greater among IGERT graduates than non-IGERT graduates (84 versus 73 percent, p=.002).[20]

We also compared the interdisciplinary teaching or training activities of IGERT and non-IGERT graduates with education responsibilities. Among graduates who were primarily teaching in higher education settings, IGERT graduates were significantly more likely than non-IGERT graduates to teach courses, seminars, or workshops that required the integration of two or more disciplines (63 versus 50 percent, p=.03).[21] There were no differences between the proportion of IGERT and non-IGERT graduates who had developed or co-developed interdisciplinary teaching or training materials for their jobs (36 versus 38 percent).[22] There also were no differences between IGERT and non-IGERT graduates with regard to supervising or advising students from other disciplines or on interdisciplinary projects—defined by whether individuals supervised an interdisciplinary undergraduate or graduate level research project, had an undergraduate or graduate student from another department work on their research projects, or served on the dissertation committee of a graduate student from another department or discipline. On average, graduates from both groups had engaged in one of these three activities within the past year.[23]

Global Awareness and Engagement

We also investigated whether IGERT graduates were more involved in activities that demonstrated being globally aware of STEM research and/or engaged in global interactions than their non-IGERT counterparts. We created composites for global awareness of STEM research[24] and engagement in global interactions, one for each concept.[25] We found no differences between IGERT and non-IGERT graduates' average number of engagement in such activities as part of their current jobs. As shown in Exhibit 5.11, IGERT and non-IGERT graduates were equally likely to be involved in work that demonstrated they were globally aware of STEM research in their discipline and interacting or collaborating with individuals who lived abroad.

Demonstrating Leadership

To explore whether IGERT graduates demonstrated greater leadership at this stage of their career than non-IGERT graduates, we created a summary measure for leadership based upon respondents' reports on the following five leadership activities:

- direct or participate in developing and/or implementing the vision and strategic direction of the organization;
- play a significant role in the development, implementation, and execution of the policies, procedures, and standards;
- develop or direct the technical or scientific agenda of the organization;
- delegate responsibilities and assignments; and
- develop and oversee budget and/or profit and loss statements.

Exhibit 5.11

Difference between IGERT and Non-IGERT Graduates on Global Awareness and Engagement in Global Interactions in Their Current Positions

Outcome	Covariate-Adjusted Mean		Estimated Differences	p-value
	IGERT	Non-IGERT		
Globally aware of STEM research in their disciplines [a b]	2.36	2.38	-.02	.81
Engaged in global interactions as part of their current responsibilities [c d]	1.44	1.48	-.04	.79

Exhibit reads: IGERT graduates were involved in an average of 2.36 global awareness activities in their current work compared to an average of 2.38 for non-IGERT STEM PhD graduates, on a range of 0 to 3. This difference was not statistically significant.

[a] Values shown were regression-adjusted estimates controlling for gender and employment sector.

[b] Includes PhD graduates who were not enrolled in degree programs and were in postdoctoral positions or employed in the workforce with responsibilities involving research, development, and/or technology: N=224 (IGERT Subsample) and 342 (Non-IGERT Subsample); Missing=0 (IGERT Subsample) and 0 (Non-IGERT Subsample).

[c] Values shown were regression-adjusted estimates controlling for number of years from graduation, STEM discipline (graduate school department), and currently holding a postdoctoral position.

[d] Includes PhD graduates who were not enrolled in degree programs and currently employed in paid positions at the time of the survey: N=255 (IGERT Subsample) and 415 (Non-IGERT Subsample); Missing=2 (IGERT Subsample) and 4 (Non-IGERT Subsample).

Source: IGERT Follow-up Survey, 2008. Combined variable "GlobAware" is the sum of yes or checked items for questions D7/E6/F9/G7/H12 (item o), D8/E7/F10/G8/H13 (item d), and J4. Combined variable "GlobInteractions" is the sum of checked items for Items D8/E7/F10/G8/H13 (items a, b, c, e, f, and g).

There were no statistically significant differences between IGERT and non-IGERT graduates on the number of leadership activities. IGERT and non-IGERT graduates were equally likely to engage in activities that demonstrated leadership in their current jobs; IGERT graduates engaged in an average of 1.91 leadership activities compared to an average of 1.87 for non-IGERT graduates, on a scale of 0 to 5.[26]

Alignment of Graduate Training with PhD Graduates' Job Requirements

We examined whether the alignment between graduate training and current job activities differed for IGERT and non-IGERT graduates by forming a dichotomous measure using information about job activities and level of preparation for such activities. We classified respondents' graduate training as being "aligned" or "not aligned" with current activities based on the following.

Graduate training was aligned when respondents indicated:
(a) regularly engaging in an activity and their training prepared them "well" or "very well"; or
(b) not regularly engaging in the activity and their training prepared them "not well."

Graduate training was not aligned when respondents indicated:
(a) regularly engaging in the activity and their graduate training prepared them "not well"; or
(b) did not regularly engage in the activity and their graduate training prepared them "well" or "very well."

As shown in Exhibit 5.12, the overwhelming majority in both groups reported alignment between graduate training and current job activities; there were no statistically significant differences between IGERT and non-IGERT graduates on 9 of the 11 outcomes. On average, IGERT and non-IGERT graduates were equally likely to have received graduate training aligned with their current job activities with the exception of working and networking with scientists or technologists in other disciplines and developing their own technical and scientific agenda; IGERT graduates were more likely to have received relevant training in these areas compared to non-IGERT graduates.

IGERT graduates were more likely than non-IGERT graduates to recommend their graduate program to prospective students interested in pursuing a career similar to their own. Nearly all IGERT graduates (94 percent) would recommend their (IGERT-related) graduate program, compared to 85 percent of non-IGERT graduates who would recommend their graduate program, a difference that was statistically significant ($p<.001$).[27] [28]

Exhibit 5.12

Percent of IGERT and Non-IGERT Graduates Reporting Alignment between Current Work Activities and Graduate Training

Outcomes	Percent [a]			
	IGERT	Non-IGERT	Estimated Differences	p-value
Balance the demands of multiple projects	93%	92%	1%	.80
Work and network with scientists or technologists in other disciplines	92	84	8	.01 **
Lead projects or programs	87	82	5	.20
Present my or my organization's research or work to nontechnical audiences	79	75	4	.26
Publish research, technical findings, and/or reports	79	74	5	.08
Develop own technical or scientific agenda	79	73	6	.03 *
Work as part of a team	78	73	5	.09
Explain my work or research to scientists or technologists in other disciplines	76	71	5	.12
Serve as a mentor	68	67	1	.73
Be informed of research in other countries	57	60	-3	.44
Obtain funding for research or project work [b]	51	48	3	.44

Exhibit reads: An estimated 93 percent of IGERT and 92 percent of non-IGERT graduates received training during graduate school that was relevant to current job activity of balancing multiple projects. The difference of 1 percentage point was not statistically significant.

Includes PhD graduates who were not enrolled in degree programs and were in postdoctoral positions or employed in the workforce: N=255 (IGERT Subsample) and 415 (Non-IGERT Subsample); Missing=0-2 (IGERT Subsample) and 1 (Non-IGERT Subsample).

[a] Values shown were regression-adjusted estimates. Models included different combinations of controls for job sector, STEM discipline of study, and time to degree.

[b] Includes PhD graduates not enrolled in degree programs and currently employed in paid positions in the industry/business sector at the time of the survey: N= 205 (IGERT Subsample) and 335 (Non-IGERT Subsample); Missing=1 (IGERT Subsample), 2 (Non-IGERT Subsample).

Source: IGERT Follow-up Survey, 2008. Created common variable measuring the alignment of graduate program across job sectors for items in D7, E6, F10, G7, and H12.

Summary

Students who graduated from IGERT doctoral programs had different motivations and interests than those who graduated from non-IGERT programs. They reported that they were more likely to seek out an interdisciplinary experience when applying for graduate school and to have chosen a career based on its intellectual challenge. IGERT students were exposed to interdisciplinary research and education in multiple ways, all related to their respective IGERT project's interdisciplinary theme, which they carried with them through the completion of their dissertations—which were more likely to draw upon multiple disciplines. Despite the supplemental IGERT requirements (i.e., above and beyond existing departmental requirements), IGERT students graduated one-half year sooner, on average, than non-IGERT graduates in similar departments.

Upon graduation, IGERT graduates reported that their graduate training provided them a competitive edge when applying for positions in the workforce and reported having had less difficulty obtaining their first positions than non-IGERT graduates. They also felt equally or better prepared than non-IGERT graduates for various employment options. IGERT graduates applied to slightly fewer employment sectors than non-IGERT graduates—we did not know if this was because they felt better prepared or if there were other reasons. Both groups were equally successful in obtaining positions in the employment sector of their choosing, although IGERT graduates were more likely to take on positions with research as their primary responsibility.

A key focus of the IGERT training program is its emphasis on interdisciplinary exposure, designed to better prepare graduates for the increasingly interdisciplinary nature of the science workplace. Not surprisingly, given the characteristics of the modern workplace, both IGERT and non-IGERT graduates were likely to obtain positions that required some level of cross-disciplinary collaboration. However, evidence suggests that IGERT students' predisposition to seek out interdisciplinary experiences, and/or the interdisciplinary training they had received through the IGERT program, may have contributed to their seeking out employment requiring interdisciplinary integration. While both groups were equally engaged in research and teaching experiences that drew upon multiple disciplines or required collaboration with individuals in other disciplines, IGERT graduates were more likely to be working on research projects and/or teaching courses that required the *integration* of two or more disciplines.

The IGERT program also encourages projects that both cultivate students' global perspective and provide them with training in professional skills so that they are better able to serve as leaders in their careers. Within the first several years of degree completion, IGERT graduates were equally—but not more—likely than non-IGERT graduates to demonstrate a global perspective, engage in global collaborations, and take on leadership responsibilities in their current positions.

---

1 See *American Association for Public Opinion Research Standard Definitions Report*. http://www.aapor.org/Standard_Definitions/1481.htm (accessed on September 23, 2009).

2 *IGERT Follow-up Study Survey, 2008. (Item A4)*. Includes PhD graduates: N=261 (IGERT Subsample) and 436 (Non-IGERT Subsample); Missing=35 (IGERT Subsample) and 62 (Non-IGERT Subsample). "I don't remember" responses were set to missing.

3 This finding has implications for possible selection bias in this comparison analysis.

[4] *IGERT Follow-up Survey, 2008. (Item B9).* Includes PhD graduates: N=261 (IGERT Subsample) and 436 (Non-IGERT Subsample); Missing=0 (IGERT Subsample) and 3 (Non-IGERT Subsample).

[5] *IGERT Follow-up Survey, 2008. (Item B9).* Includes PhD graduates: N=261 (IGERT Subsample) and 436 (Non-IGERT Subsample); Missing= 0 (IGERT Subsample) and 3 (Non-IGERT Subsample).

[6] We classified respondents as in agreement if they responded that they *agreed* or *somewhat agreed* to statements that they were prepared for positions in five different job categories.

[7] *IGERT Follow-up Survey, 2008. (Item C11).* Includes PhD graduates who were not enrolled in degree programs and were in postdoctoral appointments or employed in the workforce: N=255 (IGERT Subsample) and 415 (Non-IGERT Subsample); Missing=0 (IGERT Subsample) and 0 (Non-IGERT Subsample).

[8] *IGERT Follow-up Survey, 2008. (Item C1).* Includes PhD graduates who were not enrolled in degree programs at the time of the survey and sought employment at the time of graduation: N=253 (IGERT Subsample) and 412 (Non-IGERT Subsample); Missing= 0 (IGERT Subsample) and 0 (Non-IGERT Subsample).

[9] T. B. Hoffer, et al. *Doctorate Recipients from United States Universities: Summary Report 2006.* Chicago: National Opinion Research Center, 2007. (The report gives the results of data collected in the Survey of Earned Doctorates, conducted for six federal agencies, NSF, NIH, USED, NEH, USDA, and NASA by NORC.)

[10] *IGERT Follow-up Survey, 2008. (Item C5).* Includes PhD graduates who were not enrolled in degree programs and were either employed in paid positions or had been employed since leaving their institutions: N=252 (IGERT Subsample) and 411 (Non-IGERT Subsample); Missing=0 (IGERT Subsample) and 0 (Non-IGERT Subsample).

[11] *IGERT Follow-up Survey, 2008. (Item C6).* Includes PhD graduates who were not enrolled in degree programs, sought employment at the time of graduation, and were either in postdoctoral appointments, employed in the workforce, or had been employed since leaving their institutions: N=252 (IGERT Subsample) and 411 (Non-IGERT Subsample); Missing=9 (IGERT Subsample) and 15 (Non-IGERT Subsample). "I don't know" responses were set to missing.

[12] National Science Board. 2008. *Science and Engineering Indicators 2008*. Two volumes. Arlington, Va.: National Science Foundation (volume 1, NSB 08-01; volume 2, NSB 08-01A). Science and Engineering Indicators, 2008. Preliminary data from 2006 *Survey of Doctoral Recipients* estimates for PhD recipients from June 2003 to June 2005.

[13] *IGERT Follow-up Survey, 2008. (Item C3).* Includes PhD graduates who were not enrolled in degree programs at the time of the survey: N= 259 (IGERT Subsample) and 427 (Non-IGERT) (N=427); Missing=0 (IGERT Subsample) and 0 (Non-IGERT Subsample).

[14] *IGERT Follow-up Survey, 2008. (Item C4).* Includes PhD graduates who were not enrolled in degree programs and were in postdoctoral appointments or employed in the workforce: N=255 (IGERT Subsample) and 415 (Non-IGERT Subsample); Missing=0 (IGERT Subsample) and 0 (Non-IGERT Subsample).

[15] *Survey of Earned Doctorates*, 2006. T. B. Hoffer, et al. 2007. *Doctorate Recipients from United States Universities: Summary Report 2006.* Chicago: National Opinion Research Center.

[16] *IGERT Follow-up Survey, 2008. Combined variable created from Items C11 and C13.* Includes PhD graduates who were not enrolled in degree programs, sought employment at the time of graduation, and were currently in postdoctoral appointments or employed in the workforce: N= 249 (IGERT Subsample) and 401 (Non-IGERT Subsample); Missing=0 (IGERT Subsample) and 0 (Non-IGERT Subsample).

[17] *IGERT Follow-up Survey, 2008. (Item I1).* Includes PhD graduates not enrolled in degree programs and were currently in postdoctoral appointments or employed in the workforce: N= 255 (IGERT Subsample) and 415 (Non-IGERT Subsample); Missing=2 (IGERT Subsample) and 4 (Non-IGERT Subsample).

[18] *IGERT Follow-up Survey, 2008. Variable created was a count of the number of disciplines checked in Question I1 that matches the disciplines checked in Items B9/B10.* Includes PhD graduates who were not enrolled in degree programs and were currently in postdoctoral appointments or employed in the workforce: N=255 (IGERT Subsample) and 415 (Non-IGERT Subsample); Missing=2 (IGERT Subsample) and 4 (Non-IGERT Subsample).

[19] *IGERT Follow-up Survey, 2008. (Item J2).* Includes PhD graduates who were not enrolled in degree programs and were currently in postdoctoral appointments or employed in the workforce with responsibilities involving research, development, and/or technology, manufacturing, or technical support: N=228 (IGERT Subsample) and (356 Non-IGERT Subsample); Missing=0 (IGERT Subsample) and 3 (Non-IGERT Subsample).

[20] *IGERT Follow-up Survey, 2008. (Item J3).* Includes PhD graduates who were not enrolled in degree programs and were currently in postdoctoral appointments or employed in the workforce with responsibilities involving research, development, and/or technology, manufacturing, or technical support: N= 228 (IGERT Subsample) and 356 (Non-IGERT Subsample); Missing=0 (IGERT Subsample) and 3 (Non-IGERT Subsample).

[21] *IGERT Follow-up Survey, 2008. (Item K1).* Includes PhD graduates who were not enrolled in degree programs; were currently in postdoctoral appointments; or employed in the workforce with responsibilities involving education (training or teaching): N= 124 (IGERT Subsample) and 209 (Non-IGERT Subsample). Missing=0 (IGERT Subsample) and 1 (Non-IGERT Subsample).

[22] *IGERT Follow-up Survey, 2008. Combined responses to Items K3 and K5 (item e).* Includes PhD graduates who were not enrolled in degree programs; were currently in postdoctoral appointments or employed in the workforce; and whose responsibilities involved education (training or teaching); however, respondents who had teaching or training responsibilities in a higher education setting were only included in this analysis if they provided instruction to undergraduate or graduate students: N= 121 (IGERT Subsample) and 202 (Non-IGERT Subsample); Missing=0 (IGERT Subsample) and 2 (Non-IGERT Subsample).

[23] *IGERT Follow-up Survey, 2008. Combined variable created from Item K5 (items b, c, and g).* Includes PhD graduates who were not enrolled in degree programs; were currently in postdoctoral appointments or employed in the workforce in a higher education setting; whose responsibilities involved education (training or teaching); and who provided instruction to undergraduate or graduate students: N= 98 (IGERT Subsample) and 156 (Non-IGERT Subsample); Missing=0 (IGERT Subsample) and 1 (Non-IGERT Subsample).

[24] Aware of scientists in other countries doing work relevant to their own research; searched or used international databases or citations; job required them to be informed of research in other countries.

[25] Worked as part of a team with colleagues located in other countries; attended professional conferences outside the US; traveled to other countries for work; applied or been recruited for a position outside the US; worked abroad; studied a foreign language for career related purposes.

[26] *IGERT Follow-up Survey, 2008. Combined variable "Leadership" = sum of checked items for Questions D6/E5/F9/G6/H11 (items a through e).* Includes PhD graduates who were not enrolled in degree programs and were currently in postdoctoral appointments or employed in the workforce: N= 255 (IGERT Subsample) and 415 (Non-IGERT Subsample). Missing N=2 (Non-IGERT Subsample). Values were regression-adjusted estimates controlling for employment sector, number of years from graduation, and currently in a postdoctoral position.

[27] *IGERT Follow-up Survey, 2008. (Item O3).* Includes IGERT Subsample graduates (N=259) who were not enrolled in degree programs at the time of the survey; N=259 (IGERT Subsample); Missing= 2 (IGERT Subsample).

[28] *IGERT Follow-up Survey, 2008. (Item O6).* Includes Non-IGERT Subsample PhD graduates (N=427) who were not enrolled in degree programs at the time of the survey; N=427 (Non-IGERT Subsample); Missing=6 (Non-IGERT Subsample).

Chapter 6: Conclusions and Implications

In this study, we examined the short-term career trajectories and outcomes of IGERT PhD graduates one to eight years beyond graduation by gathering information on IGERT graduates' reasons for pursuing their graduate degrees, the influence of the IGERT program on their entry into the workforce, the relevance of their graduate training to their professional responsibilities, and the characteristics of their current employment and work responsibilities. We also assessed the influence of the IGERT model of interdisciplinary education on those trajectories and outcomes by comparing data collected from IGERT graduates with those in a matched comparison group of non-IGERT graduates as well as national data on STEM graduate students. The findings described in this report provide further evidence that the IGERT program is making progress toward achieving its well-defined goals to:

- Educate US PhD scientists and engineers who will pursue careers in research and education with the interdisciplinary backgrounds, deep knowledge in chosen disciplines, and technical, professional, and personal skills required to become, in their own careers, leaders and creative agents for change.
- Catalyze a cultural change in graduate education—for students, faculty, and institutions—by establishing innovative models of training in a fertile environment of collaborative research that transcends traditional disciplinary boundaries.
- Facilitate diversity in student participation and preparation, and contribute to the development of a diverse, globally engaged, science, and engineering workforce.

Below, we summarize progress the IGERT program has made in each of these three major areas.

Educating US Scientists and Engineers

We found evidence that most IGERT graduates felt prepared for and subsequently considered careers in a broad range of sectors. IGERT graduates credited their graduate training—especially their IGERT-related interdisciplinary experiences—with giving them a competitive edge when applying for positions in the workforce. They also reported having had less difficulty obtaining their first positions than non-IGERT graduates. Further, IGERT graduates indicated feeling equally or better prepared than non-IGERT graduates for various employment settings, including universities, government laboratories, industry, business, or other research institutions. IGERT graduates applied to slightly fewer employment sectors than non-IGERT graduates, although the majority of both groups considered employment in multiple sectors.

