



**EVALUATION OF THE INITIAL IMPACTS  
OF THE NATIONAL SCIENCE FOUNDATION'S  
INTEGRATIVE GRADUATE EDUCATION AND RESEARCH  
TRAINEESHIP PROGRAM**

*Final Report*

*Prepared for:*

**The National Science Foundation  
Directorate for Education and Human Resources  
Division of Research, Evaluation, and Communication  
and  
Division of Graduate Education**

*Prepared by:*

**Abt Associates Inc.  
4550 Montgomery Avenue  
Suite 800 North  
Bethesda, MD 20814**

**February 2006**

**EVALUATION OF THE INITIAL IMPACTS  
OF THE NATIONAL SCIENCE FOUNDATION'S  
INTEGRATIVE GRADUATE EDUCATION AND RESEARCH  
TRAINEESHIP PROGRAM**

*Final Report*

*Prepared under Contract:*  
REC9912174, B15285X

Jennifer Carney  
Deepika Chawla  
Autumn Wiley  
Denise Young



**Abt Associates Inc.**

*Prepared for:*

The National Science Foundation  
Directorate for Education and Human Resources  
Division of Research, Evaluation, and Communication  
and  
Division of Graduate Education

February 2006

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

National Science Foundation, Division of Research, Evaluation, and Communication, Evaluation of the Initial Impacts of the National Science Foundation's Integrative Graduate Education and Research Traineeship Program. (Arlington, VA 20005)

# Acknowledgements

This report on the initial impacts of the National Science Foundation's Integrative Graduate Education and Research Traineeship Program is the collaborative effort of numerous individuals. Many colleagues at the National Science Foundation ensured the success of this study. Conrad Katzenmeyer and Deh-I Hsiung in the Division of Research, Evaluation, and Communication served as contract officers of the evaluation and provided expert insight into evaluation design and methods. Mary Sladek and Suzanne Plimpton shepherded the study design and instruments through the OMB clearance process. Wyn Jennings initiated the study and helped clarify its design. We are most grateful for the guidance and support of Bianca Bernstein, Debasish Dutta, Carol Stoel, and Carol Van Hartesveldt, as well as others in the Division of Graduate Education who informed the study and reviewed the report.

Of our colleagues at Abt Associates, we must give enormous credit to Don LaLiberty for analyzing the student survey data, and to Reshad Ahsan for analyzing data from the mail and email surveys. We thank Melissa Marsh for her help with analyzing student data, and Alina Martinez for her input to study design, instrument development, and the final report. Our gratitude goes to Anne Chase and Fran O'Reilly for reviewing the draft report and providing editorial review and feedback. We would especially like to thank Denise Young for creating all exhibits and overseeing production of the final report.

Numerous other people contributed to the success of the study. We thank Shirley Panek and her team at Pulse Train Ltd. for programming and hosting the web-based surveys as well as for answering numerous technical questions. At Abt Associates, we are grateful to Tom Logan for coordinating with Pulse Train Ltd, and we greatly appreciate the efforts of Carin Chunga, Katherine Abe and their team for the excellent follow-up with the survey respondents that ensured such high response rates. We would like to thank Dominic Olivastro, Kimberly Hamilton and Peter Kroll from ipIQ (formerly CHI Research) for conducting the bibliometric analysis of faculty publications data.

Finally, and most importantly, we thank all of the IGERT PIs, students, faculty members, department chairs, university administrators, and other individuals who directly participated in the study and completed surveys and interviews to provide us with the rich data from which this study draws its conclusions.

