Evaluation of the Fulbright Foreign Student Program:

Impact on STEM Participants

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Evaluation Division
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DATA COLLECTION BY ICF INTERNATIONAL

Evaluation of the Fulbright Foreign Student Program:

Impact on *From Lab to Market* Seminar STEM Participants

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To access Volume II (which contains the report's appendices) please contact ECAevaluation@state.gov.

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Abbreviations and Acronyms

DOS – U.S. Department of State

ECA – Bureau of Educational and Cultural Affairs

FLMS – *From Lab to Market* Seminar

GIS – Geographic information systems

HVDC – High voltage direct current

ICT – Information and communications technology

IT – Information technology

LIDAR – Light detection and ranging (a remote sensing technology)

NGO – Non-governmental organization

STEM – Science, technology, engineering, and mathematics

Executive Summary

Purpose of the Evaluation

The Evaluation Division of the Bureau of Educational and Cultural Affairs (ECA) at the United States Department of State (DOS) contracted ICF International in 2013 to conduct a study on the post-program experiences of Fulbright Foreign Student Program participants who are pursuing graduate study at U.S. institutions in the STEM fields (science, technology, engineering, and mathematics). A four-day enrichment seminar, *From Lab to Market,* is offered annually to a select group of such students, who are from low to middle income developing countries with the purpose of helping students understand how scientific research and discovery could be translated through entrepreneurship into innovative products and services that spur economic development ("from lab to market"). These Seminar participants were the focus group used to measure and evaluate the impact of their overall Fulbright experience in the United States, including the *From Lab to Market* Seminar (FLMS) itself as well as the students' on-campus academic experience (where they spent the great majority of their time in the United States). The evaluation focused on:

- What effect the overall Fulbright experience and the FLMS had on Seminar participants and the institutions or organizations they were associated with;
- How the Seminar participants applied the knowledge and skills they learned;
- What was the nature of the networking or collaborations in which the Seminar participants engaged following their Fulbright experience; and
- As a result of their Fulbright experience, including the FLMS, did Seminar participants gain knowledge and skills applicable to solving issues in their respective community, country, or globally.

The study integrated quantitative and qualitative methodology, focusing on the experiences of the 548 STEM-focused Fulbright students who participated in the FLMS between 2007 and 2011 (hereinafter, "Seminar participants"). By focusing on this time period, evaluators were able to consider medium and longer-term impact of the Fulbright experience. Components of the evaluation included: a program review of documents, interviews of program administrators, an online survey distributed inclusively to all FLMS Seminar participants during the 2007 to 2011time period, in-person interviews, and site visits to select Seminar participants in four countries. The in-person interviews were conducted in Brazil, Colombia, and Indonesia, while Skype and telephone interviews were conducted with Pakistani Seminar participants. The online survey, consisting of closed, semi-structured, and open-ended questions, was fielded for an eight-week period from May to June of 2014, and achieved a 60 percent response rate, with 316 completions.

The evaluation provides documentation of how the Fulbright experience, including the FLMS, influenced STEM students in their post-program work, research, teaching, and professional collaborations with others. This influence also extended to Seminar participants' attitudes

toward applying innovation and entrepreneurship in their work, as well as contributing to international science and technology forums. Through surveys and in-depth interviewing, the Seminar participants have also provided significant examples of their accomplishments and their ongoing efforts to confront critical issues in their home country and beyond.

Key Findings

The evaluation verified the extent to which the United States is a destination for high-caliber students in STEM fields pursuing advanced levels of study. Additionally, the study found that the Fulbright and FLMS experience enhanced Seminar participants' technical skills in conducting academic research, as well as increased professional capacity in the use of technology, in technical writing and presentation delivery, and in networking, and leadership skills that enabled the Seminar participants to continue to grow and contribute in their respective STEM fields.

The Fulbright and FLMS experiences enhanced the capacity of participants to engage in the global scientific community, with the aim of finding solutions to critical issues, with American and other counterparts. The Seminar participants were prepared through skills enhancement, training in technology, access to cutting-edge scientific content, cross-cultural experiences, and exposure to international professional standards in science. Through networking and collaboration, many Seminar participants were able to actively participate in and lead international conferences or publish their work in respected, peer-reviewed journals.

The Seminar participants expanded their technical expertise, gaining greater ability to achieve excellence in research and teaching. The study found that Seminar participants had an enhanced commitment to addressing national issues and applying their training toward finding new solutions. In addressing environmental, health, agricultural and engineering issues, they used new tools and techniques to deal with some of the complex problems that confront these sectors in their countries. These activities aligned with U.S. interests in pioneering new solutions to global issues and the establishment of strong and lasting relationships with institutions and emerging leaders. More than half of the Seminar participants, as a result of their experience, have had opportunities to teach and train the next generation, thereby transferring elements of their own U.S. university experience to their students at home. The Fulbright and FLMS experiences endure through the enhancement that Seminar participants are providing to their students' educational environment by revising curricula, conducting field work, mentoring, and providing overall leadership for institutional change.

The value of entrepreneurship and the pursuit of innovation were successfully conveyed to the STEM Fellows through the Fulbright experience. They are now actively striving to make a difference in scientific and technical research by engaging in innovative approaches, and where possible, being entrepreneurial in their work. In particular, Seminar participants seek to gain support from their affiliated organizations (whether universities, private firms, governments, or

NGOs), national funding sources, and business partnerships, and continue to network and collaborate with individuals and institutions in the United States.

Chapter 1. Introduction

The Study

The Evaluation Division of the Bureau of Educational and Cultural Affairs (ECA), contracted with ICF International to study the post-program experiences of Fulbright Foreign Students in the STEM fields (science, technology, engineering and mathematics) who attended the *From Lab to Market* Seminar. Seminar participants were foreign graduate students attending U.S. universities in the STEM fields from low to middle-income developing countries that have fewer opportunities in their home countries to understand and experience the links between scientific research and collaboration, entrepreneurship and innovation.

The evaluation focuses on the outcomes for Fulbright STEM grantees who participated in the *From Lab to Market* Seminar between 2007 and 2011 and how their Fulbright experiences affected them and the institutions or organizations with which they were associated. The evaluation also considers the application of knowledge and skills the students learned, as well as the networking or collaboration that allowed Seminar participants to engage in science and technology forums on a global level. As the Fulbright and FLMS promote innovation and entrepreneurial thinking, the study also explored how Seminar participants have contributed solutions to problems in their own country as well as globally.

Study Participants

This evaluation report analyzes the responses from several different types of Seminar participants. The terms and definition are as follows:

- Seminar participant refers to *all* Fulbright Foreign Students who participated in the *From Lab to Market* Seminar from 2007 to 2011 (548 participants);
- Survey respondent refers to *all* Seminar participants who completed the online survey (316 respondents) including those that were interviewed in-person (51 respondents); and
- Interview respondent refers *only* to Seminar participants that participated in the in-person interview (51 respondents).

The characteristics of the FLMS participants reflect a wide range of national backgrounds and academic interests, as the summary table below illustrates.

Table 1: Characteristics of Study Subjects	
Number of study subjects	316
Gender	Male = 195 (62%);
	Female = 121 (38%)
Number of home countries of survey participants (in 6 regions)	84
Number of different U.S. universities attended	129
Fields of study	Agriculture = 10 (3%)
	Biology = 41 (13%)
	Computer science = 62 (20%)
	Engineering = 96 (30%)
	Environment = 38 (12%)
	Medical & Health = 53 (17%)
	Physical sciences = 14 (4%)
	Other = 2 (1%)
Degree Sought	Master's = 212 (67%)
	Ph.D. = 95 (30%)
	Other = 9 (3%)

During the research study period (2013-2014, from three to eight years after Seminar participants completed their Fulbright), the Seminar participants were in various stages of their post-program careers. Some were still continuing their studies, others had returned to their home country, or had gone to another country and were working. Overall, about two-thirds were currently employed, a quarter were continuing their studies, and about a tenth were both studying and working. Sixty percent of the Seminar participants were living in their home country, ten percent were living in another country, and 30 percent were still in the United States.

Program Description

The U.S. Congress established the Fulbright Program in 1946 under legislation introduced by the late Senator J. William Fulbright. One component of the Fulbright Program is the Fulbright Foreign Student Program, designed to give opportunities to students from other countries to study in the United States, usually as masters or doctoral students or visiting researchers. As of December 2017, about 1,800 Fulbright grants are given to non-U.S. nationals to study in the United States annually. There are about 3,800 new and continuing Fellows currently in the United States on Fulbright grants. In bringing Fulbright Foreign Students to the United States, the State Department advances the goals of: 1) increasing understanding between Americans and people of other countries, 2) making the United States a destination for students of the highest caliber, 3) enhancing the capacity of U.S. universities contributing to the advancement of

scientific research in the United States, and 4) building lasting relationships for the United States with emerging leaders worldwide.

Fulbrighters who participated in the *From Lab to Market* Seminars from 2007 to 2011 comprised the focal group from which the impact of the Seminar and other Fulbright experiences on the Seminar participants' post-program activities was measured and evaluated. The following table shows the location and theme of the seven Seminars conducted during the evaluation period. More details about the Seminars are provided in Appendix A.

Table 2: *From Lab to Market* Seminars

Year	Location	Focus
2007	San Jose, CA	Science, Technology, Entrepreneurship
2008	San Jose, CA	Science, Technology, Entrepreneurship
2009	Cambridge, MA	Agriculture, Health, Environment
2010	Cambridge, MA	Agriculture, Health, Environment
2010	Austin, TX	Energy and the Environment
2011	Cambridge, MA	Public Health
2011	Seattle, WA	Energy and the Environment

Each year during the period covered by the evaluation, a four-day FLMS was offered to a select group of about 100 Fulbright Foreign Students in STEM fields (i.e., science, technology, engineering, and mathematics) from low and middle income countries.[1] The FLMS introduces participants to scientific innovators, entrepreneurs and other notable professionals and provides a forum to present U.S. approaches and achievements in this area and exchange ideas and resources in the fields of energy, agriculture, health, engineering, technology, and environmental sciences.

Study Design

The evaluation was conducted through a multi-method approach, integrating quantitative and qualitative research methods. The first months of the study were focused on gaining a better understanding of the substance and objectives of the Fulbright Foreign Student Program and the FLMS, as well as the goals of ECA and the Department of State associated with science and technology and U.S. foreign policy.

The program review was carried out through the collection and examination of documents and interviews with program administrators. Next, a database of the target population was created (covering the 548 students who had participated in the FLMSs between 2007 and 2011) through intensive research to update Seminar participants' contact information. An online survey was

[1] Additional Fulbright Enrichment Seminars, up to about ten each year, are also offered to all Fulbright Foreign Student Program participants, hosted on ECA's behalf by U.S. higher education institutions across the country on a variety of topics.

developed to address the research questions and was sent to all Seminar participants from the five-year period. The survey yielded a response rate of 60 percent. In-depth site-visits to Seminar participants in four countries (three of which were conducted prior to the online survey and helped inform the survey development) complemented what was learned through the global survey. To conduct in-person interviews of Seminar participants and, where possible, to observe Seminar participants' work, site visits were undertaken in Brazil, Colombia, and Indonesia. These countries were selected because they had significant numbers of Seminar participants who could be interviewed. Skype and telephone calls were used for interviews conducted with alumni in Pakistan.[2]

[2] Further details of the study methodology and research questions may be found in Appendix B, the full survey can be found in Appendix C

Chapter 2. Characteristics of Study Participants

The focus of this and subsequent chapters is primarily derived from what was learned from the survey participants, and enhanced by the in-depth interviews and site visits. The primary emphasis of this chapter is on the characteristics of the survey respondents.

Table 3: Gender of Study Participants

	Survey Respondents		Total Seminar Participant Population	
	N	%		%
Female	121	38	194	35
Male	195	62	353	65
Total	316	100%	547*	100%

**One Seminar participant's gender is unidentified.*

Among the survey respondents, men comprised the larger group, outnumbering women, in a roughly 3:2 ratio (which mirrors the total population of Seminar participants). A review of the data by years showed that women were represented in greater numbers in the later years of the program (2010 and 2011).