Most IGERT graduates reported having a job offer in hand by they time they graduated, usually in their most desired job sector. The employment rate for IGERT graduates was 98 percent, which matched that of the non-IGERT comparison group and exceeded the overall employment rate in the United States. IGERT and non-IGERT graduates were equally successful in obtaining positions in their employment sector of choice. However, IGERT graduates were more likely than non-IGERT graduates to report choosing their positions based on intellectual challenge and the opportunity to create new knowledge, and they were more likely to take on positions with research as their primary responsibility. One-third of IGERT graduates were in postdoctoral positions, while the remaining two-thirds were employed in the workforce. Half of employed IGERT graduates were working for universities or colleges, one-third in industry or business, and the remainder in government, research institutions, or other organizations.

Transformational discoveries and scientific advances are often made at the interface of traditional disciplines. These discoveries and advances require an integrative approach by individuals whose science crosses multiple disciplines or who work across traditional disciplinary boundaries with scientists from different disciplinary backgrounds. Roughly half of employed IGERT graduates had broadened their current professional interdisciplinary focus to include new disciplines that had not been used in their dissertation research, suggesting that some IGERT graduates possess the knowledge and ability to continue to branch out to new fields as well. IGERT graduates reported that their graduate program prepared them well for their current responsibilities, including those that transcend disciplinary boundaries, such as explaining their research to colleagues in other disciplines and working and networking with colleagues in other disciplines. Both IGERT and non-IGERT graduates were likely to obtain positions that required some level of cross-disciplinary collaboration. However, there is suggestive evidence that IGERT students' predisposition to seek out interdisciplinary experiences, and/or their IGERT interdisciplinary training, may have impelled them to seek out employment that required interdisciplinary *integration*. While both groups were equally likely to report engaging in research experiences that drew upon multiple disciplines or required collaboration with individuals in other disciplines, IGERT graduates were more likely to be working on research projects that required the integration of two or more disciplines.

The IGERT program also encourages projects to cultivate students' global perspective and provide students with training in professional skills that will enable them to serve as leaders in their subsequent careers. Almost all IGERT graduates were aware of the relevance of international research to their own work, and 40 percent reported working on a team with colleagues who were located abroad. Even at this early stage of IGERT graduates' careers, many had already begun taking on leadership roles directing projects or programs, and some had already revised academic curricula or were responsible for directing the technical or scientific agendas of their organizations. These international and leadership-oriented activities were similar to those reported by non-IGERT graduates. IGERT graduates were equally—but not more—likely than non-IGERT graduates to demonstrate a global perspective, engage in global collaborations, and take on leadership responsibilities in their current positions.

Catalyzing a Cultural Change

The previous evaluation of the IGERT program provided evidence that IGERT projects have established innovative models for graduate education and training that transcend disciplinary boundaries.[1] During the IGERT training experience, which often takes place within students' first few years of graduate school, students are exposed to interdisciplinary research and education in a variety of ways, all of which center on the interdisciplinary theme of the IGERT project. The current evaluation reported that IGERT students carry this interdisciplinary perspective with them when they complete their doctoral theses, in which they were more likely to draw upon multiple disciplines. IGERT graduates on average reported using three broad disciplines in their dissertations, and 30 percent reported using four or more disciplines in their dissertation research. These data suggest that either the IGERT graduates' personal desires to engage in interdisciplinary work or the support and training in interdisciplinary work offered by IGERT projects may be changing the norms about having a singular disciplinary focus for the PhD thesis in departments participating in IGERT projects.

Upon graduation, many IGERT graduates carry forward their interdisciplinary training by providing interdisciplinary training opportunities for the subsequent generation of STEM researchers. Eighty-four percent of employed IGERT graduates with university-based teaching responsibilities reported training

the next generation of researchers through fostering interdisciplinary collaborations, courses, or research experiences. Equal proportions of IGERT and non-IGERT graduates reported having supervised or advised students from other disciplines or on interdisciplinary projects, or having developed or co-developed interdisciplinary teaching or training materials. However, IGERT graduates were more likely than non-IGERT graduates to report teaching courses that required the *integration* of two or more disciplines.

Promoting Diversity, Participation, and Retention

IGERT graduates reported that they had initially been drawn to IGERT projects for the interdisciplinary experiences they provided; 83 percent had an interest in interdisciplinary education or research training experience when they applied to graduate school, and 12 percent would not have enrolled at their specific institutions without the opportunity to participate in their IGERT training programs. More graduates reported that they were motivated by their own intellectual interest in interdisciplinary research than by practical reasons, such as believing it would help them get a job. These motivations and interests appeared different for those individuals who graduate from non-IGERT programs. Compared to non-IGERT graduates, IGERT graduates were more likely to seek out interdisciplinary experiences in graduate school and were also more likely to choose employment based on its intellectual challenge.

We did not find evidence that participating in IGERT had a negative influence on students' ability to complete their degrees or the time it took to do so. The median time to degree for IGERT students who graduated with their PhDs between 1999 and 2007 was 5.2 years. IGERT graduates, many of whom have completed both IGERT and departmental requirements, completed their PhD degrees at rates equal to national norms and graduated, on average, just under one-half year sooner than non-IGERT graduates in similar departments. Nearly all IGERT graduates credited aspects of their IGERT experience with helping them complete their degrees. The IGERT traineeship's financial support was highly valued by graduates, as was the accompanying interdisciplinary focus; access to resources, equipment, and technology; and freedom to pursue independent research interests.

The IGERT program aims to facilitate diversity in student participation and preparation in STEM fields. Approximately 305 women and 63 underrepresented minority individuals have graduated with IGERT PhDs between 1998 and 2007. The participation rates of women and underrepresented minorities graduating from IGERT projects are consistent with national averages. Although 43 percent of IGERT students left their institutions without completing their PhD degrees within the first 10 years of the doctoral studies, these departure rates were on par with national averages, and most of these individuals reported that IGERT did not have any influence on their departure.

Conclusions and Directions for Future Study

The IGERT program has made a substantial investment in STEM graduate education, and the findings from this evaluation can provide a basis for future decisions about the IGERT program and STEM graduate training in general. Earlier evaluations have documented that the IGERT program integrates multiple STEM disciplines in students' early years of graduate work. Our data suggest that participating students continue their interdisciplinary education through their dissertation stages, with IGERT graduates producing a more interdisciplinary dissertation than non-IGERT graduates. We do not know what enables this; it is possible that the structure provided by IGERT projects facilitates a continued interdisciplinary focus by altering degree requirements or providing students with supports (such as

faculty mentors from more than one department). Future studies could investigate the dissertation-related experiences of IGERT trainees, as well as examine whether the increased interdisciplinary nature of IGERT dissertations has any effect on the degree requirements or dissertation guidelines of participating departments.

We found evidence that IGERT graduates carry their interdisciplinary engagement into the workforce. One of the most striking findings of this study is the high level of interdisciplinary involvement in work among both IGERT and non-IGERT graduates, suggesting that interdisciplinary science is becoming increasingly common, both in teaching and research settings. However, IGERT graduates reported having received more relevant training with regard to collaborating across disciplines and were more likely to integrate disciplines (as opposed to simply working within multiple disciplines). This suggests that some combination of IGERT graduates' own abilities with their graduate training has better prepared them to engage in integrative interdisciplinary work.

This interdisciplinary focus does not appear to hinder students' ability to obtain degrees, complete their degrees in a timely fashion, or obtain jobs of their choosing in the job market. Only 14 IGERT graduates reported that their interdisciplinary training was viewed skeptically or as a disadvantage by prospective employers. Instead, most IGERT graduates perceived an advantage to having participated in IGERT when they sought their first position after graduation and felt well prepared by their training. The marketplace appears to have responded to IGERT graduates' abilities, as evidenced by a majority who were able to obtain employment in the sectors of their choice. Perhaps this is because IGERT graduates seek out employment environments that are supportive of interdisciplinary work, or because employers seek out new hires with interdisciplinary experience. IGERT graduates might be drawn to universities that have embraced interdisciplinary education, or they might be leading the charge in changing university culture to be more supportive of interdisciplinary education once hired.

IGERT projects graduate women and minorities in proportions equal to—but not greater than—STEM degree programs nationally. The program solicitation requires project PIs to "facilitate diversity" and proposals should include "strategies for recruitment, mentoring, and retention aimed at members of groups underrepresented in science and engineering," but no resources are formally allocated (for example, through designating certain traineeships for underrepresented groups). Previous IGERT evaluations have revealed that the participation rate of these underrepresented groups varies dramatically project to project, and that some projects are more active in their recruitment and efforts to retain women and minorities than others. Future studies could investigate the methods that various projects have utilized to recruit and graduate a diverse group of IGERT scholars, or examine whether the IGERT experience has different effects on the recruitment and retention of underrepresented groups relative to majority students.

The IGERT program is also intended to create a globally engaged science and engineering workforce. This study found no differences between the global perspectives and activities of IGERT versus non-IGERT graduates. Again, this may be a function of the IGERT program's implementation—while all IGERT grant proposals must specify "how trainees will develop an appreciation for the global nature and context of the proposed interdisciplinary theme," only some projects receive an international supplement. Future evaluations could assess the global perspectives and behaviors of graduates from projects with international supplements versus those without, to ascertain whether the international supplement effectively increases the global perspectives of participating students.

The greatest limitation of this study is the potential for selection bias in its comparison group. We cannot conclusively determine from this study whether the IGERT graduate experience led to the outcomes observed. It is possible that the differences observed between IGERT and non-IGERT students are a function of IGERT students' personal interests, abilities, and motivations and not the IGERT training they received. Thus, findings in this report should be viewed as exploratory rather than confirmatory. Future studies should design a more rigorous test with greater controls in the comparison group to attempt to determine whether the IGERT training was the cause of these outcomes.

Comparison groups for a competitively funded program like IGERT are challenging to construct. The first challenge is identifying the appropriate counter-factual: students in other interdisciplinary programs? students in the same departments? students in different departments? Controlling for selection bias is then essential to being able to assess the impacts of the IGERT program. Possible mechanisms for addressing selection bias in future comparison groups include using a difference-of-difference design or propensity score matching. Another challenge faced in the current study was the retrospective nature of the study's design. An alternative design could identify a comparison group of students who enroll in graduate school at the same time as IGERT students, then track both groups over time through their graduate experiences into the workforce. Such a design would provide more accurate data than retrospective recall on the nature of students' graduate experiences and would allow for pre-study matching on individuals' natural inclination toward interdisciplinary work.

Future studies could also examine the longer term outcomes of IGERT graduates. Respondents in this study were relatively new in their careers, being one to eight years postgraduation. Of interest to the NSF will be the career advancement of IGERT graduates. For example, does the interdisciplinary focus of IGERT graduates working in universities hinder their ability to obtain tenure within a single-discipline academic department? How productive are IGERT graduates, as measured by publications and presentations? Do they publish in a wider span of disciplinary journals? Are they more likely to collaborate on research with colleagues in other disciplines?

Finally, we learned some practical lessons about evaluating workforce outcomes. It takes time and resources to locate graduates years after they have left their institutions. While the Internet proved to be a useful tool, it has its limitations—both in terms of verifying the accuracy of information uncovered and in being more successful in tracking some kinds of respondents than others. Individuals in faculty positions, for example, are easier to locate on the Internet than individuals working in industry. We suspect that the nonresponse bias correlated with scientific discipline in our samples may be related to the types of careers that individuals in various disciplines typically enter and which were respectively harder or easier for us to research.

Institutions do not always maintain contact with their graduates, or if they do, will not always share such information with researchers. We found that students' former faculty advisers were a key source of information on graduates' whereabouts. NSF wisely collected information from IGERT students at the time of their IGERT funding on their local and permanent addresses, name of a contact person who would be likely to know their whereabouts in the future, and SSN and requested students' permission to use this information for tracking purposes later. Still, many resources were spent using this information to locate respondents. A less costly method would be to maintain annual contact with program participants, sending an e-mail once a year asking individuals to update their contact information.

[1] J. G. Carney, et al. 2006. *Evaluation of the Initial Impacts of the National Science Foundation's Integrative Graduate Education and Research Traineeship Program*. Cambridge, Mass.: Abt Associates, Inc. Full report available at http://www.nsf.gov/pubs/2006/nsf0617/index.jsp.

Appendix A:
Samples, Data Collection, and Weighting

Appendix A: Samples, Data Collection, and Weighting

In this appendix, we provide greater detail on the methods used in this evaluation. Specifically, we outline our approaches to sample construction, data collection and post-stratification sample weighting.

Samples

We constructed three samples for this evaluation: a sample of all IGERT PhD graduates, a subsample of selected IGERT PhD graduates, and a comparison group of non-IGERT PhD graduates from matched departments. Each is discussed in turn.

Full IGERT Sample

The Full IGERT Sample targeted students who participated in one of the first *six* cohorts of IGERT projects funded between 1998 and 2003 (N=125 projects) and who graduated with a PhD. We included in our study every student from these six cohorts who received funding from the IGERT Program at some point between 1998 and 2006 and who graduated with a PhD from the institution associated with their IGERT funding by December 2007 (N=869). This sample was designed to provide NSF with comprehensive descriptive data on the post-graduation outcomes of all IGERT graduates.

IGERT Subsample

The IGERT Subsample targeted students who participated in one of the first *four* cohorts of IGERT projects funded between 1998 and 2001 (N=77 projects) and who graduated with a PhD between January 2001 and December 2006 from a department with three or more IGERT doctoral graduates. This sample was limited to graduates from departments with at least three IGERT graduates to increase the efficiency and reduce the cost associated with constructing the Non-IGERT Subsample. Overall, 61 IGERT projects and 89 unique departments had graduates that met these criteria. One project was subsequently excluded because it draws individual students and faculty from multiple universities, and it was not possible to identify a reasonable matched comparison group of institutions/departments. Four other projects were excluded because the matched comparison departments refused to participate in the study. Consequently, the final IGERT subsample included 401 PhD graduates from 56 IGERT projects and 85 unique departments. This sample was designed to provide a cost-effective mechanism to compare IGERT graduates with non-IGERT graduates. All IGERT Subsample respondents were also included in the Full IGERT Sample.

Non-IGERT Subsample

The matched comparison group was constructed by identifying comparison departments based on academic quality and selecting graduates from these departments. We chose to identify matched comparison departments using two sources: a) self-identified IGERT competitor departments and b) U.S. News & World Report Rankings of doctoral programs by field of study.
We asked the department chairs of the selected IGERT departments to identify the departments and institutions with which they primarily compete for doctoral students. Forty-five chairs complied with our request. This method of using self-identified peers as a comparison group provides a reasonable approximation of academic quality, if one assumes that departments compete for students of similar academic ability. One possible bias in this comparison comes from the possibility that academics may

identify as their peers individuals or programs which, on other measures, may actually rank slightly higher (in other words, to self-inflate the comparison); this bias may have set a higher standard for comparing IGERT Program differences. We used the 2007 U.S. News & World Report Rankings[1] of the academic quality of graduate school programs in the sciences, mathematics, computer science, engineering, health specialties, and social sciences to identify departments of similar academic quality for the 40 remaining departments.

From these lists, we eliminated departments that were involved with another IGERT project, and then selected the department whose characteristics most closely matched the targeted IGERT department on the following dimensions: control (public/private), geographic region, number of doctoral degrees granted, number of students enrolled full-time and part-time, and overall number of degrees granted.[2] We contacted the department chairs of the departments identified as a comparison match and invited them to participate in the study.[3] Department chairs who agreed to participate in the study were asked to provide us with a list of all PhD graduates from their department between the years 2001 and 2006. We then drew a matched sample of Non-IGERT graduates for each IGERT department.

We conducted a power analysis to determine the sample size needed to detect a minimum effect size of 0.3 in outcomes between the IGERT subsample and non-IGERT graduates. Based on our power calculations, we determined that we needed a starting sample of 834 Non-IGERT graduates to achieve a comparison sample of 350 non-IGERT graduates. These calculations are based on the assumption that we would be able to locate 60 percent of the starting sample and that 70 percent of the individuals we located would respond to the survey. We then matched Non-IGERT graduates with the subsample of IGERT graduates. We matched graduates in each IGERT department with non-IGERT graduates as closely as possible on citizenship status and graduation year, using the ranked matching scale below, where one is the strongest matching criterion and six is an acceptable but weaker match:

1. A US Citizen within the same year band
2. A US Citizen with any graduation year
3. A person for whom we do not know citizenship within the same year band
4. A person for whom we do not know citizenship with any graduation year
5. A non-US Citizen within the same year band
6. A non-US Citizen with any graduation year

Additional analyses of department-level data indicated that one-to-one matching of non-IGERT graduates with IGERT graduates using the six criteria above would have yielded only 400 comparison matches. Consequently, to increase the number of matches and ensure sufficient power in the analysis, we used a one-to-many matching scheme in which we formed 12 strata comprised of four graduation-year groups and three possible citizenship statuses (US, non-US, unknown). From each stratum within a department, we selected non-IGERT graduates such that if only one comparison match were available, we selected that non-IGERT graduate; if two to five comparison matches were available we took all the non-IGERT graduates; and if more than five comparison matches were available, five non-IGERT graduates were randomly selected. This resulted in a matched comparison sample of 834 non-IGERT graduates.

Data Collection

All IGERT and comparison department chairs were contacted between August and December 2007 to obtain names and contact information for identified PhD graduates. In January 2007, the comparison sample was drawn. Between January and April 2008, we conducted research to obtain and confirm

updated contact information on each individual in the IGERT and comparison samples. IGERT and comparison department chairs were asked to provide information on graduates' current whereabouts, if available. In addition, the IGERT Distance Monitoring System maintains some information on IGERT students while they are enrolled, such as email address, phone number, and primary or secondary mailing addresses, including in some cases, the name and address of a point of contact. We used all information that was available for each individual to attempt to contact them through email, telephone, and/or paper mail. In addition, we conducted internet searches and contacted students' PIs and home departments in an effort to identify the current whereabouts of each graduate. Once we obtained a working email address, we sent notification of our study and confirmed that we reached the appropriate respondent.

On-line surveys were administered to study respondents in two waves. Each respondent received a personalized email invitation and a link to the survey. Wave 1, consisting of the full IGERT sample and the Non-IGERT Sample, was administered between April and August 2008. Data from Wave 1 were analyzed and presented to NSF in a draft report in December 2008 where the overall response rate for the full IGERT sample was 65 percent. As is standard in data collection efforts with response rates below 80 percent, we conducted additional analyses to determine, to the best of our ability, whether there were systematic differences between responders and non-responders. We used three variables from the IGERT distance monitoring system: gender, race and discipline. There were no differences between responders and non-responders on demographic variables and there was a significant difference in disciplines.

To obtain a more representative full sample and increase the response rate, we engaged in an additional wave of data collection. First, we tried to locate IGERT graduates who had not been found in earlier efforts. We did so by (a) identifying the faculty advisor of IGERT graduates and requesting any updated contact information from these advisors about their respective graduates, and (b) using the Social Security Number collected from IGERT graduates at the time of their traineeship to locate graduates' current telephone and/or mailing address. Between February and April 2009, we identified new contact information for an additional 132 IGERT graduates. The survey was re-opened in April 2009 for all respondents in the full IGERT sample who had not previously completed the survey. This second wave of data collection, lasting from April through July 2009, only targeted non-respondents in the full IGERT sample – we did not re-open the survey for the non-IGERT respondents. As a result of these two waves of data collection, the overall response rate for the full IGERT sample was 74 percent.

Analyses for the Descriptive Sub-Study (Chapters 2, 3, and 4) include all IGERT respondents from Waves 1 and 2. Analyses for the Comparative Sub-Study (Chapter 5), which was completed in Fall 2008, present results for respondents in Wave 1 only. The responses from the full IGERT sample presented in the Descriptive Sub-Study were weighted, as described below.

Post-Stratification Weighting of the IGERT Full Sample

Upon completion of the second wave of data collection, we again examined differences between IGERT respondents and non-respondents on gender, race/ethnicity and discipline. Once again, there were no differences between responders and non-responders with respect to gender or race/ethnicity, but there was a significant difference in disciplines. As a result, the final analyses of the full IGERT sample were conducted using post stratification weights, to account for the differences between responders and non-responders on discipline. We did not weight the comparative analyses.

Full IGERT sample respondents were grouped by discipline into 7 different post strata (Computer Sciences, Engineering, Life Sciences, Mathematics, Other Fields, Physical Sciences, Social Sciences) and weights were created for the responders in each stratum h, such that the sum of the weights equal to the population counts N_h for that stratum.

