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**Key Research in U.S. Study Abroad:
Findings from the Institute of International Education's
Study Abroad Capacity Series**

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February 9, 2009

Dear EDGE Participant:

The Institute of International Education (IIE) is pleased to present the report, *Key Research in U.S. Study Abroad: Findings from the Institute of International Education's Study Abroad Capacity Series*, on the occasion of the 2nd EDGE conference. As one of the world's largest and most experienced international exchange organizations, IIE is privileged to have the opportunity to share our research experience in the field of global student mobility.

The enclosed report is a compilation of IIE's extensive research on U.S. study abroad. Through its flagship research project, *Open Doors*, IIE has been collecting data on international students in the U.S. since the 1950s, and on U.S. students studying abroad since the 1980s. More recently, we have launched a Study Abroad Capacity Research Series that examines various approaches to increasing the number of American students that study abroad. One key aspect of this research is assessing the current and future capacity of host countries—like India, China, and European countries—to expand their capacity to host more foreign students. The first enclosed paper, *Exploring Host Country Capacity for Increasing U.S. Study Abroad*, presents findings on this topic that are based on a survey of over 500 higher education institutions from around the world.

The second paper, *Promoting Study Abroad in Science and Technology Fields*, examines the state of internationalization in the disciplines of science, technology, engineering and mathematics (STEM) in the U.S., which are consistently under-represented in U.S. study abroad. The paper first presents the most recent Open Doors student mobility trends in STEM disciplines, and then features two essays focusing on models for increasing study abroad in the field of engineering. Finally, it looks at evaluation methods for these programs with an essay on STEM program evaluation methods, and a sample evaluation case study.

We hope IIE's research papers will help identify potential areas for new research that will expand Study Abroad Programs in India for U.S. students. We invite you to learn more about our research and to offer your suggestions at: www.iie.org/researchevaluation. We also welcome your input and collaboration through our India office.

Best wishes,

Rajika Bhandari, Ph.D.
Director of Research and Evaluation

Ajit K. Motwani
Director, IIE India

IIE Serves India

The Institute of International Education (IIE) is among the world's largest and most experienced international exchange organizations, dedicated to increasing the capacity of people to think and work on a global and intercultural basis. Founded in 1919 as an independent, nonprofit organization, IIE currently implements more than 200 programs, benefiting nearly 18,000 men and women from 175 nations, and maintains an exceptionally strong network of offices across Asia, including New Delhi. Through our global networks, IIE helps multinational corporations, foundations, and government agencies to achieve their strategic objectives through specially tailored initiatives. IIE administers a wide spectrum of scholarship and training programs, ranging from initiatives for a handful of recipients to major annual programs for thousands of participants. Our approach to the design and management of programs is based on a respect for, and understanding of, our sponsors' objectives and intentions for the program. Illustrative programs operating in India are listed below.

Programs for Corporations and Foundations

Goldman Sachs Global Leaders Program: In partnership with the Goldman Sachs Foundation and local educational organizations, IIE conducts an annual competition on university campuses around the world to identify 150 of the most accomplished second-year students for the Goldman Sachs Global Leaders Program (of which 29 are from India). The program recognizes their outstanding achievements and abilities in a public ceremony and awards each Global Leader US\$3,000. The Global Leadership Institute offers a selected group from these 150 winners from around the world, including India, an opportunity to spend a week together, to examine collaboratively important issues such as global leadership, the new world economy, globalization, and international development. World-renowned faculty from leading U.S. business schools, guest speakers, and experienced senior Goldman Sachs executives lead challenging and thought-provoking seminars. Alumni activities further help strengthen this network of future global leaders, who are also eligible to apply for Social Entrepreneurship Funds to launch projects in their home communities or in other countries.

GE Foundation Scholar-Leaders Program: The GE Foundation Scholar-Leaders Program identifies talented young people and develops their capacity to help build the human resources in communities where GE is active. The program strives to facilitate economic and social development in countries such as India by broadening access to education and facilitating learning (and leadership skills) in management and business, finance, engineering, technology, and the sciences. In addition to receiving financial support, successful applicants will join a global network of students and professionals. They will also participate in a special Leadership Development Program that includes attendance to an all expenses-paid seminar and opportunities to be mentored by a business leader at GE. GE Foundation Scholar-Leaders also help give back to their communities through community development projects. IIE administers the program on behalf of the GE Foundation through our overseas offices, including IIE India, and country partners.

Global Travel and Learning Fund (GTLF): IIE is honored to have assisted the Ford Foundation's Global Travel and Learning Fund since the program's launch in 1998. IIE administers travel and study grants for scholars, experts and NGO leaders in a variety of fields. GTLF grants have enabled thousands of individuals to participate in international meetings or conferences and undertake short-term research/study tours in areas of professional interest. This program utilizes IIE's ability to combine grants administration with visa sponsorship; provide insurance coverage; pay tuition and registration fees; purchase airline tickets; provide traveler's checks and payment by check; make international wire transfers of funds; book hotel reservations; and respond to a diverse set of educational needs. IIE's offices in Cairo, Hanoi, Jakarta, Moscow; and New Delhi have been instrumental in providing the necessary field support to the GTLF program. More than 3,000 grantees were supported by IIE in this most recent two-year period of which over 200 were administered by New Delhi office. New Delhi office is responsible for India, Sri Lanka, Nepal and Bangladesh region.

Recently, IIE has also been associated with the Ford Foundation for an empirical research study on affirmative action/reservation quotas in undergraduate colleges and universities in India under the Pathways to Learning Program. The research project will involve authors contributing chapters for the book to be released at the completion of the empirical study.

Leadership Development Mechanism (LDM): Through a grant from the David and Lucile Packard Foundation, IIE's West Coast Regional Center in San Francisco manages a program that fosters leadership development among population leaders who live and work in Ethiopia, India, Nigeria, Pakistan, and the Philippines. LDM provides additional training opportunities and graduate study so that these leaders can continue to effectively address issues such as reproductive health service delivery, adolescent reproductive health, and HIV/AIDS in their home countries.

Law School Admission Council (LSAC): IIE assisted LSAC with background report on India and facilitated interactions during their exploratory visit to India. This was followed by interactions with heads of premier Law Schools across India through meetings and a seminar on "Indian and US Legal Education: Challenges and Opportunities"

Rockefeller Foundation Bellagio Center Residencies at Italy: IIE India has been associated with the program outreach to invite applications from scholars, creative artists, writers, scientists and policymakers.

Programs for the U.S. Government

Fulbright Student Program: For 60 years, IIE has partnered with the U.S. Department of State, Fulbright Binational Commissions (such as USIEF), and U.S. universities to administer the Fulbright Student Program, which annually benefits almost 4,000 U.S. and international students. On behalf of the U.S. Government, IIE conducts publicity, recruitment, and selection activities for approximately 1,100 U.S. Fulbright students each year. For the 1,500 foreign Fulbright students who enter the U.S. each year, IIE provides university admission, placement, pre-academic and English language training, orientation, visa support, fiscal services, supervision, and cultural and enrichment activities.

Fulbright Scholar Program: The Council for International Exchange of Scholars (CIES), a division of IIE, has had the honor to administer the Scholar component of the Fulbright Program since its formation in 1947. With support from the U.S. Department of State and bi-national Fulbright Commissions around the globe, CIES administers Fulbright fellowships through which annually nearly 800 U.S. faculty and professionals lecture and conduct research in 140 countries and 800 foreign faculty and professionals come to U.S. campuses to lecture and conduct research. To carry out its particular responsibilities, CIES maintains close contact with faculty; academic departments; institutions of higher education; bi-national commissions such as USIEF, and national education organizations, in addition to its own staff's extensive international expertise.

The India Teacher Education Administrators Seminar: This program, administered by CIES for the Indian Fulbright Commission, will introduce deans and department chairs of schools of education, education departments and teacher certification program in the U.S. to their counterparts in Indian higher education. Participants will gain first-hand knowledge of a cross-section of Indian institutions of higher education focused on teacher education and training and meet with individuals and programs that play a key role in the planning and administration of K-12 education in India. Seminar locations include highly respected universities and colleges in New Delhi, Mumbai, and Bangaluru, as well as visits to schools and relevant government agencies.

Hubert H. Humphrey Fellowship Program: With U.S. State Department funding, the Humphrey Program brings accomplished professionals from designated countries of Africa, Asia, Latin America, the Caribbean, the Middle East, and Eurasia to the United States at a midpoint in their careers for a year of non-degree graduate-level study and related professional experiences. Fellowships are granted competitively to professional candidates from both the public and private sectors, including NGOs. The focus is on selecting candidates who are committed to their country's development and to public service, and who have demonstrated leadership potential. Since 1978, nearly 3,500 Fellows from more than 140 countries, including India, have participated in the program. IIE maintains a network for its Humphrey alumni, offering up-to-date databases, World Wide Web links, and periodic renewal seminars around the world for all alumni.

Programs for Other Governments

King Abdullah University of Science and Technology (KAUST) Scholarships: IIE administers two scholarship programs for the King Abdullah University of Science and Technology (KAUST), a new international, graduate-level, independent research university being built in Saudi Arabia. The KAUST Discovery Scholarship is awarded to top undergraduate students in science, technology and engineering from universities around the world. This merit based award includes tuition, expenses and living stipend for the remainder of the student's undergraduate degree and tuition to attend KAUST for a master's degree. The King Abdullah Scholar Award is a doctoral research award conferred upon an elite number of young researchers in selected universities world-wide. This award offers a research grant, tuition and living expenses. The King Abdullah Scholars will not attend KAUST, but serve as ambassadors for the university on their home campuses. On behalf of KAUST, IIE manages the scholarship program including outreach to recruit applicants, a merit-based selection panel process, monitoring of award recipients and disbursement of award funds. IIE will also organize a number of workshops and conferences for the students in India and South Asia. These activities will be coordinated by IIE's India office.

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INSTITUTE OF INTERNATIONAL EDUCATION

Country Background: INDIA

Educational Exchange with India for 2007/08

Source: *Open Doors: Report on International Educational Exchange*, published annually by IIE with support from the U.S. Department of State's Bureau of Educational and Cultural Affairs. For more information, including press releases on foreign students in the U.S. and U.S. study abroad, and FAQs, including definitions of foreign students and foreign scholars, visit Open Doors online at opendoors.iienetwork.org. Or contact Debbie Gardner at Halstead Communications, 212-734-2190 or Sharon Witherell/Jessica Angelson at IIE, 212-984-5360.

In academic year 2007/08, there were 94,563 students from India studying in the United States (up 12.8% from the previous year). Since 2001/02, India has remained the **leading** place of origin for students coming to the United States.

- **Academic Level.** The majority of Indian students study at the graduate level. In 2006/07, their breakdown was as follows:
 - 14.4% undergraduate
 - 72.0% graduate students
 - 2.1% other
 - 11.5% OPT (Optional Practical Training)

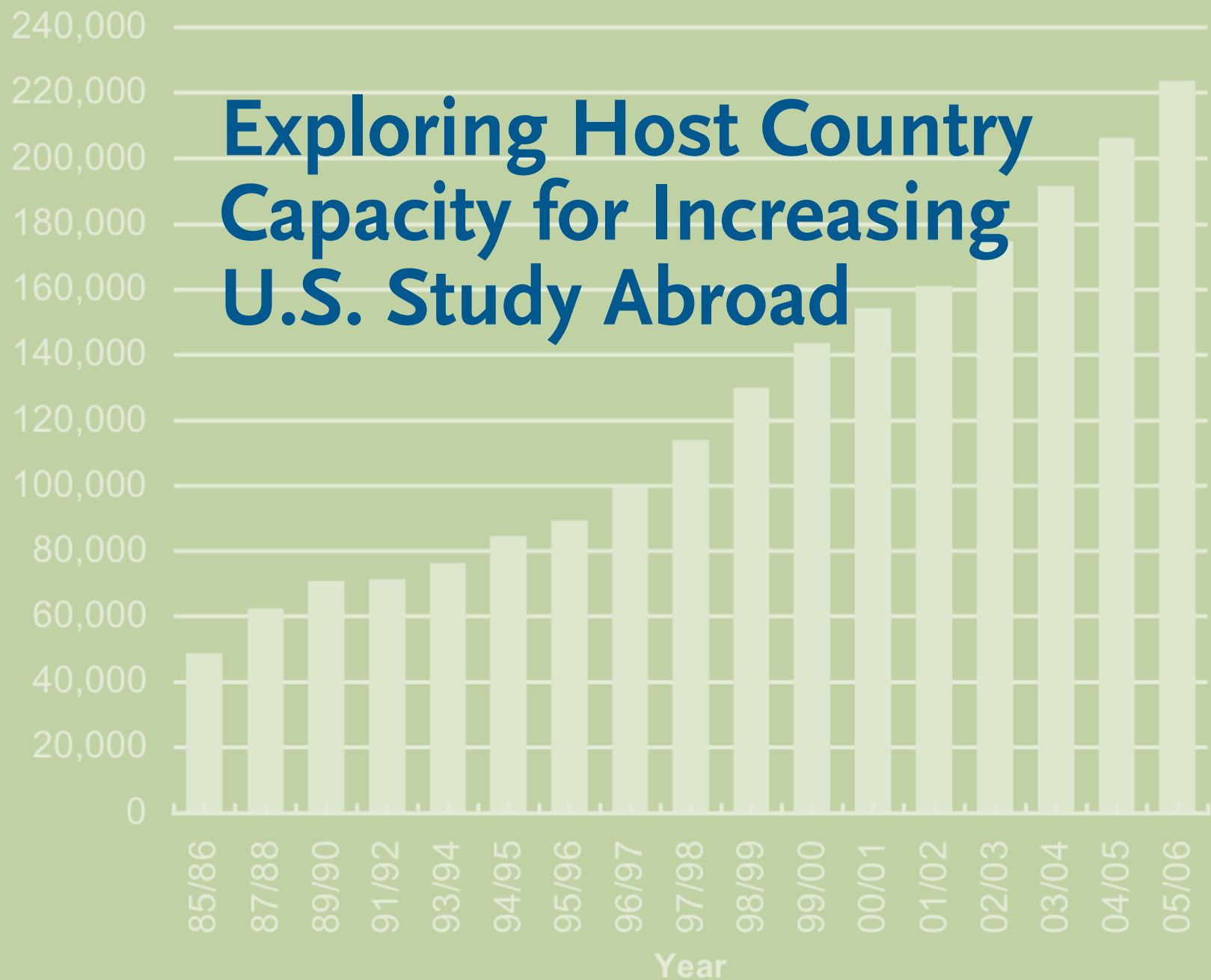
- **Historical trends.** The number of Indian students in the U.S. increased by 12.8% in 2007/08, following an increase of 9.6% the previous year. India has been the number one sending place of origin since 2001/02 when it surpassed China. 2000/01 marked a new surge in enrollments from India, with an increase of 30%, followed by two more years of double-digit growth (22% in 2002/03 and 12% in 2003/04).

Year	# of Students from India	% of Total Foreign Students in US	# of US Study Abroad Students Going to India
2007/08	94,563	15.2%	n/a
2006/07	83,833	14.4%	2,627 (up 24.2%)
2005/06	76,503	13.5%	2,115
2004/05	80,466	14.2%	1,767
2003/04	79,736	13.9%	1,157
2002/03	74,603	12.7%	692
2001/02	66,836	11.5%	627
2000/01	54,664	9.9%	750
1999/00	42,337	8.2%	811
1998/99	37,482	7.6%	707
1997/98	33,818	7.0%	684
1996/97	30,641	6.7%	601
1995/96	31,743	7.0%	470

Note: Study abroad figures in the Open Doors report reflect credit given by U.S. campuses in the survey year to their students who studied abroad in the academic year just completed, including the summer term. Study abroad in 2007/08 will be reported in the 2008/09 Open Doors, once credit is awarded by the home campus.

MEETING AMERICA'S GLOBAL EDUCATION CHALLENGE

Exploring Host Country Capacity for Increasing U.S. Study Abroad



Institute of International Education

An independent 501(c)(3) nonprofit founded in 1919, IIE is among the world's largest and most experienced international education and training organizations.

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Exploring Host Country Capacity for Increasing U.S. Study Abroad

Second in a Series of White Papers on
Expanding Capacity and Diversity in Study Abroad

Institute of International Education
May 2008

By Robert Gutierrez, Rajika Bhandari and Daniel Obst

IIE Information Resources

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www.iienetwork.org	Resources for International Educators
www.opendoors.iienetwork.org	<i>Open Doors Report on International Educational Exchange</i>
www.atlas.iienetwork.org	Atlas of Student Mobility
www.iiebooks.org	IIE's Online Bookstore
www.iiepassport.org	Directory of Study Abroad Programs
www.StudyAbroadFunding.org	Funding for U.S. Study Abroad

Programs Sending U.S. Students Abroad (administered by IIE for the U.S. Government and Other Sponsors):

www.fulbrightonline.org	<i>U.S. Department of State</i>
www.iie.org/gilman	Fulbright U.S. Student Program Benjamin A. Gilman International Scholarship Program
www.iie.org/nsep	<i>National Security Education Program</i> Boren Scholarships and Fellowships The Language Flagship Fellowships
www.iie.org/cesri	<i>National Science Foundation</i> Central Europe Summer Research Institute
www.iie.org/freeman-asia	<i>Freeman Foundation</i> Freeman Awards for Study in Asia
www.whitakerawards.org	<i>Whitaker Foundation</i> Whitaker International Fellows and Scholars Program
www.globale3.org	Global Engineering Education Exchange

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Executive Summary

According to the Institute of International Education's most recent data, over 223,000 U.S. students annually study abroad for academic credit, and there are widespread calls to double, triple or even quadruple that number in the coming decade, sending students to more diverse destinations around the globe. Where would another 300,000-700,000 Americans go to study abroad? Which university systems, especially in the non-traditional destinations, have the capacity to absorb large increases when countries like India, China, Egypt, Turkey and Brazil are struggling to accommodate the demand for higher education by their own citizens? To begin addressing these important questions, the Institute of International Education launched *Meeting America's Global Education Challenge*, a focused policy research initiative which explores from multiple perspectives the challenge of substantially expanding the numbers and destinations of U.S. students studying overseas. In May 2007, IIE published its first White Paper in this series, *Current Trends in U.S. Study Abroad & the Impact of Strategic Diversity Initiatives*.