The survey respondents were from 84 countries. In Exhibit 1, countries are listed by region. The map also depicts the countries of the in-person and virtual site visits. Given the broad distribution of survey respondents from many countries, only seven countries supplied 3 percent or more to the total survey response pool. The countries that contributed the greatest number of survey respondents were Pakistan (34 or 11%), Indonesia (24 or 8%), Ecuador (12 or 4%), Brazil (11 or 3%), Colombia (11 or 3%), Turkey (9 or 3%), and Chile (8 or 3%). In the earlier years of the program, the strong presence of Pakistani Seminar participants reflected dramatic increases in funding for the U.S.-Pakistan Fulbright Program, which was the largest Fulbright Foreign Student Program in the world at that time with a significant number of students in computer science and engineering. In the selection of FLMS participants, in later years, there was an effort to broaden the categories of disciplines constituting STEM fields, and encourage more geographic and gender diversity. Consequently, in the later groups of Seminar participants, participation was more varied, without a majority from any one country.

Exhibit 1: Countries of *From Lab to Market* Seminar Participants

Western Hemisphere N=21		
Argentina	Dominican Republic	Mexico
Bolivia	Ecuador	Nicaragua
Brazil	El Salvador	Panama
Chile	Guatemala	Paraguay
Colombia	Haiti	Peru
Costa Rica	Honduras	Trinidad and Tobago
Dominica	Jamaica	Venezuela
Sub-Saharan Africa N=25		
Benin	Kenya	Sierra Leone
Botswana	Madagascar	South Africa
Burkina Faso	Malawi	Swaziland
Cameroon	Mali	Tanzania
Democratic Republic of the Congo	Mozambique	Togo
Ethiopia	Niger	Uganda
Ghana	Nigeria	Zambia
Ivory Coast	Republic of the Congo	Zimbabwe
	Senegal	
Middle East and North Africa N=13	**Europe and Eurasia N=2**	**East Asia/Pacific N=14**
Bahrain	Bosnia and Herzegovina	Brunei
Gaza	Turkey	Burma
Iraq		Cambodia
Israel	**South Central Asia N=9**	Hong Kong
Jordan	Afghanistan	Indonesia
Lebanon	Bangladesh	Laos
Libya	India	Malaysia
Morocco	Maldives	Mongolia
Oman	Nepal	Papua New Guinea
Palestinian Territories	Pakistan	Philippines
Syria	Sri Lanka	Taiwan
West Bank	Tajikistan	Thailand
Yemen	Uzbekistan	Timor-Leste
		Vietnam

The table below summarizes the distribution of the survey respondents by region.

Table 4: Region of Study of Seminar Participants				
	Survey Respondents		Total Seminar Participant Population	
	N	%	N	%
East Asia/Pacific	52	16	72	13
Europe & Eurasia	10	3	20	4
Middle East & North Africa	43	14	94	17
South Central Asia	63	20	120	22
Sub-Saharan Arica	60	19	98	18
Western Hemisphere	88	28	144	26
Total	316	100%	548	100%

The dominant region of survey respondents was the Western Hemisphere, which produced 28 percent of the survey respondents. The second most common region was South and Central Asia (20%), followed by Sub-Saharan Africa (19%). Following these regions, were East Asia/Pacific (16%), and Middle East and North Africa (14%). The Europe and Eurasia region yielded 3 percent of the survey respondents. These response rates mirror the proportions of the total Seminar participant population.

The field of study of the FLMS participants was divided by the Fulbright program office into eight categories.

Table 5: Field of Study of Seminar Participants				
	Survey Respondents		Total Seminar Participant Population	
	N	%	N	%
Agriculture	10	3	20	4
Biology	41	13	62	11
Computer Science	62	20	135	25
Engineering	96	30	174	32
Environment	38	12	48	9
Medical & Health	53	17	79	14
Other	2	1	5	1
Physical Sciences	14	4	25	4
Total	316	100%	548	100%

The STEM fields with the largest concentration of survey respondents were those in engineering (30%) and computer science (20%), which combined constitute half of all respondents. The other most common disciplines were medical and health (17%), biology (13%), and environment (12%).

The U.S. universities where the postgraduate studies took place were diverse. Respondents attended 129 different universities. There were nine universities that hosted more than five survey respondents: Georgia Institute of Technology; Purdue University; Texas A&M, College Station; Duke University; Kansas State University; Northeastern University; Tulane University; University of Illinois, Urbana-Champaign; and University of Maryland, College Park.

About two-thirds of the surveyed respondents said it was their plan to obtain a Master's degree, and most of them were successful (96%). A third of survey respondents indicated that it was their plan to obtain a Ph.D., and about two-thirds were successful in doing so. The remaining 3 percent were conducting research toward a Ph.D., completing a Master's degree under Fulbright with the intention to then secure an assistantship for a Ph.D., or earning a professional degree.

Given the timing of this study— from three to eight years after the FLMS (which took place at the end of the Fellows' first year) and the Fulbright was completed—the survey respondents were either still continuing their studies or working in the United States but no longer under a Fulbright Fellowship, or had dispersed to a variety of locations across the globe. With the skills and connections that the Seminar participants gained through their Fulbright experience, many Seminar participants were globally mobile and had moved to another country. At the time of the survey, Seminar participants were in the following locations:

- Living in their home country 60%
- Living in the United States 30%
- Living in another country 10%

These locations also correlate to the different activities in which Seminar participants were engaged at the time of the survey. Overall, about two-thirds of the Seminar participants were currently employed and not currently studying, 25 percent were full-time students, and 9 percent were studying while also working. Those in the United States tended to be studying (with less than 25% solely working); those in their home country were predominantly working; and those in another country were also primarily working.

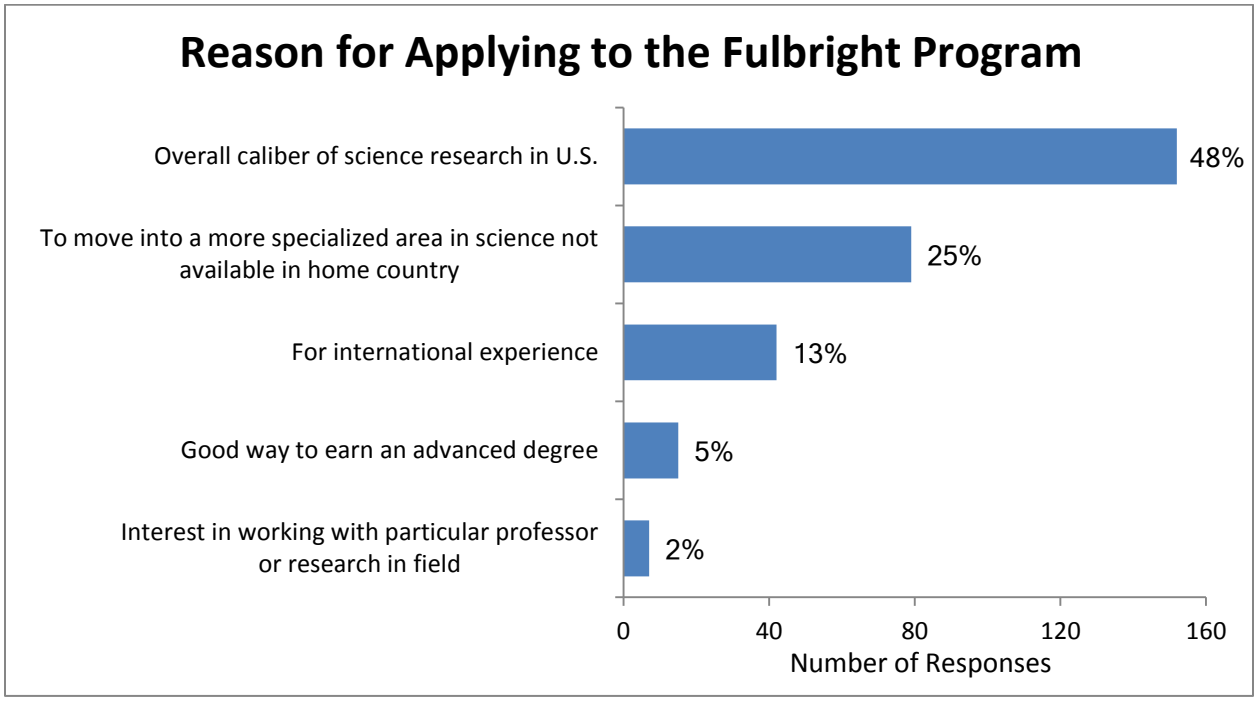
Chapter 3. Findings: The United States is a Premier Destination for Science and Technology Students

The Fulbright program expands international awareness of the United States' pre-eminent role in science and technology and provides opportunities for the best and brightest students to pursue higher level study at U.S. institutions in STEM fields. Seminar participants confirm that they were motivated to apply for the Fulbright Program based on their perceptions of the eminence of U.S. institutions in science and technology. They also confirmed that their Fulbright experience fulfilled their high expectations.

Perspectives on Studying Science in the United States

An element of this evaluation was to learn *why* a student chose to apply for a Fulbright and ultimately to spend from one to four years or more studying in the United States. In the survey, FLMS participants were asked what their main interest in applying to study in the United States was. Figure 1 summarizes their responses.

Figure 1



Nearly 50 percent of the survey respondents named the overall caliber of the science practiced in the United States as the main reason for their application. Twenty-five percent of survey respondents cited a similar, but more focused reason for pursuing U.S. study opportunities, including a desire to specialize in a field of study that was not available in their home country institutions. During site visits, interviewees described specific topics they wanted to study in the

United States, such as cell culturing techniques, computer vision, and emission measurement in ambient air.

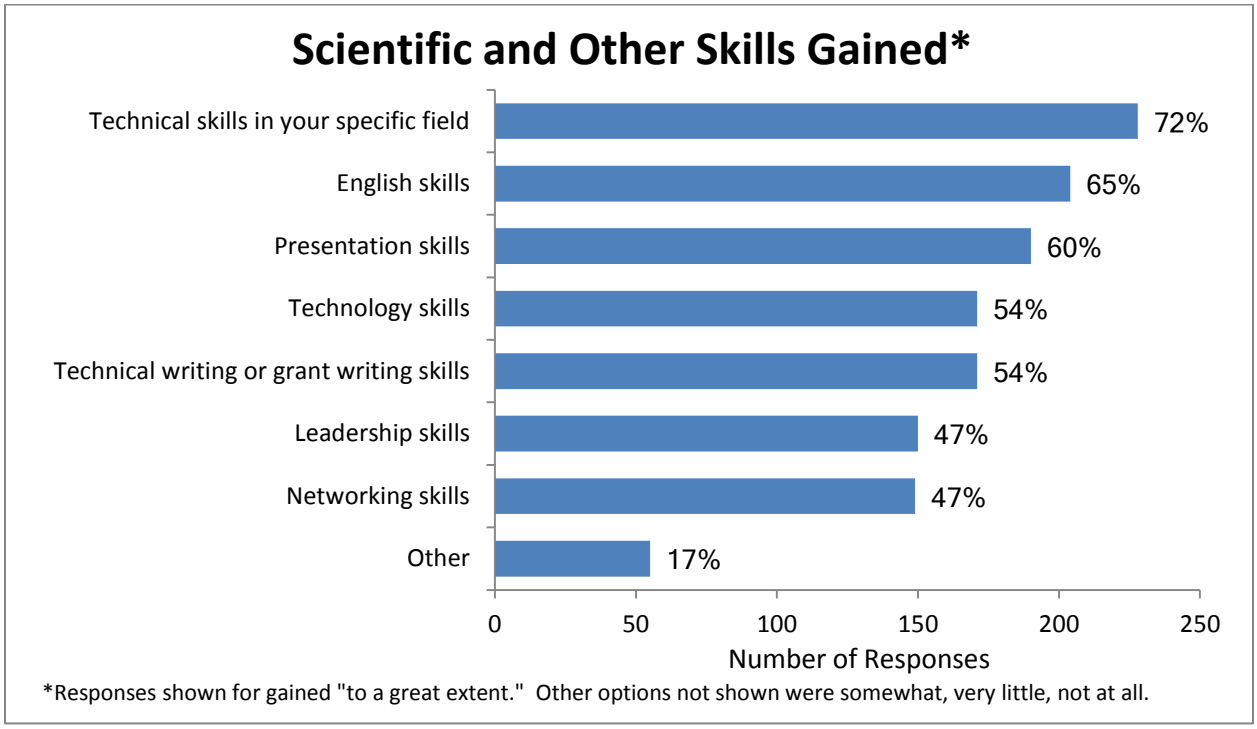
Many survey respondents were motivated to pursue a specific scientific topic, study at a particular university, or work with a specific professor/researcher. To clarify the nature of the Seminar participants' interests, the survey asked if Seminar participants' Fulbright studies were in the same general subject area as their previous studies. Eighty-six percent of survey respondents indicated that their Fulbright work was in the same field as their earlier studies. In the 14 percent of cases where survey respondents Fulbright work differed from their earlier studies, a variety of reasons emerged. A number of survey respondents expressed a desire to go from the technical (often engineering) to management in the same field. Others who had worked in an applied area wanted to strengthen their fundamental science background. Several had switched topics within the same field based on their experiences (i.e., from reproductive health to occupational epidemiology in order to improve health care worker safety in their home country); some expanded their area (i.e., from food science to health and nutrition).