This method assumes that (1) within east poststratum each unit selected to be in the sample has the same probability of being a respondent, (2) the response or nonresponse of a unit is independent of the behavior of all other units, and (3) nonresponders in a poststratum are like respondents. The data is missing completely at random (MCAR) within each post stratum (Lohr, 1999).

Base Weight

Let π_i = the probability that person i is selected to be in our sample, then this person has a sampling weight $w_i = 1/\pi_i = \frac{N}{n}$.

For our survey since all IGERT PhD graduates targeted was included in our sample $w_i = 1$.

Post Stratification Weight

Let $x_{ih} = 1$ if unit i is a respondent in poststratum h, and 0 otherwise. Then our poststratification weight is:

$$w_{ih}^{*} = w_{ih} \frac{N_h}{\sum_{i=1}^{n_h} w_{ih} x_{ih}}.$$

In other words the weight for a person in poststartum h is:

$$w_{ih}^{*} = w_{ih} \times \frac{N_h}{sumofweightsforallrespondents \text{ in } poststratumh}$$

---

1 These rankings are based on two types of data: 1) survey data from 14,000 academics and professionals (deans, program directors, and senior faculty) who are asked to judge the academic quality of programs in their field; and 2) statistical indicators such as measures of the qualities that students and faculty bring to the educational experience, and measures of graduates' achievements linked to their degrees.

2 Institutional data were obtained from the US Department of Education's Integrated Postsecondary Education Data System (IPEDS).

3 A few department chairs declined to participate and a few others could not be reached. In those cases, an alternate comparison department was substituted, when possible.

Appendix B:
Selected Data Tables

Appendix B: Selected Data Tables

This Appendix presents selected data tables from Chapter 2 and side-by-side summary information for both the Full IGERT Sample (N=645) and the IGERT Analytic Subsample (N=261) in places where the data are presented for the IGERT Analytic Subsample only throughout Chapter 5 of the report.

Chapter 2 Tables

Exhibit 2.14

IGERT PhD Graduates and National STEM PhD Graduates, by Gender and Home Discipline [a]

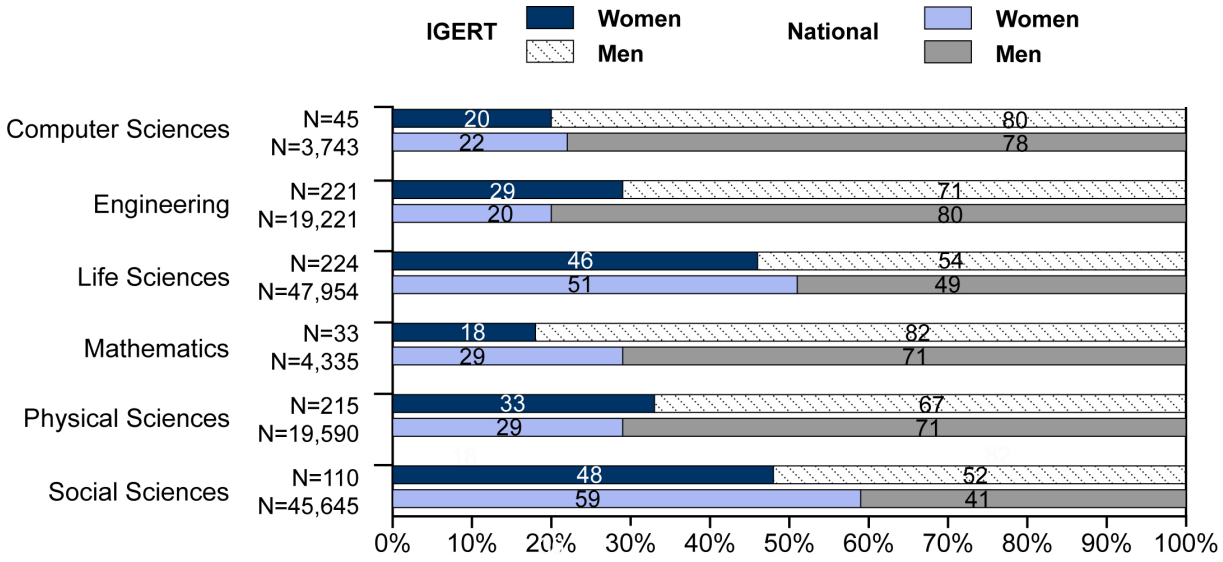

Exhibit reads: 20 percent of IGERT PhD graduates in computer sciences were women, and 22 percent of STEM PhD graduates nationwide in computer sciences were women.

Includes IGERT PhD graduates: N=45 (computer sciences), 221 (engineering), 224 (life sciences), 33 (mathematics), 215 (physical sciences), 112 (social sciences); Missing=15. Six IGERT graduates who earned degrees in other fields (N=6) are not reported in this exhibit. The total across disciplines was not reported in this exhibit because the distribution of IGERT graduates across broad disciplines differs considerably from the distribution of STEM PhD recipients nationally.

Includes National (US citizen and permanent resident) STEM PhD graduates, who received doctoral degrees in academic years 1998–1999 through 2005–2006: N=3,743 (computer sciences), 19,221 (engineering), 47,954 (life sciences), 4,335 (mathematics), 19,590 (physical sciences), 45,645 (social sciences); Missing=5.

[a] *Home discipline* is coded from the department of enrollment as reported by trainees in the Distance Monitoring System.

Sources: IGERT Distance Monitoring System, 2007. NSF/SRS, Survey of Earned Doctorate, 2006. Integrated Science and Engineering Resources Data System (WebCASPAR), http://webcaspar.nsf.gov.

Exhibit 2.15

PhD Degree Completion Rate of IGERT Trainees as of 2007, by Gender and Home Discipline

	Percent of IGERT Trainees Completing Their PhD Degrees [a]							
Years Since Initial Enrollment	**After 3 Years**		**After 5 Years**		**After 7 Years**		**After 10 Years**	
Home Discipline [b]	Men	Women	Men	Women	Men	Women	Men	Women
Computer Sciences	3%	3%	16%	20%	45%	33%	59%	42%
Engineering	2	3	17	19	39	37	46	46
Life Sciences	1	2	14	19	51	50	68	63
Mathematics	3	0	23	13	51	30	61	38
Physical Sciences	2	2	22	18	50	55	62	62
Social Sciences	2	1	16	16	41	41	54	67
TOTAL [c]	2	2	18	18	45	44	57	57

Exhibit reads: 3 percent of IGERT male trainees in computer sciences and 3 percent of IGERT female trainees in computer sciences had completed PhDs in the first three years of their graduate study. Sixteen percent of IGERT male trainees in computer sciences and 20 percent of IGERT female trainees in computer sciences had completed PhDs in the first five years of their graduate study (including those who completed PhDs in the first three years).

[a] Percent of IGERT trainees who had completed PhDs after each specific number of years since starting their IGERT-related graduate program.

[b] *Home discipline* was coded from the department of enrollment as reported by trainees in the Distance Monitoring System. Includes only IGERT trainees who had completed their degree, withdrew, or were still enrolled as of the third year of their doctoral program:

Computer Sciences: 123 (Men 3 years), 32 (Women 3 years); 87 (Men 5 years), 20 (Women 5 years); 60 (Men 7 years), 15 (Women 7 years); 49 (Men 10 years), 12 (Women 10 years); Missing=13.

Engineering: 707 (Men 3 years), 344 (Women 3 years); 486 (Men 5 years), 226 (Women 5 years); 324 (Men 7 years), 166 (Women 7 years); 277 (Men 10 years), 141 (Women 10 years); Missing=35.

Life Sciences: 396 (Men 3 years), 334 (Women 3 years); 283 (Men 5 years), 243 (Women 5 years); 193 (Men 7 years), 170 (Women 7 years); 157 (Men 10 years), 148 (Women 10 years); Missing=19.

Mathematics: 60 (Men 3 years), 35 (Women 3 years); 48 (Men 5 years), 15 (Women 5 years); 35 (Men 7 years), 10 (Women 7 years); 31 (Men 10 years), 8 (Women 10 years); Missing=1.

Physical Sciences: 457 (Men 3 years), 276 (Women 3 years); 338 (Men 5 years), 186 (Women 5 years); 221 (Men 7 years), 106 (Women 7 years); 188 (Men 10 years), 93 (Women 10 years); Missing=21.

Social Sciences: 225 (Men 3 years), 176 (Women 3 years); 155 (Men 5 years), 119 (Women 5 years); 117 (Men 7 years), 82 (Women 7 years); 98 (Men 10 years), 60 (Women 10 years); Missing=9.

[c] Total includes IGERT PhD trainees in "other" fields (N=62), who were not otherwise reported in this table.

Total: 1,986 (Men 3 years), 1,210 (Women 3 years); 1,411 (Men 5 years), 818 (Women 5 years); 962 (Men 7 years), 554 (Women 7 years); 806 (Men 10 years), 466 (Women 10 years); Missing=98.

Source: IGERT Distance Monitoring System, 2007.

Exhibit 2.17
IGERT PhD Graduates and National STEM PhD Recipients, by Race/Ethnicity and Home Discipline [a]

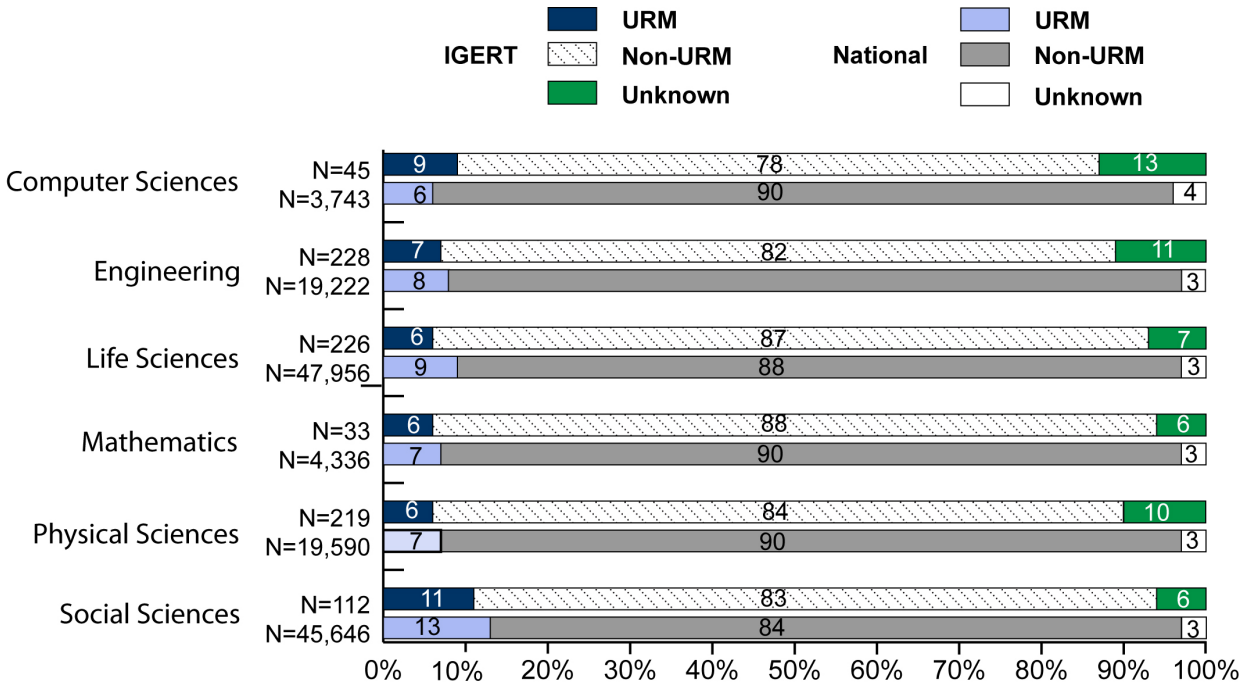

Exhibit reads: Among the IGERT PhD graduates who earned doctoral degrees in computer sciences, 78 percent identified themselves as White or Asian, 9 percent self-identified as being members of a racial/ethnic group underrepresented in STEM,, and 13 percent did not report their race/ethnicity. Nationally, 90 percent of STEM PhD graduates who earned doctoral degrees in computer sciences identified as White or Asian, 6 percent in an underrepresented racial/ethnic group, and 6 percent did not report their race/ethnicity.

Includes IGERT PhD graduates: N=45 (computer sciences), 228 (engineering), 226 (life sciences), 33 (mathematics), 219 (physical sciences), 112 (social sciences). Six IGERT graduates who earned degrees in other fields (N=6) were not reported in this exhibit. The total across disciplines was not reported in this exhibit because the distribution of IGERT graduates across broad disciplines differs considerably from the distribution of STEM PhD recipients nationally.

Includes National (US citizen and permanent resident) STEM PhD graduates who received doctoral degrees in academic years 1998–1999 through 2005–2006: N=3,743 (computer sciences), 19,222 (engineering), 47,956 (life sciences), 4,336 (mathematics), 19,590 (physical sciences), 45,641 (social sciences).

[a] *Home discipline* was coded from the department of enrollment as reported by trainees in the Distance Monitoring System. IGERT URM includes: Hispanic, American Indian, Alaskan Native, Black, Native Hawaiian, or Pacific Islander. National data on URM includes: Hispanic, American Indian, Alaskan Native, or Black. National data reports Native Hawaiian or Pacific Islander within Other/Unknown category.

Sources: IGERT Distance Monitoring System, 2007. IGERT Follow-up Survey, 2008. (Items P2 and P3). NSF/SRS, Survey of Earned Doctorate, 2006. Integrated Science and Engineering Resources Data System (WebCASPAR), http://webcaspar.nsf.gov.

Exhibit 2.18

Degree Completion Rate of IGERT PhD Trainees as of 2007, by Underrepresented Minority (URM) Status and Home Discipline [a]

	Percent of IGERT Trainees Completing Their PhD Degrees [a]							
Years Since Initial Enrollment	**After 3 Years**		**After 5 Years**		**After 7 Years**		**After 10 Years**	
Home Discipline [b]	White or Asian	URM	White or Asian	URM	White or Asian	URM	White or Asian	URM
Computer Sciences	4%	0	18%	8%	45%	20%	60%	22%
Engineering	2	2	19	12	41	24	50	30
Life Sciences	1	1	17	12	51	42	67	48
Mathematics	3	0	20	13	49	33	62	33
Physical Sciences	2	1	21	11	56	26	67	32
Social Sciences	2	2	18	6	43	39	60	58
TOTAL	2	2	19	11	47	29	60	37

Exhibit reads: 4 percent of IGERT trainees in computer sciences who identified as White or Asian completed their PhDs in the first three years of their graduate study. None of the IGERT trainees who self-identified as being members of a racial/ethnic group underrepresented in STEM completed their PhD in the first three years of their graduate study. After five years, 18 percent of White or Asian and 8 percent of URM IGERT trainees in computer sciences had completed their PhDs (including those that completed the PhD in the first three years).

[a] Percent of IGERT trainees who had completed PhD degrees after each specific number of years since starting their IGERT-related graduate program.

[b] *Home discipline* is coded from the department of enrollment as reported by trainees in the Distance Monitoring System. URM is composed of the following: Hispanic, American Indian, Alaskan Native, Black, Native Hawaiian, or Pacific Islander.

Includes only IGERT trainees who had completed their degree, withdrew, or were still enrolled as of the third year of their doctoral program:

Computer Sciences: 124 (White or Asian 3 years), 15 (URM 3 years); 83 (White or Asian 5 years), 12 (URM 5 years); 56 (White or Asian 7 years), 10 (URM 7 years); 45 (White or Asian 10 years), 9 (URM 10 years); Missing=27.

Engineering: 823 (White or Asian 3 years), 141 (URM 3 years); 558 (White or Asian 5 years), 93 (URM 5 years); 378 (White or Asian 7 years), 70 (URM 7 years); 322 (White or Asian 10 years), 60 (URM 10 years); Missing=115.

Life Sciences: 612 (White or Asian 3 years), 68 (URM 3 years); 447 (White or Asian 5 years), 45 (URM 5 years); 319 (White or Asian 7 years), 23 (URM 7 years); 268 (White or Asian 10 years), 21 (URM 10 years); Missing=53.

Mathematics: 79 (White or Asian 3 years), 11 (URM 3 years); 51 (White or Asian 5 years), 8 (URM 5 years); 35 (White or Asian 7 years), 6 (URM 7 years); 29 (White or Asian 10 years), 6 (URM 10 years); Missing=5.

Physical Sciences: 584 (White or Asian 3 years), 81 (URM 3 years); 420 (White or Asian 5 years), 54 (URM 5 years); 258 (White or Asian 7 years), 39 (URM 7 years); 224 (White or Asian 10 years), 31 (URM 10 years); Missing=78.

Social Sciences: 323 (White or Asian 3 years), 49 (URM 3 years); 219 (White or Asian 5 years), 33 (URM 5 years); 161 (White or Asian 7 years), 23 (URM 7 years); 129 (White or Asian 10 years), 19 (URM 10 years); Missing=36.

[c] Total includes IGERT PhD trainees in "other" fields (N=42) who are not otherwise reported in this table.

Total: 2,569 (White or Asian 3 years), 375 (URM 3 years); 1,794 (White or Asian 5 years), 253 (URM 5 years); 1,218 (White or Asian 7 years), 175 (URM 7 years); 1,024 (White or Asian 10 years), 147 (URM 10 years); Missing=318.

Source: IGERT Distance Monitoring System, 2007. IGERT Follow-up Survey, 2008. (Items P2 and P3).

Chapter 5 Tables

Full IGERT Sample and the IGERT Analytic Subsample

Respondent Characteristics	All IGERT PhD Sample	IGERT Subsample
Gender		
Male	59%	64%
Female	36	35
Chose not to report	5	1
Race/ethnicity		
White, Non-Hispanic	74	70
Asian	8	8
Hispanic or Latino	4	4
Black or African American	3	3
Multiple Races, Non-Hispanic	1	3
American Indian, Alaska Native, Pacific Islander	<1	<1
Chose not to report	11	12
Citizenship		
U.S. Citizen	>99	99
Non-U.S. Citizen	<1	1 [a]
Family education history		
First in family to earn a PhD in STEM field	66	66
Discipline of study in doctoral program		
Life sciences	26	31
Physical sciences	25	24
Engineering	26	18
Social sciences	13	15
Computer sciences	5	6
Math	4	5

Exhibit reads: 59 percent of all IGERT and 64 percent of IGERT Subsample PhD graduates were men.

Includes IGER PhD graduates:

Gender: N=645 (All IGERT) and 261 (IGERT Subsample); Missing=6 (All IGERT) and 1 (IGERT Subsample).

Race/Ethnicity: N=645 (All IGERT) and 261 (IGERT Subsample); Missing=6 (All IGERT) and 2 (IGERT Subsample).

Citizenship: N=645 (All IGERT) and 261 (IGERT Subsample); Missing=16 (All IGERT) and 7 (IGERT Subsample).

Family history: N=645 (All IGERT) and 261 (IGERT Subsample); Missing=6 (All IGERT) and 2 (IGERT Subsample).

Discipline of study: N=645 (All IGERT) and 261 (IGERT Subsample); Missing=0 (All IGERT) and 0 (IGERT Subsample).

[a] To receive an IGERT traineeship, students are required to be U.S. citizens. Two IGERT graduates reported that they are not U.S. citizens. They may have been incorrectly identified by their PI as receiving IGERT funding, or may have received IGERT funding when they should not have. We do not have further information on these respondents.

Sources: IGERT Follow-up Survey, 2008. IGERT Distance Monitoring System, 2007.

Percent Who Were Interested in Having Interdisciplinary Education or Research Training Experiences when Applying to Graduate School

All IGERT PhD Sample	IGERT Subsample
83%	85%

Exhibit reads: 83 percent of All IGERT and 85 percent of the IGERT Subsample PhD graduates reported that they were interested in having interdisciplinary education or research training experiences when they applied to graduate school.

Includes IGERT PhD graduates: N=645 (All IGERT) and 261 (IGERT Subsample); Missing=68 (All IGERT) and 35 (IGERT Subsample). "I don't remember" responses were set to missing.

Source: IGERT Follow-Up Survey, 2008. (Item A4).