In this second White Paper in IIE's study abroad capacity research series, we focus our research on: the efforts by higher education institutions in host countries abroad to receive and absorb a significantly larger number of U.S. students; the challenges they face; and their motivations and strategic plans to undertake this effort. An online survey conducted between September and December 2007 of over 500 higher education institutions located in different world regions produced the following key findings:

- The greatest room to absorb more international students (including U.S. students) appears to be in longer-term study abroad programs that last either a full academic year or at least one academic session, and in degree study. Yet this presents a potential supply-demand conflict, as most U.S. students tend to study abroad for shorter duration.
- Exchange agreements and joint- and dual-degree programs are also large areas of growth. The presence of U.S. students is seen as a catalyst for forming reciprocal and beneficial partnerships with U.S. higher education institutions, and for raising the international profile of the host institution.
- For many overseas institutions, increasing international enrollments is a central aspect of an overall internationalization mission. This attempt to increase enrollments is often focused on specific sending countries, with the U.S. appearing as the top choice, followed by China, India, Canada, and Russia.
- Hosting U.S. students often provides an academic incentive to receiving institutions by enabling them to increase their global competitiveness and expand their joint research opportunities with U.S. sending institutions.
- Although language continues to be a barrier, both in terms of the foreign language deficiencies of U.S. students and the shortage of courses offered in English in countries where English is not the primary language, there are also clear indications that this gap is being bridged. An increasing number of overseas institutions are now offering courses taught in English, in a wide range of academic fields, while other research has shown that more U.S. students are studying foreign languages.
- From the perspective of overseas institutions, the main steps that could be taken at the U.S. end that would significantly increase the numbers of U.S. students abroad would be: a) increasing host institutions' stature and visibility in the U.S.; and b) making available more funding and scholarships to enable a larger group of students to go abroad.

I. Introduction

A. Overview of Study Abroad and Issues of Increasing Capacity

How to increase the number of U.S. students studying abroad is an issue that has been receiving considerable attention within the U.S. academic community and among policy makers responding, in part, to the recommendations and goals of the Lincoln Commission. The Commission's goals, which were presented to the higher education community in 2005, included setting the target of annually sending one million U.S. students overseas by 2017.¹ Even before the Commission issued its report, many U.S. campuses had adopted their own ambitious goals of dramatically expanding their study abroad programs, diversifying the destinations, and making them accessible to a wider cross-section of their student body. Federal initiatives such as the Fulbright U.S. Student Program, the Benjamin A. Gilman International Scholarship Program, the David L. Boren Scholarships and Fellowships, and the Language Flagship Fellowships have expanded the resources available and encouraged students of diverse background and with financial need to undertake study in areas of the world not previously on their radar screens.

As U.S. campuses seek to make study abroad more widely available, many challenges are being intensely discussed at the campus level, and by policy makers at every level, but often with only limited data on which to frame the discussion. Wider national and media attention to the study abroad field has created windows of opportunity for highlighting best practices and more importantly, creating a heightened public appreciation of the importance of study abroad, especially for a wider and more diverse population of American students. To begin addressing the national challenge of increasing and diversifying U.S. study abroad, the Institute launched *Meeting America's Global Education Challenge*, a focused policy research initiative which, through survey research, data and policy analysis, and dialogue with key stakeholders, explores from multiple perspectives the challenges and opportunities of sending more U.S. students overseas.

In May 2007, IIE published its first White Paper in this series, *Current Trends in U.S. Study Abroad & the Impact of Strategic Diversity Initiatives*. The White Paper assessed current trends in study abroad in the United States, providing a benchmark for future expansion. It included an analysis of existing strategic funding initiatives such as the Gilman, Boren and Freeman-ASIA Scholarships, showing how resource allocation can influence the ethnic diversity of participants, geographic destinations, fields of study and length of study. In addition, the paper also highlighted institutions that have created specific program models that better facilitate a more diverse group of students participating in study abroad.²

B. The Need to Expand Capacity at the Host Country Level

According to IIE's *Open Doors Report on International Educational Exchange*, 223,534 U.S. students studied abroad for academic credit in 2005/06.³ This number has grown at the rate of approximately 8 to 10 percent over the past five years. If this rate of growth continues over the next decade, approximately 550,000 U.S. students would be studying abroad in 2017. With wider financial support at the national, state, and campus levels, the numbers could grow even more dramatically, given the strong interest in studying abroad expressed by 55 percent of incoming freshmen, according to a recent study by the American Council on Education.⁴ Such a substantial increase in study abroad participation will require dramatically expanded capacity not just within the U.S. institutions that send students

overseas, but equally at the institutions in other countries that will host the students. Therefore, the issue of increased capacity is one of both demand and supply and whether one exceeds the other.

For this second White Paper in IIE's study abroad capacity research series, we focused our research on the supply side of the equation: the question of whether higher education institutions in host countries abroad can absorb a significantly larger number of U.S. students, and whether there exists a strong motivation and intent on their part to host more Americans. The "capacity" to host more U.S. students was defined broadly to include not just physical capacity and infrastructure (e.g., classroom and dormitory space) in host institutions, but also other, equally important, aspects of institutional capacity such as the availability of courses taught in English; availability of programs of varying and suitable duration; and existing challenges and effective strategies associated with hosting more U.S. students.

C. Methodology

With the goal of examining capacity at the host country level, IIE developed and administered a snapshot survey to explore key issues for non-U.S. institutions in expanding their host opportunities for international students in general and U.S. students in particular. Key topics covered by the survey included:

- International and U.S. student enrollment patterns at the host institution
- Motivations and drivers for increasing U.S. student enrollment in host institutions
- Outreach and marketing to U.S. students
- Challenges and barriers to expanding host institution capacity
- Strategies to increase growth

Designed by IIE and reviewed by an external group of advisors in the U.S. and overseas, the survey was administered online between September and December 2007. Survey respondents ranged from managers and directors of study abroad offices, to deans and vice-presidents of international offices to registrars. Reaching out through IIE's 20 worldwide offices and close partnerships with many international and national academic exchange organizations through *Project Atlas*,⁵ IIE distributed the survey to institutions in target countries in the European Union (EU), Oceania (Australia and New Zealand), Mexico, Canada, and several other regions.⁶

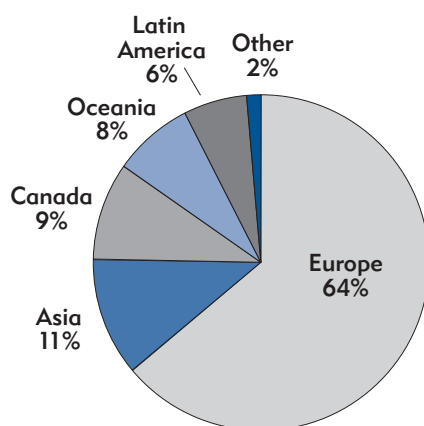
The sections that follow summarize key quantitative findings from the survey, and offer a broader look at the contextual and qualitative issues for expanding U.S. study abroad capacity at institutions abroad. While the majority of findings are presented for all countries as a single group, results for specific world regions and countries are discussed where they serve to highlight or illustrate a particular finding or strategy. IIE plans to publish separate country profiles with findings related to several of the key responding countries.⁷ Through this initiative as well as other IIE research projects, we also hope to in the future explore the capacity of non-traditional destinations such as India, Brazil, China, and Egypt to host more U.S. study abroad students.

II. Respondent Demographics

A. Responses by Country and World Region

Overall, 533 institutions responded to the survey, of which 64 percent were located in European countries (both EU and non-EU members) (Figure 1). Western European countries with the largest number of responding institutions included Germany, the UK, France, Finland, and Poland. Institutions from Australia, New Zealand, and Canada also participated in high numbers. The high response rates from these countries are likely a result of particularly extensive outreach to institutions by our international partner organizations.

Figure 1: Percent of Responding Institutions, by World Region



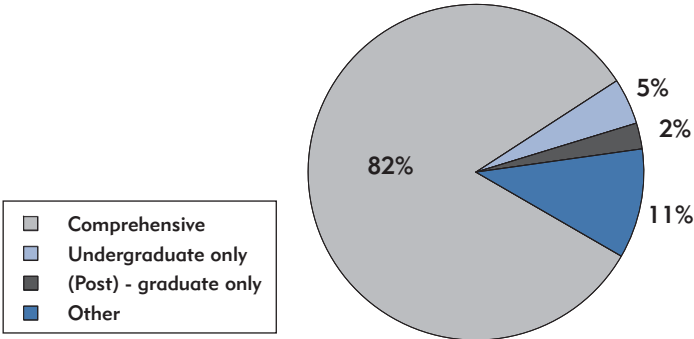
Although the number of responding institutions was substantial, especially for a new survey of this scope, the findings should not be interpreted as being representative of all higher education institutions in a particular country or world region. Rather, the survey provides a critical snapshot of and key insights into the types of issues and challenges at institutions overseas that U.S. colleges and universities are likely to encounter as they attempt to send more of their students abroad. For host institutions seeking to increase their capacity to host international students, the findings provide important information on the types of internationalization strategies adopted by institutions in other host countries, and the challenges they seek to address.

B. Sector and Classification of Responding Institutions

The majority of responding institutions (79 percent) reported that they were public institutions, while the remaining were private. Although not a focus of this survey, the degree to which public institutions in Europe and elsewhere are committed to diversifying their student population with more international students has strong implications on the financing (public or private) of higher education in many parts of the world. Governments and their ministries of education will no doubt have to balance international enrollment targets with the ever-expanding demand for seats from their own domestic students, while sufficiently meeting capacity for both groups of students.

The type of institution and the degrees awarded did not vary much among survey respondents: 82 percent described themselves as “comprehensive” institutions (i.e., those offering degrees up to the doctoral level); 11 percent classified themselves as “other”, which included vocational and specialized/professional schools; and relatively few (less than 5 percent) were solely undergraduate or post-graduate level institutions (Figure 2).

Figure 2: Institutional Classification



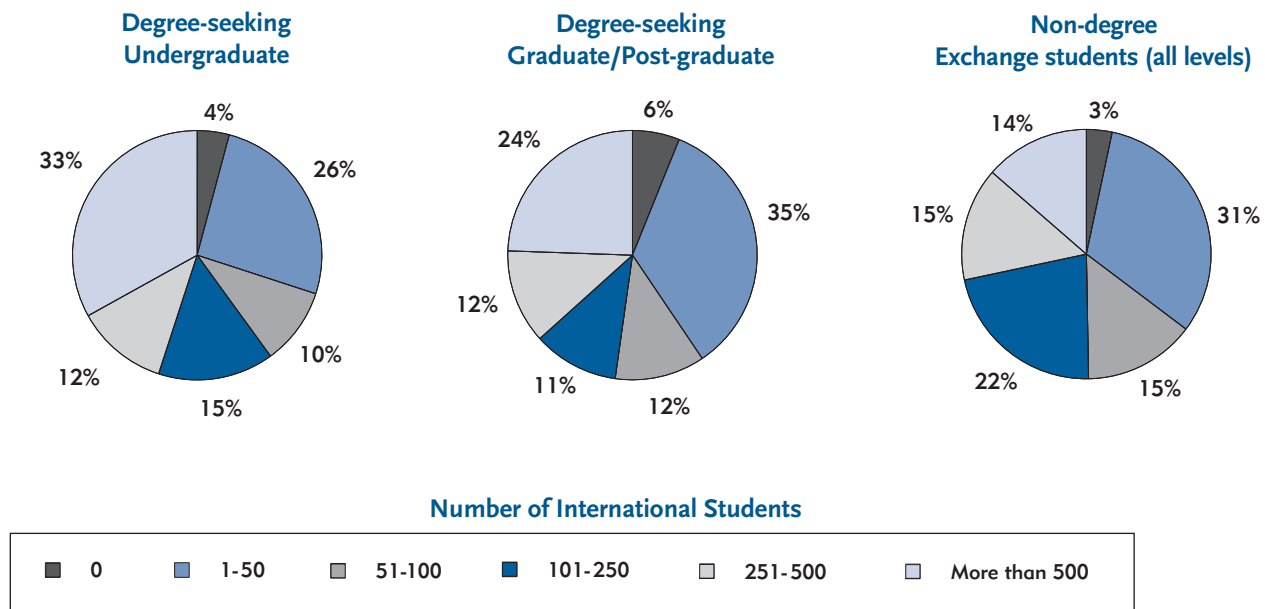
III. International Student Enrollment at Host Institutions Abroad

Responding institutions were first surveyed about all international enrollments at their institution and were then asked specific questions pertaining to U.S. student enrollment. Three broad categories were defined for an international student in this portion of the survey: undergraduate, graduate/post-graduate, and non-degree exchange students. The first two categories include those students directly enrolled in the institution. The third category, non-degree exchange, includes students (at any academic level) that participate in a study abroad program for a set period of time at a host institution but who are not receiving degrees from the host institution.

A. Total International Student and U.S. Student Enrollment

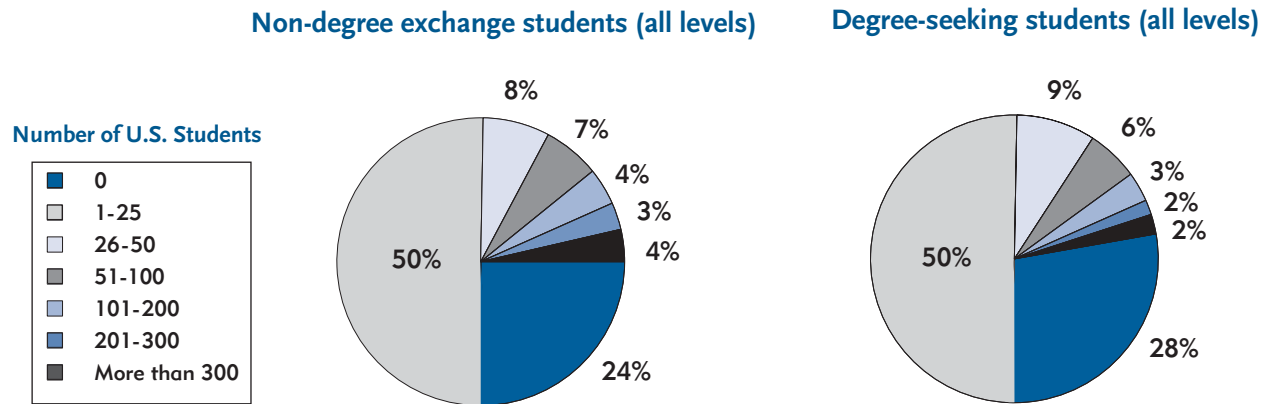
Figure 3 presents the number of international students enrolled in responding institutions for the 2006-2007 year.⁸ This survey represents a broad range of host institutions, with the majority of respondents either hosting more than 500 or less than 50 international students. For example, at the undergraduate level, about a third of institutions enroll over 500 international students, while at the graduate/post-graduate level more institutions (35 percent) are likely to enroll students in the 1-50 range. Another way of looking at these findings is that the largest international enrollment at most institutions (33 percent) was at the undergraduate level, followed by the graduate level (24 percent), and non-degree study (14 percent).

Figure 3: Percent of Institutions Reporting International Student Enrollment at their Institution, by Level of Study



When asked a similar question about the enrollment of U.S. students (as opposed to all international students), approximately half of the respondents reported hosting 25 or fewer U.S. students for degree or non-degree study, while about one quarter reported hosting no U.S. students regardless of the academic level (Figure 4). Only about one quarter of the responding institutions indicated hosting more than 25 U.S. students either in degree or non-degree study.

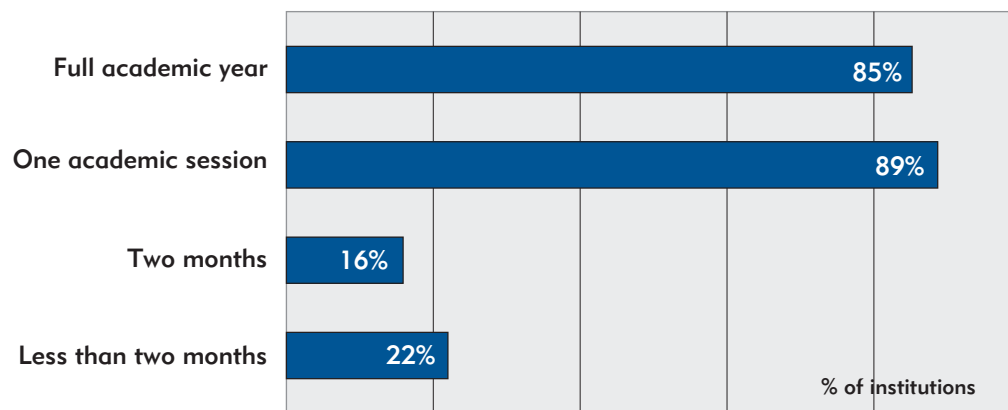
Figure 4: Percent of Institutions Reporting U.S. Student Enrollment at their Institution, by Type of Study



B. Durations of Study at Host Institutions

The vast majority of responding host campuses offer longer-term programs for their non-degree seeking international students: approximately 85 percent of all responding institutions reported that they offer programs lasting a full academic year and 89 percent offered programs for at least one academic session (e.g., a quarter, semester, or term) to international non-degree exchange students (Figure 5). Only about 38 percent of the responding institutions offer programs of two months or shorter duration, a category of study abroad duration often described as “short-term.”