Besides having specific science-related motivations for wanting to study in the United States through the Fulbright Program, 65 percent of the survey respondents had a preference prior to the Fulbright for a specific U.S. university they wanted to attend. Of that group, 55 percent attended their preferred university. Ninety percent of survey respondents stated they were satisfied with the course of study they pursued and the university they attended.

Skills and Knowledge Gained

The potential value of post-graduate education in the United States-in terms of new skills gained that could be applied in future work as scientists, researchers, or teachers-was also examined. For almost all Seminar participants, the Fulbright and FLMS experience was enriching and enhanced their professional skills. The survey listed seven general skills that contribute to the professional success of a scientist, researcher or teacher in their respective STEM field. Survey respondents were asked to indicate the extent to which they gained each skill. Figure 2 depicts the percentage of survey respondents who indicated that they gained the skills to a great extent. Between 47 and 72 percent of survey respondents indicated significant skill gains.

Figure 2



Approximately 75 percent of the survey respondents said that to a great extent they gained technical skills in their STEM field. Furthermore, the high level of other skills gained, such as technology, technical writing, networking and leadership skills, also enhanced their ability to perform in their chosen professions and increased opportunities to engage with the international scientific community.

To better capture the field-specific skills that the survey respondents gained in their years of study, the survey asked them to name one or two things they learned in terms of content knowledge (i.e., facts or procedures specific to their field of study) and conceptual knowledge (i.e., basic ideas that underlie scientific thought). There were many distinct subject-specific items named, given the diversity of STEM fields and subfields represented among these survey

respondents (from computer science to medicine—see Table 4 for the eight basic fields of study). The survey respondents also articulated several common areas of learning across multiple fields reflecting the advanced concepts and procedures that are applied in many STEM fields.

Frequently Reported Content Knowledge Learned (In Multiple Fields)

Experimental design
State-of-the-art-technologies
Modelling techniques
Geographic information systems
Data analysis and statistics
Systems thinking
Nanotechnology
Implementing field-based studies

At the same time, survey respondents reported a desire to learn specialized academic content that research in the United States offered, and that could later be applied to critical issues globally. Survey respondents provided examples of content and conceptual knowledge in specific STEM fields that U.S. study afforded.

Field-specific Content and Conceptual Knowledge Learned

Agriculture – Factors influencing transformation of national agricultural systems, genomics

Biology – Hydrologic modeling, genetics, microarray analyses, cloning enzymes

Computer science – Analysis of algorithms, data mining techniques, scientific visualization

Engineering – Desalinization, earthquake engineering, solid waste management, fuel cells

Environment – Analysis of dispersion models, passive solar design, biomarkers in toxicology

Medical & Health – Social determinants of health, epidemiology, disease surveillance

Physical Sciences – Electron microscopy, patterns & processes, wildlife population dynamics

Other – Designing instructional materials, working in teams to solve real-world issues

Personal Reflections on Studying Science in the United States

Individual reflections of survey respondents on what they gained from this academic exchange experience demonstrate that bringing exceptional students to the United States and strengthening their competencies to conduct scientific research at advanced levels results in multiple positive outcomes for these students and their work in their home countries, as well as for U.S. influence in the STEM fields globally. Interview respondents provided concrete examples of what they had gained and gave evidence of future benefits.

- *In the United States, you have a much more competitive environment, especially in the sense of publications, and your advisor is a lot more demanding. So it helped me to plan better. I think it was the most influential thing. Also I know what to look for in people who work on particular things [for future collaborations].*
- *Academically my professor influenced me a lot. She became one of the inspirational personalities for me and a role model to me. Her knowledge and her areas of expertise have become my areas of expertise because the way she taught me was amazing.*
- *One of the objectives of my studying in the United States was to get the … latest technology and get to know what's in the industry and what has now become obsolete from the industry.*
- *The first words that came to mind about studying in the United States are expectations and demanding. My professor was so demanding and set very high expectations. When I did project work in the States, the level is twice as hard as what I did for my thesis in my bachelor's. That's what drives me to be better. The professionalism I saw from my college and my professor was outstanding.*
- *The United States is a big country with state-of-the-art labs. I felt that I could do almost everything, I could make everything I needed for my research, because I would have the equipment, I would have every material I would need. I could try to apply some theory I saw here, but I never had the opportunity to see it in the real world, have real practice.*

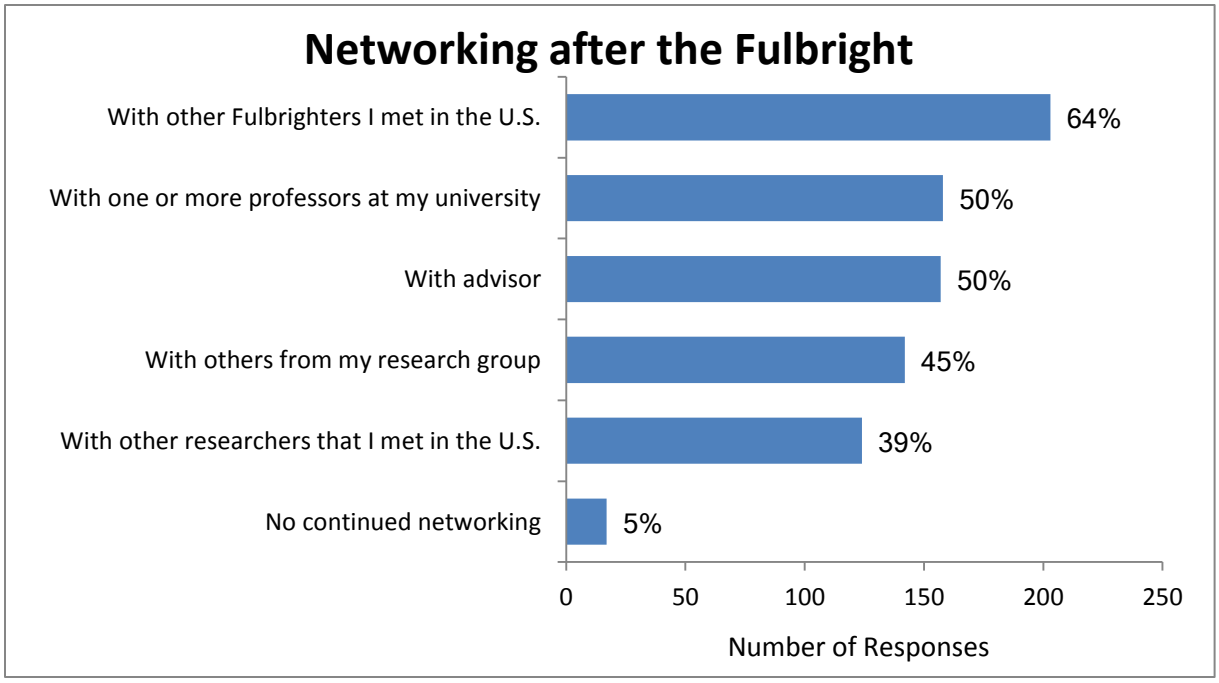
Chapter 4. Findings: Seminar Participants Contribute to Global Engagement in Science

By bringing promising students to the United States, the Fulbright program and FLMS cultivate and strengthen relationships between researchers in the United States and abroad and promote collaboration across borders. Survey respondents indicated that they are prepared through skills development, training in technology and new content, familiarization with international standards, and cross-cultural experiences to contribute in the international arena in STEM fields. Many actively participate in and lead international conferences and are publishing research in international publications (examples of their work are being circulated in international publications.

Networking and Collaboration

The Fulbright experience is extended beyond the end of the Seminar participants' formal program through their continued engagement with scientific and cross-cultural networks established during their' time in the United States. The survey asked whether respondents were involved in active collaborations and continuing networks. The figure below identifies the types of people with whom the survey respondents continued to maintain the network relationships established during their Fulbright years.

Figure 3

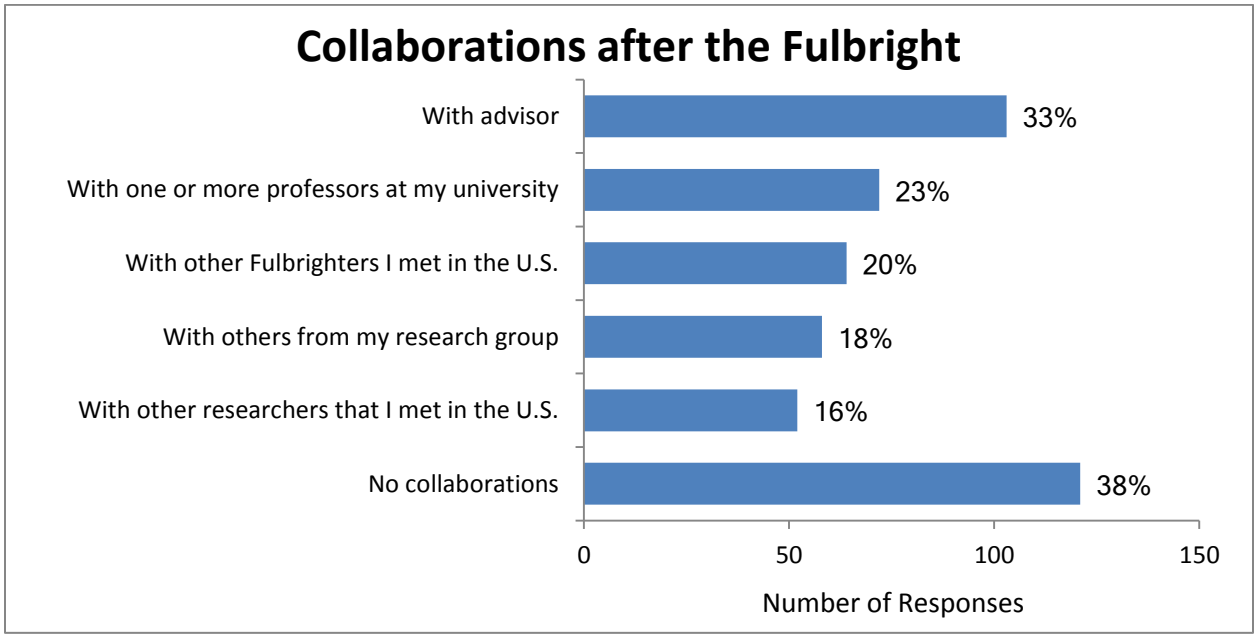


Ninety-five percent of survey respondents reported that they continued cultivating and participating in networks made up of many different individuals with whom they met in the

United States during their program period. Most frequently, Fellows maintained contact with each other; sixty-four percent said they interact with other Fellows, enabling them to develop worldwide networks that they continued to nurture and reinforce following their years studying in the United States. Many networks involved their advisors and professors, other researchers from their research group, and others they had met during the course of their studies.