# Contents

<b>Executive Summary .....</b>	<b>vii</b>
<b>Chapter 1: IGERT and the Landscape of Interdisciplinary Science and Graduate Education . 1</b>	<b>1</b>
The IGERT Program .....	3
Recent Changes in the Literature of Reform .....	6
Summary .....	8
<b>Chapter 2: Evaluation Methodology .....</b>	<b>9</b>
Previous Monitoring and Evaluation .....	9
The IGERT Impacts Evaluation.....	9
Evaluation Questions.....	10
Sampling Methods .....	10
IGERT Sample .....	10
Comparison Group – Non-IGERT Sample .....	11
Final Sample Sizes .....	13
Data Collection Instruments .....	13
Response Rates and Sample Characteristics.....	13
Sample Characteristics .....	14
Prevalence of IGERT Projects in Comparison Institutions .....	16
Analysis Techniques.....	17
Organization of This Report .....	18
<b>Chapter 3: Impacts on Students.....</b>	<b>19</b>
The IGERT Model of Education.....	19
Interdisciplinary Experiences .....	20
Interdisciplinary Interactions.....	22
Depth versus Breadth of Knowledge .....	23
Preparation for Diverse Careers.....	25
Exposure to Diverse Careers .....	25
Perceptions of Career Preparation.....	27
Students’ Career Goals.....	28
Development of an International Perspective .....	29
International Experiences .....	29
International Perspective .....	30
Professional Training.....	30
Preparation to Conduct Research .....	30
Preparation to Work in Teams.....	32
Communication Skills .....	34
Summary .....	37
<b>Chapter 4: Impacts on Faculty .....</b>	<b>39</b>
Faculty Characteristics.....	39
Faculty Participation in IGERT.....	39
Impact on Teaching.....	41
Team Teaching .....	41

Interdisciplinary Teaching .....	42
Impact on Interdisciplinary Networks .....	42
Impact on Mentoring Students .....	43
Impact on Research .....	43
Interdisciplinary Research .....	44
Impact on Faculty Productivity .....	44
Perceived Added Value of Participation in IGERT.....	46
Summary .....	50
<b>Chapter 5: Impacts on Institutions.....</b>	<b>51</b>
Impacts on Institutional Culture .....	51
Faculty Perceptions of Institutional Support.....	52
Impact on Institutional Policies and Procedures.....	56
Impact of IGERT on Tenure Review Policies .....	56
Policies Governing Interdisciplinary Teaching.....	58
Impact on Institutional Structures .....	59
Joint Faculty Appointments .....	59
New Interdisciplinary Courses/Degrees/Certificates .....	60
Interdisciplinary Centers and Institutes.....	61
Leveraging Funds .....	62
Institutionalization and Spread of IGERT Elements .....	62
Sustainability .....	62
Adoption of IGERT Features by Others .....	63
Summary .....	63
<b>Chapter 6: Impacts on Recruitment.....</b>	<b>65</b>
Increasing Access in Higher Education.....	65
Increasing Participation of United States Citizens.....	65
Increasing Participation of Underrepresented Groups (Women and Minorities) .....	66
Increasing Interest in Doctoral Education Among Undergraduates .....	67
Student Characteristics .....	67
Expanding Interdisciplinary Graduate Education Opportunities.....	69
Summary .....	70
<b>Chapter 7: Conclusions and Directions for Future Research .....</b>	<b>71</b>
Educating United States Ph.D. Scientists and Engineers .....	71
Catalyzing a Cultural Change in Graduate Education .....	72
Facilitating Diversity in Student Participation and Preparation.....	72
Directions for Future Research.....	73
Assessment of Diversity Enhancement.....	73
Assessment of IGERT Graduate Career Outcomes .....	73
Assessment of IGERT Institutional Impacts.....	73
Assessment of the IGERT Model of Interdisciplinary Graduate Education .....	74
<b>Appendix A: Supplementary Tables .....</b>	<b>A-1</b>
<b>Appendix B: Bibliometric Analysis .....</b>	<b>B-1</b>

# List of Exhibits

## Chapter 2

Exhibit 2.1	Final Sample Sizes .....	13
Exhibit 2.2	Final Sample Size and Response Rates for Web-Based and Email Surveys.....	14
Exhibit 2.3	Size of IGERT and Non-IGERT Departments .....	14
Exhibit 2.4	Discipline Distribution of IGERT and Non-IGERT Department Chairs, Faculty Members, and Students (Completed Surveys) .....	15
Exhibit 2.5	Program Status of IGERT and Non-IGERT Students at Time of Survey .....	16
Exhibit 2.6	Prevalence of IGERT Grants Among Institutions in Research and Doctoral Carnegie Classifications .....	17