Number of Disciplines IGERT Graduates Used in Dissertation Research

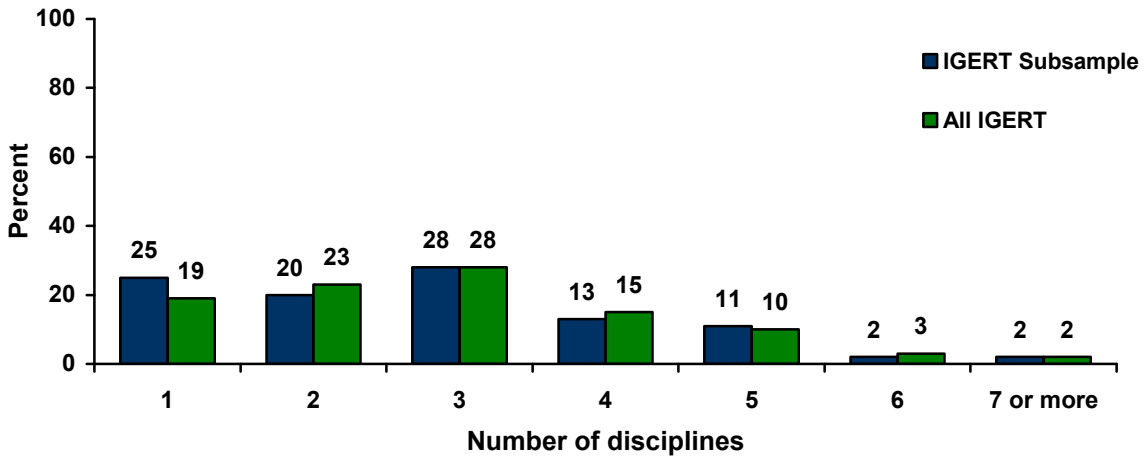

Exhibit reads: 25 percent of All IGERT and 19 percent of the IGERT Subsample PhD graduates reported that they used one discipline in their dissertation research.

Includes IGERT PhD graduates: N=645 (All IGERT) and 261 (IGERT Subsample); Missing=0 (All IGERT) and 0 (IGERT Subsample).

Source: IGERT Follow-Up Survey, 2008. (Item B9).

Average Number of Disciplines IGERT Graduates Used in Dissertation Research

All IGERT PhD Sample	IGERT Subsample
2.94	2.78

Exhibit reads: On average, All IGERT graduates used an average of 2.94 broad disciplines in their dissertation and the IGERT Subsample used an average of 2.78 disciplines.

Includes IGERT PhD graduates: N=645 (All IGERT) and 261 (IGERT Subsample); Missing=1 (All IGERT) and 0 (IGERT Subsample).

Source: IGERT Follow-Up Survey, 2008. (Item B9).

Average Time to Degree[a]

All IGERT PhD Sample	IGERT Subsample
5.37	5.49

Exhibit reads: The average time to degree was 5.37 years for All IGERT PhD graduates and 5.49 years for the IGERT Subsample.

Includes IGERT PhD graduates: N=645 (All IGERT) and 261 (IGERT Subsample); Missing=1 (All IGERT) and 0 (IGERT Subsample).

[a] Graduate Time to Degree is calculated based on when student first enrolled in graduate program until doctoral degree completion.

Note: Numbers reported in this table differ from the numbers reported in Chapter 5 because they are not adjusted for covariates.

Source: IGERT Follow-up Survey, 2008. (Variable created from Items B1 and B5).

Factors Most Important to IGERT Graduates When Choosing a Career in STEM

Factors	All IGERT PhD Sample	IGERT Subsample
Intellectual challenge	78%	83%
Follow passion	43	43
Create new knowledge/make decisions	40	42
Independence	39	42
Contribute to society	38	34
Salary/benefits	16	15
Opportunity to learn new skills	10	10
Job security	9	8
Opportunity for advancement	6	5
Responsibility	3	3
Other	2	2

Exhibit reads: 78 percent of All IGERT and 83 percent of IGERT Subsample PhD graduates reported that intellectual challenge was an important factor in choosing a career in STEM.

Includes IGERT PhD graduates: N=645 (All IGERT) and 261 (IGERT Subsample); Missing=0 (All IGERT) and 0 (IGERT Subsample).

Source: IGERT Follow-Up Survey, 2008. (Item A2).

IGERT Graduates' Sense of Preparedness for Various Positions

Positions	All IGERT PhD Sample		IGERT Subsample	
	Somewhat Agree	Agree	Somewhat Agree	Agree
Researcher at a government lab or research institution	19%	76%	18%	76%
Faculty member at a university with only research responsibilities	28	61	27	62
Faculty member at a university with teaching and research responsibilities	35	48	36	49
Research/developer in industry/business	28	54	28	53
Non-research policy or planning position in government or nonprofit	31	27	29	24

Exhibit reads: 19 percent of All IGERT PhD graduates somewhat agreed and 76 percent agreed that they were prepared for a job as a researcher at a government lab or research institution upon completing their degree. Eighteen percent of IGERT Subsample graduates somewhat agreed and 76 percent agreed that they were prepared for this type of job.

Includes IGERT PhD graduates who were not enrolled in a degree program and were in a postdoctoral position or employed in the workforce: N=628 (All IGERT) and 255 (IGERT Subsample); Missing=4-76 (All IGERT) and 2-34 (IGERT Subsample). "I do not know" responses were set to missing.

Source: IGERT Follow-Up Survey 2008. (Item C7).

Primary Employment Sectors Considered by IGERT Graduates When Entering the Workforce

Employment Sectors	All IGERT PhD Sample	IGERT Subsample
College or university	83%	84%
Industry or business	46	42
Government	45	41
Non-government lab, research institution, or think tank	27	24
Other nonprofit organization or private foundation	14	12
Entrepreneur or self-employed	9	5
K-12 school	2	2

Exhibit reads: 83 percent of All IGERT and 84 percent of IGERT Subsample PhD graduates considered employment at a college or university.

Includes IGERT PhD graduates who were not enrolled in a degree program and were in a postdoctoral position or employed in the workforce: N=628 (All IGERT) and 255 (IGERT Subsample); Missing=0 (All IGERT) and 0 (IGERT Subsample).

Note: Percents total more than 100% because respondents could check more than one response.

Source: IGERT Follow-Up Survey, 2008. (Item C11).

IGERT Graduates Success in Obtaining a Position in the Workforce

	All IGERT PhD Sample	IGERT Subsample
Obtained a position in the workforce upon graduation	86%	87%

Exhibit reads: 86 percent of All IGERT and 87 percent of IGERT Subsample PhD graduates had a obtained a position in the workforce upon graduation.

Includes IGERT PhD graduates who were not enrolled in a degree program and had sought employment at the time of graduation: N=615 (All IGERT) and 253 (IGERT Subsample); Missing=0 (All IGERT) and 0 (IGERT Subsample).

Source: IGERT Follow-Up Survey 2008. (Item C1).

Average Level of Difficulty In Obtaining Post-Graduate Employment

	All IGERT PhD Sample	IGERT Subsample
Average level of difficulty	1.80	1.75

Exhibit reads: The average level of difficulty in obtaining a post-graduate workforce position was 1.80 for All IGERT and 1.75 for IGERT Subsample PhD graduates on a scale of 1 (not at all difficult) to 5 (very difficult).

Includes IGERT PhD graduates who were not enrolled in a degree program, had sought employment at the time of graduation and were either employed in a paid position or had been employed since leaving their institution: N=612 (All IGERT) and 252 (IGERT Subsample); Missing=0 (All IGERT) and 0 (IGERT Subsample).

Source: IGERT Follow-Up Survey 2008. (Item C5).

IGERT Graduates' Perception that their Graduate Preparation Gave Them a Competitive Edge When Applying for Workforce Positions

All IGERT PhD Sample	IGERT Subsample
93%	95%

Exhibit reads: 93 percent of All IGERT and 95 percent of IGERT Subsample PhD graduates reported that their graduate preparation gave them a competitive edge when applying for workforce positions.

Includes IGERT PhD graduates who were not enrolled in a degree program, had sought employment at the time of graduation and either employed in a paid position or had been employed since leaving their institution: N=612 (All IGERT) and 252 (IGERT Subsample); Missing=23 (All IGERT) and 9 (IGERT Subsample). Responses of "I don't know" to this question were set to missing.

Source: IGERT Follow-Up Survey, 2008. (Item C6).

Current Employment Rate of IGERT Graduates

	All IGERT PhD Sample	IGERT Subsample
Paid Employment (part or full-time)	98%	98%
Unemployed or unpaid employment	2	2

Exhibit reads: 98 percent of both All IGERT and IGERT Subsample PhD graduates reported that they were employed (part or full-time) at the time of the survey.

Includes IGERT PhD graduates who were not enrolled in a degree program: N=639 (All IGERT) and 259 (IGERT Subsample); Missing=0 (All IGERT) and 0 (IGERT Subsample).

Source: IGERT Follow-Up Survey, 2008. (Item C3).

IGERT Graduates in a Postdoctoral Appointment of Fellowship

	All IGERT PhD Sample	IGERT Subsample
Current position is postdoctoral appointment or fellowship	32%	29%

Exhibit reads: 32 percent of All IGERT and 29 percent of IGERT Subsample PhD graduates reported that their current position was a postdoctoral appointment.

Includes IGERT PhD graduates who were not enrolled in a degree program and were employed in a paid position: N=628 (All IGERT) and 255 (IGERT Subsample); Missing=0 (All IGERT) and 0 (IGERT Subsample).

Source: IGERT Follow-Up Survey, 2008. (Item C3).

Current Employment Sector of IGERT Graduates

	All IGERT PhD Sample	IGERT Subsample
Higher education (college or university)	56%	62%
Industry or business	23	19
Government (including government research labs)	13	11
Non-governmental lab, research institution, think tank, private foundation, or nonprofit organization	6	8
Entrepreneur or self-employed	2	3
K-12 school	0	0

Exhibit reads: 56 percent of All IGERT and 62 percent of IGERT Subsample PhD graduates reported that they were working in a higher education (college or university) setting.

Includes IGERT PhD graduates who were not enrolled in a degree program and were employed in a paid position: N=628 (All IGERT) and 255 (IGERT Subsample); Missing=0 (All IGERT) and 0 (IGERT Subsample).

Source: IGERT Follow-Up Survey 2008. (Item C13).

IGERT Graduates Success in Obtaining a Most Desired Position in the Workforce Upon Graduation

	All IGERT PhD Sample	IGERT Subsample
Currently in job sector that was their most desired upon graduation	76%	81%

Exhibit reads: 76 percent of All IGERT and 81 percent of IGERT Subsample PhD graduates reported that they were working in the job sector that was their most desired upon graduation.

Includes IGERT PhD graduates who were not enrolled in a degree program, had sought employment at the time of graduation and were employed in a paid position: N=607 (All IGERT) and 249 (IGERT Subsample); Missing=0 (All IGERT) and 0 (IGERT Subsample).

Source: IGERT Follow-Up Survey 2008. (Items C11 and C13).

Factors Most Important to IGERT Graduates When Choosing Their Current Position

	All IGERT PhD Sample	IGERT Subsample
Intellectual challenge	59%	63%
Independence	33	41
Salary/Benefits	32	29
Follow passion	29	31
Contribute to society	25	22
Opportunity to create new knowledge/make decision	23	24
Opportunity for advancement	22	18
Opportunity to learn new skills	16	16
Job security	15	16
Responsibility	9	7
Other	10	10

Exhibit reads: 59 percent of All IGERT and 63 percent of IGERT Subsample PhD graduates reported that intellectual challenge was one of the most important factors in choosing their current position.

Includes IGERT PhD graduates who were not enrolled in a degree program and were employed in a paid position: N=628 (All IGERT) and 255 (IGERT Subsample); Missing=0 (All IGERT) and 0 (IGERT Subsample).

Note: Percents total more than 100% because respondents could check more than one response.

Source: IGERT Follow-Up Survey 2008. (Item C12).

Primary and Secondary Employment Responsibilities of IGERT Graduates

	All IGERT PhD Sample	IGERT Subsample
Research, Development and/or Technology	87%	89%
Education: Teaching or Training	44	49

Exhibit reads: 87 percent of All IGERT and 89 percent of IGERT Subsample PhD graduates reported that their primary or secondary job responsibilities involved research, development, and/or technology.

Includes IGERT PhD graduates who were not enrolled in a degree program and were employed in a paid position: N=628 (All IGERT) and 255 (IGERT Subsample); Missing=5 (All IGERT) and 2 (IGERT Subsample).

Note: Percents total more than 100% because they reflect the percent who checked research or teaching as either a primary or secondary responsibility in their current work.

Source: IGERT Follow-up Survey, 2008. (Item I2).

Primary Employment Responsibility of IGERT Graduates

	All IGERT PhD Sample	IGERT Subsample
Research, Development and/or Technology	73%	75%
Education: Teaching or Training	16	17

Exhibit reads: 73 percent of All IGERT and 75 percent of IGERT Subsample PhD graduates reported that their primary job responsibility was research, development, and/or technology.

Includes IGERT PhD graduates who were not enrolled in a degree program and were employed in a paid position: N=628 (All IGERT) and 255 (IGERT Subsample); Missing=5 (All IGERT) and 2 (IGERT Subsample).

Note: Percents only reflect the percent who checked research or teaching as a primary responsibility in their current work.

Source: IGERT Follow-up Survey, 2008. (Item I2).

Average Number of Broad Disciplines and Detailed Disciplines Used in Current Work

	All IGERT PhD Sample	IGERT Subsample
Average number of disciplines	2.9	2.9
Average number of sub disciplines	8.4	8.0

Exhibit reads: All IGERT PhD graduates used an average of 2.9 broad disciplines and 8.4 detailed disciplines in their current work. IGERT Subsample graduates used an average of 2.9 broad disciplines and 8.0 detailed disciplines in their current work.

Includes IGERT PhD graduates who were not enrolled in a degree program and were employed in a paid position: N=628 (All IGERT) and 255 (IGERT Subsample); Missing=5 (All IGERT) and 2 (IGERT Subsample).

Source: IGERT Follow-up Survey, 2008. (Item I2).

Percent Who Collaborate with Individuals from Disciplines Other Than Their Own

All IGERT PhD Sample	IGERT Subsample
86%	83%

Exhibit reads: 86 percent of All IGERT and 83 percent of IGERT Subsample PhD graduates reported that they collaborate with individuals from disciplines other than their own in their current work.

Includes IGERT PhD graduates who were not enrolled in a degree program and were employed in a paid position with responsibilities involving research, development, and/or technology, manufacturing, or technical support: N=558 (All IGERT) and 228 (IGERT Subsample); Missing=1 (All IGERT) and 0 (IGERT Subsample).

Source: IGERT Follow-up Survey, 2008. (Item J2).

Percent Who Use a Discipline Which They Did Not Draw Upon in Their Dissertation Research in Their Current Line of Work

All IGERT PhD Sample	IGERT Subsample
43%	43%

Exhibit reads: 43 percent of both All IGERT and IGERT Subsample PhD graduates were using a discipline that they did not draw upon in their dissertation research in their current line of work.

Includes IGERT PhD graduates who were not enrolled in a degree program and were employed in a paid position: N=628 (All IGERT) and 255 (IGERT Subsample); Missing=5 (All IGERT) and 2 (IGERT Subsample).

Sources: IGERT Follow-up Survey, 2008. (Items B9 and B10).

Disciplinary Focus of IGERT Graduates with Research, Development, Technology, Manufacturing or Technical Support Responsibilities

I most often work on scientific/technical projects that…	All IGERT PhD Sample	IGERT Subsample
are centered in a single discipline	15%	16%
require the integration of two or more disciplines	85	84

Exhibit reads: 15 percent of All IGERT and 16 percent of IGERT Subsample PhD graduates who had research, development, technology, manufacturing or technical support responsibilities reported that their work was primarily centered in a single discipline.

Includes IGERT PhD graduates who were not enrolled in a degree program and were employed in a paid position with responsibilities involving research, development, and/or technology, manufacturing, or technical support: N=558 (All IGERT) and 228 (IGERT Subsample); Missing=1 (All IGERT) and 0 (IGERT Subsample).

Source: IGERT Follow-Up Survey, 2008. (Item J3).

Disciplinary Focus of IGERT Graduates with Teaching or Training Responsibilities

I most often teach content that…	All IGERT PhD Sample	IGERT Subsample
are centered in a single discipline	40%	37%

Exhibit reads: 40 percent of All IGERT and 37 percent of IGERT Subsample PhD graduates who had teaching or training responsibilities reported that their work was primarily centered in a single discipline.

Includes IGERT PhD graduates who were not enrolled in a degree program and were employed in a paid position with responsibilities involving education (training or teaching): N=278 (All IGERT) and 124 (IGERT Subsample); Missing=0 (All IGERT) and 0 (IGERT Subsample).

Source: IGERT Follow-Up Survey, 2008. (Item K1).

Percent Who Developed or Co-Developed Interdisciplinary Teaching or Training Materials or a New Interdisciplinary Course of Study for their Job

All IGERT PhD Sample	IGERT Subsample
34%	36%

Exhibit reads: 34 percent of All IGERT and 36 percent of IGERT Subsample PhD graduates, who had teaching or training responsibilities, reported that they had developed or co-developed teaching or training material or helped develop a new interdisciplinary course of study for their job.

Includes IGERT PhD graduates who were not enrolled in a degree program; were employed in a paid position; and whose responsibilities involved education (training or teaching). However, respondents who had teaching or training responsibilities in a higher education setting were only included in this analysis if they provided instruction to undergraduate and graduate students: N=270 (All IGERT) and 121 (IGERT Subsample); Missing=0 (All IGERT) and 0 (IGERT Subsample).

Sources: IGERT Follow-Up Survey, 2008. (Items K3 and K5 (item e)).

Average Number of Activities IGERT Graduates Engage in that Involve Supervising or Advising Students from Other Departments or Interdisciplinary Projects

All IGERT PhD Sample	IGERT Subsample
1.15	1.19

Exhibit reads: Both All IGERT and IGERT Subsample PhD graduates had engaged in an average of one out of three activities that involved supervising or advising students from other departments or interdisciplinary projects.

Includes IGERT PhD graduates who were not enrolled in a degree program; were employed in a paid position in a higher education setting; whose responsibilities involved education (teaching or training); and who provide instruction to undergraduate or graduate students: N=215 (All IGERT) and 98 (IGERT Subsample); Missing=0 (All IGERT) and 0 (IGERT Subsample).

Sources: IGERT Follow-Up Survey, 2008. (Item K5 (items b, c, and g)).

Average Number of Activities IGERT Graduates Engage in that Involve Global Awareness and Engagement in Global Interactions in their Current Position

Outcomes	All IGERT PhD Sample	IGERT Subsample
Globally aware of STEM research in their discipline[a]	2.09	2.18
Engaged in global interactions as part of their current responsibilities[b]	1.49	1.62

Exhibit reads: All IGERT PhD graduates were involved in an average of 2.09 global awareness activities in their current work and IGERT Subsample PhD graduates were involved in 2.18 activities, on a range of 0 to 3.

[a] Includes IGERT PhD graduates not enrolled in a degree program and employed in a paid position with primary or secondary job responsibilities involving research, development and/or technology: N=541 (All IGERT) and 224 (IGERT Subsample); Missing=0 (All IGERT) and 0 (IGERT Subsample)

Sources: IGERT Follow-Up Survey, 2008. Combined variable "GlobAware" = sum of yes or checked items for questions D7 (item o), D8 (item d), J4, and K5 (item d).

[b] Includes IGERT PhD graduates not enrolled in a degree program and were employed in a paid position: N=628 (All IGERT) and 255 (IGERT Subsample); Missing=5 (All IGERT) and 2 (IGERT Subsample).

Numbers reported in this table differ from the numbers reported in Chapter 5 because they are not adjusted for covariates.

Sources: IGERT Follow-Up Survey, 2008. Combined variable "GlobInteract" = sum of checked items for Questions D8/E7/F10/G8/H13 (items a, b, c, e, f, and g).

Average Number of Activities IGERT Graduates Engage in that Demonstrate Leadership in Current Position

Outcomes	All IGERT PhD Sample	IGERT Subsample
Demonstrate leadership in current position	2.35	2.36

Exhibit reads: All IGERT PhD graduates were involved in an average of 2.35 activities that demonstrated leadership and IGERT Subsample PhD graduates were involved in 2.36 activities, on a range of 0 to 5.