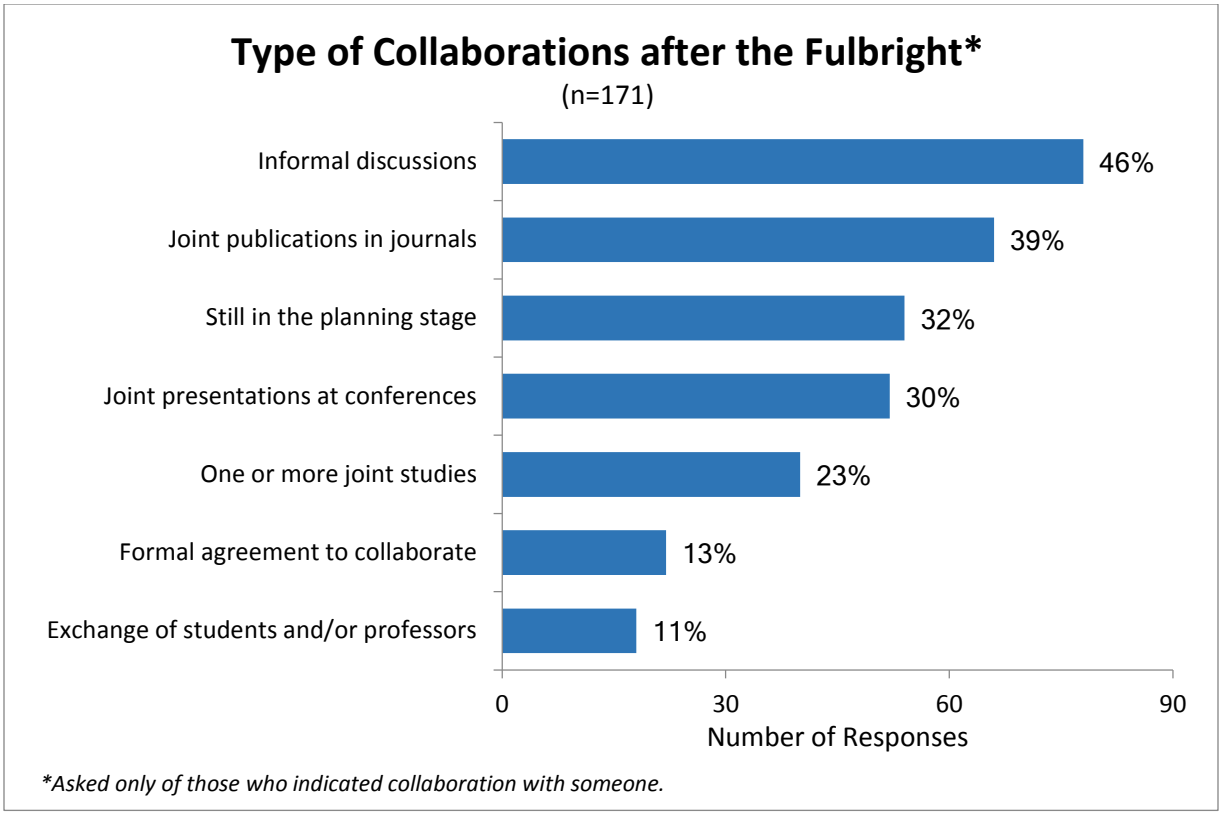
The survey asked the extent to which survey respondents actively engaged in collaborations with their peers and other researchers. The graph below shows responses on the extent of collaboration with various people encountered during the Fulbright program.

Figure 4



Collaborations took place most frequently with Seminar participants' advisors or other professors from the university where the survey respondent had studied. More details were obtained about the nature (and in some cases, the result) of the collaborations from 171 of those survey respondents who said they had engaged in some degree of collaboration. The figure below summarized the extent of these interactions—from formal agreements and exchanges to informal discussions. Survey respondents could select more than one response demonstrating different types of collaborations with one person or institution, or multiple collaborations with several individuals.

Figure 5



Above the survey respondents characterized the types of collaborations they developed after completion of their Fulbright Fellowship, which helped to foster and sustain engagement between people in the United States and the survey respondents. The most common form of collaboration at 46 percent was "informal discussions." About one-third of collaborations were still in the planning stage. Additionally, 30 and 39 percent of the survey respondents reported they made joint presentations at conferences or had a joint publication in a journal, respectively. Other substantial collaborations included the researchers carrying out one or more joint studies (23 percent), operating with a formal agreement (13%), or facilitating an exchange of students and/or professors (11%).

The evaluation found that survey respondents were well equipped to engage in global scientific collaboration and networks because of their Fulbright and FLMS experience. Interviews with survey respondents made clear that this formative period was defined by the opportunity Seminar participants had to live and study in the United States and exposure to the diverse colleagues in their U.S. university programs and on the laboratory teams in which they worked. The Fulbright and FLMS experiences made survey respondents better prepared to participate in international scientific conferences and collaborations, as they indicated that they gained confidence in understanding these environments and relationships and their ability to navigate cultural differences. Many respondents also have built continuing relationships with individuals and

academic institutions in the United States that enhance their own standing and abilities as STEM practitioners and academic leaders in their home countries and internationally.

Fulbrighters' Examples of their Global Reach

The following comments provide illustrations of the survey respondents' global engagement in science.

- *Collaboration in Biology in Environmental Sustainability: The commitment to enhance research in my home country by collaborative research, allowed me to be part of this selective group as a Global Sustainability Fellow 2013-2014. My experience under the Fulbright Program has provided me with skills for international collaborative work. (Ecuador)*

- *Collaboration among Universities in Engineering: I started a collaboration with my advisor to compare product design efforts from teams in the United States and in Colombia for problems of small farmers in Colombia. Working from the prototypes for low-cost tools that have been published online—like a tractor or a low-cost tool for weeding or for seeding—we use the prototypes as a baseline to compare. So we are trying to see where we can improve on their solutions and help get to the goal of the right kinds of tools to small- to mid-size farmers. We are calling them micro-tractors that have a small platform where you can attach different tools for the different part of the farming process. (Colombia)*

- *Computer Science Citations: My work has been cited more than 130 times by other researchers, as measured by Google scholar. I am able to publish my research in seven journal papers, four conference proceedings, and two book chapters. It has received a significant acknowledgment from the experts in engineering and technology management. (Pakistan)*

- *Dissemination on a Critical Topic in Computer Science: I am publishing my research work in selective journals and conferences about finding new ways to improve security and protect privacy in the highly connected mobile networks of today. (Ecuador)*

- *Physical Sciences Publications: I have published more than 60 international peer reviewed journal papers and applied for and had approved more than six national patents. My experience and what I have learned and established during my Fulbright Fellowship is critically important for me. (China)*

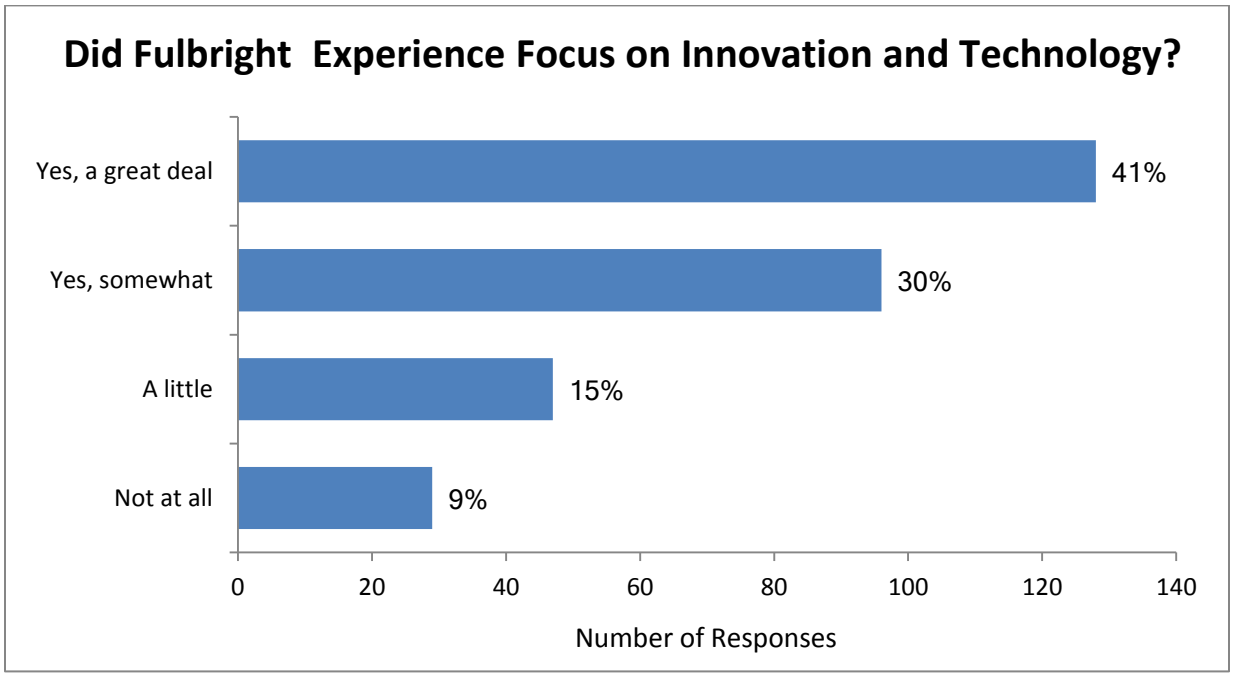
- *Joint Publication in the Medical & Health Field: At the end of the Fulbright Program, I had a chance to do an internship at UNICEF where I collaborated with my supervisor to write a manuscript on violence against children in Vietnam. The manuscript has been submitted to Journal of Interpersonal Violence and accepted for publication. (Vietnam)*

Chapter 5. Findings: Entrepreneurship and Innovation Are Valued and Practiced by Seminar Participants

Innovation and Entrepreneurship in the Fulbright STEM Experience

This chapter discusses a variety of survey respondents' experiences that contributed to their exposure to, and in many cases, adoption of, initiatives that embrace the use of innovation and entrepreneurship to address and expand research and academic initiatives, as well as address wider societal or global challenges. Some survey respondents found that after returning home, their institution or country was receptive to "new and innovative ways of doing things," including being able to bring innovative ways of teaching into the classroom. The survey outcomes and qualitative remarks demonstrate the ripple effect in entrepreneurship and innovation inspired by the Fulbright program, including the FLMS experiences.

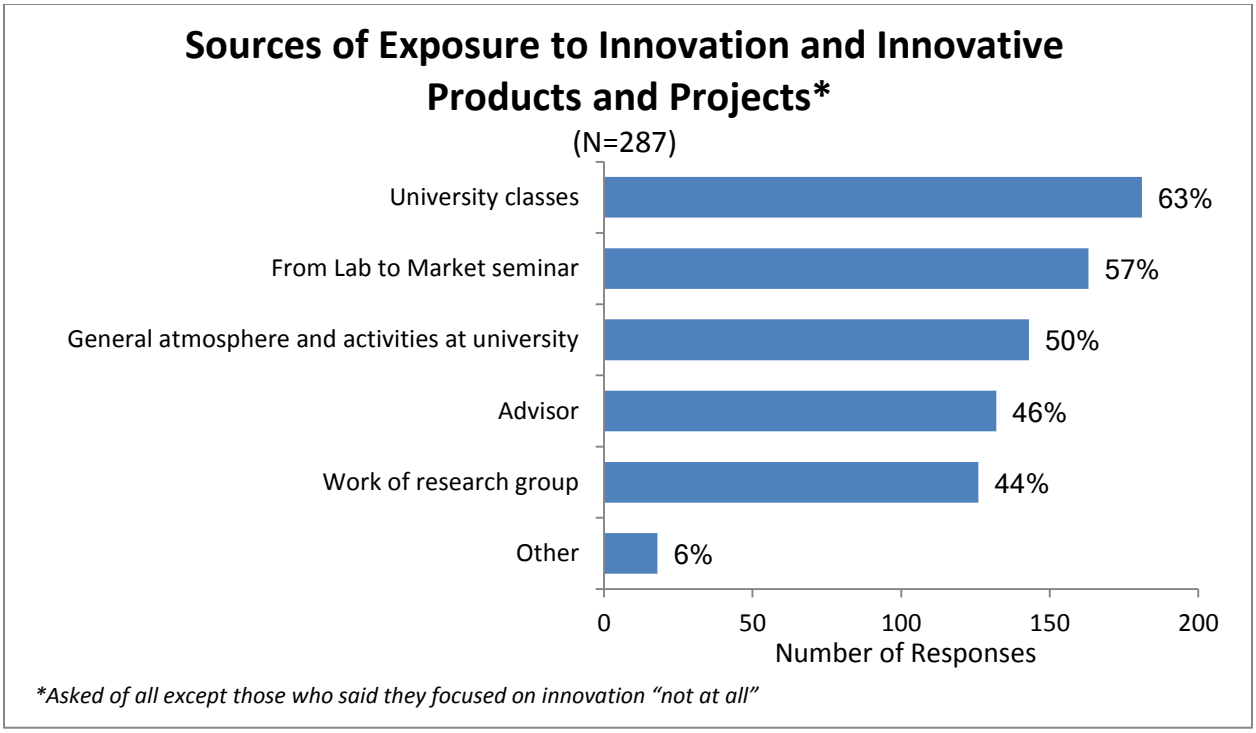
Figure 6



Approximately 71 percent of the survey respondents indicated that their Fulbright and FLMS experience was focused on innovation and technology (41% "a great deal" and 30% "somewhat").