Figure 5: Duration of Non-Degree Programs Offered by Host Institutions



These findings suggest a potential supply-demand conflict: while the majority of overseas institutions indicate that they offer mid-term and long-term programs for non-degree students, most U.S. students tend to study abroad for shorter duration. According to IIE's most recent *Open Doors Report*, 53 percent of U.S. students participate in short-term study abroad sojourns, which include summer, January term, or any program of eight weeks or less during the school year.⁹ This number has risen sharply over the past few years. The "semester-abroad" model now attracts 37 percent of those studying abroad, and only 6 percent spend a full academic or calendar year abroad.

While some large overseas institutions with substantial capacity may have the requisite academic and support services to host U.S. students for shorter periods of time, the majority may find this to be a challenge. The case of Finland, which has a number of mid- and long-term study abroad opportunities available in English for international students, is particularly illustrative: 97 percent (34) of all Finnish institutions identified long-term study as the number one potential area for growth, compared to only 14 percent who reported non-degree study as an area for growth.

It appears from survey responses that the desire and capacity to expand short-term programs may be quite limited in some countries by overriding national-level internationalization policies to attract full-degree international students or those enrolled in longer-term programs. Institutions not represented in this survey may face similar challenges in meeting the U.S. demand for short-term programs, not out of a reluctance to accommodate such programs, but often because of higher-level policies that might provide incentives and funding for programs of longer duration. With the majority of survey respondents in Europe, the Erasmus/Socrates exchange model seems to prevail, which favors long-term exchanges as institutions have built up the capacity for these exchanges over the past 15 years and may have focused less on hosting students on short-term exchanges. Developing short-term programs for U.S. students may also meet some resistance from overseas partner institutions who worry that the quality of their academic programs may be affected. On the other hand, the findings reveal a potential market opportunity for institutions that wish to attract more U.S. students by developing customized summer programs or other high impact shorter-term programs.

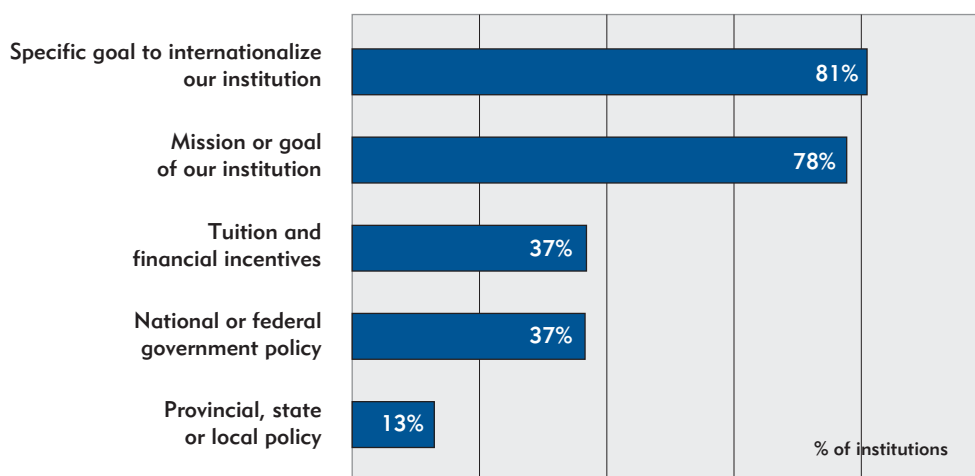
IV. Motivations and Targets for Growth

A key goal of this survey was to assess host institutions' plans to increase international student enrollment (and U.S. student enrollment in particular), and to identify factors or incentives that might drive this type of growth. Virtually all institutions surveyed (98 percent) responded that they had plans to increase their international student enrollments. Among this large group, more than two-thirds (68 percent) had set specific targets for increasing international enrollment at their institution; these targets for annual growth typically ranged between 10 to 20 percent for most institutions.

A. Key Factors Driving Increases in International Enrollment

A number of interrelated factors are likely to motivate overseas institutions to increase their international enrollments, including but not limited to: student demand, faculty interest, internationalization goals at individual institutions, and cost to both the student and institution. This section of the survey explored some of these factors, among others. In particular, an overwhelming majority of respondents reported that the institution's specific goal to internationalize (cited by 81 percent) as well as the overall mission of the institution (cited by 78 percent) were major factors in increasing international student enrollment at the institution (Figure 6).

Figure 6: Motivating Factors to Increase International Enrollments



Only 37 percent of responding institutions indicated that revenue earned through tuition and other financial incentives was a motivating factor. However, as can be expected, this is not a significant incentive for institutions in countries where tuition is waived for international students, or where institutions are largely publicly-funded and offer substantial subsidies to all students.

Just over a third of the institutions (37 percent) reported that national or federal government policies play a role in their motivation to attract more international students and to increase capacity. The major types of policies and strategies reported by institutions are summarized in the sidebar on the following page. In Australia, for example, institutions reported that the federal government has supported a policy of internationalization of higher education with a US\$1.3 billion scholarship initiative to attract and enroll international students.¹⁰ Institutions recognized this commitment from the

government to promote their universities abroad. Some Australian institutions noted a shortage of federal support and direct funding in the past and suggested that these new targeted funding initiatives might help to not only recoup lost revenue, but might also help broaden the international student profile at many of Australia's institutions.

These anecdotal examples point to the potential role of government policies in expanding or restricting the internationalization of higher education. Just as several institutions reported a strong governmental incentive for enrolling international students, many institutions reported that there was, in fact, no government policy on internationalization and that the government's immigration and visa-related policies can often hinder internationalization.

B. Growth Areas for International Students

The factors described above generally suggest *why* institutions are diversifying their student population to include more international students. The degree to which national policies or institutional goals might play a part in an institution's efforts to expand its host capacity does not necessarily predict growth in the various forms or mechanisms through which international educational exchange is most likely to take place. To explore realistic perceptions of growth and the best pathways through which expanded capacity in international enrollments can be achieved on host campuses, respondents were asked about five areas—exchange agreements, tuition swap, degree study, non-degree study and joint degree programs—and were also invited to provide information on other pathways in which they saw a potential for growth. Underlying this survey question is also the critical issue of whether U.S. institutions would identify and prioritize similar areas of growth for sending their students overseas, a subject that is not within the scope of the current paper, but one that we plan to explore through future research.

The largest area of growth identified was that of *exchange agreements*, with 81 percent of institutions reporting that this was an area in which their campuses could increase international enrollments (Figure 7). Close to three-fourths of all institutions considered *degree study*, that is, enrollment leading to a degree from the host institution, as the second largest potential growth area for international student enrollment. What this suggests is that the recruitment efforts of overseas institutions—especially those in

Governmental policies & strategies that have motivated survey respondents to increase international enrollments:

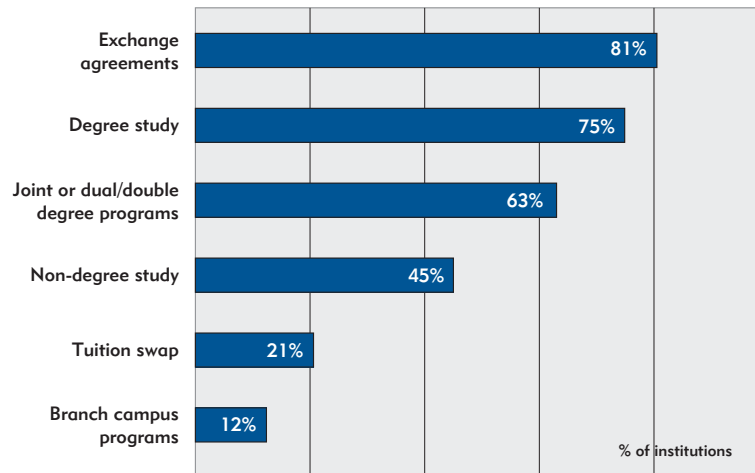
- Government-sponsored marketing and promotion at the national, state, and local level
- Local, state, and federal government-sponsored scholarships for international students
- Implementing activities related to the Bologna Process (for European institutions)
- Allowing international students to extend their visas to stay and work in the country (e.g., in New Zealand, Australia and Canada)
- Promotion of English as a second language in order to attract native English-speaking students (in countries where English is not the primary language).

Several survey respondents also indicated other motivating factors, including:

- Attracting international students to make up for declining domestic student enrollments
- Improving globally-oriented programs and courses of study
- Enhancing research competitiveness and collaborations
- Positioning the institution as an internationally respected global institution

Europe—are heavily focused on attracting full-degree students. A growing number of U.S. students considering study abroad may in the future also consider full degrees earned abroad, responding to vigorous efforts of institutions to attract them, and the financial incentive to earn a degree abroad (where cost may be considerably less).

Figure 7: Growth Areas for International Enrollment



A large proportion of institutions (63 percent) also mentioned dual and joint-degree programs as an area that could potentially attract more international students. These types of programs have been encouraged significantly by the Erasmus Mundus initiatives, and hence are particularly widespread in Europe. Among other potential areas for growth cited in response to open-ended questions were: providing more host-country language courses; offering short-term and/or summer programs; implementing or expanding marketing efforts; and offering more graduate programs as well as post-graduate/research opportunities designed to attract and retain international students beyond their initial course of study.

C. Eyes on the Horizon: Target Countries

When asked if they seek to enroll international students from particular countries, almost 60 percent of responding institutions said they focused on specific countries for meeting their recruitment targets. Figure 8 lists the top twenty target countries for international student recruitment among all responding institutions. The United States appears as the top choice, followed by China, India, Canada, and Russia. While this ranking reflects the most sought-after students overall, it varies somewhat when responses are disaggregated at the country or regional level. Figure 8A illustrates the example of how four countries—Australia, Finland, Germany, and Russia—compare to the consolidated list in terms of which countries they target for international student recruitment.

Figure 8: Top 20 Target Countries for International Student Recruitment

1	United States	11	Japan
2	China	12	Brazil
3	India	13	Mexico
4	Canada	14	Malaysia
5	Russia	15	Vietnam
6	Germany	16	Ukraine
7	United Kingdom	17	Spain
8	South Korea	18	Indonesia
9	Australia	19	Turkey
10	France	20	Poland

Figure 8A: Top 5 Target Countries for International Student Recruitment, for Selected Host Countries

<u>AUSTRALIA</u>	<u>FINLAND</u>	<u>GERMANY</u>	<u>RUSSIA</u>
1 China	1 China	1 United States	1 China
2 India	2 Russia	2 China	1 United States
3 United States	3 United States	3 Russia	2 Germany
4 Malaysia	4 Germany	4 Australia	3 Kazakhstan
5 Germany	5 India	4 Canada	4 Mongolia

In addition to the top targeted countries listed above, responding institutions also mentioned other world regions from which they were attempting to recruit international students. These included (in descending order of priority): Latin America; the Middle East; Europe; North America; East Asia; Southeast Asia; Eastern & Central Europe (as regions of focus within Europe); and South Asia.

V. Attracting More U.S. Students

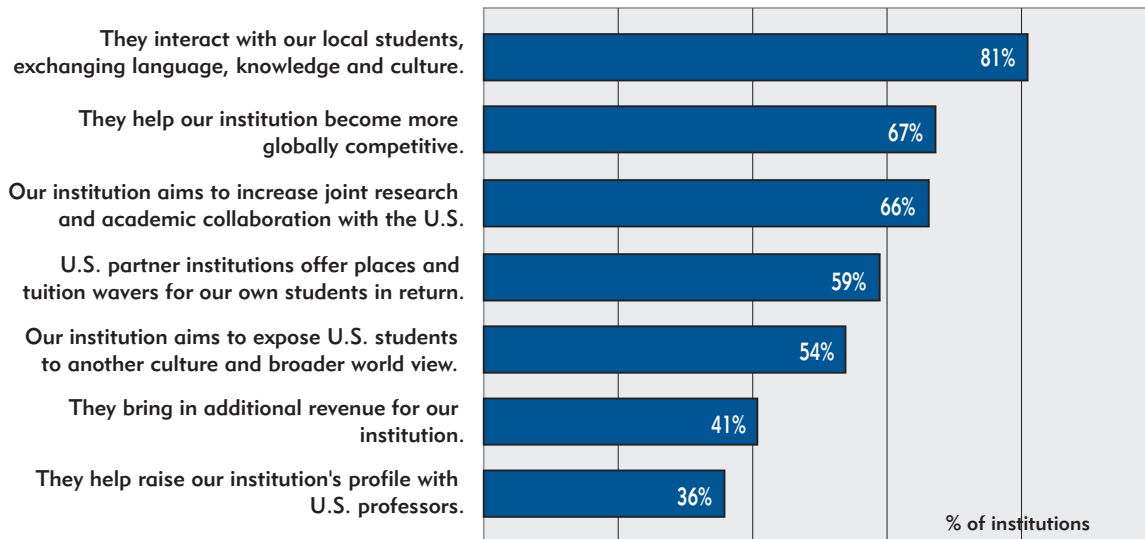
Virtually all institutions (99 percent) expressed interest in attracting more U.S. students to their programs. From an international education policy and academic perspective, this is good news: an expansion of U.S. students at non-U.S. campuses might help create and expand international academic discourse; lead to a deeper understanding of other cultures through educational exchange; and help institutions overseas and in the U.S. build and strengthen their mutually-beneficial academic and research partnerships.

A. Why Do Overseas Institutions Want More U.S. Students?

When asked why they wanted to attract more U.S. students, 81 percent of responding institutions reported that exchange of knowledge, culture, and language through personal interaction between

U.S. and domestic students was the most important reason (Figure 9). Similarly, but to a lesser extent, 54 percent see their institution as serving a primary role in exposing U.S. students to a broader world view and another culture.

Figure 9: Reasons for Attracting More U.S. Students



Two top-cited and interrelated reasons, each of which accounts for approximately 67 percent of responding institutions, are that U.S. students can help the host institution become more globally competitive, and that a larger U.S. student presence helps promote research and academic collaboration between both sending and receiving institutions. The academic reputation that many U.S. institutions have and the potential to connect with such an institution can be a draw for institutions abroad. At the same time, institutions which have established partnerships with the U.S. (either in the form of exchange agreements, joint or dual/double degrees, etc.) may be able to position themselves globally (in countries other than the U.S.) to leverage these relationships to build and expand their own global network.

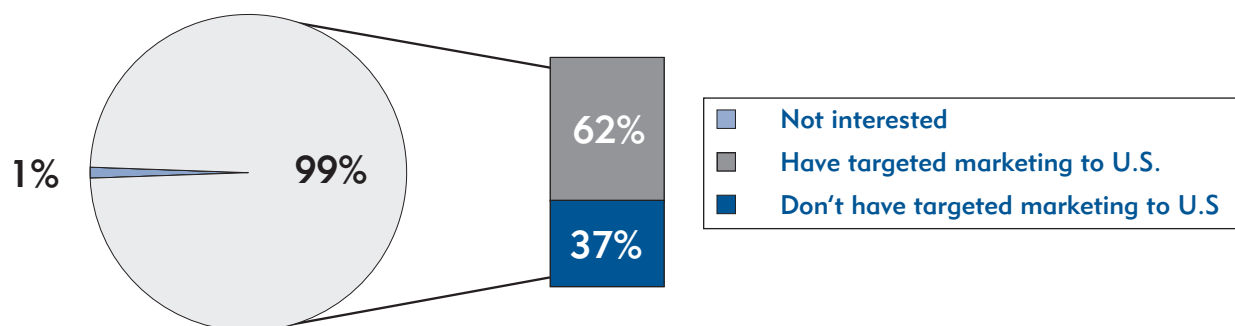
U.S. students, like other international students, often provide a financial incentive to receiving institutions. About 41 percent of institutions, especially private ones and those located in countries that charge higher fees for non-resident students, seek to attract more U.S. students because they would help to bring in additional revenue. However, it appears that overseas institutions place an even greater value on the financial incentive their own students might be able to receive in the U.S.: 59 percent reported that they encourage more U.S. students on their campuses in order that their own students might study on a “tuition swap” basis at a U.S. partner institution.

For the few institutions that reported they were not interested in attracting more U.S. students, one of the reasons cited was they did not place a specific priority on U.S. students; others cited a lack of resources and infrastructure (such as facilities and space,) and limited English-medium instruction.

B. How to Reach, Attract and Enroll U.S. Students

Of the 99 percent of responding institutions that want to attract more U.S. students to their campuses, 62 percent have developed outreach and marketing strategies targeted specifically toward U.S. students (Figure 10). The other 37 percent of institutions do not have any specific strategies in place to attract more U.S. students.

Figure 10: Percent of Institutions Interested in More U.S. Students and their Market Strategies



For many of the responding institutions, direct marketing toward the U.S. study abroad student may not always be a feasible option when broader recruitment goals may place an equal, if not greater, emphasis on all international students. However, as the sidebar to the right indicates, a number of institutions are employing a range of marketing approaches and promotional activities geared towards recruiting students from the U.S.