Includes IGERT PhD graduates who were not enrolled in a degree program and were employed in a paid position: N=628 (All IGERT) and 255 (IGERT Subsample); Missing=2 (All IGERT) and 0 (IGERT Subsample).

Note: Numbers reported in this table differ from the numbers reported in Chapter 5 because they are not adjusted for covariates.

Sources: IGERT Follow-Up Survey, 2008. Combined variable "Leadership" = sum of checked items for Questions D6/E5/F9/G6/H11 (items a through e).

Percent of IGERT Graduates who would Recommend their IGERT-Related Graduate Program

All IGERT PhD Sample	IGERT Subsample
95%	94%

Exhibit reads: 95 percent of All IGERT and 94 percent of IGERT Subsample PhD graduates reported that they would recommend their graduate program to prospective students interested in pursuing a career similar to their own.

Includes IGERT PhD graduates who were not enrolled in a degree program: N=639 (All IGERT) and 259 (IGERT Subsample); Missing=0 (All IGERT) and 0 (IGERT Subsample).

Source: IGERT Follow-Up Survey, 2008. Item O3.

Alignment between Current IGERT Graduates' Job Activities and Graduate Training

Outcomes	All IGERT PhD Sample	IGERT Subsample
Balance the demands of multiple projects	88%	85%
Work as part of a team	85	81
Develop own technical or scientific agenda	85	87
Publish research, technical findings, and/or reports	83	87
Explain my work or research to scientists or technologists in other disciplines	82	82
Work and network with scientists or technologists in other disciplines	81	82
Lead projects or programs	76	76
Serve as a mentor	72	72
Be informed of research in other countries	69	69
Obtain funding for research or project work [a]	67	69
Present my or my organization's research or work to non-technical audiences	66	69

Exhibit reads: An estimated 88 percent of All IGERT and 85 percent of IGERT Subsample PhD graduates received training during graduate school that was relevant to current job activity of balancing multiple projects.

Includes IGERT PhD graduates who were not enrolled in a degree program and were employed in a paid position: N=628 (All IGERT) and 255 (IGERT Subsample); Missing=2-4 (All IGERT) and 0-2 (IGERT Subsample).

[a] Includes IGERT PhD graduates not enrolled in a degree program and were employed in a paid position in the industry/business sector: N=492 (All IGERT) and 205 (IGERT Subsample); Missing=3 (All IGERT) and 1 (IGERT Subsample).

Note: Numbers reported in this table differ from the numbers reported in Chapter 5 because they are not adjusted for covariates.

Sources: IGERT Follow-Up Survey, 2008. Created common variable measuring the alignment of graduate program across job sectors for items in D7, E6, F10, G7, and H12.

Appendix C:
STEM Discipline Mapping

Appendix C: STEM Discipline Mapping

This report listed IGERT graduates and trainees in seven broad graduate home departments. The detailed home departments were standardized from the IGERT Distance Monitoring System and mapped to the Survey of Earned Doctorates crosswalk of disciplines when appropriate. Exhibit C.1 depicts the mapping of IGERT graduates' detailed home department to a broad home department, along with the frequency of each occurrence. The mapping of IGERT home departments is slightly different from the IGERT Follow-Up Survey discipline mapping in Questions B10, B11, and I1, where differences exist we used contextual data from the IGERT project (e.g. advisor's or PI's department) to assign people to a single broad disciplines that more accurately reflected the disciplinary focus of their graduate experience.

Exhibit C.2 displays the mapping of Non-IGERT graduates' detailed home departments to broad home departments.

Exhibit C.1

IGERT Graduates' Home Department Mapping

Broad Home Department	Detailed Home Department	N
Engineering	Chemical Engineering	33
	Biomedical Engineering	27
	Mechanical Engineering	24
	Electrical Engineering	18
	Materials Science and Engineering	18
	Electrical Engineering and Computer Engineering	16
	Bioengineering	15
	Civil and Environmental Engineering	13
	Materials Science	7
	Mechanical and Aerospace Engineering	6
	Chemical Engineering and Materials Science	5
	Civil Engineering	5
	Electrical and Computer Engineering	4
	Industrial and Systems Engineering	4
	Transportation Studies	4
	Electrical Engineering and Computer Science	3
	Engineering Sciences and Applied Mathematics	3
	Engineering Physics	2
	Macromolecular Science and Engineering	2
	Transportation Technology and Policy	2
	Wind Science and Engineering	2
	Agriculture and Bioengineering	1
	Chemical and Biological Engineering	1
	Civil Construction and Environmental Engineering	1
	Engineering	1
	Engineering Systems	1
	Engineering and Applied Sciences	1
	Engineering and Public Policy	1
	Industrial and Manufacturing Systems Engineering	1
	Industrial and Operations Engineering	1
	Manufacturing Engineering	1
	Materials Engineering	1
	Mechanical Engineering/Materials Science and Engineering	1
	Metallurgical Engineering	1
	NeuroEngineering	1
	Physiology and Biomedical Engineering	1
Life Sciences	Biology	34
	Neuroscience	15
	Bioinformatics	10
	Ecology and Evolutionary Biology	10
	Molecular Biology	8
	Biological Sciences	7
	Ecology	6
	Genetics	6
	Biochemistry	5

Exhibit C.1

IGERT Graduates' Home Department Mapping

Broad Home Department	Detailed Home Department	N
	Biophysics	5
	Forest Resources	5
	Molecular and Cellular Biology	5
	Neurobiology	5
	Molecular and Cell Biology	4
	Rehabilitation Science and Technology	4
	Zoology	4
	Biochemistry, Biophysics, and Molecular Biology	3
	Biology and Wildlife	3
	Crop and Soil Science	3
	Evolution and Ecology	3
	Genomic Sciences	3
	Integrative Biology	3
	Kinesiology	3
	Natural Resources and Environment	3
	Organismic and Evolutionary Biology	3
	Soil Science	3
	Bioinformatics and Computational Biology	2
	Environmental Science and Policy	2
	Environmental, Population and Organismic Biology	2
	Fishery and Wildlife Biology	2
	Functional Genomics	2
	Plant, Soil, and Entomological Sciences	2
	Agronomy	1
	Aquatic Biology	1
	Biochemistry and Cell Biology	1
	Biochemistry and Molecular Biology	1
	Biology and Neurosciences	1
	Biology/Plant Biology	1
	Biomathematics	1
	Botany	1
	Cell Biology	1
	Cell Biology and Neuroscience	1
	Cellular and Molecular Biology	1
	Computational Neurobiology	1
	Conservation Social Sciences	1
	Ecology and Evolution	1
	Ecology, Evolution, and Behavior	1
	Ecology, Evolution, and Behavioral Biology	1
	Entomology	1
	Environmental Population and Organismic Biology	1
	Environmental Science	1
	Environmental Studies	1
	Fish and Wildlife	1
	Food Science and Technology	1
	Forest Ecology and Management	1

Exhibit C.1

IGERT Graduates' Home Department Mapping

Broad Home Department	Detailed Home Department	N
	Forest Resources and Conservation	1
	Forestry	1
	Genetics/Bioinformatics	1
	Human Genetics	1
	Insect Science	1
	Life Sciences	1
	Maternal and Child Health	1
	Microbiology	1
	Microbiology and Molecular Genetics	1
	Other Life Sciences	1
	Molecular Biosciences	1
	Molecular Cell and Developmental Biology	1
	Molecular Celly Biology	1
	Molecular Pharmacology and Cancer Therapeutics	1
	Molecular immunogenetics	1
	Molecular, Cellular and Developmental Biology	1
	Natural Resources	1
	Nematology	1
	Neurology	1
	Pathobiology	1
	Physical Medicine and Rehabilitation	1
	Plant Pathology	1
	Plant Sciences	1
	Plant, Soil, and Insect Sciences	1
	Scientific Computation/Neuroscience	1
	Soil, Environmental and Atmospheric Sciences	1
	Zoology and Genetics	1
	Zoology and Physiology	1
Physical Sciences	Chemistry	90
	Physics	46
	Chemistry and Biochemistry	13
	Microelectronics-Photonics	9
	Oceanography	8
	Theoretical and Applied Mechanics	7
	Biophysics	6
	Astronomy	4
	Geological Sciences	4
	Earth and Planetary Sciences	3
	Geosciences	3
	Applied Physics	2
	Chemistry and Materials Science	2
	Geology	2
	Marine Biology	2
	Optics and Photonics	2
	Photonics	2

Exhibit C.1

IGERT Graduates' Home Department Mapping

Broad Home Department	Detailed Home Department	N
	Applied Physics and Applied mathematics	1
	Astrophysical Sciences	1
	Atmospheric and Oceanic Sciences	1
	Atmospheric, Oceanic and Space Sciences	1
	Biochemistry and Biophysics	1
	Chemistry and Chemical Biology	1
	Geological Engineering	1
	Hydrologic Sciences	1
	Limnology and Marine Sciences	1
	Other physical sciences	1
	Pharmaceutical Sciences	1
	Pharmacy Practice and Science	1
	Physics and Photonics	1
	Polymer Science	1
	Economics	16
Social Sciences	Sociology	15
	Cognitive Science	12
	Geography	11
	Psychology	11
	Government	10
	Sociology and Social Policy	7
	Anthropology	6
	Political Science	4
	Cognitive and Linguistic Sciences	2
	Environmental Science and Policy	2
	Social Policy	2
	Cognitive Neuroscience	1
	Cognitive Psychology	1
	Cognitive and Neural Systems	1
	Environmental Science and Management	1
	Government and Social Policy	1
	Philosophy	1
	Policy, Planning, and Development	1
	Political Economy	1
	Political Economy and Government	1
	Psychological and Brain Sciences	1
	Public Policy	1
	Public Policy and Management	1
	Rural Sociology	1
	Urban Planning	1
Computer Sciences	Computer Science	28
	Bioinformatics	9
	Computer Science and Engineering	2
	Information	2
	Bioinformatics and Computational Biology	1

Exhibit C.1

IGERT Graduates' Home Department Mapping

Broad Home Department	Detailed Home Department	N
	Computational Biology and Mathematics	1
	Human Computer Interaction	1
	Robotics	1
Mathematics	Applied Mathematics	16
	Mathematics	9
	Statistics	3
	Applied Mathematics and Physiology	1
	Biostatistics and Computational Biology	1
	Engineering Sciences and Applied Mathematics	1
	Mathematical Sciences	1
	Statistics and Applied Probability	1
Other Fields	Business Information Technology	2
	Education	1
	English	1
	History and Philosophy of Science	1
	Music	1

Exhibit C.2

Non-IGERT Graduates' Home Department Mapping

Broad Home Department	Detailed Home Department	N
Engineering	Chemical Engineering	21
	Electrical and Computer Engineering	19
	Biomedical Engineering	12
	Electrical and Systems Engineering	10
	Materials Science and Engineering	8
	Mechanical Engineering	7
	Chemical and Materials Engineering	6
	Industrial Engineering and Operations Research	5
	Operations Research	1
Life Sciences	Biology	29
	Molecular and Cell Biology	22
	Ecology	21
	Ecology and Evolutionary Biology	17
	Biochemistry, Molecular Biology, and Biophysics	14
	Neuroscience	12
	Biological Sciences	8
	Integrative Biology	8
	Biology & Biomedical Sciences -- Plant Biology Program	6
	Ecology, Evolution, and Marine Biology	3
Physical Sciences	Chemistry	49
	Physics	28
	Physics and Astronomy	8
	Medicinal Chemistry	5
Social Sciences	Sociology	17
	Psychology	11
	Anthropology	9
	Political Science	8
	Linguistics	7
	Geography	6
	Geography and Regional Development	2
Computer Sciences	Computer Science	33
Mathematics	Applied Mathematics	24

Appendix D:
IGERT Survey

IGERT Survey

Programming notes are in blue…

- **The variable "Sample" listed in the sample file determines if a respondent is IGERT or not. The variable is coded so that IGERT respondent =1 and Comparison respondent =2. Throughout the survey where there are "IGERT only" questions, we use the variable name "IGERT" to identify that a question should be given only to the IGERT respondents.**
- **Response choices that are all numbered with one are to allow the respondent to choose more than one answer to the question. Response choices that are numbered sequentially are where the respondent is to choose only one answer to the question**

Section A: Your Decision to Pursue a Career Related to STEM (Science, Technology, Engineering, and/or Mathematics

[Programming note: For IGERT only]

A1. According to NSF's records, you received IGERT funding through a grant awarded to [Institution Name]. We know that some IGERT grants involved multiple institutions. While receiving IGERT support, were you enrolled at [Institution Name]?

☐ 1 Yes

☐ 2 No, I was enrolled at another institution (please specify: _____)

[Programming note: Institution Name in the following questions should be filled into question stems from sample file unless respondent reports and alternate institution in Question A1.]

A2. In deciding to pursue a career related to Science, Technology, Engineering, and/or Mathematics (STEM), which of the following factors were most important to you? ***(Please select up to three responses from the list below)***

Choose up to three:	
☐ 1	Salary/Benefits
☐ 1	Job security
☐ 1	Opportunities for advancement
☐ 1	Intellectual challenge
☐ 1	Level of responsibility
☐ 1	Degree of independence
☐ 1	The opportunity to create new knowledge/make decisions
☐ 1	The opportunity to contribute to society
☐ 1	The opportunity to follow my passion
☐ 1	The opportunity to learn new skills
☐ 1	Other _____

A3. Which of the following were factors in your decision to pursue a graduate degree in science, technology, engineering or mathematics at [Institution Name]? In the left hand column, *check all that apply*, and in the right hand column, *check the one most important factor*.

All factors (Check all that apply)		Most important factor (Choose one)
☐1	Needed a graduate degree to advance in a career in my field of study	☐1
☐1	Wanted to change my field of study	☐2
☐1	Wanted to increase my knowledge in my field of study	☐3
☐1	Wanted to earn more money, and expect my earnings will increase with a graduate degree	☐4
☐1	Prestige of an advanced degree	☐5
☐1	Could not find a job, so I decided to go back to school	☐6
☐1	Other, specify _____	☐7

A4. When you were applying to graduate programs, were you interested in having any interdisciplinary education or research training experiences at [Institution Name]? (*Check only one*)

☐1 Yes

☐2 No

☐3 I don't remember

[Programming note: If IGERT respondent then continue to question A5; Non IGERT respondents, skip to Section B: "Graduate School Experience"]

[Programming note: For IGERT only—This question is OPTIONAL]

A5. Why were you interested in interdisciplinary graduate programs?

[TEXTBOX]

[Programming note: For IGERT only]

A6. If your IGERT program had not existed, would you still have gone to graduate school at [Institution Name]?

☐ 1 Definitely not
☐ 2 Probably not
☐ 3 Probably
☐ 4 Definitely
☐ 5 N/A—I did not know about IGERT until after I was enrolled

[Programming note: Go to Section B: "Graduate School Experience"]

Section B: Graduate School Experience

In this section we would like you to answer a few questions about your graduate school experience.

B1. In what month and year did you originally ENROLL in your graduate program at [Institution Name]?

___ ___ / ___ ___ ___ ___(MM/YYYY)

[Programming notes:
If IGERT respondent, continue to question B2. If Comparison respondent, skip to question B3.

[Programming note: If IGERT respondent only]

B2. When you received IGERT traineeship support through [Institution Name], were you pursuing a Master's or a PhD degree?

☐ 1 Master's program
☐ 2 PhD program (with or without a corresponding Master's degree along the way)

B3. Did you have a Master's degree prior to enrolling in your graduate program at [Institution Name]?

☐ 1 Yes
☐ 2 No

B4. Please indicate the highest graduate degree that you earned from [Institution Name], if any? (*Check one)*

☐ 1 Ph.D.
☐ 2 Master's
☐ 3 Other, specify _____
☐ 4 I did not complete a degree
☐ 5 I am still enrolled in my degree program

[Programming notes:
If response 1 (PhD) is checked then continue to question B5.
If response 2 (Master's) is checked then skip to question B6
If response 3 (Other) is checked then skip to question B7
If response 4 (No degree) is checked then skip to question B8.
If response 5 (I am still enrolled) is checked then skip to thank you note at the end of the survey.

[Programming note: If question B4=1 only]

B5. In what month and year was your doctoral degree from [Institution Name] awarded/conferred? ___ ___ / ___ ___ ___ ___(MM/YYYY)

[Programming note: Skip to question B7]

[Programming note: If question B4= 2 only]
B6. In what month and year was your Master's degree from [Institution Name] awarded/conferred? ___ ___ / ___ ___ ___ ___(MM/YYYY)

B7. Have you subsequently pursued additional education (excluding postdoctoral positions)?

☐$_1$ Yes, completed. Please specify degree(s) earned _____

☐$_2$ Yes, still enrolled

☐$_3$ No

[Programming note:
If B4=1 (i.e., respondent earned a PhD degree) then skip to question B9.
If B4=2 or 3 (i.e., respondent earned a Master's or Other degree) then skip to question B10.
If B4=4 (i.e., respondent did not earn a degree in B4) then continue to B8.]

[Programming note: If question B4= 4 only]
B8. In what month and year did you leave [Institution Name]?
___ ___ / ___ ___ ___ ___(MM/YYYY)

[Skip to Section C, question C2]

[Programming note: If question B4=1 only]

B9. From the list of disciplines below, please select those you drew upon in your dissertation research. (*Check all that apply*)

If your dissertation was centered in an interdisciplinary area, please mark all of the disciplines upon which you drew. For example, for Bioinformatics, you might select Mathematics, Computer and Information Sciences, Biological Sciences, and Chemistry.

Put your mouse over the academic disciplines to see the sub-fields included in each discipline.

- ☐$_1$ **Agricultural Sciences/Natural Resources**
- ☐$_1$ **Astronomy**
- ☐$_1$ **Atmospheric Science and Meteorology**
- ☐$_1$ **Biological/Biomedical Sciences**
- ☐$_1$ **Chemistry**
- ☐$_1$ **Communications**
- ☐$_1$ **Computer and Information Sciences**
- ☐$_1$ **Education**
- ☐$_1$ **Engineering**
- ☐$_1$ **Geological and Earth Sciences**
- ☐$_1$ **Health Sciences**
- ☐$_1$ **Humanities**
- ☐$_1$ **Mathematics**
- ☐$_1$ **Ocean/ Marine Sciences**
- ☐$_1$ **Physics**
- ☐$_1$ **Professional Fields/Business Management/Administration**
- ☐$_1$ **Psychology**
- ☐$_1$ **Social Sciences**
- ☐$_1$ **Other**

[Programming note: For each response item checked above, respondent will receive a follow up question with sub-fields. See APPENDIX for sub-questions and an example].

[Programming note: If IGERT respondent, skip to question B11. Otherwise, go to section C "Entering the Workforce"]

[Programming note: If question B4=2, 3, or 4 only]

B10. Which of the following discipline(s) listed below are most closely aligned with what you studied during your graduate education at [Institution Name]? *(Check all that apply)*

If you primarily studied an interdisciplinary area, please mark all of the disciplines upon which you drew. For example, for Bioinformatics, you might select Mathematics, Computer and Information Sciences, Biological Sciences, and Chemistry.

Put your mouse over the academic disciplines to see the sub-fields included in each discipline.

- ☐ 1 **Agricultural Sciences/Natural Resources**
- ☐ 1 **Astronomy**
- ☐ 1 **Atmospheric Science and Meteorology**
- ☐ 1 **Biological/Biomedical Sciences**
- ☐ 1 **Chemistry**
- ☐ 1 **Communications**
- ☐ 1 **Computer and Information Sciences**
- ☐ 1 **Education**
- ☐ 1 **Engineering**
- ☐ 1 **Geological and Earth Sciences**
- ☐ 1 **Health Sciences**
- ☐ 1 **Humanities**
- ☐ 1 **Mathematics**
- ☐ 1 **Ocean/ Marine Sciences**
- ☐ 1 **Physics**
- ☐ 1 **Professional Fields/Business Management/Administration**
- ☐ 1 **Psychology**
- ☐ 1 **Social Sciences**
- ☐ 1 **Other**

[Programming note: Format is same as question B9. For each response item checked above, respondent will receive a follow up question with sub-disciplines. See APPENDIX for sub questions]

[Programming note:
1) If IGERT respondent, continue to question B11.
2) IF NON-IGERT COMPARISON RESPONDENT AND IF B7 = 2 ("Yes, still enrolled") then skip to question N2 of Section N ("Have you worked for salary or wages since leaving [Institution Name]")
3) All other Non-IGERT comparison respondents, go to Section C "Entering the Workforce"

[Programming note: If IGERT respondent]

B11. To what extent did your IGERT experience contribute to your ability to complete your degree?