This study sought to learn where survey respondents were exposed to innovation and introduced to innovative projects and products. The survey respondents identified several environments that encouraged their innovative input, as Figure 7 demonstrates.

Figure 7



Sixty-three percent of the survey respondents named university classrooms as the source of innovation and its applications. The FLMS was influential in this regard as well, as 57 percent of survey respondents indicated the Seminar was a source of exposure to innovation and innovative products and projects, making it the most prevalent source of exposure to innovation after university classes. While the Seminar was cited as a place where respondents were exposed to cutting-edge ideas and innovation, survey respondents also found attending conferences and professional meetings, participating in internships, fieldtrips and company visits, and gaining exposure to Silicon Valley (which was the location of the first two Seminars) as highlights of the program.

Some interview respondents described their efforts to plan and create start-up ventures related to their areas of expertise and interest. One respondent described his volunteer work as supporting a new enterprise by developing the company's website. Several interview respondents, who taught at universities after returning home, sought to inspire innovation in their classrooms. They used their own educational experiences in the United States to reshape and strengthen their teaching and mentorship, and promote innovation among their students.

Influences of the *From Lab to Market* Seminar

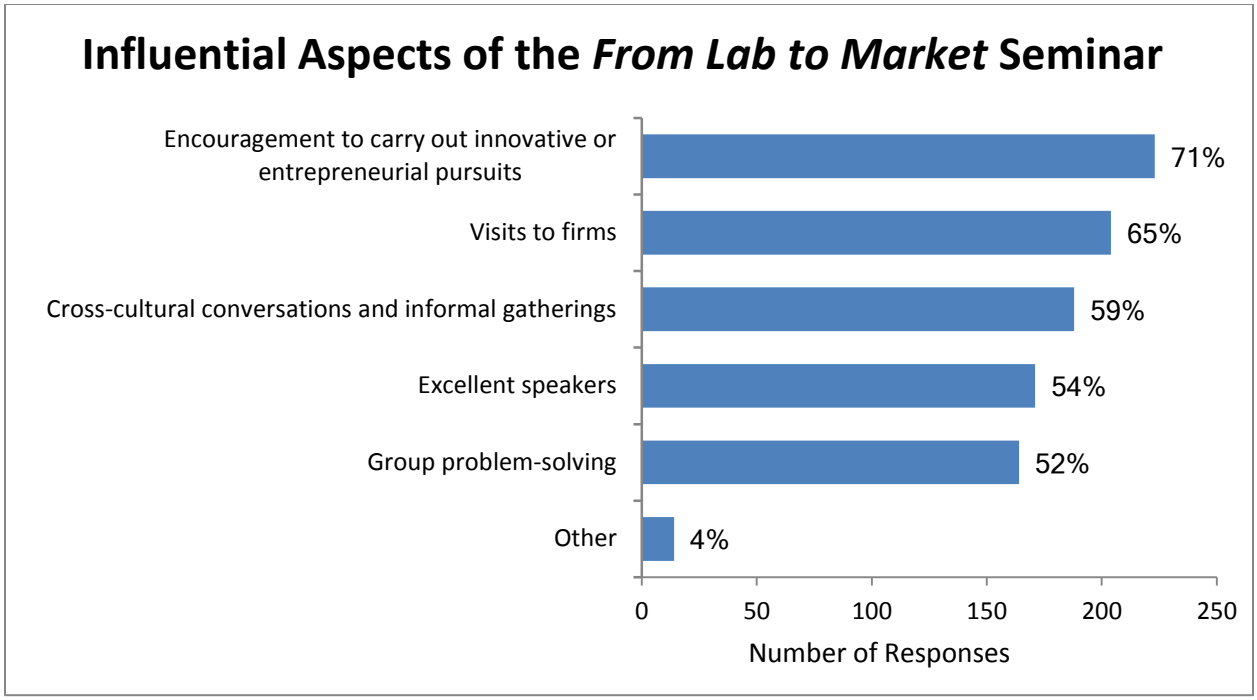
The FLMS was launched in 2007 as a way to enhance the Fulbright experience and help students understand how to translate scientific research into innovative products and services that would promote economic development and progress. The seminar augments the roles of Fulbrighters' U.S. host universities in strengthening global scientific activities, emphasizing the role of applied research in meeting critical global challenges and promoting innovation through entrepreneurship.

During the period of 2007 – 2011, seven FLMS seminars were held around four different themes: Science, Technology and Entrepreneurship; Agriculture, Health and Environment; Energy and Environmental Sciences; and Public Health. The seminars introduced participants to scientific innovators and experts in the applied sciences, public-private research consortia, centers of innovation, start-up companies, and research and development laboratories. The workshop provided a forum for Seminar participants to learn from experts and exchange ideas, particularly around the use of technological advances across scientific disciplines to support achievements in fields of energy, agriculture, health, technology, and environmental sciences. The Seminars included discussions with experts, site-visits to industry-leading companies, research institutions and NGOs, and a problem-solving case-study to produce practical solutions to real-world issues by interdisciplinary teams of Seminar participants. Seminar participants had an opportunity to build on their knowledge and establish new networks of their peers in addressing globally challenging issues.

31% *of seminar participants after returning to their home country said presentations or activities in the From Lab to Market Seminar helped them to be successful after the program.*

Many interview respondents described in detail the varied impacts of the Seminar. The survey queried respondents for their opinion of the most influential elements in the four-day seminar. Figure 8 highlights the activities or experiences that stood out for the majority of the respondents.

Figure 8



Seventy-one percent of survey respondents said, "the encouragement to carry out innovative or entrepreneurial pursuits" was a key aspect of the FLMS experience. Interviewed seminar planners said they had intended this message to be effectively communicated throughout the various program activities. Seminar activities (which included site-visits to high tech firms and labs, conversations with other Seminar participants, speakers on various topic, and group problem-solving exercises) all reinforced themes of innovation and entrepreneurship.

As a result of their Seminar experience, interview respondents described their enhanced awareness of how new ideas could move into the marketplace, and how innovation could help scientific research and its application to societal issues and challenges. For many, this new awareness emerged during the Seminar. For other respondents, the Seminar takeaways were more apparent as they returned to their home countries.

The interview respondents provided recollections of the Seminar's emphases on entrepreneurship and innovation and how they might apply these concepts to their respective STEM field:

- *I started appreciating those things that were said in terms of that we need to have applied sciences rather than the theoretical sciences and give entrepreneurs a jump up to actually have the economy grow. We cannot just all keep asking for jobs other than creating jobs.*

- *I think it gave a good perspective on how we can actually, as the name says, put our research in a more practical way. It's something that we can really give back to society*

and how, with the invited speakers, how they did it and how we can create success and how we can refine our projects to get that success, not just leave it in a thesis in the library and finish our work.

- *This is an interesting market here [with new hospitals being built] to offer these kinds of things…you see that from your research you can come out with an idea, and then you can decide to move this to the market, then just start with a spinoff or a startup and offer this kind of product and then just get the funding from people, investors.*

- *The talk about venture capitalists…You have an idea and you take it to people and if it's good enough you can get investors to back you. So it is a whole lot different—it really introduced me to the way things work in the entrepreneurial world.*

- *I remember a speaker [who] sold us the idea that we have to see how to put our research in production, like how to really make an impact on the commerce or in the industry, how to make industry and academia go together.*

- *That was a nice exposure to the students and give them some understanding of how the Silicon Valley culture and how startups initiate and how they go for public offerings and how they market their innovative ideas. How the officers get the venture capitalists [to go] for it. It gives us some ideas.*

- *The site visits were really cool. I mean the chance to see Google headquarters was incredible. The fact that we were receiving talks from this professor from Stanford or these people that are investors. I had been focused more in the engineering and technical aspects, and I wasn't thinking too much of what's happening afterwards. So then you need to think of, are you going to take this to something more? So that was actually really good.*

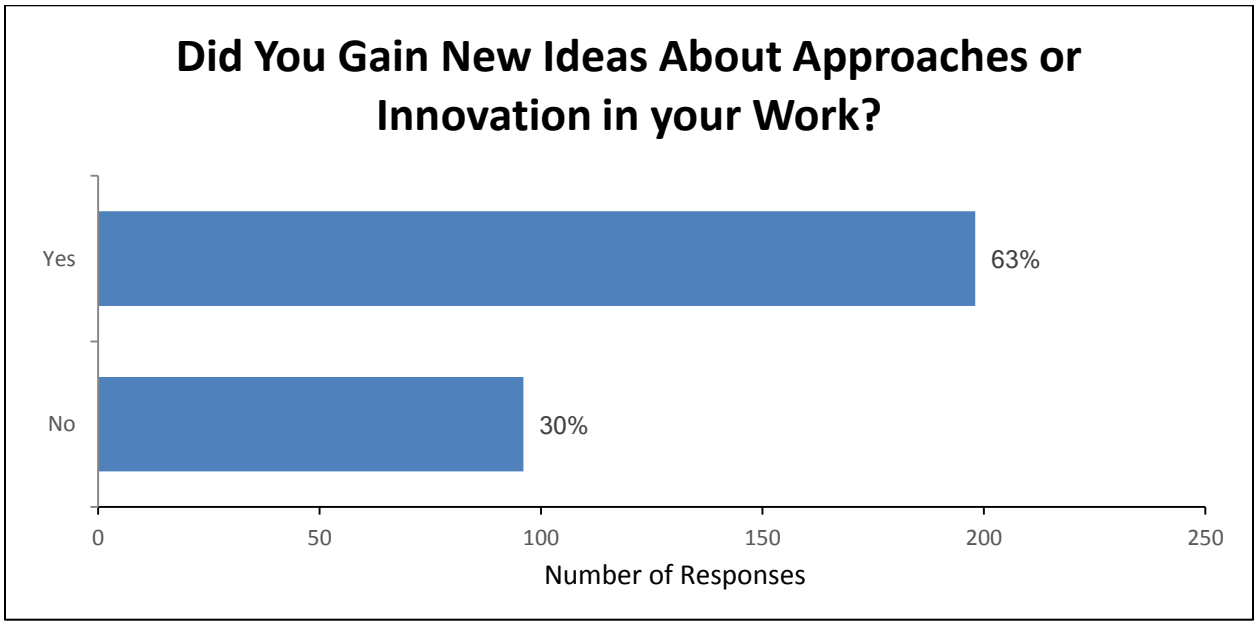
- *It was good to visit the headquarters of Google and of other enterprises. The kind of message that I got was there was space to do research in industry in the United States, and that was something that I found very interesting, and which is starting to become more common here, especially at my university.*

Post-program Innovative Ideas

Many aspects of the Fulbright Foreign Student Program and specifically, the FLMS, encouraged Seminar participants to follow up on innovative applications of their work. Asked if the Seminar experience had prompted ideas about innovation or new approaches to their work, 63 percent of survey respondents responded positively. Those that responded positively were then asked how

they had applied innovation in their specific STEM field, which ranged from environmental studies to computer science.

Figure 9



During the course of this evaluation, it was revealed that innovation may take numerous forms and have varying degrees of impact: exploring a new idea to address a recurrent problem, applying new techniques or procedures, conducting research in new or expanded areas, or inventing a new device or process. When survey respondents were asked their views about where innovation is possible, they generally cited uses of technology or systems to innovate. Specific references were made to mobile devices, applications, and GIS in a range of STEM fields.

Table 6 is a representative sample of the innovative ideas and pursuits survey in which respondents were engaged. The fields and issues undertaken represent some of the critical international problems that the United States is addressing, especially in the environmental and health sectors. The U.S. universities hosting foreign Fulbright graduate students in the STEM fields are also addressing some of the priority issues that the respondents' home countries are striving to tackle. Below are direct quotes from survey respondents as they described their new research and innovative ideas in their respective STEM field.