Outreach strategies to attract U.S. and other international students:

- Joining consortia of schools or partnering with a specific institution
- Creating linkages through attendance of educational fairs and conferences
- Providing short-term and summer programs, as U.S. students are more inclined to participate in shorter programs
- Creating linkages through faculty exchanges and visits
- Utilizing web sites as a marketing tool to attract and inform potential students
- Diversifying programs by offering more internships & practical experiences

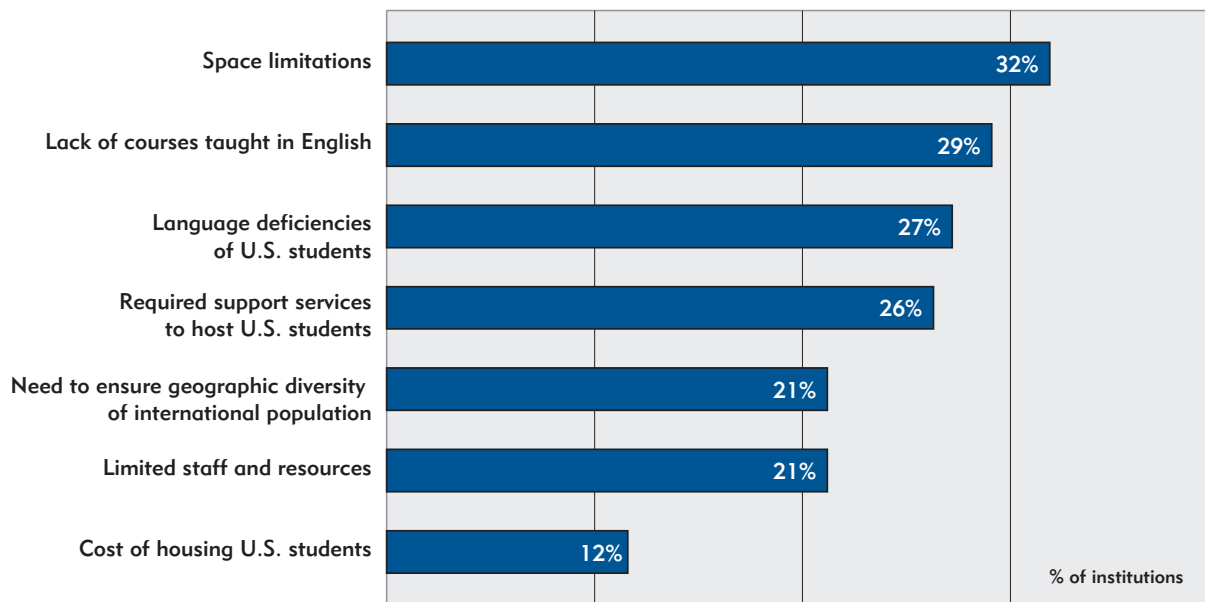
VI. Overcoming Challenges in Attracting More U.S. Students

Wanting more U.S. students is one thing, but actually absorbing more of them into an institution presents challenges that might ultimately limit expansion. Institutions were surveyed regarding what they perceived to be the key challenges to increasing the number of U.S. students enrolled at their campus, and were also asked to identify factors or strategies that could mitigate these challenges or limitations.

A. Critical Challenges in Hosting More U.S. Students

Challenges in hosting more U.S. students seem to vary from institution to institution (Figure 11). Many have cited space limitations, limited staff and resources, and challenges with providing adequate support services to host U.S. students. Others have noted that language deficiencies of U.S. students, coupled with their own lack of courses taught in English, pose challenges.

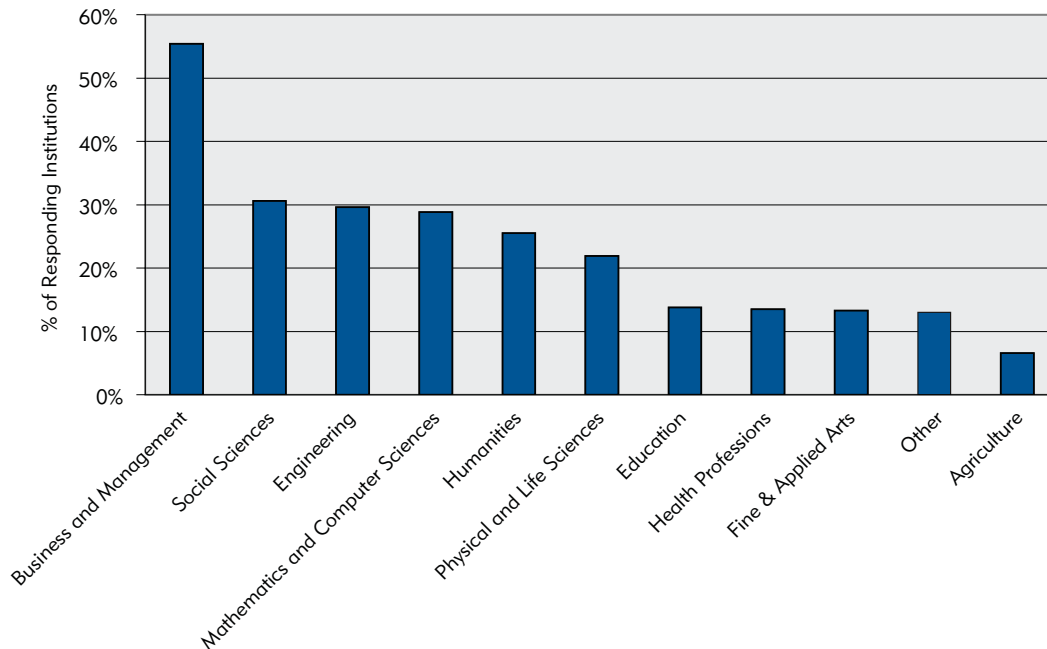
Figure 11: Potential Challenges for Receiving More U.S. Students



Language barriers continue to exist for host institutions abroad as well as for U.S. students aspiring to study overseas. After excluding institutions in Anglophone countries (Australia, Canada, Ireland, New Zealand and the UK) where virtually all courses are already offered in English, almost 40 percent of institutions in non-Anglophone countries cite their limited ability to offer instruction in English as a significant challenge, which surpassed “space limitations” as the number one challenge.

Despite the perceived shortage of courses taught in English at host institutions in non-Anglophone countries, English increasingly seems to have found its way into the mainstream curriculum and pedagogy of higher education classrooms around the world.¹¹ Many institutions in the EU that now offer full degree programs in English are eager to draw U.S. students directly to these programs.¹² A recent study by the Academic Cooperation Association (ACA) also found that programs taught in English in non-English-speaking European countries are on the rise, primarily at the Master’s level and in the engineering and business fields.¹³ Our survey also shows that overseas institutions in non-Anglophone countries are taking steps to address the English language challenge: 86 percent of responding institutions in non-Anglophone countries do offer some courses taught in English. Among institutions in non-Anglophone countries, Figure 12 reflects top fields of study where English is used.

Figure 12: Top Fields of Study for Courses Offered in English Among Respondents in Non-Anglophone Countries



But the language issue is two-directional, and simply increasing the availability of English language offerings at host institutions is only part of the solution to increasing U.S. study abroad capacity. Foreign language deficiencies of U.S. students also pose a challenge in increasing the number of U.S. students that study abroad, and as many as 37 percent of responding institutions (again, excluding institutions in Anglophone countries) cite this limitation. A lack of adequate preparation in the required foreign language at the home institution prior to departure might prevent a student from fully benefiting from the study abroad experience, especially when achievement depends on the level of immersion in the academic and social culture of the host country. Institutions abroad recognize this and are likely to push their counterparts in the U.S. to develop more rigorous requirements for language preparation—of the kind the National Security Language Initiative has addressed¹⁴—while also expanding their own intensive language instruction for incoming students.

Beyond infrastructure and language constraints, other key challenges reported by institutions included: the additional support services required to host U.S. students (26 percent); ensuring diversity in the student population by recruiting from a variety of countries and not just the U.S. (21 percent); working with limited staff and resources (21 percent); and the high cost of providing adequate housing for U.S. students (12 percent) (Figure 11). The sidebar to the right lists other challenges that were reported that are largely beyond a school’s control.

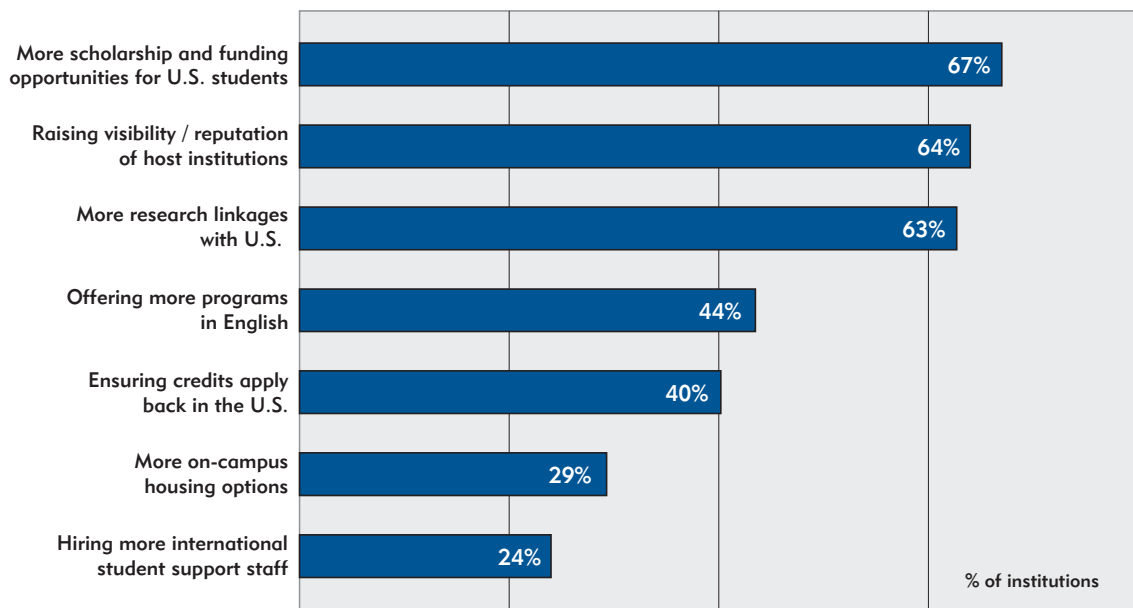
Additional challenges to increasing U.S. enrollment in overseas institutions:

- Devaluation of U.S. currency
- Lack of flexibility in American universities’ credit transfer system
- Climate and location of the host institution
- American perceptions that the quality of a U.S. education cannot be matched by international institutions
- Competition from other institutions as an increasing number of schools are offering quality programs at cheaper costs in many host countries

B. Key Strategies to Increase Institutions' Capacity to Host U.S. Students

The final section of the survey asked institutions to identify strategies or specific steps that could be taken to increase their capacity to attract and host U.S. students. A large proportion of institutions (67 percent) reported that providing more scholarship and funding opportunities for U.S. students was an important strategy (Figure 13). This top-cited strategy suggests that institutions outside the U.S. are just as concerned about the high costs of an overseas education for students as are their counterparts on U.S. campuses. More funds going directly toward U.S. students for study abroad would most likely help to increase the number of U.S. students on foreign campuses.

Figure 13: Key Strategies to Increase Institutional Capacity to Host U.S. Students



The next two strategies—raising the visibility and reputation of the institution among a U.S. higher education audience, and creating more research linkages with the U.S.—were also seen as highly effective approaches and are ones that are closely related. Many study abroad and exchange partnerships that grow from faculty networking and an institution's efforts to develop international linkages are likely to have a positive impact on its visibility and reputation within the U.S. and in the higher education systems of other countries. Not surprisingly, a fairly large proportion (44 percent) of respondents felt that offering more courses taught in English was likely to attract more U.S. students. Other strategies included: ensuring credits apply back in the U.S. (40 percent); providing more on-campus housing options (29 percent); and hiring more international student support staff (24 percent).

A few institutions also mentioned other factors that they considered important in changing the landscape of U.S. study abroad participation at their institutions. One respondent in Turkey thought a “general change of attitude toward Muslim countries would be beneficial.” Others cited more specific factors at the institutional level, including more effectively transmitting information on available programs in English and of programs in less-traditional destinations to U.S. students and institutions, which would help raise the profile of the host institution, its credibility and ability to attract more students. Also, respondents noted that more needs to be done on the U.S. side to encourage and motivate students to study abroad and to convince the general public (and the employment sectors) that study abroad is indeed a worthy venture.

VII. Conclusion

Increasing overseas capacity to host more U.S. study abroad students is a complex undertaking, the dimensions of which this second White Paper has only just begun to explore. While there is high interest and motivation among overseas institutions to host a larger number of U.S. study abroad students, there is no single strategy or formula for increasing capacity. Current and future capacity to host U.S. students, and the motivations for attracting more U.S. students and the specific strategies in place to achieve this goal, vary based on factors such as: the existence of national-level internationalization policies in a country; other institutional goals that might compete with the goal of internationalization; the actual infrastructure to host students, both in terms of the total number of institutions in a country that can accommodate more students and in terms of the physical space available at institutions; and the extent to which overseas institutions perceive an increased number of U.S. students on their campuses to be an outcome of reciprocity between their institution and U.S. institutions. Despite these institutional- and country-level variations, the findings of this White Paper suggest the following general conclusions:

- Institutions in other countries feel that the greatest room to absorb more international students (including U.S. students) appears to be in longer-term study abroad programs that last at least one academic session or an academic year, and in degree study. In contrast, the majority of U.S. students go abroad for shorter periods of study. This suggests a disconnect between host institution priorities and U.S. study abroad trends and is an area that requires more attention to help guide the national dialogue of increasing U.S. study abroad participation.
- Exchange agreements and joint- and dual-degree programs are also large areas of growth. In a related finding, the presence of U.S. students is seen as a catalyst for forming reciprocal and beneficial partnerships with U.S. higher education institutions, and for raising the international profile of the host institution.
- In addition to creating opportunities for institutional-level linkages, the presence of U.S. students on a campus is valued because it fosters an exchange of knowledge, culture and language through personal interaction.
- For many overseas institutions, increasing international enrollments is a central aspect of an overall internationalization mission. This attempt to increase enrollments is often focused on specific sending countries, with the U.S., China, India, Canada, and Russia figuring among the top five.
- Hosting U.S. students often provides an academic incentive to receiving institutions by enabling them to increase their global competitiveness and expand their joint research opportunities with U.S. sending institutions.
- Although language continues to be a barrier, both in terms of the foreign language deficiencies of U.S. students and the shortage of courses offered in English in countries where English is not the primary language, there are also indications that this gap is being bridged. An increasing number of U.S. students are beginning to acquire foreign languages,¹⁵ especially through federal

programs under the National Security Language Initiative and the National Security Education Program, as well as campus-based programs. And an increasing number of overseas institutions are also now offering courses in English. This finding is also supported by a recent study by the Academic Cooperation Association (ACA) that found that programs taught in English in non-English-speaking European countries are on the rise.

- From the perspective of overseas institutions, the most significant steps that could be taken at the U.S. end that would increase the numbers of U.S. students abroad would be: a) increasing host institutions' stature and visibility in the U.S.; and b) making available more funding and scholarships to enable a larger group of students to go abroad.

While this White Paper provides some early and broad-based findings of the key issues that U.S. institutions might encounter when attempting to send more students overseas, it also lays the groundwork for future in-depth research that is needed to address critical questions such as: What are the fundamental differences in the academic systems of the U.S. and various host countries and how these can be aligned to allow more international educational exchange? Will the Bologna Process help or hinder the U.S. study abroad exchange process? Is it reasonable to expect an increasing number of U.S. students to study abroad in destinations that already face pressure to accommodate their own student population? What will be the impact—positive or negative—of a larger U.S. student presence on the campus and wider community, especially in non-traditional destinations? And finally, and perhaps most important, how do we balance the goals of quality vs. quantity in attempting to send an increasing number of students overseas?

As part of the Institute's policy research initiative and with ongoing input from study abroad experts, the Institute plans to expand the dialog on these and other issues, in the context of assessing the overall capacity for increasing the number of American students who study abroad. We welcome your feedback on this second White Paper and your input on future research efforts.

Contact us at policyresearch@iie.org. Copies of this report can be downloaded at: www.iie.org/StudyAbroadCapacity.

Endnotes

¹The full report by the Commission on the Abraham Lincoln Study Abroad Fellowship Program, “Global Competence & National Needs: One Million Americans Studying Abroad”, can be accessed online at: <http://www.alliance-exchange.org/Lincoln%20Commission%20Report.pdf>.

²A copy of the paper is available at: www.iie.org/StudyAbroadCapacity.

³Bhandari, R. and Chow, P. (2007). *Open Doors 2007: Report on International Educational Exchange*. New York: Institute of International Education.

⁴American Council on Education (2008). *College-bound students' interest in study abroad and other international learning activities*. <http://www.acenet.edu/AM/Template.cfm?Section=International&Template=/CM/ContentDisplay.cfm&ContentFileID=3997>.

⁵IIE's Project Atlas is a research project that brings together a community of international exchange researchers to share common definitions and data on global mobility. Visit the Atlas of Student Mobility website at: <http://atlas.iienetwork.org>.