## Chapter 3

Exhibit 3.1	Interdisciplinary Educational Experiences of IGERT and Non-IGERT Students.....	22
Exhibit 3.2	Percent of IGERT and Non-IGERT Students Reporting They Have Worked with Faculty from Their Own or Different Departments on Research Projects During Their Graduate Program .....	23
Exhibit 3.3	Percent of IGERT and Non-IGERT Faculty Indicating That Their Students Are Prepared to Know Their Own Discipline in Depth .....	24
Exhibit 3.4	Percent of IGERT and Non-IGERT Students Reporting They Have Worked With Various Individuals on Research Projects During Their Graduate Program.....	26
Exhibit 3.5	Percent of IGERT and Non-IGERT Students Reporting Opportunities to Conduct an Off-Campus Internship .....	27
Exhibit 3.6	Career Goals of IGERT and Non-IGERT Students .....	28
Exhibit 3.7	Percent of IGERT and Non-IGERT Students Reporting Research-Related Training .....	31
Exhibit 3.8	How well is your graduate program preparing you to conduct research? (Percent of Students) .....	32
Exhibit 3.9	Teamwork Experiences Reported by IGERT and Non-IGERT Students .....	33
Exhibit 3.10	How well is your graduate program preparing you to work in teams? (IGERT and Non-IGERT students).....	34
Exhibit 3.11	Percent of IGERT and Non-IGERT Students Reporting Having Received Training or Coursework in Communication.....	35
Exhibit 3.12	Student Perceptions of How Well Their Program is Preparing Them to Communicate with Various Individuals.....	36

<b>Chapter 4</b>	
Exhibit 4.1	Ways in which Faculty Participate in the IGERT Program ..... 40
Exhibit 4.2	Changes in Time Spent on Departmental Activities as a Result of IGERT Participation ..... 41
Exhibit 4.3	Percent of IGERT and Non-IGERT Faculty Who Have Team Taught with Faculty Members Outside Their Home Department, or Plan to in the Future ..... 42
Exhibit 4.4	Percent of IGERT and Non-IGERT Faculty Awarded New Research Grants in the Last Two Years ..... 43
Exhibit 4.5	Percent of IGERT and Non-IGERT Faculty Engaged in Interdisciplinary Research Activities ..... 44
Exhibit 4.6	Interdisciplinary Publications and Presentations by IGERT and Non-IGERT Faculty ..... 45
Exhibit 4.7	Impact of Participation in the IGERT Program on Faculty Research..... 47
Exhibit 4.8	Percent of Department Chairs Reporting Impacts of the IGERT Grant on Their Departments' Faculty..... 48
Exhibit 4.9	Interdisciplinary Activities of Non-IGERT Faculty at Institutions With and Without IGERT Projects Compared to IGERT Faculty ..... 49
<b>Chapter 5</b>	
Exhibit 5.1	Percent of IGERT PIs Reporting Various Central University Administrative Support for Inter/Multidisciplinary Graduate Education ..... 52
Exhibit 5.2	Faculty Agreement with Statements about Support for Interdisciplinary Activities at Their Institution ..... 53
Exhibit 5.3	To What Extent are Recent Increases in Your University's Support for Inter/Multidisciplinary Graduate Education the Result of the IGERT Grant? (Percent of PIs) ..... 54
Exhibit 5.4	Number of Faculty Members Involved in IGERT Projects Over Time, by Cohort... 55
Exhibit 5.5	Tenured vs. Non-Tenured Faculty Engagement in Interdisciplinary Research Activities ..... 58
Exhibit 5.6	Percent of IGERT PIs Reporting Changes in University Policies Resulting from the IGERT Grant..... 59
Exhibit 5.7	Percent of IGERT PIs Reporting Changes in Educational Structures Resulting from the IGERT Grant ..... 60
Exhibit 5.8	Percent of IGERT Department Chairs Reporting Changes in Educational Structures Resulting from the IGERT Grant ..... 61
Exhibit 5.9	Percent of PIs Reporting IGERT Benefits They Expect to Maintain (Post Funding) 62
<b>Chapter 6</b>	
Exhibit 6.1	GRE Scores for IGERT Students and U.S. Citizen Non-IGERT Students..... 68
Exhibit 6.2	Professional Productivity of IGERT and Non-IGERT Students..... 68