Table 6: Innovative Ideas Advanced via the Fulbright and *From Lab to Market* Experience	
Agriculture	*Seed system for vegetatively propagated planting materials targeting small landholder farmers living in high disease spot areas*
	Specifically in doing agricultural surveys, I am able to utilize more innovative tools, such as specific software to prepare and conduct surveys.
Biology	*Usage of new types of traps for the collection of mosquitos for malaria control*
	There are three areas we are trying to focus in Ophthalmology: 1. new technology for early diagnosis of disease, 2. forecasting of outcomes of disease and clinical interventions, 3. designing new clinical interventions for better outcomes.
	The technology of enzymes: the use of microorganisms to isolate new enzymes with potential in industries
	I am working with a team at NIH on the development of malaria vaccine.
	The use of remote sensing technology to evaluate carbon stock in the Congo basin forest
	Using new morphometric analysis and techniques in biological research
Computer Science	*My research project was on creating unmanned group of harvesters that can work by the dynamic instructions generated by the state of proximity sensors deployed in harvest field.*
	Using technology while at the same time taking care of the environment and pushing for a Green Computing initiative
	Use of new visualization in the biomedical informatics field
Engineering	*I am currently doing research on novel materials to improve the properties of water purification membranes. The findings of the research could lead to innovative products which would help save significant costs of producing fresh water or reuse/recycle water.*
	I am working on an interdisciplinary research laboratory where we highly get inspired by the animal kingdom to build new bio-inspired robotic systems.
	I have invented 5 seismic devices during my Ph.D. program. We are currently in process of patenting them. All of the devices have potential

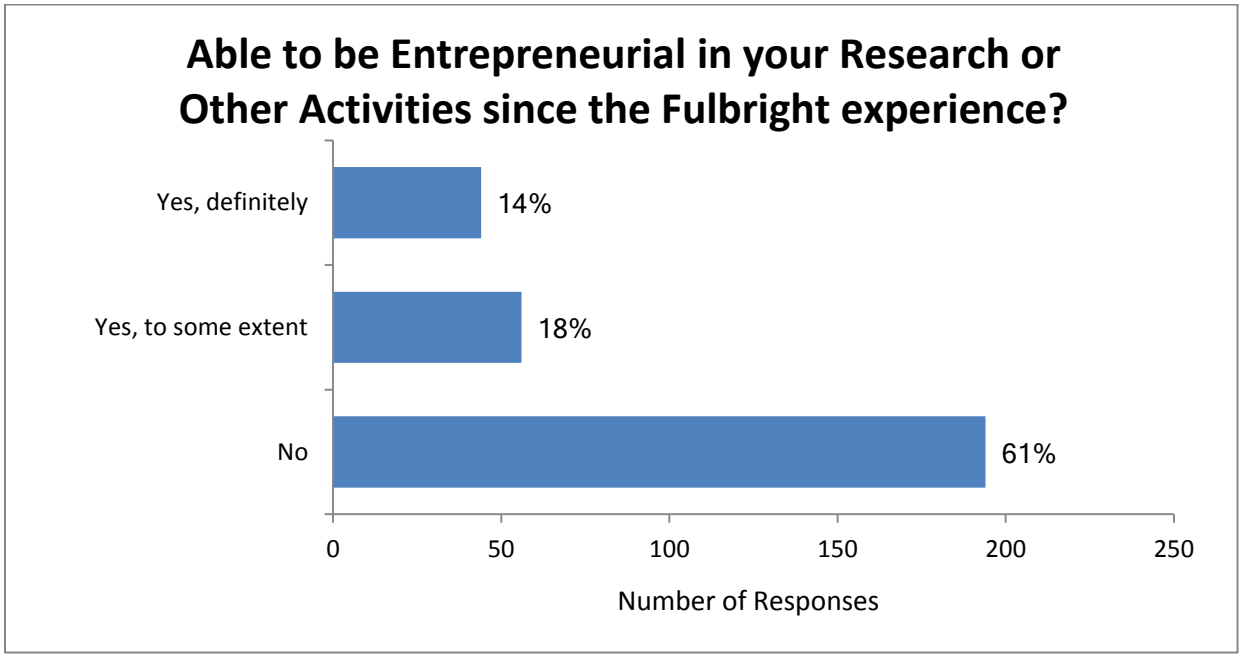
	applications in building/bridge structures in earthquake zones.
	I am thinking on the technology how to separate plastic from the other waste (they are not separated at the collection point) in Africa.
	My current research is about improving dynamic behavior of the power grid by using renewable generating sources.
	Using low power processor architecture for smartphones and tablets
	The idea of my research was building a multi-terminal HVDC (high voltage direct current) network between the United States and Mexico. This will benefit both countries economically. It is also an innovative engineering concept.
Environment	*Using well designed constructed wetlands to treat contaminated wetlands with petroleum and other organics and metal toxicity in the wetlands in my country*
	New methods of collecting ecological data in my country, e.g., the use of LIDAR (remote sensing technologies) to collect vegetation cover variables
	Being in a very humid and forested area we can do more to protect our environment by focusing on the riparian buffer zone of all our rivers
	Usage of new materials to replace products such as cement
Medical & Health	*By attending the Lab to Market seminar, I learned how easily available resources can be harnessed to be used for cost effective public health strategies, especially in resource constrained environments. For example, to use breath analyzers for TB detection in developing countries, where other diagnostic facilities are very limited.*
	Improving record keeping and reporting systems
	The application of health communication to zoonotic diseases (diseases of animal origin but affecting human's health and livelihood)
Physical Science	*The possibility of using low and medium geothermal energy in rural areas of my country to refrigerate products*
	I am working on Radio Frequency Identification Devices (RFIDs) and their possible use for a secured Pakistan.

Note: Quotes are categorized based on survey respondent's field of study.

Fulbright: *From Lab to Market* Seminar Participants' Views of Entrepreneurship

In addition to promoting innovative ideas, survey respondents said that the FLMS has served as a source of inspiration for entrepreneurial activities in their post-Fulbright period. A survey question asked about the extent to which survey respondents had been able to be entrepreneurial in their research or in other activities since their fellowship. Figure 10 presents responses from survey respondents.

Figure 10



Thirty-two percent of the survey respondents answered "Yes" to their ability to be entrepreneurial in their research or other activities since their Fulbright experience—either "definitely" or "to some extent."

Some survey respondents who had returned home indicated that they had started their own business or consultancy. Additionally, respondents cited volunteering to help start-ups, applying for grants, working to commercialize research applications, and opening new lines of business within one's current workplace.

Illustrations of entrepreneurial activities described by survey respondents provide insight into their specific accomplishments in varying STEM fields and in different countries.

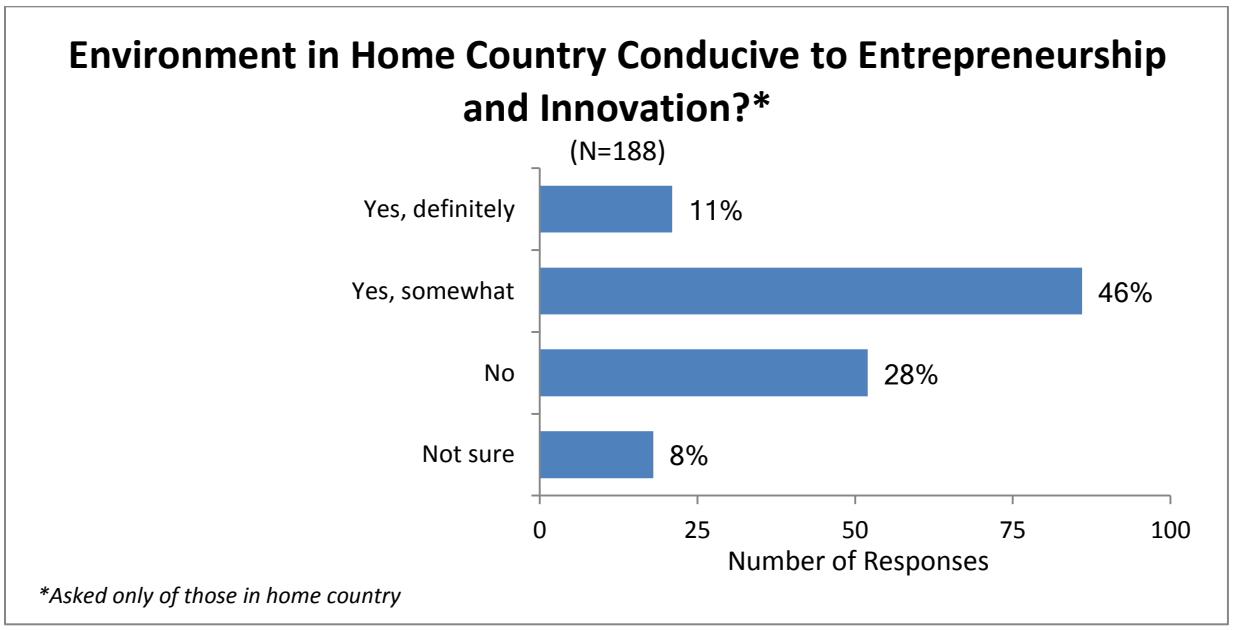
- *Created Viogaz, a social enterprise using bio-digesters as a tool to empower farmers to use their waste to produce renewable energy and treat their waste.* (*Costa Rica)*
- *On my way to starting a biotechnology company in Nepal--it would deal with medical diagnostics and others like skin generation for burn patients. The Fulbright experience*

has given me a lot of exposure, networking, and confidence in starting my own work. (Nepal)

- *Founded my own consulting firm focusing on providing technical consulting services for our clients working in telecommunications, energy and construction sectors*. (*Afghanistan*)
- *I developed a module in our statistical machine system that translates Arabizi (Arabic written in Latin characters) into English. (Morocco)*
- In engineering: *I have been able to develop fault detection and reconfiguration algorithm for one of the satellite projects of [my organization]. I have worked in a team on altitude control systems of the satellite projects*. (*Pakistan*)
- In computer science: *I was able to provide new methods (with lower and upper bounds guarantees) for optimizing high degree binary polynomials. Despite being an interesting and important question from the theoretical point of view, it has many practical applications, as in computer vision problems (a field in which I actually applied these methods).* (*Brazil)*
- In physical sciences: *I have been creating new approaches, methods and protocols to study microorganisms that are in ice. That will allow us to use them as paleo-indicators of climate and environmental conditions, but also study their physiology in harsh environments.* (*Chile*)

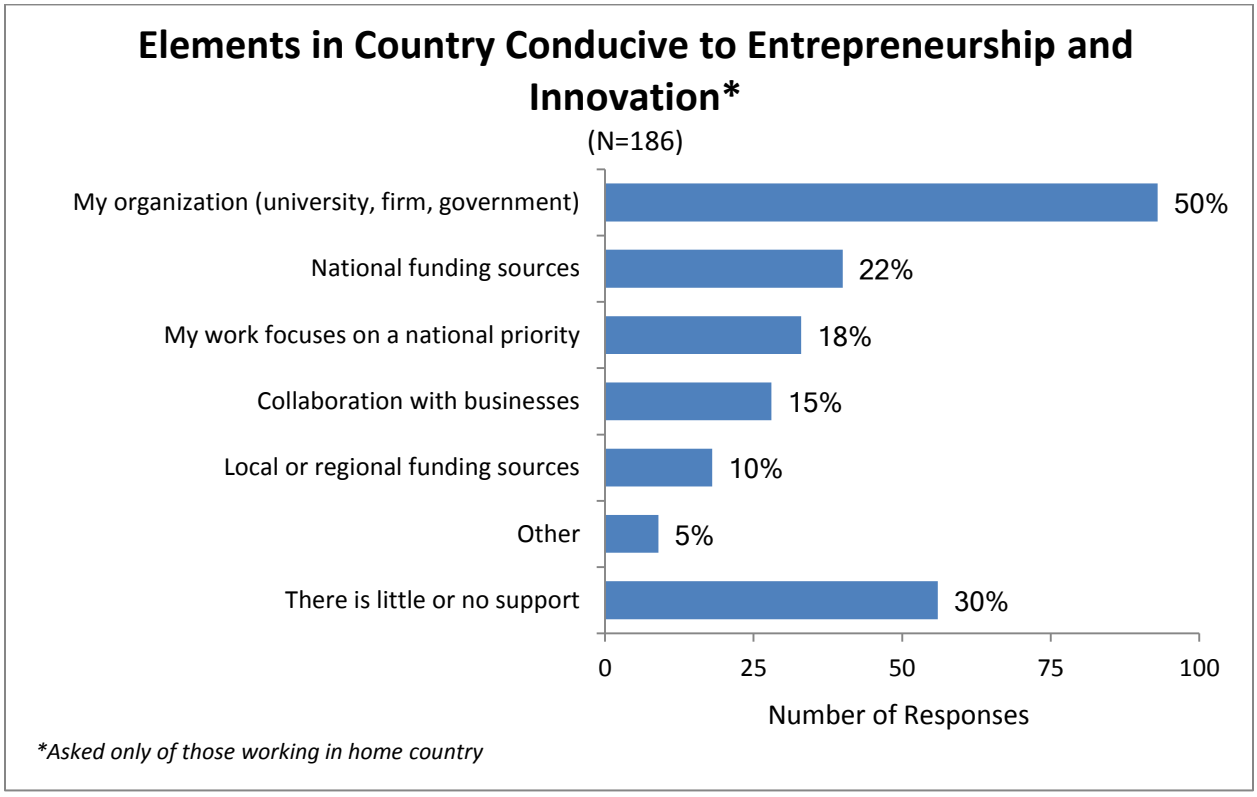
In considering the post-program entrepreneurial opportunities for survey respondents after returning home, the respondents' perceptions of their cultural and economic environment were varied. These contextual questions serve as an indicator of whether Seminar participants were actual facilitators of innovative and entrepreneurial activities as well as their receptivity to future business ventures.