⁶Project Atlas partner organizations and others assisting with survey distribution included: the Academic Cooperation Association (ACA); the Asia-Pacific Association for International Education (APAIE); the Association of Indian Universities (AIU); the Association of Universities and Colleges of Canada (AUCC); Australian Education International (AEI); British Council; CampusFrance; the Canadian Bureau for International Education (CBIE); the China Education Association for International Exchange (CEAIE); the China Scholarship Council (CSC); the Consortium for North American Higher Education Collaboration (CONAHEC); Education Ireland; Education New Zealand; Education Singapore; EducationUSA Advising Centers supported by the Bureau of Educational and Cultural Affairs at the U.S. Department of State; the European Commission; Fórum de Assessorias das Universidades Brasileiras para Assuntos Internacionais (FAUBAI); Fulbright Center Finland; the German Academic Exchange Service (DAAD); the Hollings Center for International Dialogue; the International Association of Universities (IAU); the International Education Association of South Africa (IEASA); the Japanese Fulbright Commission; the Japan Network for International Education (JAFSA); the Korean Fulbright Commission; the Mexican National Association of Universities and Higher Education Institutions (ANUIES); the Netherlands Organisation for International Cooperation in Higher Education (NUFFIC); Perspektywy Education Foundation; the Swedish Institute; Turca Education Group Ltd.; the United Nations Educational, Scientific and Cultural Organization (UNESCO); and Universities UK. IIE is grateful for the valuable support and assistance from these organizations.

⁷Separate country profiles will be available online at: www.iie.org/StudyAbroadCapacity.

⁸To minimize the reporting burden on institutions, the survey asked them to estimate the range that most closely matched the number of international students at their institution instead of asking them to report the specific number of international students that fell within each academic level.

⁹For more information and data, visit: <http://opendoors.iienetwork.org>.

¹⁰Australian Government Endeavor Awards Scholarship website. <http://www.endeavour.dest.gov.au/default.htm>. Accessed 3/18/08.

¹¹Altbach, Philip. “The Imperial Tongue: English as the Dominating Academic Language”. *International Higher Education*. The Boston College Center for International Higher Education. No. 49 (2007): 2-4.

¹²For example, according to the Erasmus Mundus Masters Courses Compendium, in June 2007, there were 80 Masters Courses (degree programs) that had been established between multiple institutions in the EU, covering fields from engineering, natural sciences, social and life sciences, the humanities and multi-disciplinary programs. Just over 75 percent of the available programs either used English as the primary language of instruction or incorporated some English to a certain degree for instruction.

¹³Wächter, Bernd & Maiworm, F. (2008). *English-taught programmes in European higher education. The picture in 2007*. Academic Cooperation Association (ACA) Papers on International Cooperation in Education. Bonn: Lemmens.

¹⁴For more information on the National Security Language Initiative (NSLI), visit: <http://www.ed.gov/about/inits/ed/competitiveness/nsli/index.html>.

¹⁵Based on a 2006 survey, the Modern Language Association (MLA) reported a 12.9% increase in enrollments in languages other than English since 2002 (<http://www.mla.org>).

About IIE

The Institute of International Education is a world leader in the international exchange of people and ideas. An independent, nonprofit organization founded in 1919, IIE has a network of 20 offices worldwide. IIE designs and implements programs of study and training for students, educators and professionals from all sectors with funding from government and private sources. Programs that IIE administers for the U.S. Government and other sponsors, such as the Fulbright U.S. Student Program, the Benjamin A. Gilman International Scholarship Program, the David L. Boren Scholarships and Fellowships, the Language Flagship Fellowships, the Freeman Awards for Study in Asia, the Whitaker International Fellows and Scholars Program, and the Central Europe Summer Research Institute, send U.S. students abroad in growing numbers, preparing a new generation for global citizenship. The Institute is a resource for educators and institutions worldwide, publishing *IIE Passport: Academic Year Abroad* and *Short Term Study Abroad* and operating www.IIEPassport.org, the search engine for study abroad programs, as well as www.StudyAbroadFunding.org. IIE conducts policy research, program evaluation and provides advising and counseling on international education and opportunities abroad. IIE's annual survey of student mobility is published annually in the *Open Doors Report on International Educational Exchange* (www.opendoors.iienetwork.org), supported by the Bureau of Educational and Cultural Affairs of the U.S. Department of State.
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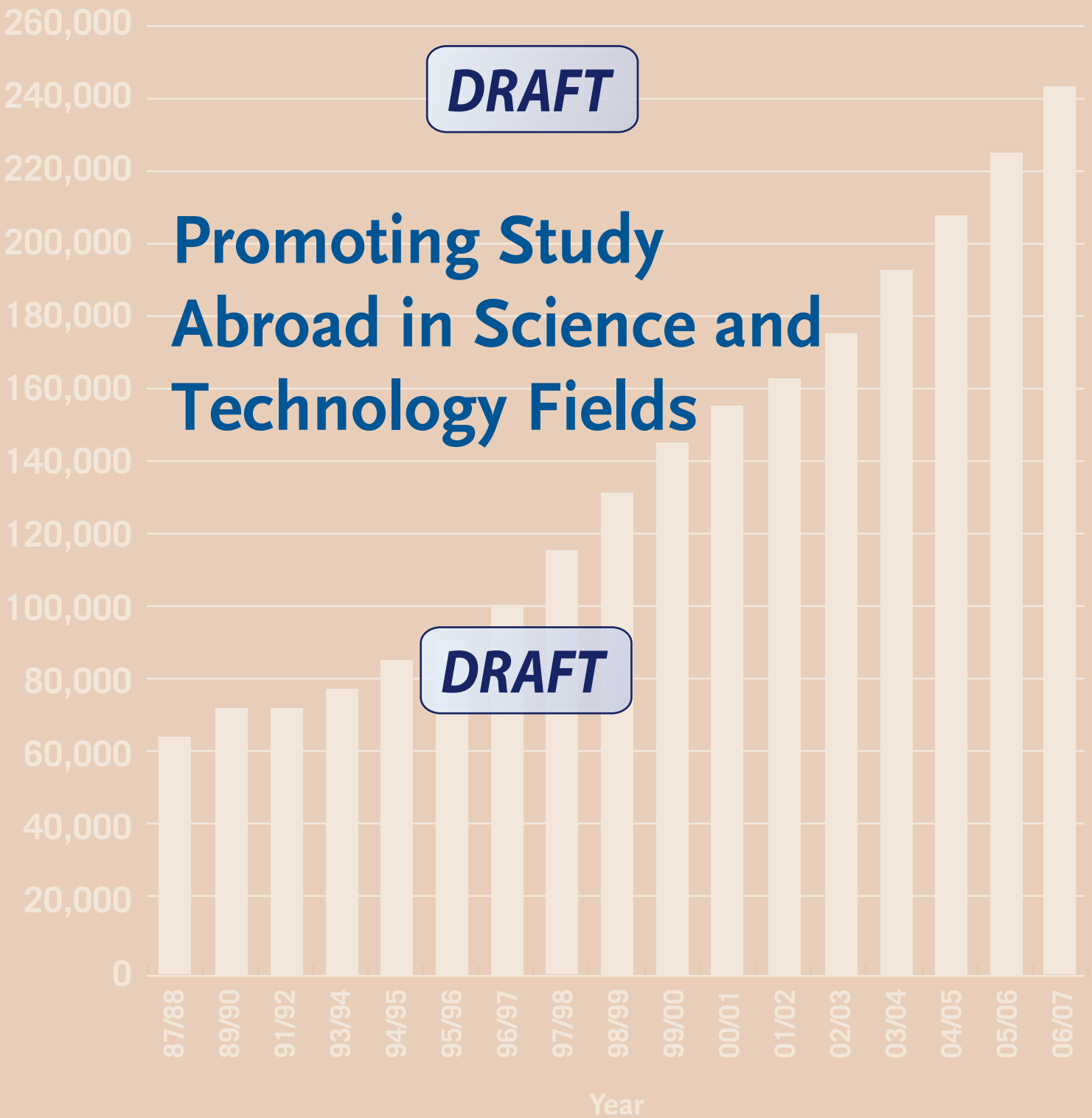
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Promoting Study Abroad in Science and Technology Fields

Fifth in a Series of White Papers on
Expanding Capacity and Diversity in Study Abroad

Institute of International Education
March 2009

Edited by Peggy Blumenthal and Shepherd Laughlin

Foreword by Allan E. Goodman

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About the IIE White Paper Series

U.S. students and teachers are going abroad in growing numbers, gaining the international exposure and cross-cultural knowledge that will prepare them for their future role in an interconnected world.

According to the *Open Doors 2008 Report on International Educational Exchange*, 241,791 U.S. students studied abroad for academic credit in 2006/07, an increase of 8.2 percent over the previous year, and a 150 percent increase over the past decade. Still, only a small percentage of U.S. students study abroad during their college years. The late Senator Paul Simon urged that America send abroad as many of our students as those coming to the U.S. from abroad, currently 624,000 and rising. IIE shares this goal of more than doubling the number of U.S. students abroad. It is imperative that efforts to expand the number of students studying abroad make efficient use of existing resources and insure that access to education abroad is available to all, including students of underrepresented economic and social groups.

To address these challenges, the Institute of International Education (IIE) launched *Meeting America's Global Education Challenge*, a focused policy research initiative which explores the challenge of substantially expanding the numbers and destinations of U.S. students studying overseas. In May 2007, IIE published its first White Paper in this series, *Current Trends in U.S. Study Abroad & the Impact of Strategic Diversity Initiatives*, which examines the current state of study abroad in the U.S., providing a benchmark for future expansion. Analysis of strategic funding initiatives showed that resource allocation can influence diversity of participants, geographic destinations and length of study.

The second White Paper, *Exploring Host Country Capacity for Increasing U.S. Study Abroad* (published in May 2008), focuses on the capacity of higher education institutions abroad to absorb a significantly expanded number of U.S. students, as well as the challenges they face and their motivations and strategic plans to undertake this effort. The next White Paper in the series, *Expanding Education Abroad at U.S. Community Colleges*, provides an overview of education abroad at community colleges, addresses the challenges in expanding study abroad, and offers recommendations for institutional reform.

The fourth White Paper, released in February 2009 and titled *Expanding U.S. Study Abroad in the Arab World: Challenges and Opportunities*, is based on a workshop that took place in Ifrane, Morocco in March 2008. The Hollings Center for International Dialogue and the Institute of International Education convened this workshop, "Expanding American Study Abroad in the Arab World: Challenges and Opportunities," at Al Akhawayn University in Ifrane. Its purpose was to examine the issues that will arise as more U.S. students seek to study in the region. Is there enough capacity in the region to accommodate more students? Are there opportunities in countries and universities that are currently underrepresented? What challenges will U.S. and Arab world educators face if more young Americans are to study in the region?

This fifth paper in the series, *Promoting Study Abroad in Science and Technology Fields*, examines the state of internationalization in the disciplines of science, technology, engineering and mathematics (STEM), which are consistently underrepresented in study abroad. We first examine the most recent *Open Doors* student mobility trends in STEM disciplines, and then feature two essays focusing on models for increasing study abroad in the field of engineering. Finally, we look at evaluation methods for these programs with an essay on STEM program evaluation methods, and a sample evaluation case study. Looking separately at trends, program models, and evaluation in STEM study abroad, the paper offers an overall view of the dynamics of study abroad in these specific fields of study.

Each of these White Papers is available for download at www.iie.org/StudyAbroadCapacity, and hard copies can be purchased at www.iiebooks.org.

Foreword

By Allan E. Goodman, President and CEO, IIE

Recent reports on United States competitiveness in science and technology suggest that immediate action is needed to stave off distressing trends. The need to rise above the “gathering storm,” as one report put it, was the topic of an address by Bill Gates on the occasion of the 50th anniversary of the House Committee on Science and Technology in March 2008. “I know we all want the United States to continue to be the world’s center for innovation. But our position as the global leader in innovation is at risk,” Gates testified. “If we don’t reverse these trends, our competitive advantage will continue to erode. Our ability to create new high-paying jobs will suffer.”

A month earlier before a hearing of the same committee, I had a chance to lay out the benefits of foreign students and scholars to the U.S. scientific enterprise and to the U.S. more broadly. It turns out that their impact is quite substantial. According to the National Science Foundation, in 2006 non-U.S. citizens earned 45% of all doctorates in the fields of science, technology, engineering and mathematics (STEM). American campuses and graduate departments increasingly rely on international students to provide valued research or assistance in teaching.

A few numbers from IIE’s *Open Doors Report on International Educational Exchange* can help clarify just how significant this trend is. In academic year 2007/08, a record high of 623,805 international students were studying in U.S. higher education institutions, and 39% of them studied STEM fields. A near-record number studied engineering: 96,000, or 17% of all international students. Physical and life sciences students numbered an additional 82,000. After several years of declining enrollments, these numbers are starting to show an increase.

If we look at international scholars, the numbers are even more striking. In 2007/08, 70% of all international scholars engaged in research or teaching on a U.S. campus were specialists in one of the STEM fields. The natural and physical sciences accounted for 56% of all international scholars, with engineering at 13%. These international students and scholars bring incalculable benefits to U.S. scientific research. As one example, consider that more than one-third of Nobel Laureates from the United States are immigrants. And a 10% increase in the share of foreign graduate students in the total number of graduate students tends to increase patent grants earned by universities by 6%.

While international students benefit in large numbers from their time outside their home country, U.S. students have far fewer international experiences of a sustained nature. Too often, working with international colleagues on campus is the only intercultural experience they get: American science and technology students study abroad at much lower rates than the general student population. About 16% of all study abroad students plan to major in the STEM fields, compared to about 26% of the general undergraduate population. And too often, their time overseas is quite short, due to curricular and financial constraints. Like the majority of all U.S. students who go abroad, STEM students may spend only eight to ten weeks outside the country.

IIE and our network of 1,000 colleges and universities is deeply committed to sustaining and expanding the flows of talented international students in the STEM fields, who continue to see America as the destination of choice for their overseas training. We also are working hard to expand opportunities for Americans from all backgrounds and in all fields, particularly the challenging STEM fields, to study abroad at some point in their academic career and to gain the international perspectives and global experience that will be vital to their success and to our country's competitiveness in the 21st century. Through the Global Engineering Education Exchange, a consortium of 35 U.S. engineering schools and over 50 higher education institutions outside the U.S., IIE helps several hundred engineering students each year study outside their country on a tuition swap basis. Several other programs that IIE has the honor to administer for far-sighted sponsors also provide opportunities for young American scientists and engineers to study and do research abroad. Information about these programs appears in the appendix to this volume, and on our StudyAbroadFunding.org website.

Bill Gates is absolutely right that we need to attract and retain foreign students in order for our universities to continue to produce enough of “the type of science and engineering graduate that we need to continue to add jobs and drive innovation.” I would add that innovation and job growth require individuals to possess the capacity to think and act on a global basis, and that there's no faster path to this skill set than study abroad. The foreign-born students in our universities already have had the experience of total immersion in a culture different than their own. We need to make sure that U.S.-born students in STEM fields also get the chance to gain a global perspective before they enter the global science and technology workforce.

Allan E. Goodman
February 2009
New York

I. Trends in Science and Technology Study Abroad from *Open Doors 2008*

By *Rajika Bhandari and Patricia Chow*

U.S. higher education enrollments in science and engineering disciplines have received considerable attention in the past decade primarily because of their implications for U.S. progress and competitiveness in a global economy that is increasingly knowledge-driven. This section focuses on trends regarding international students and scholars and U.S. students studying abroad in the Science, Technology, Engineering and Mathematics (STEM) fields.¹

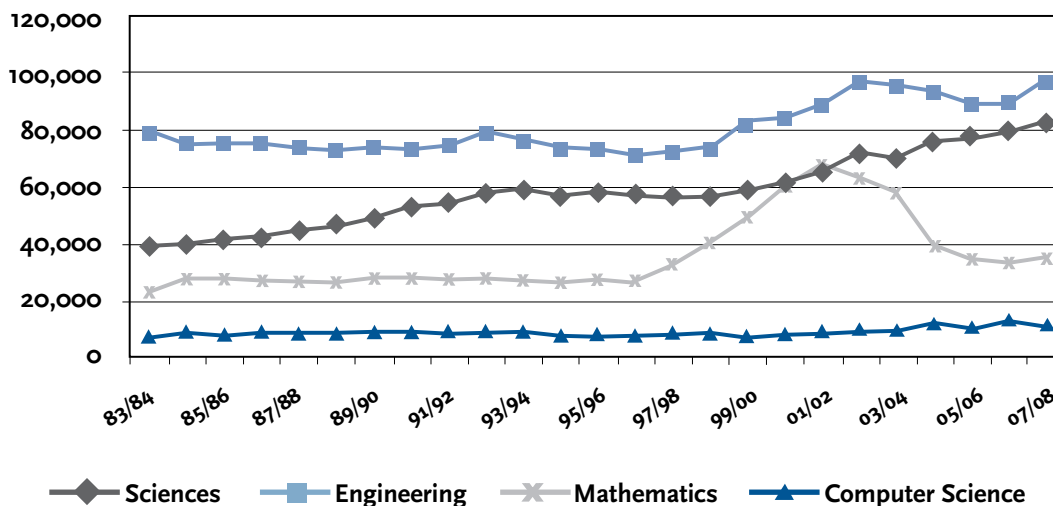
International Students in STEM fields

In 2007/08, engineering continued to be one of the most popular fields of study for international students, chosen by approximately 96,000 (17%) of all international students in the U.S. The sciences (including physical, life and biological sciences, and health professions) accounted for an additional 82,000 students (14%), and mathematics and computer science were selected by 46,000 more (8%). Together, these STEM fields enrolled 40% of international students.