Exhibit 6.3	Conference Attendance of IGERT and U.S. Citizen Non-IGERT Students .....	69
Exhibit 6.4	Programs to which IGERT and Non-IGERT Students also Applied when Applying to Their Current Program .....	70

**Appendix A**

Exhibit A.1	IGERT PI Descriptions of their Projects .....	A-1
Exhibit A.2	Training and Coursework Received by IGERT and non-IGERT Students .....	A-2
Exhibit A.3	PI Perceptions of Trainee Preparedness .....	A-3
Exhibit A.4	Faculty Perceptions of Student Preparedness .....	A-4
Exhibit A.5	Student Perceptions of How Well Their Program is Preparing Them .....	A-5
Exhibit A.6	Student Perceptions on Their Program .....	A-6
Exhibit A.7	Faculty Reported Impacts of Participating in IGERT .....	A-7
Exhibit A.8	IGERT Department Chair Perceptions of the Impact of IGERT on Departmental Admissions .....	A-8
Exhibit A.9	PI Reports of Project Impact .....	A-9
Exhibit A.10	PI Perceptions of Project Impact .....	A-10

**Appendix B**

Figure 1	Number of Authors by the Author's Discipline .....	B-8
Figure 2	Publication Rates by Year .....	B-9
Figure 3	Publication Rates by Author's Discipline .....	B-10
Figure 4	Percent of Publications Outside of Author's Discipline .....	B-11
Figure 5a	Percent of Authors in the four Discipline Types .....	B-12
Figure 5b	Percent of Publications by Authors in the four Discipline Types .....	B-12
Figure 6	Interdisciplinary Spread .....	B-13
Figure 7	Citation Frequency by Publication Year .....	B-14
Figure 8	Citation Frequency by Author's Discipline .....	B-15
Figure 9	Citation Frequency by Field of Publications .....	B-15
Figure 10	Frequency of Referencing .....	B-16
Figure 11	Percent of References to Journals outside the Researcher's Field .....	B-17
Figure 12	Institutions Per Paper .....	B-18
Figure 13	Percent of Papers at each level of Co-Authorship .....	B-18
Figure 14	Percent of Papers at each level of Departments .....	B-19
Table 1	Listing of K-Codes as supplied by the Institute of Scientific Information .....	B-21
Table 2	Listing of Publication Fields and Author Disciplines .....	B-21



Table 3	Number of Authors in each Discipline .....	B-22
Table 4	Number of Publications by Publication Year (Across all Disciplines).....	B-22
Table 5	Number of Publications by Author’s Discipline.....	B-23
Table 6	Number of Publications by Author’s Discipline and Publication Field.....	B-24
Table 7	Number of Publications by Discipline Type.....	B-25
Table 8	Number of Researchers by Publication Spread.....	B-26
Table 9	Number of Citations by Publication Year.....	B-26
Table 10	Number of Citations by Author’s Discipline .....	B-27
Table 11	Number of Citations by Publication Field .....	B-28
Table 12	Number of References by Author’s Discipline.....	B-29
Table 13	Number of References by Author’s Discipline and Publication Field.....	B-30
Table 14	Number of Institutions on a Publication by Author’s Discipline.....	B-31
Table 15	Number of Institutions on a Publication .....	B-32
Table 16	Number of Departments on a Publication.....	B-32