Figure 11



Fifty-seven percent of survey respondents felt their home country's environment was conducive to entrepreneurship and innovation (either definitely or somewhat). Survey respondents detailed the specific sources of support to innovation and entrepreneurship found in their country.

Figure 12



Even if a survey respondent had not been entrepreneurial to date, 70 percent of those surveyed named one or more elements conducive to entrepreneurship and innovation in their home country. Fifty percent of survey respondents ascribed a supportive atmosphere for entrepreneurship to their organization (such as a university, a private firm, or government agency). As a survey respondent, if applicable, they were instructed to give multiple responses, or identify several sources of support which might be identified. National funding for research was cited by 22 percent of those surveyed (with local and regional funding listed by 10%). Eighteen percent referred to their work as a national priority, and therefore, in a position to be supported. Fifteen percent pointed to collaborations with business as another means of support. Some of those who listed "other" identified collaborations with colleagues as a source of support. Thirty percent of survey respondents expressed the view that there was little or no support for innovation and entrepreneurship in their home country.

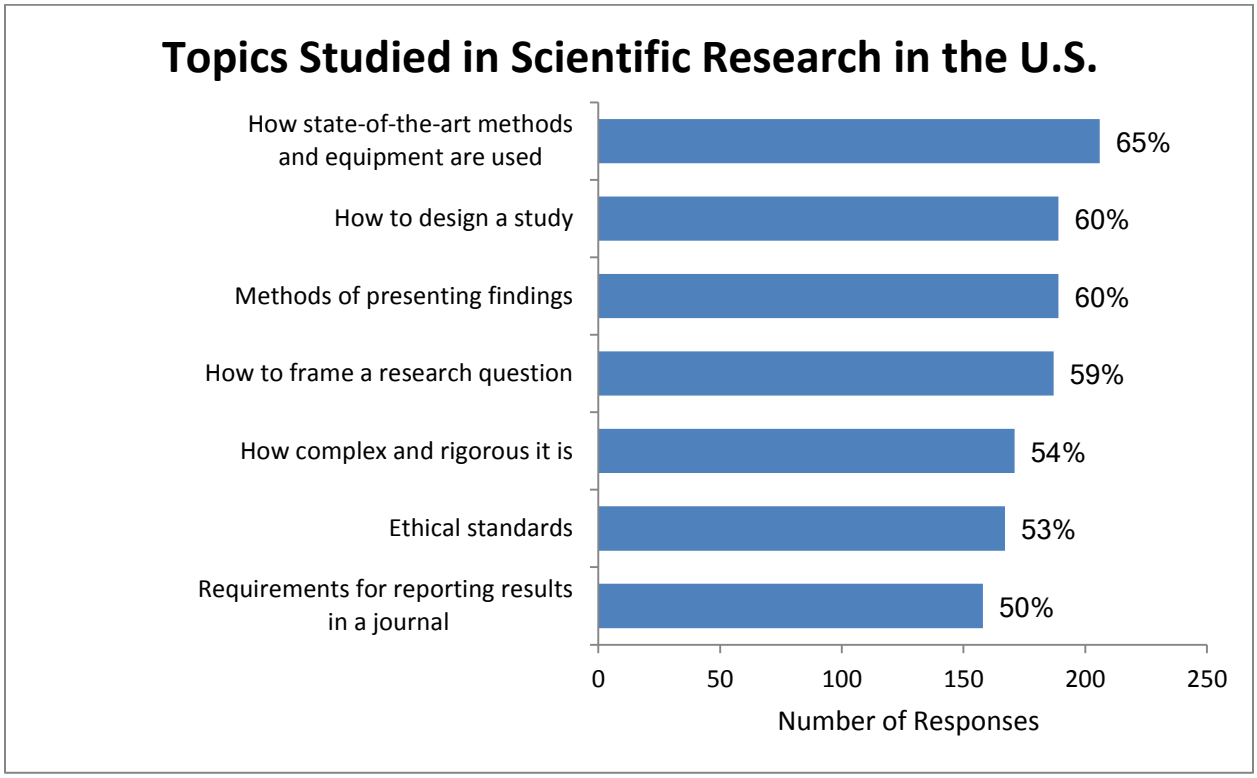
Chapter 6. Findings: Seminar Participants Increased Technical Expertise and Awareness into Critical Issues in STEM Fields

Scientific Research

Some students in the Fulbright Foreign Student Program for STEM fields and the FLMS expressed an increased awareness or insight into the nature of scientific inquiry—and especially how it is practiced in centers of excellence as a result of their time spent at U.S universities. To assess survey respondents' increased awareness, they were asked to describe how much they learned about scientific research.

Sixty-seven percent of survey respondents said they had learned "a great deal" about scientific research in the United States.

Figure 13



Sixty-five percent of survey respondents noted that they had learned about the application of state-of-the-art methods and equipment. Sixty percent of survey respondents also said they learned how to design a study, frame a research question, and present findings. Other significant areas of learning about conducting science in the United States address the complexity and rigor of science as well as applicable ethical standards and the requirements for journal reporting. These areas of increased awareness and knowledge allow survey respondents to apply their research skills at an advanced level nationally and internationally. Survey respondents,

mentioned learning about other aspects of advanced scientific research such as: how to collect data (47%), management of a study (44%), and application of standards of objectivity (36%) and evidence (28%). A number of survey respondents included the importance of collaboration, and several mentioned the use of statistics and statistical modeling.

Excellence in STEM

Survey and interview respondents were asked to describe a significant accomplishment they had made in their STEM field—whether in research or teaching or on behalf of their organization—and the extent to which the Fulbright and FLMS experience contributed to their accomplishment. Their descriptions underscore the transition from U.S. academic study to the application of methods and content expertise in their home countries.

Of the many descriptions provided regarding survey respondents' accomplishments since their Fulbright experience, below is a sample of the varied responses, indicating their field of study and country.

- **Biology:** *I was able to establish the Institute of Translational Research, Engineering and Advancement of Technology in Hyderabad. With this I was able to demonstrate that engineering aspect is equally important in clinics and human care, in addition to medicine and biology. We are working on several ground breaking projects in ophthalmology with numerous collaborators in India, United States, and other parts of the world. (India)*

- **Engineering:** *I have designed algorithms and training signals for synchronization in wireless networks. My research contributions have a potential to impact both current and future wireless communications standards. It has been made possible by my Fulbright Program, which gave me the opportunity to come to United States and get engaged in this type of research work.* (*Pakistan*)

- **Environment:** *I contributed to the improvement of the field operations from the identification of strategic conservation areas for water sources to the implementation of innovative Reduction of Greenhouse Gas Emissions projects. All of these skills were learnt during my thesis research in my Fulbright program.* (Bolivia)

- **Medical & Health:** *I successfully led the development and management of a national resource center website for prevention of mother to child transmission of HIV in my country.* (*Tanzania*)

- **Engineering:** *There are two major types of stream bank erosion, namely mass failure and fluvial erosion. Mass failure is defined as a massive collapse of stream bank soils due to geotechnical instability. On the other hand, fluvial erosion represents particle-by-particle entrainment. Study in fluvial erosion is limited due to the difficulty in observing fluvial erosion and the fact that there is no commonly-accepted technique for measuring*

this type of erosion. In my study, a technique was developed using a conduit flume which overcame the limitations associated with the existing techniques for measuring fluvial erosion. This finding will help researchers and engineers to measure fluvial erosion. The Fulbright scholarship program gave me a chance to access the required facility and technology as well as meet and collaborate with my academic advisor, therefore this new technique can be developed. (*Indonesia*)

- **Biology:** *Through my research, a key misconception about the cause of grey leaf spot disease in corn was uncovered that will refocus the effort of breeding for resistance to grey leaf spot of corn. This data has yet to be made public in a peer-reviewed journal.* (*Ghana*)

- **Agriculture:** *I obtained funding ($180,000) for the implementation of a research project (sustainable agriculture production in the green mountain using tertiary treated wastewater) and I'm the project manager. (Oman*)

- **Environment:** *I have been involved in the development and implementation of an innovative approach to watershed management for a dry area in Swaziland which has been experiencing drought for a number of years. Due to putting in place different structures in the project area to recharge ground water, we have seen one of the rivers in the project area producing a small flow of water where water had not been flowing for almost a decade. I also developed a monitoring and evaluation plan for my organization and put in place data collection systems.*

- **Medical & Health:** *Since, I returned to my country, I was able to help implement a family medicine training program literally from scratch and in a resource limited setting.* (*Haiti*)

- **Medical & Health:** *During my teaching and working with my colleagues in the hospital, when they conduct a research, I am helping them … to do it in a right way. For example how to gather data, how to analyze them, how to write the paper. Having this skill is not common here in Iraq because they do not have the Fulbright experience.* (*Iraq*)

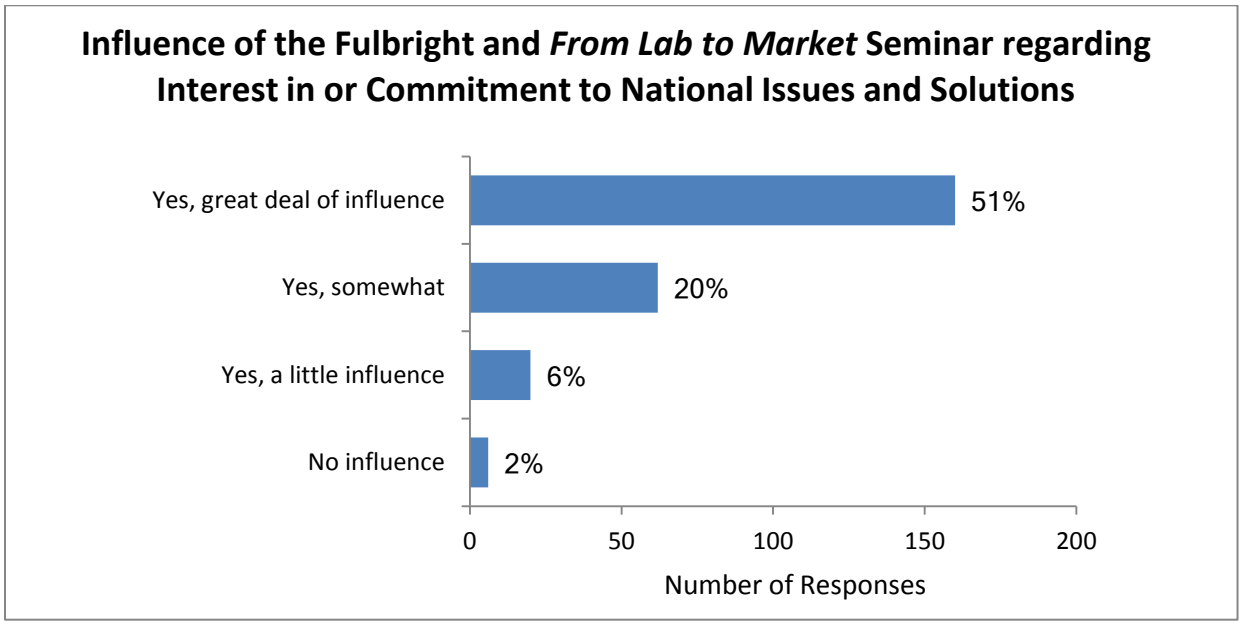
- **Medical & Health:** *I have been able to change the attitude of my colleagues to desist from the habit of old "comfortable" routines and switch towards evidence-based practice. Through my Fulbright experience, I came to understand better the need and importance of keeping up to date with current evidence and best practices. I gained knowledge and understanding on how to evaluate the impact of new evidence and best practices on outputs and outcomes.* (*Cameroon*)

Interest in Critical National Issues

The Fulbright recruitment and selection process focuses on priority fields for the United States and for Seminar participants' home countries. The survey addressed this priority by asking how

respondents' Fulbright experiences influenced their engagement capacity in addressing critical national issues.