Enrollment in these fields over the last two decades shows differing trends for the four STEM fields (Figure 1). International student enrollment in engineering increased sharply between 1998/99 and 2002/03, reaching a high of almost 97,000 in 2002/03. A few years of decline followed, with numbers again beginning to rise in 2006/07, followed by an 8% gain in 2007/08. Despite the continuing popularity of engineering, the proportion of all international students enrolled in the field has declined from 25% in the late 1970s to 15% in 2007/08.

With the exception of a small dip in 2003/04, enrollments in the sciences have increased at a steady pace: in 1983/84 only 39,000 international students were enrolled in the sciences; today there are more than 82,000.

Figure 1: International Students in STEM Fields, 1983/84 - 2007/08



The proportion of international students studying the sciences has increased from 11.5% in 1983/84 to 13% in 2007/08.

While international enrollment in mathematics has remained relatively steady over time, the number of international students studying computer science began to increase sharply in 1996/97, reaching an all-time high of almost 77,000 in 2001/02. Following this peak, the number of international students in computer science has plummeted, with the most current data (2007/08) showing a decline of nearly 40% from this peak.

Figure 2: International Students in STEM Fields of Study by Institutional Type, 2007/08

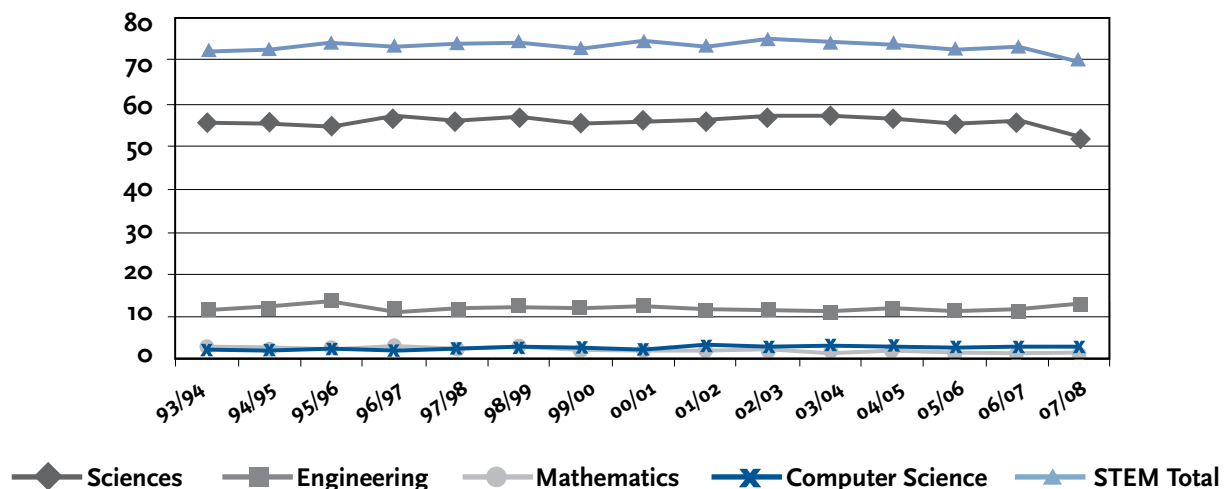
Field of Study	% ENROLLMENT				
	Doctorate Institutions	Master's Institutions	Baccalaureate Institutions	Associate's Institutions	Specialized Institutions
Engineering	22.4	10.3	3.6	5.1	1.7
Health Professions	4.1	4.6	2.4	11.0	11.4
Mathematics & Computer Sciences	8.8	9.6	4.7	5.4	2.5
Physical & Life Sciences	11.4	5.9	7.6	3.0	8.2
TOTAL*	46.7	30.4	18.3	24.4	23.8

* Total percent of all international students enrolled in each institutional type studying STEM fields.

International Scholars in STEM fields

As of 2007/08, over two-thirds (70%) of all international scholars engaged in research or teaching on a U.S. campus belonged to one of the STEM fields (Figure 3). The sciences alone account for 52% of all international scholars; followed by engineering (13%), computer science (3%) and mathematics (2%). The presence of international scholars in these fields of specialization has remained relatively constant since 1993/94 (Figure 2).

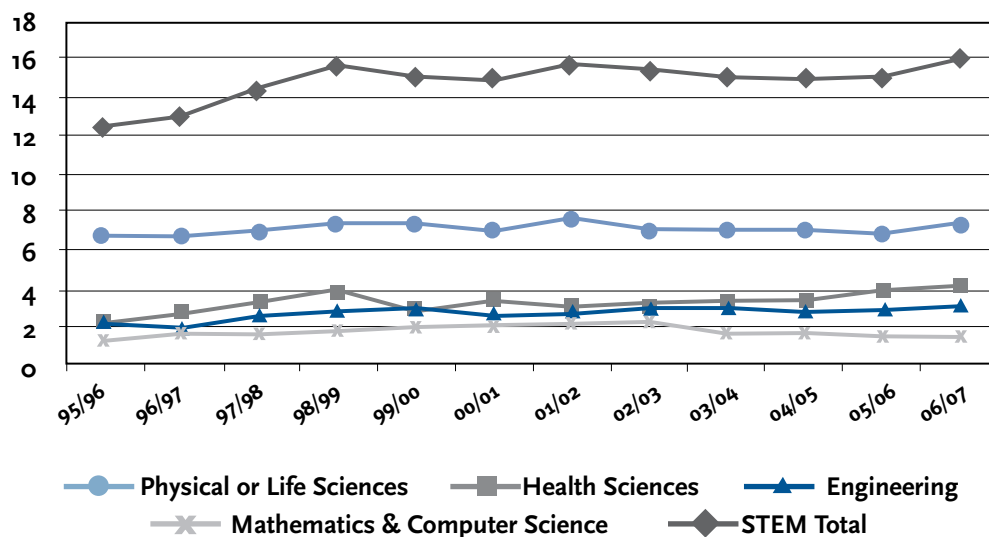
Figure 3: Percent of International Scholars Specializing in STEM Fields, 1993/94 – 2007/08



U.S. Study Abroad in the STEM fields

Relatively few U.S. students enrolled in the STEM fields pursue a study abroad experience for which they receive academic credit. Only 16% of study abroad students were majoring in the STEM fields (Figure 4), compared to 23% of all U.S. undergraduates who plan to major in STEM fields.² Of the four STEM fields, study abroad students were most likely to be in the life sciences (7%), followed by the health sciences (4%), engineering (3%), and computer sciences (1.5%). Although the absolute numbers of study abroad participants from STEM fields have increased over time, their relative share compared to other study abroad fields has remained fairly constant over the past decade.

Figure 4: Percent of U.S. Study Abroad Students Majoring in the STEM fields, 1995/96 – 2006/07 (in thousands)



Rajika Bbandari is Director and Patricia Chow is Senior Program Officer, Research and Evaluation Division, Institute of International Education.

¹ Social sciences and agriculture are not included.

² Ibid.

II. Expanding Study Abroad in the STEM Fields: A Case Study of U.S. and German Programs*

By Peggy Blumenthal and Ulrich Grothus

Both the United States and Germany are challenged to graduate and retain enough well-qualified engineers and scientists to meet the needs of their own economies, without relying increasingly on international students and professionals. Each country is addressing this challenge in various ways, based on their higher education systems and the interests of government and the private sector. This article will address one element of the problem and response, the efforts by government and academia to attract and train international talent while also ensuring that its home-grown engineering professionals have the international perspectives that will make them competitive in the global market place. Both of the authors work for national level non-governmental organizations devoted to stimulating international exchange of academics and professionals, working closely with their own governments and the private sector. Neither is an engineer, so our article will focus mostly on how to enhance the “soft skills” increasingly demanded by industry and how to recruit and train a globally effective engineering workforce for the 21st century. We will present initiatives that each country has launched recently, and share some common concerns. Finally, we will offer some conclusions about the likely challenges going forward and how government, academia, and corporations may need to invest in new solutions.

The United States: Maintaining a Leading Role through Transnational Exchange

With over 4,200 accredited institutions of higher learning and an enrollment of almost 18 million students (including over half a million international students), America’s higher education system is one of the largest and most flexible in the world, supported with an enviable mix of public and private funding for research and academic innovation.

However, despite these advantages, U.S. higher education continues to face many challenges, including growing competition for international students, shrinking federal investment in basic research, rising infrastructure costs, and concerns about the employability of today’s graduates. To meet these many challenges, U.S. higher education continues to evolve, enabled by new technologies such as distance education, new funding paradigms (including an explosion of for-profit degree granting institutions), and expanded collaboration in teaching and research across disciplines and across borders. All of these will have substantial impact on the education of undergraduate and graduate students in the United States and around the world.

A rapidly evolving international academic environment is also pushing American higher education to compete more vigorously for international talent. In Asia, especially in countries like China, Korea,

* This chapter was originally published as “Developing Global Competence in Engineering Students: U.S. and German Approaches,” *Online Journal for Global Engineering Education* 3, no. 2 (2008). Available at <http://digitalcommons.uri.edu/ojgee>.

and India, the expanding higher education sector is already affecting the numbers of their students enrolled not just in the U.S. but also in other major host countries such as the U.K., Australia, and Germany. Many foreign trained graduate students are heading home to build strong graduate programs in their home country universities, which over time may lessen the need to send large numbers abroad for professional training. These developments can be seen as a problem, a success, or a bit of both: they are the logical outcome of America's definition of international students as "non-immigrants" who come here for training and then are required to return home.

International education from the U.S. perspective was aimed at building home country capacity and, as such, is succeeding: Korea and Taiwan are just two examples where huge numbers of U.S.-trained academics have returned to teach or do research at home. With rapidly expanding economies, a growing urban middle class, and increased demand for educated managers, countries like China and India must follow the same educational path as Korea and Taiwan did, sending large numbers abroad to be trained while also expanding their home country higher education capacity to meet the needs of millions more students each year, a need that far outstrips the absorptive capacity of international host campuses.

In Europe, reforms in the higher education system are also affecting America's role in international education. The European Union has vigorously promoted and supported academic mobility within Europe, through which hundreds of thousands of students spend a semester or more in another European country on programs like ERASMUS, SOCRATES, and LEONARDO, in recognition of the fact that their future careers will require the ability to function in several European languages and cultures. This dramatic upsurge in student mobility has stimulated the growth of specialized personnel and infrastructure at European universities to manage student mobility, paralleling the international education professionals and structures on U.S. campuses. European higher education institutions are also developing "American-style" master's degree programs, pushed by the Bologna process and the market, and they are reforming the higher education system in ways that will simplify the transfer of academic credits across borders.

In the U.S., campuses are developing new strategies to serve the educational needs of students who do not travel to the U.S. to study, in addition to continuing to recruit large numbers of international students. Many "host" campuses are developing joint degree programs to be delivered locally at the home country university through a combination of distance learning, visiting faculty, and short-term stays abroad. Such programs provide students with access to international faculty and also encourage joint research collaboration among faculty. However, this model fails to transmit the full benefits of studying outside of one's own culture, with full access to the educational resources of the host university's faculty, libraries, and laboratories. Some higher education researchers raise concerns about whether the quality and level of graduate training and research conducted in these rapidly expanding home country institutions will be sufficient to sustain their high tech development needs.

Challenge to America: Competitiveness in STEM

While the developments cited above respond to the changing needs of national and regional economies, they can also be viewed as a challenge to American higher education's long-held self-perception as the "destination of choice" for internationally mobile students and faculty. The ripple effect

on U.S. higher education is increasingly noticeable, especially in key scientific and technical fields where international students are heavily concentrated, and American students significantly under-represented, especially at the graduate level. While STEM (science, technology, engineering, and mathematics) graduate programs in the U.S. are dominated by international students (foreign students made up 47 percent of all graduate enrollments in engineering in the U.S.), other countries are outpacing the U.S. in producing scientists and engineers: of all undergraduate degrees awarded worldwide in science and engineering, 72 percent were awarded outside the United States. Similarly, of all doctoral degrees earned worldwide in science and engineering, 78 percent were earned outside the United States.¹

There is a growing acknowledgement among American educators and policy makers that scientific research is a global, rather than national, enterprise, and a realization that several countries already surpass America in the production of PhDs in key science/technology fields. This awareness calls for a “revolution” in higher education. These concerns grew along with declines in the number of international students and scholars in U.S. universities: an overall drop of 2.4 percent was reported in *Open Doors 2004*, the annual report by the Institute of International Education (IIE) on international academic mobility, followed by a 1.4 percent drop the following year, leveling off in 2005-2006. Larger percentage declines were noted in engineering and science fields. The drop was especially pronounced in the field of engineering, where numbers of incoming students from China and India declined sharply at some leading graduate schools. Those numbers have started to rebound, according to subsequent *Open Doors* reports² and recent surveys by the Council of Graduate Schools, but the issue has highlighted for key policy makers America’s vulnerability in terms of reliance on foreign-born STEM talent and possible shifts occurring as a result of international developments and U.S. responses. In the years following September 11, 2001, business and congressional leaders have joined academics in a proactive call to reform STEM education, strengthen U.S. competencies beginning at the pre-college level, and reduce the perceived dependence on international students and scholars in STEM departments at many U.S. universities.

A number of national studies, including the National Academy of Sciences’ *Rising Above the Gathering Storm* and similar reports by the Committee for Economic Development, the National Bureau of Economic Research, and the Council on Competitiveness focus attention on America’s growing shortages in STEM graduates, the need to dramatically expand the number of American undergraduate and graduate students in these fields, and the need to improve the teaching of math and science at secondary schools so that the pipeline is increasingly filled with domestic students and less reliant on international graduate students and scholars.³ These reports also voice growing concerns that current American graduates of such programs lack the cross-cultural skills and international experience required in the global academic community.

The increasing alarm over this issue has been compared to a similarly pivotal event in the 1950s, the Soviet launch of Sputnik, which produced a major U.S. investment in STEM teaching and research. The 1958 passage of the National Defense Education Act provided major new federal funding to strengthen teaching and research in key STEM fields, as well as funding for study of foreign languages and cultures. Rising demand from industry and academia for renewed federal support of STEM teaching and research, expanding America’s global competence and competitiveness, may well produce another revolution in secondary and higher education, fueled in part by the realization

that we have become overly reliant on international students, and that the competition for globally mobile talent is becoming tighter and less predictable.

To compete more effectively for global talent, the U.S. government and higher education are actively engaged in dialog and joint action. There has been general agreement in recent years on the need to further streamline the student visa application and review process, to expand student recruitment efforts abroad, and to develop a national strategy for attracting students from outside the United States, countering the post-September 11 misperceptions abroad that international students are no longer welcome. At the same time, U.S. higher education and the federal government are recognizing the urgent need to strengthen the global competence of our own students and faculty members, increasingly at a disadvantage linguistically and in terms of international experience compared to their counterparts in Europe, Asia, and elsewhere.

At the state level, legislators are increasingly calling for reforms in state-funded institutions to ensure that their graduates obtain such skills in the course of their state-supported study. A 2005 article in *International Educator* found that four states (California, Louisiana, Texas and Nevada) had passed legislation stressing the importance of international education;⁴ today NAFSA counts 22 states that have passed such a legislation, a tremendous change in only a few years.⁵ Other states are considering similar legislation, which will help state-funded institutions to reallocate resources and make curriculum changes. The 2005 article summarized key elements of the Nevada Senate's resolution, which contains elements similar to the other states' legislation:

- Develop courses of study in as many fields as possible to increase students' understanding of global issues and cultural differences;
- Expand foreign language courses;
- Provide opportunities for students in all majors to study abroad;
- Provide opportunities for domestic and international students to interact effectively and routinely share views, perceptions and experience; and
- Develop innovative public educational forums and venues to explore global issues and showcase world cultures.

While there is growing consensus on the broad outlines of what is needed, there is also an awareness that such innovations require time and funding to achieve, and that not all majors can readily accommodate new elements given the constraints of existing course requirements, especially in scientific and technical fields. Calls to bring back a foreign language requirement, for example, meet with strong resistance in science and engineering programs already under heavy pressure to accommodate an ever-expanding body of knowledge in the core curriculum. Attention is increasingly turning to the vehicle of short-term study abroad as a way to infuse American undergraduate education with the global competencies listed above. Such study offers an intense educational opportunity and ideally stimulates longer-term interest in international education, language study, and global careers, while also providing students with skills that will better prepare them to be competitive in the global market place.

Broadening the Definition of Competence to Include Global Competence

There is no consensus on the content or methodology that best develops global competency, and U.S. higher education institutions are undertaking a number of different approaches, but the national dialog has clearly begun. It will evolve very differently than it has in European or Asian universities, since America lacks the kind of national/regional structures which can set higher education policy and mandate reforms. Without a “Ministry of Education” at the federal or state level, America’s academic institutions are largely responsible for developing their own academic programs to respond to new challenges, and for doing so within the context of each institution’s own educational vision and mission. Increasingly, institutions have expanded their mission statements to include a commitment to producing “globally competent” graduates who are able to function effectively in the global marketplace and provide leadership in the international arena. The approaches of different types of institutions to implement this vision vary widely and are still evolving. But the direction is clear and is reinforced by a growing commitment to this same goal within various agencies at the federal and state level, and through the professional and regional accrediting agencies.