☐1 1 (Not at all)

☐2 2 (A little)

☐3 3 (To some extent)

☐4 4 (Quite a bit)

☐5 5 (A great deal)

[Programming note: If IGERT respondent]

B12. Did any of the following elements of your IGERT experience contribute to your ability to complete your degree? (Check all that apply)

☐1 Access to resources, equipment, or technology

☐1 Training in a range of research methods representing the range of disciplines in my IGERT

☐1 Interdisciplinary theme of my IGERT

☐1 Freedom to pursue my own research interests

☐1 Increased time to conduct my own research

☐1 Support network of other IGERT students

☐1 Support network of IGERT faculty members

☐1 Connections to faculty members in departments outside of my own

☐1 Financial support

☐1 Opportunities to explain my work to others

☐1 Having two faculty advisors

☐1 Experience conducting research in multiple laboratories

☐1 Other:_____

☐1 None of the above

[Programming note: IGERT only]

B13. Please briefly elaborate, *if desired,* on the role (positive and/or negative) your IGERT experience played in completing your degree and why.

[TEXTBOX]

[Programming note:
If B7 = 2 ("Yes, still enrolled") then skip to question N2 of Section N ("Have you worked for salary or wages since leaving [Institution Name]").

Otherwise, go to Section C: "Entering the Work Force"]

Section C: Your Experience Entering the Workforce

Thank you. We would next like to ask you a few questions about your experience entering the work force.

C1. What was your job situation at the time you graduated from [Institution Name]?

☐1 I was not looking for work
☐2 I was looking for work, but did not have an offer
☐3 I had an offer
☐4 I was already working
☐5 Other, specify_____

[Programming Note: If Question B4=4 only]
C2. What was your job situation at the time you left [Institution Name]?

☐1 I was not looking for work
☐2 I was looking for work, but did not have an offer
☐3 I had an offer
☐4 I was already working
☐5 Other, specify_____

C3. Are you currently employed?

☐1 Yes, in a paid full-time position
☐2 Yes, in a paid part-time position
☐3 Yes, in an unpaid position (e.g., internship)
☐4 No

[Programming note: If respondent answered 4 ("No") then skip to Section N: "Unemployed"; Else, continue to question C4]

[Programming note: If question C3=1, 2 or 3]
C4. Is your current position a postdoctoral appointment or fellowship?

☐1 Yes
☐2 No

C5. On the following scale of 1 to 5, how difficult was it to obtain your first paid position in the workforce (including postdoctoral positions) after leaving or graduating from [Institution Name]?

☐1 1 (Not difficult at all)
☐2 2 (A little difficult)
☐3 3 (Moderately difficult)
☐4 4 (Difficult)
☐5 5 (Very difficult)

C6. To what extent do you agree with the following statement?

In my opinion, my graduate preparation gave me a competitive edge when applying for positions in the workforce.

☐1 Disagree
☐2 Somewhat disagree
☐3 Somewhat agree
☐4 Agree
☐5 I don't know

C7. Regardless of which career options you decided to pursue, how prepared do you think you were for the following types of jobs when you left or graduated from [Institution Name]? ***(Check one response in each row)***

I felt prepared for the following types of jobs…	Disagree	Somewhat disagree	Somewhat agree	Agree	I don't know
Faculty member at a university with teaching and research responsibilities	☐1	☐2	☐3	☐4	☐5
Faculty member at a university with only research responsibilities	☐1	☐2	☐3	☐4	☐5
Researcher at a government lab or research institution	☐1	☐2	☐3	☐4	☐5
Research/developer in industry/business	☐1	☐2	☐3	☐4	☐5
Non-research policy or planning position in government or nonprofit	☐1	☐2	☐3	☐4	☐5

[Programming note: If IGERT respondent, continue to question C8; Non IGERT Comparison respondents skip to question C11]

[Programming note: IGERT only]

C8. On the following scale of 1 to 5, to what extent did your IGERT experience contribute to your ability to obtain a position in the workforce.

☐$_1$ 1 (Not at all)

☐$_2$ 2 (A little)

☐$_3$ 3 (To some extent)

☐$_4$ 4 (Quite a bit)

☐$_5$ 5 (A great deal)

[Programming note: IGERT only]

C9. Did any of the following elements of your IGERT experience contribute to your ability to obtain a position in the workforce? Check all that apply.

☐$_1$ Exposure to multi/interdisciplinary research

☐$_1$ Interdisciplinary research training

☐$_1$ Interdisciplinary research conducted

☐$_1$ Access to cutting-edge tools & equipment

☐$_1$ Freedom to explore my research interests in more depth

☐$_1$ Networking opportunities with IGERT faculty members

☐$_1$ Career guidance from IGERT faculty members

☐$_1$ Networking opportunities outside my home institution

☐$_1$ Networking opportunities with people from other disciplines

☐$_1$ Exposure to nonacademic job opportunities

☐$_1$ Connections made through IGERT-related internships

☐$_1$ Opportunities to present my work to other IGERT students

☐$_1$ Opportunities to present my work at professional conferences

☐$_1$ Other: _____

☐$_1$ None of the above

[Programming note: IGERT only] Question is optional.

C10. Please briefly elaborate, *if desired,* on the role (positive and/or negative) your IGERT experience played in obtaining a position in the workforce and why.

[TEXTBOX]

C11. After leaving graduate school, which of the following employment sectors did you consider for your first position in the workforce (including postdoctoral positions)? In the left hand column, *check all that apply*, and in the right hand column, *check the <u>one sector</u> in which you most desired to work*.

All that you considered *(Check all that apply)*		**Most desired** *(Choose one)*
☐1	Government (including government research labs)	☐1
☐1	Industry/Business	☐2
☐1	College or university	☐3
☐1	Non-government lab, research institution, or think tank	☐4
☐1	Other nonprofit organization or private foundation	☐5
☐1	K-12 school	☐6
☐1	Entrepreneur/Self-employed	☐7

Section C: Your Current Position

C12. Which of the following factors were most important to you in choosing your current position in the workforce? *(Please select up to three responses from the list below)*

Choose up to three:	
☐1	Salary/Benefits
☐1	Job security
☐1	Opportunities for advancement
☐1	Intellectual challenge
☐1	Level of responsibility
☐1	Degree of independence
☐1	The opportunity to create new knowledge/make decisions
☐1	The opportunity to contribute to society
☐1	The opportunity to follow my passion
☐1	The opportunity to learn new skills
☐1	Other_____

C13. Which of the following best describes your principal employer?

☐1 Government (including government research labs)

☐2 Industry/Business

☐3 College or university

☐4 Non-government lab, research institution, or think tank

☐5 Other nonprofit organization or private foundation

☐6 K-12 school

☐7 Entrepreneur/Self-employed

[Programming note:
If respondent answered 1, then go to Section E: "Government";
If respondent answered 2, then go to Section D: "Business/Industry";
If respondent answered 3 or 6, then go to Section F: "Education";
If respondent answered 4 or 5, then go to Section G: "Nonprofit";
If respondent answered 7, then go to Section H: "Entrepreneur/Self-Employed"]

Section D: Your Current Position

[Programming note: Respondents sent here if question C13=2 only]

D1. Please select the sector below which most closely aligns with your area of professional concentration.

Goods-Producing/Manufacturing

☐ 1 Agriculture, forestry, fishing and hunting
☐ 1 Mining
☐ 1 Construction
☐ 1 Food, beverage, and tobacco products
☐ 1 Textiles and apparel
☐ 1 Wood products, paper products, printing
☐ 1 Energy/Fuels
☐ 1 Chemical products (basic/specialty; polymers/plastics; consumer products)
☐ 1 Pharmaceutical
☐ 1 Biotechnological products
☐ 1 Mineral and metals products
☐ 1 Computer and electronic products
☐ 1 Electrical equipment, appliance, and components
☐ 1 Transportation
☐ 1 Other manufacturing

Service-Providing

☐ 1 Information, communications, media services
☐ 1 Finance and banking services
☐ 1 Professional, scientific, and business services
☐ 1 Education services
☐ 1 Health and healthcare-related services
☐ 1 Leisure and hospitality services
☐ 1 Public administration
☐ 1 Other services

D2. Did your employer come into being as a new business within the past 5 years?

☐ 1 Yes

☐ 2 No

D3. What is your job title?

[TEXTBOX]

D4. What is the name of the company for which you work?

[TEXTBOX]

D5. Which of the following best describes your position?

☐ 1 First line Supervisor, Administrator, Manager (e.g. Director, Department/Division head)

☐ 2 Individual Contributor/Program or Project Leader (e.g., Researcher, Scientist, Fellow)

☐ 3 Other- (please specify) _____

D6. Do you regularly engage in any of the following activities as part of your current job? (*Check all that apply)*

☐ 1 Direct or participate in developing and/or implementing the vision and strategic direction of the organization

☐ 1 Play a significant role in the development, implementation, and execution of policies, procedures, and standards

☐ 1 Develop or direct the technical or scientific agenda of the organization

☐ 1 Delegate responsibilities and assignments

☐ 1 Develop and oversee budget and/or profit and loss statements

☐ 1 None of the above

D7. In the left column, please indicate which of the following (if any) you regularly engage in as part of your current job.

In the right column, please indicate how well your graduate program at [Institution Name] prepared you for each area.

Regularly engage in			How well your graduate program prepared you		
Yes	**No**		**Not Well**	**Well**	**Very Well**
☐1	☐2	Publish research/technical findings/reports	☐1	☐2	☐3
☐1	☐2	Balance the demands of multiple projects	☐1	☐2	☐3
☐1	☐2	Develop my own technical or scientific agenda	☐1	☐2	☐3
☐1	☐2	Work and network with scientists/technologists in other disciplines	☐1	☐2	☐3
☐1	☐2	Work as part of a team	☐1	☐2	☐3
☐1	☐2	Explain my work/research to scientists/technologists in other disciplines	☐1	☐2	☐3
☐1	☐2	Present my or my organization's research/work to non-technical audiences	☐1	☐2	☐3
☐1	☐2	Be informed of research in other countries	☐1	☐2	☐3
☐1	☐2	Serve as a mentor	☐1	☐2	☐3
☐1	☐2	Lead projects or programs	☐1	☐2	☐3
☐1	☐2	Develop and or commercialize a service or product	☐1	☐2	☐3

D8. In your current position, have you done any of the following? (*Check all that apply*)

☐1 Applied or been recruited for a position outside the United States
☐1 Attended professional conferences outside the US
☐1 Worked as part of a team with colleagues located in other countries
☐1 Searched or used international databases or citations
☐1 Studied a foreign language for career-related reasons
☐1 Worked abroad
☐1 Traveled to other countries for your work
☐1 None of the above

[Programming note: Go to Section I "Function"]

Section E: Your Current Position

[Programming note: Respondents sent here if question C13=1 only]

E1. By which of the following are you employed? (*Check only one)*

- ☐ 1 U.S. federal government – legislative branch
- ☐ 2 U.S. federal government department or agency (not lab)
- ☐ 3 U.S. federal government laboratory (any department or agency)
- ☐ 5 U.S. state government
- ☐ 6 U.S. local government
- ☐ 7 Foreign government
- ☐ 8 Other_____

E2. For which specific agency/department/lab etc. do you work?

[TEXTBOX]

E3. What is your job title?

[TEXTBOX]

E4. Which of the following best describes your position?

- ☐ 1 First line Supervisor, Administrator, Manager (e.g. Director, Department/Division head)
- ☐ 2 Individual Contributor/Program or Project Leader (e.g., Researcher, Scientist, Fellow)
- ☐ 3 Other- (please specify)_____

E5. Do you regularly engage in any of the following activities as part of your current job? (*Check all that apply)*

☐1 Direct or participate in developing and/or implementing the vision and strategic direction of the organization

☐1 Play a significant role in the development, implementation, and execution of policies, procedures, and standards

☐1 Develop or direct the technical or scientific agenda of the organization

☐1 Delegate responsibilities and assignments

☐1 Develop and oversee budget and/or profit and loss statements

☐1 None of the above

E6. In the left column, please indicate which of the following (if any) you regularly engage in as part of your current job.

In the right column, please indicate how well your graduate program at [Institution Name] prepared you for each area.

Regularly engage in			How well your graduate program prepared you		
Yes	**No**		**Not Well**	**Well**	**Very Well**
☐1	☐2	Publish research/technical findings/reports	☐1	☐2	☐3
☐1	☐2	Balance the demands of multiple projects	☐1	☐2	☐3
☐1	☐2	Develop my own technical or scientific agenda	☐1	☐2	☐3
☐1	☐2	Work and network with scientists/technologists in other disciplines	☐1	☐2	☐3
☐1	☐2	Work as part of a team	☐1	☐2	☐3
☐1	☐2	Explain my work/research to scientists/technologists in other disciplines	☐1	☐2	☐3
☐1	☐2	Present my or my organization's research/work to non-technical audiences	☐1	☐2	☐3
☐1	☐2	Be informed of research in other countries	☐1	☐2	☐3
☐1	☐2	Obtain funding for research/project work	☐1	☐2	☐3
☐1	☐2	Serve as a mentor	☐1	☐2	☐3
☐1	☐2	Lead projects or programs	☐1	☐2	☐3
☐1	☐2	Develop and or commercialize a service or product	☐1	☐2	☐3

E7. In your current position, have you done any of the following? (*Check all that apply*)

☐ 1 Applied or been recruited for a position outside the United States
☐ 1 Attended professional conferences outside the US
☐ 1 Worked as part of a team with colleagues located in other countries
☐ 1 Searched or used international databases or citations
☐ 1 Studied a foreign language for career-related reasons
☐ 1 Worked abroad
☐ 1 Traveled to other countries for your work
☐ 1 None of the above

[Programming note: Go to Section I "Function"]

Section F: Your Current Position

[Programming note: Respondents sent here if question C13=3 or 6 only]

F1. By which of the following are you employed? *(Check only one)*

☐1 U.S. PhD granting institution

☐2 U.S. non-PhD granting institution

☐3 U.S. junior or community college or technical institute

☐4 Preschool, elementary, or secondary school in the U.S.

☐5 Foreign educational institution

☐6 Other, Please Specify_____

[Programming note: Create variable called HigherEd from question F1 as follows: If F1=1,2,3 then HigherEd=Yes. If F1=4,5,6 then HigherEd=No. This HigherEd variable will drive skip patterns throughout the rest of this survey.)
If HigherEd=Yes continue to question F2;
If F1=4 then skip to question F5;
If F1= 5 or 6, then skip to question F6]

[Programming note: If HigherEd=Yes only]

F2. Which of the following best describes your position? (C*heck only one*)

☐1 Faculty

☐2 Postdoctoral fellow or associate

☐3 Other university staff

☐4 Other- (please specify) _____

[Programming note: Continue to question F3]

[Programming note: If HigherEd=Yes only]

F3. What is your faculty rank? *(Check only one)*

☐1 Professor
☐2 Associate Professor
☐3 Assistant Professor
☐4 Instructor/Lecturer
☐5 Adjunct Professor
☐6 Not applicable: no ranks designated in my organization or for my position
☐7 Other, specify: _____

[Programming note: Continue to question F4]

[Programming note: If HigherEd=Yes only]

F4. What is your tenure status? *(Check only one)*

☐1 Tenured
☐2 On tenure track but not tenured
☐3 Not on tenure track
☐4 Not applicable: no tenure system at this organization
☐5 Not applicable: no tenure system for my position

[Programming note: Skip to question F7]

[Programming note: If question F1=4 only]

F5. Which of the following best describes your position? (C*heck only one*)

☐1 Teacher
☐2 School administrator
☐3 District administrator
☐4 Curriculum specialist
☐5 Professional development specialist/provider
☐6 Evaluator
☐7 Other- (please specify) _____

[Programming note: Skip to question F7]

[Programming note: If question F1=5 or 6]

F6. What is your job title?

[TEXTBOX]

F7. What is the name of the school/institution/organization for which you work?

[TEXTBOX]

[Programming note: If HigherEd=Yes only]

F8. What is the name of the department(s) or academic unit(s) for which you work?

[TEXTBOX]

F9. Have you engaged in any of the following activities as part of your current job? (*Check all that apply)*

- ☐ 1 Participate in developing and/or implementing the vision and strategic direction of the institution
- ☐ 1 Develop or direct the technical or scientific agenda of a center
- ☐ 1 Play a significant role in the development, implementation, and execution of policies, procedures, and standards in your department
- ☐ 1 Participate in revising or developing curricula
- ☐ 1 Develop new degree programs
- ☐ 1 None of the above

F10. In the left column, please indicate which of the following (if any) you regularly engage in as part of your current job.

In the right column, please indicate how well your graduate program at [Institution Name] prepared you for each area.

Job responsibilities			How well your graduate program prepared you		
Yes	**No**		**Not Well**	**Well**	**Very Well**
☐1	☐2	Publish research/technical findings/reports	☐1	☐2	☐3
☐1	☐2	Balance the demands of multiple projects	☐1	☐2	☐3
☐1	☐2	Develop my own technical or scientific agenda	☐1	☐2	☐3
☐1	☐2	Work and network with scientists/technologists in other disciplines	☐1	☐2	☐3
☐1	☐2	Work as part of a team	☐1	☐2	☐3
☐1	☐2	Explain my work/research to scientists/technologists in other disciplines	☐1	☐2	☐3
☐1	☐2	Present my or my organization's research/work to non-technical audiences	☐1	☐2	☐3
☐1	☐2	Be informed of research in other countries	☐1	☐2	☐3
☐1	☐2	Obtain funding for research/project work	☐1	☐2	☐3
☐1	☐2	Serve as a mentor	☐1	☐2	☐3
☐1	☐2	Lead projects or programs	☐1	☐2	☐3
☐1	☐2	Develop and or commercialize a service or product	☐1	☐2	☐3

F11. In your current position, have you done any of the following? (*Check all that apply)*

☐1 Applied or been recruited for a position outside the United States

☐1 Attended professional conferences outside the US

☐1 Worked as part of a team with colleagues located in other countries

☐1 Searched or used international databases or citations

☐1 Studied a foreign language for career-related reasons

☐1 Worked abroad

☐1 Traveled to other countries for your work

☐1 None of the above

[Programming note: Go to Section I "Function"]

[Programming note: Respondents sent here if question C13=4 or 5 only]

Section G: Your Current Position

G1. By which of the following are you employed? *(Check only one)*

☐1 Private foundation
☐2 Professional association
☐3 Nongovernmental organization (NGO)
☐4 Nongovernmental research lab or institution
☐5 Consulting organization
☐6 Other, specify_____

G2. Did your employer come into being as a new business within the past 5 years?

☐1 Yes
☐2 No

G3. What is your job title?

[TEXTBOX]

G4. What is the name of the organization for which you work?

[TEXTBOX]

G5. Which of the following best describes the nature of your position?

☐1 First line Supervisor, Administrator, Manager (e.g. Director, Department/Division head)
☐2 Individual Contributor/Program or Project Leader (e.g., Researcher, Scientist, Fellow)
☐3 Other- (please specify)_____

G6. Do you regularly engage in any of the following activities as part of your current job? (*Check all that apply)*

☐1 Direct or participate in developing and/or implementing the vision and strategic direction of the organization

☐1 Play a significant role in the development, implementation, and execution of policies, procedures, and standards

☐1 Develop or direct the technical or scientific agenda of the organization

☐1 Delegate responsibilities and assignments

☐1 Develop and oversee budget and/or profit and loss statements

☐1 None of the above

G7. In the left column, please indicate which of the following (if any) you regularly engage in as part of your current job.

In the right column, please indicate how well your graduate program at [Institution Name] prepared you for each area.