Figure 14



Seventy-one percent of survey respondents indicated the Fulbright and FLMS had "some" or "a great deal of influence" on their interest in national issues and solutions, with six percent indicating "little influence" and two percent indicating "no influence" at all. Another ten percent said that they either do not work on development issues or do no work on issues related to their home country. The survey respondents who most frequently indicated the greatest influence on their interest in national development issues were the 60 percent residing in their home countries following their Fulbright experience. Of this group, 76 percent indicated "a great deal" or "some influence" on their commitment to or interest in these issues.

Of all respondents surveyed, 242 of them felt that their studies during the Fulbright Foreign Student Program, including their participation in the FLMS had influenced their interest in or commitment to issues of national importance. Survey respondents were asked about and provided examples of significant problems they have addressed in their home countries. A sample of the 179 responses received is highlighted here by STEM field of study, underscoring the critical contributions the survey respondents credit to their Fulbright experience.

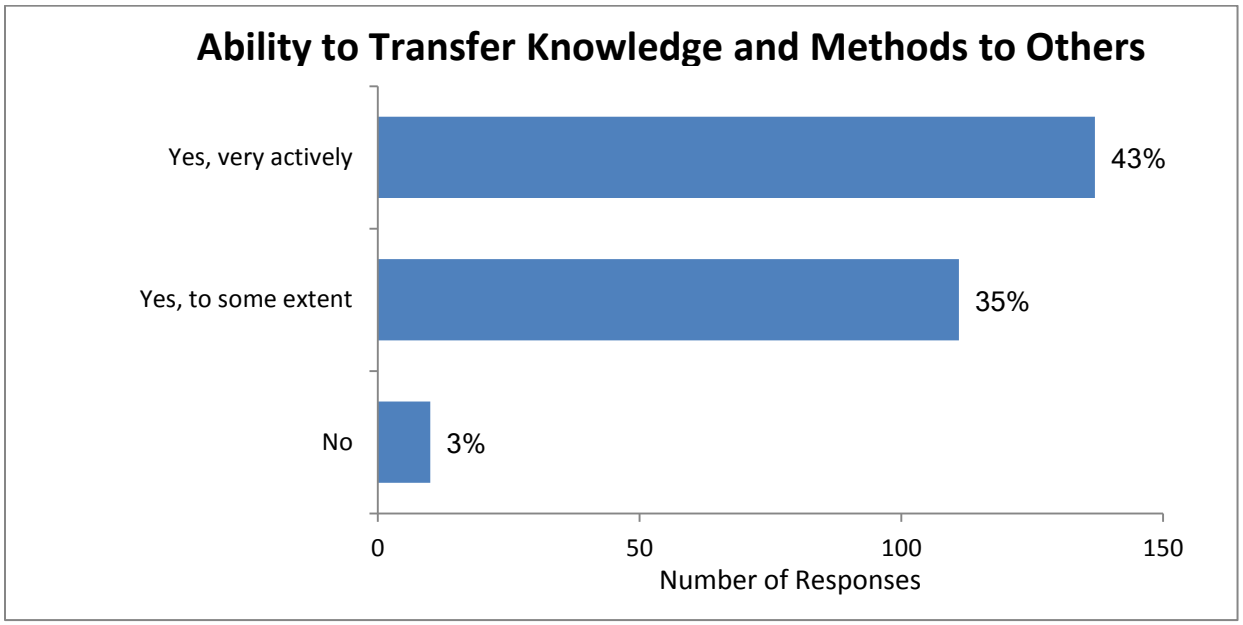
- **Agriculture**—Environmentally-friendly agricultural practices; strengthening the role of farmers' organizations; water scarcity.
- **Biology**—HIV/AIDS and prevention of mother to child transmission; national security issues; management of trypanosomiasis (sleeping sickness); fabrication of affordable and reliable machines for everyday use.

- **Computer science**—Decision-making with the help of real time databases; remote monitoring; automation of government processes; energy crisis in Pakistan.
- **Engineering**—Bringing research in soil mechanics and geo-technical engineering to Guatemala; STEM education as a national priority; improving the very low level of automation in manufacturing; implementation of biofuels in Colombia.
- **Environment**—Correlation between air quality and public health; mining contamination; how climate change will influence the water sector in Swaziland; geothermal energy and climate change challenges.
- **Medical & Health**—Strengthening laboratory capacity for infectious disease diagnosis; childhood stunting; cardiovascular risk factors assessment in children; increasing access to under-utilized services such as family planning and out-patient consultations; developed healthcare reform program for Afghanistan presidential candidate.
- **Physical Sciences**—Lack of skills in the government to improve conservation of natural resources; adaptation to climate change with focus on indigenous peoples.

Leadership for Growth and Change

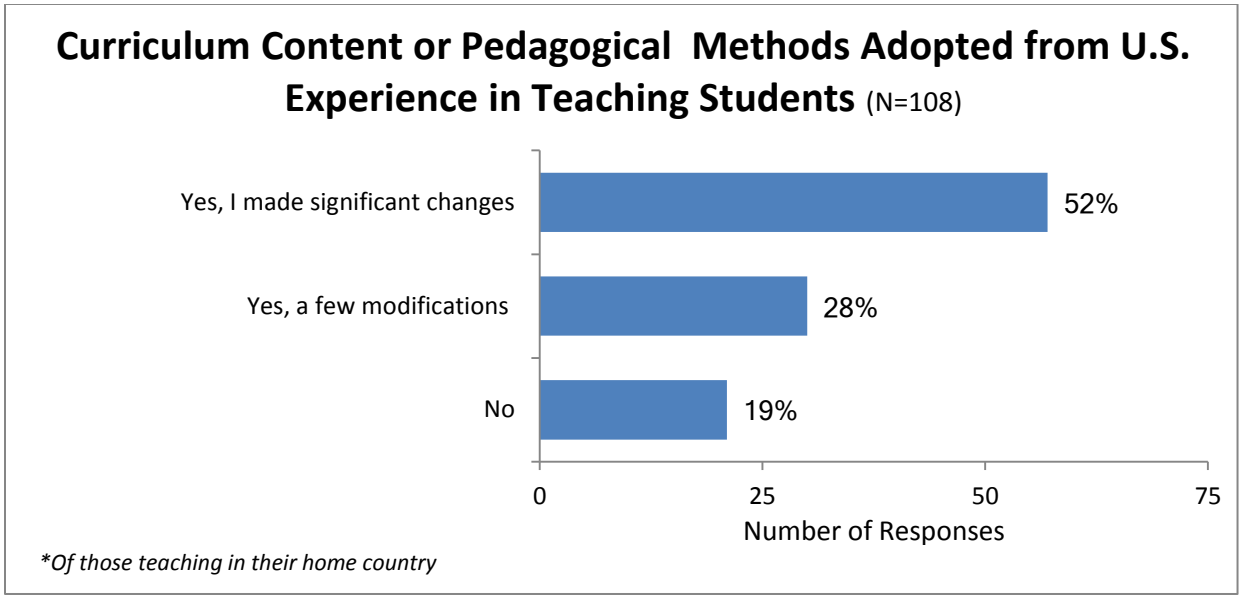
Another measure of impact of the Fulbright and FLMS is the degree to which survey respondents had been able to convey knowledge, methods, or insights they gained from their experience to others in their organization or researchers in their STEM field. The graph below shows more than three-quarters of the survey respondents (78%) transferred knowledge and methods to others—and 43 percent reported they had been actively doing so.

Figure 15



An important way that survey respondents had impact after their Fulbright experience was through their work in universities at home. Survey data illustrated that more than half of survey respondents who were back in their home countries (n=108 or 57%) were teaching university students. The graph below shows the extent to which those who had an opportunity to teach had made modifications in content or methods, based on their academic experience in the United States. Survey respondents brought curriculum changes to their departments, focused on real-world experiences and applications in promoting student projects, and ran their classrooms with greater problem-solving activities and more open communication.

Figure 16



Of those working in universities in their home country, 52% made significant changes in either their curriculum content or their teaching methods. In some cases, the survey respondent taught new courses or revised courses to use the new techniques and information they learned. The in-person interviews and survey feedback revealed that common changes included creation of a more interactive learning environment with an increased focus on class projects, discussions, and presentations; a more collaborative approach through group projects; and use of PowerPoint to aid in student learning. Content was more practical and hands-on (problem-based learning), with a focus on mastery. Technology and IT tools were also employed more frequently. Survey respondents also expressed the need to strengthen their students' understanding of mathematical and scientific fundamentals, something they often found lacking when comparing their home experiences and school curriculum with their coursework at U.S. universities.

Fulbrighters' Examples of Institutional Change or Impact

In a wide variety of STEM fields, survey respondents provided examples of how they were promoting institutional change.

- Computer science: *She contributed to the design of the Informatics Department's proposed Bachelor of Science Program. This new curriculum is currently under final revision after having received approval by the University*. (*Syria*)
- Engineering: *Enabled the university in Aceh to launch a curriculum for the new mining engineering department, based on his Fulbright study at Colorado School of Mines. He also secured significant funding from the government for new projects and involving students in research projects.* (*Indonesia*)

- Computer science: *Program Coordinator for the new Diploma in Computer Engineering program in a technical college. His experience and field of study in Computer Engineering were sought after by the Department of Technical Education*. (*Brunei*)
- Medical & Health: *She set up a new family medicine residency program. Proposed a new model of graduate medical education at the national level.* (*Haiti*)
- Biology: *The Fulbright experience enabled him "to get out of my box and interact with persons from different research areas and countries." The result is new confidence in teaching and supervising of students*. (*Trinidad & Tobago*)
- Agriculture: *Teaching in an underprivileged South Africa black university campus enabled the respondent to impact knowledge in such a community and assume the role of a mentor to show them that they could attain any educational level they so wish provided they stayed focused, and as she noted, "especially because with the end of apartheid, the young generation now has opportunities that their parents never had in their time."*(*South Africa*)

Chapter 8: Conclusion

This study focused on Fulbright Foreign Students in STEM fields who were selected to attend a special enrichment program, the *From Lab to Market* Seminar from 2007 to 2011. The Fulbright experience, including the FLMS, emphasized ways in which science and technology can be applied to problems and critical issues in students' home countries. Their Fulbright and FLMS experiences promoted entrepreneurship and innovation through academic study, presentations by scholars, entrepreneurs and NGO leaders, participation on research teams, site-visits to companies and laboratories, networking opportunities and problem-solving activities.

The study revealed numerous ways in which the Fulbright Program and the FLMS promoted STEM education and scientific enquiry, both in the United States and participants' home countries. Educational exchange programs such as the Fulbright Foreign Student Program encourage high-performing students abroad to consider pursuing advanced studies in the United States, especially in the science and technology areas. Repeatedly, survey respondents said they sought a Fulbright award because of the high caliber of U.S. scientific research and the possibility of undertaking specialized studies *not* available in their home country. Reflecting on their Fulbright experiences, survey respondents reported that they gained technical skills in their STEM field and other skills (i.e., the use of technology, technical writing and presentation skills, networking and leadership experiences) that have enabled them to be successful and engage at higher levels of scientific enquiry and as a result, have impact and influence in their home country as well as internationally. Survey respondents indicated that the Fulbright Program and FLMS furthered the development of their knowledge and skills through networking, collaboration, and cross-cultural engagement. They noted that the Fulbright experience increased their capacity to use methodologies and conduct research that met international standards. Following their Fulbright, they reported participating in regional and international conferences, publishing in peer-reviewed journals, and serving as leaders and role models for others in their own country. Survey respondents indicated that particularly as teachers, they are able to transfer their Fulbright experience to others, shaping the next generation of scientists through curriculum improvements and interactive teaching methods, including giving students opportunities to pursue real-world problems.