The issue is especially challenging for engineering schools, where the curriculum is tightly focused on acquiring a set of technical skills and where faculty have traditionally not seen much value in sending students abroad for an international experience. For the first time ever, in 2006/07 more than 3% of all study abroad students were engineering students, but this very slight increase comes after a decade of virtually no changes in this percentage. With the majority of their graduate students (and much of their faculty) foreign-born, many engineering schools find it hard to see the logic in sending their own students abroad for further training, or how that will enhance their students’ professional development. Without pressure from employers or government agencies, there has been little incentive to change this approach, although the leadership within the field of engineering is beginning to encourage change through the peer-based accreditation system, as well as through competitive pressure to recruit the best students domestically and internationally.

The voluntary network of quality assurance agencies that review and accredit each academic program and academic institution in the U.S. is led by academics within each field, with only indirect leverage applied by the Department of Education, which can deny support to students attending unaccredited institutions. Many of these accrediting agencies have expanded their assessment criteria to incorporate the notion of “global competence” into the outcomes required for the successful graduate. In some disciplines, including engineering education, this objective is still expressed somewhat tentatively and indirectly, but with a growing acknowledgement that graduates need skills that go beyond mastery of the course content of the traditional curriculum. For example, the Accrediting Bureau for Engineering and Technology programs (ABET) expanded its expectation of skills required in graduates of accredited engineering programs by adding the following “soft skills” in Criterion 3 of the ABET 2000 guidelines:

- Ability to function in multidisciplinary teams
- Ability to communicate effectively
- The education necessary to understand the impact of engineering solutions in a global and societal context
- Knowledge of contemporary issues

An earlier report published by the Institute of International Education (*Towards Transnational Competence*, 1997) presented the conclusions of a joint U.S.-Japan Task Force for Transnational Competence, which spelled out a more general set of core competencies recommended for American and Japanese graduates in any academic field, including:⁶

- Ability to imagine, analyze, and creatively address the potential of local economies/cultures
- Knowledge of commercial/technical/cultural developments in a variety of locales
- Awareness of key leaders and ability to engage such leaders in useful dialog
- Understanding of local customs and negotiating strategies
- Facility in English and at least one other major language, and facility with computers
- Technical skills in business, law, public affairs and/or technology, and awareness of their different nature in different cultural contexts.

The Evolution of Study Abroad as a Mechanism to Develop Global Competence

Decades earlier, the U.S. government had already begun to invest in a global program to achieve these same goals, named after the young Senator who proposed the legislation shortly after World War II. The Fulbright Program, created in 1947 and administered by IIE for the U.S. Department of State, was for many years one of the few vehicles that supported American students and scholars for overseas study and teaching, and also allowed an equal number of international students and scholars to study and teach on U.S. campuses (www.fulbrightonline.org).

Aside from the Fulbright Program and a small number of foundation-funded fellowships for international research, U.S. study abroad was for many decades largely the province of wealthy female undergraduates in arts and humanities fields, who spent a semester abroad in Europe to perfect their language skills and visit leading cultural institutions, often accompanied by American faculty members and residing in “foreign student” residences, somewhat isolated from local students and faculty. This picture is starting to change, but slowly. Today, roughly two-thirds of Americans still study in Europe and many fit this general profile, according to IIE’s *Open Doors* data.

Growing concern in the late 1950s about America’s shortage of foreign language and area studies specialists stimulated a new infusion of federal funding (the previously cited National Defense Education Act of 1958) which provided funding for language study in countries or regions where American expertise was lacking. This funding was vital to the creation and expansion of Area Studies across the U.S. higher education scene, and also provided massive funding for scientific research, but did not specifically link these two goals and encourage study or research abroad by science and engineering majors. It was generally assumed that science and engineering majors would not have time in their crowded curricula to pursue language study or to spend a semester abroad, especially if they wished to graduate within the normal four-year timetable. NDEA funding continued for several decades, but at declining levels.

It was not until the end of the Cold War that America again began re-investing in programs to build the global competence of American undergraduates. The National Security Education Program’s (NSEP) David L. Boren Scholarships, funded by the Department of Defense and administered by IIE, support approximately 140 undergraduates annually to build language competence and

pursue study abroad in “non-traditional” destinations outside of Western Europe and Australia. The most popular language for applicants this year is Arabic, followed by Mandarin, with about 40 percent of Boren Scholars studying in the Middle East/North Africa and another 30 percent studying in East Asia. NSEP’s David L. Boren Fellowships provide funds for approximately 85 graduate students to add an international component to their educations, studying languages such as Arabic, Mandarin, and Russian (www.borenawards.org). A third component of NSEP is The Language Flagship, which provides advanced level language training in African languages, Arabic, Central Asian Turkic languages, Chinese, Hindi/Urdu, Korean, Persian, and Russian and Eurasian languages (www.thelanguageflagship.org).

Another national program funded by the U.S. Department of State, Bureau of Educational and Cultural Affairs and administered by IIE is the Benjamin A. Gilman International Scholarship Program, which has provided study abroad support for 4,728 American undergraduates on financial aid from its inception in 2001 through academic year 2008-2009. All of these programs reach out especially to minority students and students in “non-traditional” majors for study abroad (such as engineering). Engineering majors in the NSEP and Gilman programs make up nearly 5 percent of total awardees, with numbers of applications to the Gilman program from engineers up 81 percent since the inception of the program six years ago (www.iie.org/gilman).

In January 2006, the U.S. president, along with the secretaries of state, education, and defense and the director of national intelligence, announced a series of initiatives designed to increase the teaching and study of the above mentioned lesser-taught languages, including significant increases in opportunities to study these languages abroad. One of these major initiatives is the National Strategic Language Initiative, focused on a dozen or more languages that are not sufficiently studied or taught in the U.S., such as Arabic, Chinese, Russian, Hindi, and Farsi.

By expanding funding for programs like Fulbright, Gilman, and NSEP, as well as exploring support for language teachers and other strategies, the initiative seeks to improve U.S. language skills and expertise in key world areas. While this is not the first time America has tried to make this issue a national priority, the widespread resonance of the issue at the local and campus level suggest that U.S. higher education has finally accepted and embraced the notion that its graduates need to be prepared for global careers and that their educations are not complete without adding international perspectives.

New Models in STEM Exchange

The challenge of “fitting” the study abroad semester into a very tightly sequenced curriculum remains a significant deterrent for engineering majors, as does the labor-intensive work required of home campus faculty seeking to develop exchange programs with international partners. Three unique programs described here aim to address these challenges.

A group of U.S. and European engineering schools formed a consortium in 1995 in order to exchange undergraduate engineering students on a “tuition swap” basis and to pre-certify that the course of study abroad would be accepted for credit toward the engineering degree back home. IIE was asked to administer the U.S. side of this consortium, with a counterpart agency in Paris managing the Western European membership.

Originally called the American-European Engineering Exchange (AE3), the program received National Science Foundation support to expand the consortium to engineering programs in Asia, Latin America, and Eastern Europe. Renamed the Global Engineering Education Exchange (Global E3), the consortium now includes over 80 institutions around the world. This past year, over 200 students participated in the two-way exchange, with more than half of them American engineering students studying abroad for a semester or year. Their counterparts come to the U.S. host institutions for non-degree study (6-12 months) or for research opportunities. With support from ABB, Inc.-USA between 2001 and 2007, the program has become especially successful at encouraging female engineering students to study abroad, with women now representing about one-third of Global E3 students, although they represent only about 20 percent of undergraduates in most U.S. engineering programs.

An NSF-funded evaluation of the program's impact on alumni documented their increased confidence in international settings, their broadened interest in international research collaboration and international careers, as well as increased ability to meet the ABET 2000 Criterion 3 outcomes which related to the "soft skills" required for globally competent engineers. This unique national program continues to attract new member campuses in the U.S. and abroad. It also serves as a resource for campus-based programs, through an online database that lists courses taken abroad by U.S. students and accepted by U.S. engineering programs as equivalent to required courses back home (www.iie.org/programs/global-e3).

Member institutions in the consortium have also developed their own bilateral programs with European institutions, including field-specific exchanges and short-term summer study programs through which students can gain international experience, ideally gaining confidence to pursue longer stays abroad later in their career.

In 2005, IIE launched a Central European Summer Research Institute with NSF support, through which U.S. graduate students in science and engineering can pursue research internships in Austria, the Czech Republic, Germany, Hungary, Poland, and Slovakia. An evaluation of the program and its impact on developing global competence among participants is currently in progress.

Private foundations have also recognized the need to create opportunities for science and engineering students to study abroad. For example, the Winston Churchill Foundation's Scholarship Program offers American students of exceptional ability and outstanding achievement the opportunity to pursue graduate studies in engineering, mathematics, or the sciences at Churchill College, the University of Cambridge. For the past 4 years, IIE has worked with the Winston Churchill Foundation to administer the competition to select 12 scholarship recipients who have recently received their bachelor's degrees for awards that will lead to a master's of philosophy (M.Phil.) or certificate from Cambridge after their one-year tenure at Churchill College.

The Whitaker Foundation has also asked IIE to administer their program to support overseas study and research by American biomedical engineering students and scholars. The goal of the program, similar to that of other programs described above, is "to assist in the development of professional leaders who are not only superb engineers and scientists, but who also will lead and serve the profession with an international outlook" (www.whitakeraward.org).

These innovative programs, along with many others developed by individual campuses, are necessary and important steps but are by no means sufficient to produce the large numbers of globally competent professionals needed in the 21st century, not just in science and technology fields but in every discipline. Curricular innovation, international collaborative research, development of dual/joint degree programs across borders, and distance learning will all be needed to provide students with an international perspective and to produce globally competent professionals. Most important, the need has been acknowledged and the challenge accepted by academics and university officials who are now actively engaged in efforts to expand the international character of their programs and graduates. With growing calls for support from federal and private sources, and a recognition that America's global competitiveness depends on globally competent graduates, campus leaders across the U.S. are accepting the challenge to internationalize their institutions.

Germany: Capitalizing on the Moving Force of Europe

Engineering has traditionally occupied a prominent place in German higher education and society. While only about 5 percent of U.S. baccalaureate degrees are awarded to engineering majors, 18 percent of graduates in Germany earn their degree in an engineering discipline.⁷

Still, that is down from nearly a quarter in the '90s, when the popularity of engineering with high school graduates heading for university declined sharply. From 1991 to 1997, the number of first year engineering students dropped 20 percent. The decrease was initially caused by a temporary fall in job opportunities for recent graduates, but continued for several years after the job market had fully recovered. In fact, due to the shortage of engineering graduates, the Schröder government launched a kind of German "green card" for the first time in the late '90s, in order to attract more foreign engineers and computer specialists to Germany. Since the beginning of the new millennium the number of first-year students has risen and in 2005, more than 67,000 students began their tertiary studies in the field of engineering, an increase of 50% since 1998.⁸

German higher education has two separate branches, research universities (including some "Technical Universities" like Munich or Aachen that started as engineering schools but now offer a wide range of fields) and the more recent *Fachhochschulen* (universities of applied sciences) providing more practical-oriented programs at bachelor's and master's level. *Fachhochschulen* account for nearly two-thirds of all engineering degrees offered in Germany.

Reshaping the Curriculum: the Bologna Process

As in most of continental Europe, higher education in Germany is currently undergoing a thorough reform connected to the Bologna process, which has the ambitious aim of creating a European Higher Education Area with compatible and comparable degrees by the year 2010. The most salient feature of the process is the substitution of traditional national degrees with a three-tier system of bachelor's, master's, and doctoral degrees. In the past, students in German research universities earned their first degree (called *Diplom*) after at least five years of study. *Fachhochschulen* offered shorter programs of normally four year duration (including two "practical semesters" spent with

internships and project work in companies) leading to a *Diplom* (FH) degree, in this case roughly at bachelor honors level.

In the future, both types of institutions will offer bachelor's and master's programs, though the institutions will keep and develop their distinguishing profiles, with universities preparing for more research-oriented careers and *Fachhochschulen* being more application-oriented.

The transition to the new degree structure requires a profound revision of existing curricula if the new bachelor's degrees are to enable graduates to function in employment. Though this curricular reform requires a lot of energy of both faculty and administrators, it also provides a unique opportunity to reshape educational programs and think out of the box.

The purpose of the reform is twofold:

Domestically, the introduction of bachelor's degrees at research universities would shorten the time needed to earn a first degree. In addition, more structured programs should increase the percentage of students completing programs within their standard duration and diminish dropout. At present, engineering students, for example, on average take nearly 16 months longer than the standard duration of the program to complete their degrees. The number of graduates earning a *Diplom* degree in engineering is currently only about 60 per cent of the number enrolling as first year students five or six years earlier.

Internationally, the more compatible degree structures will help to attract more graduate students from other countries in Europe and beyond and enhance outbound mobility of German graduates seeking a graduate program elsewhere.

While some other European countries have introduced the new degree structure for all of their students at once, Germany has opted for a more gradual transition, during which traditional and new programs are offered in parallel. So far, only a minority of students is enrolled in bachelor's programs. But about half of first year students are now enrolled in bachelor's programs and universities expect to complete the transition in the next four to five years.

It is therefore somewhat early to predict whether and how the new degree structure will change current patterns of international mobility of engineering students. Presumably, both incoming and outgoing mobility for master's programs will increase significantly. On the other hand, many German students might find it more difficult to squeeze a semester or year abroad into shorter and more structured undergraduate programs. Some educators have even voiced concerns that the creation of a "European Higher Education Area" may eventually lead to less rather than more outgoing international mobility. These challenges and concerns would probably be addressed most effectively if institutions entered into even more agreements with partner institutions abroad on organized student mobility, thus pursuing a trend that had already begun in the early '80s.

Attracting More International Students to Germany

The introduction of more internationally compatible degree programs has contributed to the phenomenal increase of the number of international students studying in Germany in recent years. In just five years, from 1999 to 2004, the total number of foreign students in Germany increased 50% to 246,000 (numbers have been stable since then). Virtually all of the increase is due to non-resident international students, while the number of immigrant students with foreign passports who have already attended high school in Germany has been stagnant at the low level of some 60,000.⁹

Germany is, along with France, the third most common destination worldwide for international students, second only to the U.S. and Britain. Not surprisingly, given the good reputation of engineering education in Germany (and of German technology), many international students seek degrees in these fields. More than 51,000 foreign students were enrolled in engineering programs in 2006, comprising 21 percent of the total international student population. Overall, the most important sending countries, not counting resident aliens, are China, Bulgaria, Poland, Russia, Morocco, and Turkey. As recently as a decade ago, India sent only very few students to Germany. Now, India is second to China only in the number of international PhD recipients in Germany (first in chemistry and biology and second in mechanical engineering).

Though German post-war governments have always been more supportive of international student mobility, both incoming and outgoing, than most other countries, the internationalization of higher education has ranked very high on a non-partisan political agenda since the late '90s. Policy makers feared that Germany might lag behind some competitors, in particular the U.S., in attracting students from the emerging countries in Asia and Latin America. The international attractiveness of German higher education is now also widely seen as a benchmark of its quality and of the services it provides to domestic students and to society at large.

In a big program of “investments into the future” launched by the German federal government in 2000, internationalization and international marketing of German universities ranked alongside high tech communication and transportation infrastructure in importance. The German Academic Exchange Service (DAAD), the national agency for international higher education cooperation and the largest organization of its kind worldwide, got a budget increase of more than €20 million from this program.

DAAD was thus able to launch a huge international campaign to better market German higher education and help individual institutions implement their own internationalization strategies, including start-up funding for the first “off shore” campuses or departments of German universities in places like Cairo, Singapore, or Bangkok. Much of the German effort in transnational education is in engineering, as potential students and international partner institutions and governments perceive German universities to be particularly strong in this field. Engineering accounts for nearly half of the 74 German off-shore programs currently supported by DAAD.

Mobilizing Engineering Students: the Surge in Study Abroad

While engineering programs in Germany have always attracted a sizeable number of international students, outgoing international mobility was weak until the '80s. This has now changed.

Overall, the percentage of German university graduates who have studied at an international university for at least a semester is now around 16 percent (and even higher in research universities). The leading destinations are the France, the UK, Spain, and the U.S., each with a share between 10 and 15 percent. An additional sixth of the student body spends time abroad for other education-related activities such as language courses or internships, and the U.S. is the most popular destination.

These percentages have more than doubled since 1991. But the increase in engineering has been even more spectacular. Less than 2 percent of students in these disciplines studied abroad in the early '90s. That number is now up to more than 10 percent. Participation rates of engineering students at research universities are now close to the overall average, while *Fachhochschule* students still lag somewhat behind, as their fellow students do in all fields of study.

Two main reasons explain this surge of outbound student mobility:

First, students and employers are more aware that graduates will need to function in global working environments for much of their career. On a *résumé*, study abroad is now nearly as indispensable as good computer skills or proficiency in English.

Second, the European Union has supported study abroad for hundreds of thousands of students through its ERASMUS program. The program was launched in 1987 to enhance student mobility within Europe, and a 10 percent international mobility goal was set for European students. As ERASMUS is based on inter-institutional arrangements on programs and credit, it has also led to much more open and generous attitudes of faculty when it comes to the recognition of courses taken abroad, even if they may be slightly different in content or structure from those offered at the home institution. Participating students receive some, though mostly rather small, financial support from the EU (€ 100 or so per month). Nearly 160,000 European students now participate in ERASMUS each year, including 24,000 Germans.¹⁰

For many years, DAAD has run a similar program (ISAP) to support the exchange of small groups of students between departments in Germany and their counterparts outside Europe. While DAAD funds the German students (much more generously than under ERASMUS) and some faculty exchange, partners contribute tuition waivers and fund their own students going to Germany. Exchanges with North American institutions account for about 70 percent of this program that sends nearly 1,000 German students overseas each year, more than 200 of them in engineering.