Required to do in current position			How well your graduate program prepared you		
Yes	**No**		**Not Well**	**Well**	**Very Well**
☐1	☐2	Publish research/technical findings/reports	☐1	☐2	☐3
☐1	☐2	Balance the demands of multiple projects	☐1	☐2	☐3
☐1	☐2	Develop my own technical or scientific agenda	☐1	☐2	☐3
☐1	☐2	Work and network with scientists/technologists in other disciplines	☐1	☐2	☐3
☐1	☐2	Work as part of a team	☐1	☐2	☐3
☐1	☐2	Explain my work/research to scientists/technologists in other disciplines	☐1	☐2	☐3
☐1	☐2	Present my or my organization's research/work to non-technical audiences	☐1	☐2	☐3
☐1	☐2	Be informed of research in other countries	☐1	☐2	☐3
☐1	☐2	Obtain funding for research/project work	☐1	☐2	☐3
☐1	☐2	Serve as a mentor	☐1	☐2	☐3
☐1	☐2	Lead projects or programs	☐1	☐2	☐3
☐1	☐2	Develop and or commercialize a service or product	☐1	☐2	☐3

G8. In your current position, have you done any of the following? (*Check all that apply*)

☐ 1 Applied or been recruited for a position outside the United States

☐ 1 Attended professional conferences outside the US

☐ 1 Worked as part of a team with colleagues located in other countries

☐ 1 Searched or used international databases or citations

☐ 1 Studied a foreign language for career-related reasons

☐ 1 Worked abroad

☐ 1 Traveled to other countries for your work

☐ 1 None of the above

[Programming note: Go to Section I "Function"]

Section H: Your Current Position

[Programming note: Respondents sent here if question C13= 7 only]

H1. How would you best characterize your business? (*Please check the one which best applies*)

☐$_1$ Service provider

☐$_2$ Product provider

☐$_3$ Other (please specify)_____

H2. To which of the following industrial sectors do you provide your products/services? *(Check all that apply)*

Goods-Producing/Manufacturing

☐$_1$ Agriculture, forestry, fishing and hunting
☐$_1$ Mining
☐$_1$ Construction
☐$_1$ Food, beverage, and tobacco products
☐$_1$ Textiles and apparel
☐$_1$ Wood products, paper products, printing
☐$_1$ Energy/Fuels
☐$_1$ Chemical products (basic/specialty; polymers/plastics; consumer products)
☐$_1$ Pharmaceutical
☐$_1$ Biotechnological products
☐$_1$ Mineral and metals products
☐$_1$ Computer and electronic products
☐$_1$ Electrical equipment, appliance, and components
☐$_1$ Transportation
☐$_1$ Other manufacturing

Service-Providing

☐$_1$ Information, communications, media services
☐$_1$ Finance and banking services
☐$_1$ Professional, scientific, and business services
☐$_1$ Education services
☐$_1$ Health and healthcare-related services
☐$_1$ Leisure and hospitality services
☐$_1$ Public administration
☐$_1$ Other services

H3. Did your company come into being as a new business within the past 5 years?

☐$_1$ Yes
☐$_2$ No

H4. How is your business funded? (*Check all that apply*)

☐$_1$ Self-funded
☐$_1$ Seeking external funding
☐$_1$ Have external funding (describe from where: ____)
☐$_1$ Other

H5. How many individuals do you employ including yourself? _____

H6. Is your business based on proprietary intellectual property?

☐$_1$ Yes
☐$_2$ No

[Programming note: If respondent answered 1 then continue to question H7, else skip to question H8]

[Programming note: If question H6=1 only]

H7. Please describe where your business intellectual property is from:

☐$_1$ Self-developed
☐$_2$ Self-developed, licensed from another source
☐$_3$ Not self-developed, licensed from another source
☐$_4$ Other-(please specify)_____

H8. What is the name of your company or business?

[TEXTBOX]

H9. What is your job title?

[TEXTBOX]

H10. Which of the following best describes the nature of your position? (*Check only one)*

☐ 1 Top level executive (e.g. President, CEO, VP)

☐ 2 First line Supervisor, Administrator, Manager (e.g. Director, Department/Division head)

☐ 3 Individual Contributor/Program or Project Leader (e.g., Researcher, Scientist, Fellow)

☐ 4 Other- (please specify):_____

H11. Do you regularly engage in any of the following activities as part of your current job? (*Check all that apply)*

☐ 1 Direct or participate in developing and/or implementing the vision and strategic direction of the organization

☐ 1 Play a significant role in the development, implementation, and execution of policies, procedures, and standards

☐ 1 Develop or direct the technical or scientific agenda of the organization

☐ 1 Delegate responsibilities and assignments

☐ 1 Develop and oversee budget and/or profit and loss statements

☐ 1 None of the above

H12. In the left column, please indicate which of the following (if any) you regularly engage in as part of your current job.

In the right column, please indicate how well your graduate program at [Institution Name] prepared you for each area.

Required to do in current position			How well your graduate program prepared you		
Yes	**No**		**Not Well**	**Well**	**Very Well**
☐1	☐2	Publish research/technical findings/reports	☐1	☐2	☐3
☐1	☐2	Balance the demands of multiple projects	☐1	☐2	☐3
☐1	☐2	Develop my own technical or scientific agenda	☐1	☐2	☐3
☐1	☐2	Work and network with scientists/technologists in other disciplines	☐1	☐2	☐3
☐1	☐2	Work as part of a team	☐1	☐2	☐3
☐1	☐2	Explain my work/research to scientists/technologists in other disciplines	☐1	☐2	☐3
☐1	☐2	Present my or my organization's research/work to non-technical audiences	☐1	☐2	☐3
☐1	☐2	Be informed of research in other countries	☐1	☐2	☐3
☐1	☐2	Obtain funding for research/project work	☐1	☐2	☐3
☐1	☐2	Serve as a mentor	☐1	☐2	☐3
☐1	☐2	Lead projects or programs	☐1	☐2	☐3
☐1	☐2	Develop and or commercialize a service or product	☐1	☐2	☐3

H13. In your current position, have you done any of the following? (*Check all that apply)*

☐1 Applied or been recruited for a position outside the United States

☐1 Attended professional conferences outside the US

☐1 Worked as part of a team with colleagues located in other countries

☐1 Searched or used international databases or citations

☐1 Studied a foreign language for career-related reasons

☐1 Worked abroad

☐1 Traveled to other countries for your work

☐1 None of the above

[Programming note: Go to Section I "Function"]

Section I: Your Current Work Responsibilities

Thank you. Next, we would like you to learn a little more about the nature of your work.

I1. From the list of disciplines below, please select those you use in your current work.

If your work is centered in an interdisciplinary area, please mark all of the disciplines upon which you draw. For example, if you work in Bioinformatics, you might select Mathematics, Computer and Information Sciences, Biological Sciences, and Chemistry.

Put your mouse over the academic disciplines to see the sub-fields included in each discipline.

- ☐$_1$ **Agricultural Sciences/Natural Resources**
- ☐$_1$ **Astronomy**
- ☐$_1$ **Atmospheric Science and Meteorology**
- ☐$_1$ **Biological/Biomedical Sciences**
- ☐$_1$ **Chemistry**
- ☐$_1$ **Communications**
- ☐$_1$ **Computer and Information Sciences**
- ☐$_1$ **Education**
- ☐$_1$ **Engineering**
- ☐$_1$ **Geological and Earth Sciences**
- ☐$_1$ **Health Sciences**
- ☐$_1$ **Humanities**
- ☐$_1$ **Mathematics**
- ☐$_1$ **Ocean/ Marine Sciences**
- ☐$_1$ **Physics**
- ☐$_1$ **Professional Fields/Business Management/Administration**
- ☐$_1$ **Psychology**
- ☐$_1$ **Social Sciences**
- ☐$_1$ **Other**

[Programming note: Format is same as question B9 and B10. For each response item checked above, respondent will receive a follow up question with sub-disciplines. See APPENDIX for sub questions]

I2. Please indicate your primary and, if applicable, secondary work responsibilities.

Primary		Secondary, if applicable
☐1	Research, Development and/or Technology	☐1
☐2	Manufacturing	☐2
☐3	Technical Services or Technical Support	☐3
☐4	Education: Training, Teaching	☐4
☐5	Administration, Management	☐5
☐6	Media/Journalism (e.g., science writing, technical writing/editing)	☐6
☐7	Policy, Advocacy, and/or Lobbying	☐7
☐8	Other – Specify_____	☐8

[Programming note:
If respondent answered 1, 2, or 3 in either Primary or Secondary column then go to Section J: "Research";
If respondent answered 4 in either Primary or Secondary column, then go to Section K: "Teaching/Training";
If respondent answered 5 in either Primary or Secondary column, then go to Section L: "Administration/Management";
If respondent only answered 6, 7, or 8 and did not choose any other response, then go to Section M: "Other"]

Section J: Your Current Work Responsibilities

[Programming note: Respondents sent to this section J "Research/Technology" if question "I-2"=1, 2, or 3 only]

J1. Which of the following characterize(s) the type of research or development that you do? (*Check all that apply*)

☐1 Basic research – study directed toward gaining scientific knowledge primarily for its own sake

☐1 Applied research –study directed toward gaining scientific knowledge to meet a recognized need

☐1 Development – using knowledge gained from research for the production of materials, devices, and products

☐1 Design of equipment, processes, structures, models

☐1 Computer applications, programming, systems development

☐1 Production, operations, manufacturing, maintenance (e.g., chip production, operating lab equipment)

☐1 Technology services/technological support

☐1 Other, specify _____

J2. Do you currently collaborate with individuals from disciplinary backgrounds other than your own?

☐1 Yes

☐2 No

J3. How would you best describe the disciplinary focus of your work?

I most often work on scientific/technical projects that…(Check only one)

☐1 are centered in a single discipline

☐2 require the integration of two or more disciplines

J4. Are there scientists/technologists in other countries doing work that is relevant to your current research?

☐$_1$ Yes
☐$_2$ No
☐$_3$ I don't know

[Programming note: From here…
If respondent answered 4 in either column on question "I-2", then go to Section K: "Teaching/Training";
If respondent answered 5 in either column on question "I-2", then go to Section L: "Administration/Management";
If respondent only answered 6, 7 or 8 on question "I-2"and did not choose any other response, then go to Section M: "Other";
Else, go to Section O: "Reflections on your IGERT training]

Section K: Your Current Work Responsibilities

[Programming note: Respondents sent here if question "I-2"= 4 only]

Please answer a few additional questions about your work responsibilities related to teaching/training.

K1. How would you best describe the content of the courses, seminars, or workshops you teach or the training activities you conduct? (*Check all that apply*)

I most often teach content that…

☐$_1$ is centered in a single discipline

☐$_2$ requires the integration of two or more disciplines

[Programming note: If HigherEd=Yes, skip to question K4; Else continue to question K2]

K2. Do you currently lead or co-lead teaching or training sessions for your employer or related to your job?

☐$_1$ Yes

☐$_2$ No

K3. Do you currently develop or co-develop interdisciplinary teaching or training materials for your employer or related to your job?

☐$_1$ Yes

☐$_2$ No

[Programming note: If IGERT respondent, skip to question K6; If non-IGERT respondent, skip to question K7]

[Programming note: For HigherEd=Yes only]

K4. Do you currently provide instruction to undergraduate or graduate students, including teaching, preparing courses, and/or advising or supervising students?

☐$_1$ Yes

☐$_2$ No

[Programming note: If K4=Yes then continue to K5; else if IGERT respondent, skip to question K6; else if non IGERT respondent, skip to question K7]

[Programming note: For Higher Ed=Yes only]

K5. In the past year, have you engaged in any of the following activities related to undergraduate or graduate education? (*Check all that apply)*

☐ 1 Team taught a course with colleague(s) from another discipline

☐ 1 Supervised an interdisciplinary undergraduate or graduate level research project

☐ 1 Had an undergraduate or graduate student from another department work on your research projects

☐ 1 Discussed the international nature of the scientific enterprise in a course

☐ 1 Helped develop a new interdisciplinary course

☐ 1 Helped develop a new interdisciplinary undergraduate or graduate program of study

☐ 1 Served on the dissertation committee of a graduate student from another department or discipline.

☐ 1 None of the above

***[Programming note: From here…**
If respondent answered 5 in either column on question "I-2", then go to Section L: "Administration/Management";
If respondent only answered 6, 7 or 8 on question "I-2"and did not choose any other response, then go to Section M: "Other";
Else, go to Section O: "Reflections on your IGERT training]

Section L: Your Current Work Responsibilities

[Programming note: Respondents sent here if either response to question "I-2"= 5]

Please answer a few additional questions about your work responsibilities related to administration/management.

L1. How would you best describe the content of the work you currently oversee? (*Check only one)*

I primarily oversee work that…

☐1 is centered in a single discipline

☐2 requires the integration of two or more disciplines

L2. What is the primary function of the group/organization that you manage or supervise? (*Please check one)*

☐1 Research and/or Development

☐2 Manufacturing/Production

☐3 Quality Control

☐4 Safety/Environment/Health

☐5 Professional services (e.g. health care, counseling.)

☐6 Teaching/Training

☐7 Business/Marketing/Development

☐8 Other_____

L3. Please select the status of the personnel whom you manage or supervise (*Check only one)*

☐1 Primarily professional

☐2 Some professional and some non-professional

☐3 Primarily non-professional

☐4 Unionized workers

☐5 Other_____

[Programming note: If respondent answered 6, 7 or 8 on question "I-2"and did not choose any other response, then go to Section M: "Other";
Everyone else, go to Section O: "Reflections on your IGERT training]

Section M: Your Current Work Responsibilities

[Programming note: Respondents sent here if question "I-2"=6, 7 or 8 only]

Please answer a few additional questions about your work responsibilities.

[Programming note: If question I-2 = 8 only]

M1. Which of the following best describes your primary and, if applicable, secondary work responsibilities? (Check one)

Primary		Secondary, if applicable
☐1	IT Services	☐1
☐2	Financial Services	☐2
☐3	Consulting Services On what do you provide consulting services:_____	☐3
☐4	Marketing/Business Development	☐4
☐5	Medical Services	☐5
☐6	Legal Services	☐6
☐7	Counseling Services	☐7
☐8	Quality Control	☐8
☐9	Environmental/Safety/Health	☐9
☐10	Intellectual Property: Patent review/examination; technology transfer; external relations	☐10
☐11	Other, specify_____	☐11

[Programming note: Skip to question M4]

[Programming note: If question I-2 = 7 only]

M2. Which of the following characterizes the policy area(s) that relate to your work? (Check all that apply)

- ☐1 Communications & Information
- ☐1 Domestic
- ☐1 Economic/Monetary
- ☐1 Education
- ☐1 Energy
- ☐1 Environmental
- ☐1 Foreign
- ☐1 Health
- ☐1 Housing
- ☐1 Intellectual Property/Intangible Assets
- ☐1 Labor/Workforce Development
- ☐1 National defense
- ☐1 Population
- ☐1 Social
- ☐1 Transportation
- ☐1 Urban Planning
- ☐1 Water
- ☐1 Welfare
- ☐1 Other, please specify_____

[Programming note: Skip to question M4]

[Programming note: If question I-2 = 6 only]

M3. Which of the following characterizes the type of media/journalism work that you do? (Check all that apply)

- ☐1 Science writing
- ☐1 Technical writing and/or editing
- ☐1 Medical writing
- ☐1 Marketing
- ☐1 Science public information office
- ☐1 Other, please specify_____

M4. Do you currently collaborate with individuals from disciplinary backgrounds other than your own in your current work?

☐ 1 Yes

☐ 2 No

M5. Are there individuals in other countries doing work that is relevant to your current job?

☐ 1 Yes

☐ 2 No

☐ 3 I don't know

M6. How would you describe the disciplinary focus of your job?

The work related to my job is primarily… (Check only one)

☐ 1 centered in a single discipline

☐ 2 requires the integration of two or more disciplines

M7. Please describe your primary roles and responsibilities.

[TEXTBOX]

[Programming note: Everyone go to section O: "Reflections on your IGERT training"]

Section N: Your Employment Status

[Programming note: Respondents sent here if question C3=4 or if question B7=2 only]

In this section we would like to ask you a few questions about your current work status.

[Programming note: If question B7=2, skip to question N2]

[Programming note: If question C3=4 only]

N1. What are your reasons for not working? (*Check all that apply*)

☐$_1$ Seeking employment
☐$_1$ Student
☐$_1$ Family responsibilities
☐$_1$ Suitable job not available
☐$_1$ Do not need or want to work
☐$_1$ Other, please specify:_____

N2. Have you been employed since leaving [Institution Name]?

☐$_1$ Yes
☐$_2$ No

[Programming note: Institution Name should be filled into question stem from sample file.]
[Programming note: If respondent answered 1 then continue to question N3;
Else, skip to question O3 for IGERT respondents and question O6 for non-IGERT respondents in the Section O: "Reflections on Your IGERT/Graduate Training"]

[Programming note: If question N2=1]

N3. After leaving graduate school, which of the following employment sectors did you consider for your first position in the workforce (including postdoctoral positions)?

In the left hand column, *check all that apply*, and in the right hand column, *check which <u>one sector</u> you most desired*.

All that you considered *(Check all that apply)*		**Most desired** *(Choose one)*
☐1	Government (including government research labs)	☐1
☐1	Industry/Business	☐2
☐1	College or university	☐3
☐1	Non-government lab, research institution, or think tank	☐4
☐1	Other nonprofit organization or private foundation	☐5
☐1	K-12 school	☐6
☐1	Entrepreneur/Self-employed	☐7

N4. In which of the following sectors did you work? (*Check all that apply*)

☐1 Government (including government laboratories)

☐1 Industry/Business

☐1 College or university

☐1 Non-government lab, research institution, or think tank

☐1 Other nonprofit organization or private foundation

☐1 K-12 school

☐1 Entrepreneur/Self-employed

N5. Which of the following factors were most important to you in choosing your prior position in the workforce? (*Please select up to three responses from the list below)*

Cchoose up to three:	
☐1	Salary/Benefits
☐1	Job security
☐1	Opportunities for advancement
☐1	Intellectual challenge
☐1	Level of responsibility
☐1	Degree of independence
☐1	The opportunity to create new knowledge/make decisions
☐1	The opportunity to contribute to society
☐1	The opportunity to follow my passion
☐1	The opportunity to learn new skills
☐1	Other_____
	[Source: SDR C10– modified]

N5A. On the following scale of 1 to 5, how difficult was it to obtain your first paid position in the workforce (including postdoctoral positions) after leaving or graduating from [Institution Name]?

☐1 1 **(**Not difficult at all)

☐2 2 (A little difficult)

☐3 3 (Moderately difficult)

☐4 4 (Difficult)

☐5 5 (Very difficult)

N6. To what extent do you agree with the following statement?

In my opinion, my graduate preparation gave me a competitive edge when applying for positions in the workforce.

☐1 Disagree

☐2 Somewhat disagree

☐3 Somewhat agree

☐4 Agree

☐5 I don't know

N7. Regardless of which career options you decided to pursue, how prepared do you think you were for the following types of jobs when you graduated from [Institution Name]? ***(Check one response in each row)***

I felt prepared for the following types of jobs…	Disagree	Somewhat disagree	Somewhat agree	Agree	I don't know
Faculty member at a university with teaching and research responsibilities	☐1	☐2	☐3	☐4	☐5
Faculty member at a university with only research responsibilities	☐1	☐2	☐3	☐4	☐5
Researcher at a government lab or research institution	☐1	☐2	☐3	☐4	☐5
Research/developer in industry/business	☐1	☐2	☐3	☐4	☐5
Non-research policy or planning position in government or nonprofit	☐1	☐2	☐3	☐4	☐5

[Programming note:
If IGERT respondent, continue to question N9;
If non IGERT respondent go to question O4 in section O: "Reflections on your graduate training"]

[Programming note: For IGERT only]

N8. On the following scale of 1 to 5, to what extent did your IGERT experience contribute to your ability to obtain a position in the workforce?

Not at all 1…	A little …2…	To some extent …3…	Quite a bit …4…	A great deal …5…
☐1	☐2	☐3	☐4	☐5

Programming note: IGERT only]

N9. Did any of the following elements of your IGERT experience contribute to your ability to obtain a position in the workforce? Check all that apply.

☐1 Exposure to multi/interdisciplinary research
☐1 Research training
☐1 Access to cutting-edge tools & equipment
☐1 Freedom to explore my research interests in more depth
☐1 Networking opportunities with IGERT faculty members
☐1 Career guidance from IGERT faculty members
☐1 Networking opportunities outside my home institution
☐1 Exposure to nonacademic job opportunities
☐1 Connections made through IGERT-related internships
☐1 Opportunities to present my work to other IGERT students
☐1 Opportunities to present my work at professional conferences
☐1 Other: _____
☐1 None of the above

[Programming note: IGERT only]

N10. Please briefly elaborate, if desired, on the role (positive and/or negative) your IGERT experience played in obtaining a position in the workforce and why.

[TEXTBOX]

[Programming note: Go to section O: "Reflections on your IGERT training" question O3]

Section O: Reflections on Your Graduate Training

The next three questions ask you to reflect back on your graduate training.

[If IGERT respondent then continue; if Non-IGERT respondent skip to question O4.]

O1. Given your current job responsibilities, what was the single greatest contribution of your IGERT-related graduate education? (If none, write none.)

[TEXTBOX]

O2. Given your current job responsibilities, what was the single greatest deficit in your IGERT-related graduate education? (If none, write none.)

[TEXTBOX]

O3. Would you recommend your IGERT-related graduate program to prospective graduate students interested in pursuing a career similar to your own?

☐$_1$ Yes

☐$_2$ No

[Programming note: Go to Section P: Background and Demographic Information"]

[Programming note: For NON IGERT Comparison Respondents]

O4. Given your current job responsibilities, what was the single greatest contribution of your graduate education? (If none, write none.)

[TEXTBOX]

[Programming note: For NON IGERT Comparison Respondents]

O5. Given your current job responsibilities, what was the single greatest deficit in your graduate education? (If none, write none.)

[TEXTBOX]

[Programming note: For NON IGERT Comparison Respondents]

O6. Would you recommend your graduate program to prospective graduate students interested in pursuing a career similar to your own?

☐$_1$ Yes

☐$_2$ No

[Programming note: For NON IGERT Comparison Respondents]

O7. To your knowledge, did you ever receive funding as a graduate student under the National Science Foundation's Integrative Graduate Education and Research Traineeships (IGERT) Program?

☐$_1$ Yes

☐$_2$ No

[Programming note: Go to section P: "Background and Demographic Information"]

Section P: Questions About Your Background—

Providing data on race, ethnicity, gender and disability status is entirely voluntary. Providing this information, however, is helpful to this study.
{This information will only be asked of IGERT trainees if missing from the IGERT Distance Monitoring System.}

P1. In what month and year did you earn your bachelor's degree? (if you have more than one bachelor's degree, enter date of most recent.)

[month dropdown] / [year dropdown]

The following questions ask about your background. Providing data on race, ethnicity, gender, and disability status is entirely voluntary. Providing this information, however, is very helpful to this study.

P2. What is your ethnicity? (C*heck only one)*

☐$_1$ Hispanic or Latino

☐$_2$ Not Hispanic or Latino

☐$_3$ I choose not to report this information

P3. What is your race? *(Check all that apply)*

☐$_1$ American Indian or Alaska Native, specify tribal affiliation(s)_____

☐$_1$ Asian

☐$_1$ Black or African American

☐$_1$ Native Hawaiian or Other Pacific Islander

☐$_1$ White

☐$_1$ I choose not to report this information

P4. What is your gender? (*Check only one*)

☐$_1$ Male

☐$_2$ Female

☐$_3$ I choose not to report this information

Programming note: This question is required for NON IGERT comparison respondents]

P5. What is your citizenship status? *(Check only one)*

US Citizen

☐$_1$ Since birth

☐$_2$ Naturalized

Non-US Citizen

☐$_3$ With a Permanent U.S. Resident Visa ("Green Card")

☐$_4$ With a Temporary U.S. Visa

P6. Has anyone in your immediate family earned a Ph.D. degree in a Science, Technology, Engineering, or Mathematics field? (*Check all that apply)*

☐$_1$ Any parent or guardian

☐$_1$ Any sibling

☐$_1$Spouse/Partner

☐$_1$ Other, specify:_____

☐$_1$ None of the above

[Programming note: For IGERT who are Employed in the Research sector only—This question is OPTIONAL]

P7. In a few brief sentences, please describe how you would explain to someone who is not an expert in your field the scientific or technical problem on which you are currently working, highlighting the importance of the question and /or any innovative methodologies you are using.

[TEXTBOX]

P8. If there is anything else about your graduate training or current career path that you would like us to know, please use the textbox below.

[TEXTBOX]

[Programming note: End of survey, show "Thank You" note below]

Thank you for taking the time to respond to this survey. Your responses will help the National Science Foundation plan support for graduate education in the future.

Disciplinary Sub-Questions

Survey should be programmed so that questions B10, B11, and I1 have one or more follow up questions that appear based on the discipline(s) the respondents check in each question. The follow up question stem is different for each of the three questions.

The "Field Name" should be filled into each question stem.

- Any follow up questions for B10 should have the following question stem:

  Which [Field Name] discipline(s) did you use for your dissertation research? (check all that apply)

  Response choices are the sub-fields (that correspond with the Field Names) listed in the table below.

- Any follow up questions for B11 should have the following question stem:

  Which [Field Name] discipline(s) are most closely aligned to what you studied during your graduate education? (check all that apply)

  Response choices are the sub-fields (that correspond with the Field Names) listed in the table below.

- Any follow up questions for I1 should have the following question stem:

  Which [Field Name] discipline(s) do you use in your current work? (check all that apply)

Response choices are the sub-fields (that correspond with the Field Names) listed in the table below.

Field Names	Sub-Fields
Agricultural Sciences/ Natural Resources	Agricultural Economics Agriculture Business & Mgmt. Agricultural Animal Breeding Animal Nutrition Dairy Science Animal Science, Poultry (or Avian) Animal Science, Other Agronomy and Crop Science Agricultural & Horticultural Plant Breeding Food Science, & Technology, Other Soil Chemistry/Microbiology Soil Sciences, Other Horticulture Science Fishing & Fisheries Sciences/Management Forest Sciences & Biology Forest Engineering Forest/Resources Management Wood Science & Pulp/Paper Technology Natural Resources/Conservation Forestry & Related Sciences, Other Wildlife/Range Management Environmental Sciences Agricultural Sciences, General or Other

Field Names	Sub-Fields
Biological/Biomedical Sciences	Biochemistry Bioinformatics Biomedical Sciences Biophysics Biotechnology Bacteriology Plant Genetics Plant Pathology/Phytopathology Plant Physiology Botany/Plant Biology Anatomy Biometrics & Biostatistics Cell/Cellular Biology & Histology Evolutionary Biology Ecology Developmental Biology/Embryology Endocrinology Entomology Immunology Molecular Biology Microbiology Cancer Biology Neurosciences Nutrition Sciences Parasitology Toxicology Genetics/Genomics, Human & Animal Pathology, Human & Animal Pharmacology Physiology, Human & Animal Zoology Biology/Biomedical Sciences, General or Other
Health Sciences	Speech Language Pathology and Audiology Environmental Health Environmental Toxicology Health Systems/Services Administration Public Health Epidemiology Kinesiology/Exercise Science Nursing Science Medicinal/Pharmaceutical Sciences Rehabilitation/Therapeutic Services Veterinary Sciences Health Sciences, General or Other

Field Names	Sub-Fields
Engineering	Aerospace, Aeronautical & Astronautical Engineering Agricultural Engineering Bioengineering & Biomedical Engineering Ceramic Sciences Engineering Chemical Engineering Civil Engineering Communications Engineering Computer Engineering Electrical, Electronics, & Communications Engineering Engineering Mechanics Engineering Physics Engineering Science Environmental Health Engineering Industrial & Manufacturing Engineering Material Science Engineering Mechanical Engineering Metallurgical Engineering Mining & Mineral Engineering Nuclear Engineering Ocean Engineering Operations Research Petroleum Engineering Polymer & Plastics Engineering Systems Engineering Engineering Management & Administration Engineering, General or Other
Computer & Information Sciences	Computer Science Information Sciences & Systems Computer and Information Science, Other
Mathematics	Applied Mathematics Algebra Analysis & Functional Analysis Geometry/Geometric Analysis Logic Number Theory Statistics Topology/Foundations Computing Theory & Practice Operations Research Mathematics/Statistics, General or Other
Astronomy	Astronomy Astrophysics
Atmospheric Science & Meteorology	Atmospheric Chemistry & Climatology Atmospheric Physics & Dynamics Meteorology Atmospheric Science/Meteorology, General or Other

Field Names	Sub-Fields
Chemistry	Analytical Chemistry Inorganic Chemistry Nuclear Organic Chemistry Medicinal/Pharmaceutical Physical Chemistry Polymer Chemistry Theoretical Chemistry Chemistry, General or Other
Geological & Earth Sciences	Geology Geochemistry Geophysics & Seismology Paleontology Mineralogy & Petrology Stratigraphy & Sedimentation Geomorphology & Glacial Geology Geology & Earth Sciences, General or Other
Physics	Acoustics Atomic/Molecular/Chemical Physics Particle (Elementary Physics) Biophysics Fluids Nuclear Physics Optics/Photonics Plasma/Fusion Physics Polymer Physics Condensed Matter/Low Temperature Physics Applied Physics Physics, General or Other
Ocean/Marine Sciences	Environmental Science Hydrology & Water Resources Oceanography, Chemical & Physical Marine Sciences Ocean/Marine, Other
Psychology	Clinical Psychology Cognitive Psychology & Psycholinguistics Comparative Psychology Counseling Developmental & Child Psychology Human Development & Family Studies Experimental Psychology Educational Psychology Family Psychology Industrial & Organizational Personality Psychology Physiological/Psychobiology Psychology Psychometrics & Quantitative Psychology School Psychology Social Psychology Psychology, General or Other

Field Names	Sub-Fields
Social Sciences	Anthropology Area/Ethnic/Cultural/Gender Studies Criminal Justice & Corrections Criminology Demography/Population Studies Economics Econometrics Geography International Relations/Affairs Linguistics Political Science & Government Public Policy Analysis Sociology Statistics Urban Affairs/Studies Urban/City, Community & Regional Planning Social Sciences, General or Other
Humanities	History Letters Foreign Languages & Literature Music Religion/Religious Studies Drama/Theater Arts Humanities, General or Other
Education	Curriculum & Instruction Educational Administration & Supervision Educational Leadership Educational/Instructional Media Design Educational Statistics/Research Methods Educational Assessment/Testing/Measurement Educational Psychology Social/Philosophical Foundations of Education Special Education Counseling Education/Counseling & Guidance Higher Education/Evaluation & Research Pre-elementary/Early Childhood Teacher Education Elementary Teacher Education Secondary Teacher Education Adult & Continuing Teacher Education Education, Other or General

Field Names	Sub-Fields
Professional Fields/Business Management/Administration	Accounting Finance Banking/Financial Supportive Services Business Administration & Management Business/Managerial Economics International Business/Trade/Commerce Management Information Systems/Business Statistics Marketing Management & Research Human Resources Development Operations Research Organization Behavior Business Management/Administration, General or Other
Communications	Communication Research Mass Communication/Media Studies Film, Radio, TV & Digital Communication Communication Theory Communication, General or Other
Other	Architecture/Environmental Design Home Economics Law Library Science Parks/Sports/Rec./Leisure/Fitness Public Adminstration Social Work Theology/Religious Education Professional Fields, General Other Fields

Examples:

- **For survey question B10, if respondent checks Agricultural Sciences/Natural Resources, he/she should get the following sub-question:**

  Which Agricultural Sciences/Natural Resources discipline(s) did you use for your dissertation research? (check all that apply)

  ☐$_1$ Agricultural Economics
  ☐$_1$ Agriculture Business & Mgmt.
  ☐$_1$ Agricultural Animal Breeding
  ☐$_1$ Animal Nutrition
  ☐$_1$ Dairy Science
  ☐$_1$ Animal Science, Poultry (or Avian)
  ☐$_1$ Animal Science, Other
  ☐$_1$ Agronomy and Crop Science
  ☐$_1$ Agricultural & Horticultural Plant Breeding
  ☐$_1$ Plant Pathology/Phytopathology (also in Bio Sciences)
  ☐$_1$ Plant Sciences, Other
  ☐$_1$ Food Science
  ☐$_1$ Food Science, & Technology, Other
  ☐$_1$ Soil Chemistry/Microbiology
  ☐$_1$ Soil Sciences, Other
  ☐$_1$ Horticulture Science
  ☐$_1$ Fishing & Fisheries Sciences/Management
  ☐$_1$ Forest Sciences & Biology
  ☐$_1$ Forest Engineering
  ☐$_1$ Forest/Resources Management
  ☐$_1$ Wood Science & Pulp/Paper Technology
  ☐$_1$ Natural Resources/Conservation
  ☐$_1$ Forestry & Related Sciences, Other
  ☐$_1$ Wildlife/Range Management
  ☐$_1$ Environmental Sciences
  ☐$_1$ Agriculture, General
  ☐$_1$ Agricultural Sciences, Other

❖ **For survey question B11, if respondent checks Mathematics, he/she should get the following sub-question:**

Which Mathematics discipline(s) are most closely aligned to what you studied during your graduate education? (check all that apply)

☐$_1$ Applied Mathematics
☐$_1$ Algebra
☐$_1$ Analysis & Functional Analysis
☐$_1$ Geometry/Geometric Analysis
☐$_1$ Logic
☐$_1$ Number Theory
☐$_1$ Statistics
☐$_1$ Topology/Foundations
☐$_1$ Computing Theory & Practice
☐$_1$ Operations Research
☐$_1$ Mathematics/Statistics, General or Other

❖ **For survey question I1, if respondent checks Ocean/Marine Sciences, he/she should get the following sub-question:**

Which Ocean/Marine Sciences discipline(s) do you use in your current work? (check all that apply)

☐$_1$ Environmental Science
☐$_1$ Hydrology & Water Resources
☐$_1$ Oceanography, Chemical & Physical
☐$_1$ Marine Sciences
☐$_1$ Ocean/Marine, Other

Appendix E:
Interview Protocol

IGERT Interview Protocol
(Trainees Withdrawing without Doctoral Degree)

Introduction

Thank you for taking time out of your schedule to participate in this interview. As you know I work at Abt Associates and we are conducting an evaluation of the National Science Foundation's IGERT Integrative Graduate Education and Research Traineeship program. You have been selected to be interviewed because you received IGERT funding through professor [PI Name] at [IGERT Institution] as part of an IGERT traineeship.

I wanted to ask you a few questions about your IGERT experience and about what you have been doing since receiving the funding. The interview shouldn't take more than 15 minutes.

All of the information you provide will be confidential. Your name will not be linked to any of the information we report.

Do you have any questions before I begin the interview?

Interview Questions

1. I'll begin by asking you to describe your current occupation. Are you currently employed in the workforce?
   (Yes or No)

   *If **YES**, answer Questions **2** through **6.***
   *If **NO**, skip to Question 7 – (did you get a degree).*

2. How would you describe the type of organization you work for? For example, is it a for-profit business, a federal government research lab, or are you self-employed?
   a. Government, including government research labs;
   b. Industry/Business;
   c. College or university;
   d. Non-government lab, research institution, or think tank;
   e. Other nonprofit organization or private foundation;
   f. K-12 school;
   g. Entrepreneur/Self-employed)

3. Please describe your primary job responsibilities.
    a. Research & Development
    b. Manufacturing
    c. Technical Services or Support
    d. Education (including teaching or training)
    e. Administration or Management
    f. Media/Journalism (e.g., science writing, technical writing/editing)
    g. Policy, Advocacy, and/or Lobbying
    h. Other – Specify_____

Only if they do research, ask:

Would you describe any of your current research projects as multi- or interdisciplinary?
(Yes or No)

If **YES**, please describe the multi-or interdisciplinary nature of your research project.

4. Do you currently collaborate with individuals from other disciplines?
(Yes or No)

If **YES**, please describe the nature of the collaboration.

5. Has the interdisciplinary or multidisciplinary nature of your IGERT training had any influence on how you conduct or think about your current research or work?
(Yes or No)

If **YES**, please describe.

6. I'd like you to think back to other aspects of the experiences you had as an IGERT trainee, and the relevancy of those experiences to your current occupation. In what ways, if any, does your current work draw upon or benefit from your IGERT experiences?

Thank you for the information on your current occupation.

---

7. According to NSF's records, you received the IGERT traineeship while you were at [IGERT institution]. Did you receive a graduate degree from [IGERT institution]?
(Yes or No)

If **YES**, what kind of degree did you receive – Masters or PhD?

*If **received a PhD**, Skip to Question 12 (participation in IGERT and graduate school experiences)*

*If **did not receive a PhD degree**, continue to Question 8.*

8. There are many reasons that one might leave a graduate program, including academic requirements, research requirements, family or personal issues, financial issues, new goals, or other opportunities.

   Can you describe the reasons you left the graduate program at [IGERT institution]?

9. I will now ask you some questions relating to your graduate school experiences and your participation in IGERT.

   a. Did the time you devoted to IGERT affect your progress in your coursework?
   (Yes or No)

      YES, please describe how.

   b. Did the time you devoted to IGERT affect your research progress?
   (Yes or No)

      If **YES**, please describe how.

   c. Did the time you devoted to IGERT affect your ability to develop relationships with peers in your home discipline or department?
   (Yes or No)

      If **YES**, please describe how.

   d. How manageable was the combined workload of participating in IGERT and in your regular department?

   e. Did the loss of funding after IGERT ended, affect your financial ability to remain in school?
   (Yes or No)

      If **YES**, please describe how

   f. How did your primary faculty advisor feel about your participation in IGERT?

10. Thinking about the time you devoted to IGERT activities, did your IGERT experiences have anything to do with your decision to leave the institution?
   (Yes or No)

      If **YES**, how did your IGERT experience influence your decision to leave?

11. Did you enroll at another institution after you left [IGERT institution]? (Yes or No)
    a. If **YES**, did you earn a degree? (Yes or No)
    b. What type of degree did you receive, and in what field?
        - Master's
        - PhD
        - Other

Skip to Question 13.

[Question 12 - PhD Graduates only]

12. I will now ask you some questions relating to your graduate school experiences and your participation in IGERT.
    a. Did the time you devoted to IGERT affect your progress in your coursework? (Yes or No)

       If **YES**, please describe.

    b. Did the time you devoted to IGERT affect your research progress? (Yes or No)

       If **YES**, Please describe.

    c. Did the time you devoted to IGERT affect your ability to develop relationships with peers in your primary field? (Yes or No)

       If **YES**, Please describe.

    d. How manageable was the combined workload of participating in IGERT and in your regular department?

    e. Did the loss of funding after IGERT ended, affect your financial ability to remain in school? (Yes or No)

       If **YES**, Please describe.

    f. How did your primary faculty advisor feel about your participation in IGERT?

13. Which of the following statements best describes your job search situation at the time you were leaving graduate school?
    a. I was not looking for work
    b. I was looking for work, but did not have an offer
    c. I had an offer
    d. I was already working
    e. Other, specify:

If respondent says "I was not looking for work" then ask,
Did you look for work later?
(Yes or No)

*If **yes**, continue to Question 14.*
*If **no**, skip to **Question 19***

14. Which of the following responses best describes how difficult it was for you to obtain your first job after leaving graduate school?
    a. Not difficult at all
    b. A little difficult
    c. Moderately difficult
    d. Difficult
    e. Very difficult

15. Which of the following responses best describes the extent that your IGERT experience positively affected your ability to obtain a position in the workforce?
    a. Not at all
    b. A little
    c. To some extent
    d. Quite a bit
    e. A great deal

*If they say response **b**, **c**, **d**, or **e** continue to **Questions 16 & 17**. If they say response **a** ("Not at all"), then skip to Question **18**.*

16. Now I will ask you some questions about how your IGERT experiences may have contributed to your ability to obtain a position in the workforce.
    a. Did you gain exposure to multi/interdisciplinary research as an IGERT trainee?
    (Yes or No)

    If YES,
    i. Did that experience help you get your job?
    (Yes or No)
    ii. If YES, please describe how.

    b. Did you have the opportunity to work with or network with people in other disciplines though IGERT?
    (Yes or No)
    i. If YES, did that experience help you get your job?
    (Yes or No)
    ii. If YES, please describe how.

    c. Did you have access to cutting-edge equipment and/or research as an IGERT trainee?
    (Yes or No)
    i. If YES, did that exposure help you get your job?
    (Yes or No)
    ii. If YES, please describe how.

17. What other aspects of your IGERT training, if any, contributed to your ability to get a job?

18. Was there anything about your IGERT training that made it difficult to obtain a job? (Yes or No)
    If **Yes**, ask, what made it difficult?

19. That wraps up my questions. Is there anything else you'd like the NSF to know about the IGERT program?

20. Thank you very much for taking the time to talk with me. If I would like to follow-up with you to clarify any of your responses, may I call or e-mail you?
    (Yes or No)