Some institutions have even gone a step further and developed joint degree programs, where students study at a German and an international institution and are awarded both degrees, thus enabling them to compete for positions on at least two national labor markets at par with domestic applicants. The longest-running programs of this type were already launched in the '80s, most in engineering or business administration, with a very strong participation of *Fachhochschulen* on the German side. French

and German institutions have developed the greatest number of such joint degree programs thanks to strong political and financial support by both governments since 1988. Twenty-two percent of the students enrolled in one of the 142 programs now being offered under the umbrella of the “Franco-German University” are in engineering. Transatlantic degree programs are also in the focus of the EU-U.S. Atlantis Program jointly run by the European Commission and the U.S. Department of Education (FIPSE). Twenty-three such programs were selected under the first three competitions from 2006 to 2008, six in engineering, of which three were with German partners.

Developing Study in Germany for American Engineering Students

Leading U.S. engineering schools are developing comprehensive strategies to include a global component into their programs and encourage their students to have an international experience, as discussed in the section of this article devoted to U.S. perspectives. Europe should figure prominently in such strategies as much of America’s economic and technological cooperation is with its transatlantic partners. For example, more than a third of total U.S. direct investment in 2004 was in the European Union, and Germany attracted twice as much American investment as China.

Organizations such as DAAD are reaching out more actively to scientists and engineers, trying to pave the way for more reciprocal mobility and to overcome obstacles like the language barrier and credit issues with innovative programs, as highlighted below.

As early as 1987, the University of Rhode Island (URI) started its International Engineering Program (IEP) where students major in both engineering and a foreign language and spend a semester or even a year abroad with an internship in industry and/or regular enrollment at a partner university.¹¹ Due to the additional content and qualifications, the program takes five years to complete instead of the usual four. The oldest and largest component of the program is the German one, the Technical University of Braunschweig being URI’s partner institution. IEP has now been expanded to French, Spanish and Chinese. Currently, a total of 200 students are enrolled in the program, and over 150 students have completed six month internships in Germany alone. URI and the Technical University Braunschweig are now developing a dual degree program at the master’s level, with support from the National Science Foundation.

Earlier in this decade, DAAD invited groups of North American engineering deans to tour Germany to learn more about engineering education there and to establish contacts with German colleagues. For three years now, DAAD has organized German-American workshops in conjunction with the annual conferences of the American Society for Engineering Education (ASEE). The 2006 workshop in Chicago was dedicated to transatlantic degree programs.

One immediate result of these and other efforts has been a considerable increase in the number of science and engineering applications to scholarship programs to Germany for North American undergraduates and graduates. The share of science and engineering students in DAAD’s flagship graduate scholarship program has doubled since 2001 and now makes up close to a quarter of the program. Typically, these graduate students do experiments for their doctoral research in German labs, often

based on existing contacts of their American advisors. However, the percentage of engineering applicants and awardees is only around 5 percent, far from satisfactory given the good quality and reputation of engineering research in Germany.

With the support of start-up funding from DAAD, 13 German universities ran content based summer programs in 2008, developed jointly with leading American universities to serve the specific needs of American undergraduates. Seven of these programs are in engineering, and two more engineering programs are expected to launch in 2009. These programs focus on fields like process engineering, automotive engineering, and renewable energy. American partner institutions include the University of Michigan, the University of Rhode Island, Northwestern University and California Polytechnic State University.

A Success Story: RISE

However, the most exciting and attractive program by far has proven to be RISE (Research Internships in Science and Engineering), which was first launched two years ago. RISE is for American undergraduates to work with German doctoral students in their labs for 6 to 12 weeks during the summer. The students make real contributions to their research field while experiencing full immersion into a foreign culture. RISE interns do not need to be, and mostly are not, proficient in German, as the working language in the host labs is English.

Close to 500 different projects in universities and research institutes such as Max Planck, Fraunhofer, and Helmholtz expressed interest in the 2008 program cycle. American and Canadian students register in a database in December/January and apply directly to potential hosts for projects in which they are interested. 846 students filed a full paper application after initial online contacts with a host. DAAD was able to support 298 students with a cost-of-living scholarship, health insurance, and work permits, triple the number originally budgeted for, thanks to additional support from universities, research institutions, private industry, and professional associations.

The RISE projects are not trivial and the interns are generally involved with serious research, focusing on specialized topics and state-of-the-art methods and equipment. This makes the program attractive for students who are genuinely interested in research and eager to get hands-on experience. It is hardly surprising that many applicants are first-rate students, often from excellent institutions. In fact, the grade point cut-off for a scholarship in this program in 2006 was a near-perfect 3.8.

Based on a survey of former RISE participants, IIE evaluated the program in early 2006.¹³ At the same time, applicants registering for the 2006 round were also surveyed about their motivations for wanting to participate in the program. Interestingly, in the latter group research experience (“ability to engage in practical, hands-on research”) ranked nearly as high as the international dimension of the program (“desire to work/travel abroad”), both with around 60 percent of respondents registering these reasons among their “most important” motivations.

Sixty percent of actual participants had never been to Germany before and only 43 percent had learned German before their RISE experience. The program does, therefore, seem to attract considerable

interest with students who would not otherwise have thought about studying in Germany, and perhaps not even in any foreign country. All the more interesting is the fact that 92 percent of returnees are considering working or studying in Germany again. This reflects a high degree of satisfaction. Ninety-seven percent of the undergraduates and 86 percent of the German hosts were satisfied overall with their RISE experience, and most would recommend it to their peers.

German graduate students had been a largely untapped resource for international education so far. Besides getting some help in carrying out their own research (in fact, the net benefit in terms of time saved was limited for most hosts if time spent on supervision is subtracted), most hosts said they improved their English language skills and their capability to function in a multicultural environment, both important advantages for their further careers.

And although easy communication in English is no doubt critical for the success of this program, many participants have felt encouraged to learn German by their positive experience in Germany. Thirty percent of RISE interns have taken language classes after their return to North America. From 2008, DAAD is offering a two week intensive language course in Germany before the internship for RISE participants with no or little German.

In 2007, the DAAD launched a parallel program, called *RISE professional*. The program consists of internships that provide a hands-on experience, impart important professional skills and help to develop a professional network, all while allowing students to experience life in Germany. The program is open to DAAD alumni, graduate students, Ph.D. students and recent graduates. More than 220 projects are on offer for the summer of 2009, and DAAD will be able to support up to 70 interns.

Conclusions: A Challenge for Higher Education

Engineers need global competencies and multi-cultural skills as much as any other professionals. Still, there is less of a tradition in this field to acquire such skills through study abroad than in many other fields. The academic benefit of study at a foreign university is less immediately obvious in engineering than, say, in languages or history. Engineering professors tend to be more reluctant than others to grant credit for studies conducted with international colleagues. And the students themselves typically are not fluent in foreign languages.

Still, both European and, more recently, American experience shows these obstacles can be overcome through innovative programming. The international mobility of German (and other European) engineering students has increased dramatically over the last 15 years. This is to a great extent due to exchange programs involving faculty on the departmental level. Through specific agreements on courses and credits, they better understood each other's educational principles and developed trust in the quality of their partners' teaching, the indispensable basis for more flexible and generous approach to curricular differences.

Similar attitudes should develop as more American universities develop exchange agreements with European partners, which will be made easier with the convergence of degree structures on both sides of the Atlantic.

There are also interesting new models for how engineering students can get access to meaningful international experience in which barriers like language and credit are circumvented or at least lowered. Opportunities for research experience, internships, and summer programs taught in English may encourage more American engineering students to make that most difficult first step – and perhaps come back later for longer and more ambitious projects.

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- ⁴ Christopher Connell, “Front Lines: California, Louisiana, Texas, Nevada: Putting Their States on the International Education Map,” *International Educator* (November-December 2005): 4-8.
- ⁵ States that have passed resolutions include: Kentucky, California, Louisiana, Texas, Mississippi, Nevada, Arkansas, Hawaii, Indiana, Montana, Vermont, Oklahoma, Minnesota, Massachusetts, New Mexico, West Virginia, Illinois, Wisconsin, Georgia, Missouri, Pennsylvania and Florida. See NAFSA: Association of International Educators, “Public Policy: International Education at the State Level.” Available online: www.nafsa.org/statelevel. Updated March 2008.
- ⁶ Institute of International Education, *Towards Transnational Competence: IIE Research Report Number 28* (New York: Institute of International Education, 1997).
- ⁷ Bundesministerium für Bildung und Forschung, *Grund- und Strukturdaten 2005* (Berlin: Bundesministerium für Bildung und Forschung, 2005).
- ⁸ Ibid.
- ⁹ Deutscher Akademischer Austauschdienst DAAD, ed., *Wissenschaft weltweit 2007*. (Bielefeld: DAAD, 2007). Available online [German and English]: www.wissenschaft-welttoffen.de.
- ¹⁰ European Commission – Education and Training, “Erasmus – Statistics: Erasmus student and teacher mobility” (2006-2007). Available online: http://ec.europa.eu/education/programmes/llp/erasmus/stat_en.html.
- ¹¹ John Grandin, “Preparing Engineers for the Global Workplace,” *The Online Journal for Global Engineering Education* 1, no. 1 (2006).
- ¹² Institute of International Education *Evaluation of the RISE Program* (New York: Institute of International Education, 2006). Available online: www.iienetwork.org/page/81828. IIE evaluated the program again in again in 2008 to assess longer-term outcomes of RISE; a summary of this evaluation is included in this paper.

III. Developing Evaluation Approaches to International Collaborative Science and Engineering Activities*

By Elizabeth Kirk

Background and Introduction

The strategic plan of the U.S. National Science Foundation (NSF) clearly acknowledges the growing need for U.S. scientists and engineers to address questions of global scale and significance.¹ It also recognizes that applying the results of basic research to longstanding international challenges—such as epidemics, natural disasters, and the development of alternative energy sources—will require globally engaged investigators working collaboratively with agencies and organizations both within the United States and abroad.

The information included in this chapter resulted from a workshop conducted by Sigma Xi, The Scientific Research Society, on July 28 and 29, 2008, at the NSF headquarters in Arlington, Virginia. The purpose of the workshop was to gather advice from experts on how to evaluate the impact of international programs that involve U.S. students, researchers, and educators in international scientific and engineering collaborations, such as those funded by NSF's Office of International Science and Engineering (OISE). The goal of the workshop was to help identify the unique contributions that international collaborations make to promoting excellence in scientific and engineering research and to use that information to develop monitoring and evaluation criteria for OISE programs.

Two specific types of programs were discussed. The first includes programs that focus on funding individual scientists and engineers to begin collaborative projects with international partners for the first time, such as NSF's International Research Fellowship Program (IRFP), which provides awards to individual postdoctoral scholars for up to two years of international research.² The second type of program discussed includes those that involve more complex collaborations across institutions and disciplines, both in the United States and abroad. One example is NSF's Partnerships for International Research and Education (PIRE), which awards up to \$2.5 million per year for five years to Ph.D.-granting institutions and involves participants at all stages of their academic careers.

The workshop looked at developing ways to monitor and evaluate such programs in terms of the impact on individuals, institutions, and quality of research—and the extent to which those effects were unique to international collaborations. How do these international collaborations contribute to the creation of globally competent (and therefore globally competitive) scientists and engineers and science and engineering educational and research institutions, and how do they add to the knowledge environment? Effective assessments would be able to compare an international collaboration to a domestic project, measure a project's contributions to the overall goals of a funding program, evaluate its costs and benefits in terms

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of human and other resources, and measure the degree to which initial support from NSF led to sustained collaborations even after such funding ended.

The full report contains discussions and conceptual frameworks for each of the three levels and includes sections on appropriate methods, research agendas, and specific testable hypotheses. This summary provides a brief description of each level and the research questions that arose during the workshop.

Individual Level

Anecdotal evidence suggests that students and researchers who participate in international collaborative activities experience a unique set of challenges and opportunities that directly contribute to the knowledge, skills, and behaviors of a globally competent scientist or engineer. In turn, the added knowledge, skills, and behaviors have a direct impact on the career paths of these individuals. Identification of these key elements and their causal relationships is an empirical question.

The following research agendas provide a path for more explicitly assessing the contribution of international collaborations to the global competence of scientists and engineers:

- Examine what other science and engineering programs have done to evaluate the career development of students and faculty who participate in international programs. Support a series of pilot projects that will explore the short- and long-term effects of international experiences on career outputs and outcomes.
- Conduct studies that more fully identify the underlying motives for a scientist's or an engineer's desire for international collaboration. Identify possible correlations to previous experiences and level of education and career development. Previous studies can be used as a backdrop for developing motivational variables.
- Support research that seeks to identify the impact of international collaboration on the careers of scientists and engineers at all stages of their career development.
- Identify institutions (both four-year and graduate-degree-granting) and programs to use as models for developing best practices for international experiences. Support the development of systematic monitoring, assessment, and evaluation tools to compare the impact of international experiences across institutions and programs. As part of this project, develop consensus definitions of monitoring and evaluation terms and a common time line. Develop clear distinctions between those involved in the activities and the observers who are doing the monitoring and assessing.
- Support a series of research projects that explicitly link characteristics of global competence (such as curiosity, flexibility, and trust) to professional competence and the development of science and engineering knowledge, skills, and behaviors. Be able to identify experiences (such as putting students in an unfamiliar domestic environment or providing virtual learning opportunities) that might contribute to global competence among scientists and engineers without requiring travel abroad.

Institutional Level

In addition to advancing the career development of individual scientists and engineers, another underlying goal of NSF OISE is to enhance the capabilities of the institutions it supports to participate actively and continuously in international collaborations. Of particular importance is the ability of institutions to sustain, deepen, and expand existing international networks to meet new science and engineering challenges and opportunities around the globe. Developing the institutional flexibility to participate in cutting-edge research wherever and whenever it occurs will help to promote globally competent research and educational institutions. Both the funding institutions and the institutions that they fund were discussed in terms of how to develop evaluation criteria for tracking the impact of international collaborations on the institutions.

- Identify the appropriate level—university-wide, departmental, or somewhere in between—of an institution to study in order to measure the impact of a specific program on that institution. When an institution has multiple international projects simultaneously, how can the direct effects of specific projects like those supported by a PIRE or an IRFP grant be separated from other factors?
- Conduct studies of funded projects that examine the effect of the type of project on any changes in institutional development at the U.S. institution. Is there a difference between projects that involve only one researcher initiating a project abroad versus those that involve multiple researchers and multiple disciplines? Is there a difference in short-term versus long-term projects on institutional policies and practices? Taxonomies of project types need to be developed for all levels before comparisons can be made and impacts assessed.
- Conduct research to determine if the region of the world where the research is conducted and field of study affect the kinds of institutional changes that take place at the host U.S. institution. (An explanation of these differences is found in more detail on page 13 of this report.)

Knowledge Environment Level

The research areas below are intended to start the process of pinpointing the effects of international collaborations on the knowledge environment and the degree to which international collaborations add to the quality (of outputs and outcomes) of both “normal” science and “transformative research.” Of the three elements that were discussed at the workshop, participants found that this was the most difficult to address.

- Conduct background research to determine what other agencies, institutions, and programs (both within and outside NSF) have done to evaluate their international science and engineering programs in terms of qualitative and quantitative impacts on discovery and innovation. One possibility is to compare the effects that an international component had within NSF disciplinary programs to those without an international component.
- Clearly identify learning styles, methods, techniques, and problem-solving approaches used outside the United States that might help advance science and engineering research. Which of these might facilitate productive research and lead to new discoveries and innovations?

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- Develop prototypes of effective international collaborations at all levels of education and research, and include models of both short-term and long-term projects. This process should include a more detailed examination of what it means to produce better research “outputs” and “outcomes.”
 - Develop examples of discovery, innovation, and best practices that constitute transformative science, with a focus on those that involved international collaborations. Continue to refine the characteristics of transformative research.

Methods

Because of the dearth of quantitative and qualitative studies that directly measure the impact of international collaborations on science and engineering at all three levels, the methods that were suggested were primarily exploratory in nature. They are intended to define categories (taxonomies) more clearly and to suggest causal links, as well as to produce descriptive and explanatory models. Of particular interest was the development of models that examine the depth and breadth of science and engineering social and information networks that can be established, sustained, and expanded, and the use of both traditional and nontraditional means of communication (CIT) that intercultural science and engineering communications might require.

The discussion centered on the following groups of methods across all three levels:

- Surveys and longitudinal data collection
- Comparative case studies
- Interviews and focus groups
- Social and knowledge (communications) network analysis

Summary and Conclusions

Developing effective tools to evaluate such collaborations will take time and money. Participants arrived at the workshop with years of experience participating in, administering and evaluating international projects, but no one was able to offer existing long-term systematic evaluations or models that address all three of the levels of interest to NSF. At this point, most of the evidence remains anecdotal and unsystematic.

To address this shortcoming by doing everything suggested in the report would be quite time-consuming and expensive, and it would require the dedicated efforts of faculty and staff at various institutions for many years. The key recommendation is to develop some short-term feasible metrics that can be used to evaluate the impacts of IRFP and PIRE while studying some of the leading elements to develop more complex models in the future.

It also became clear at the workshop that specific programs such as PIRE and IRFP cannot be studied in a vacuum. Evaluations of their effectiveness must take into account other international activities that are taking place at institutions and the students and faculty involved in them. It was also noted

that it is important to study the failures of international collaborations as well as the successes. Another point of agreement is that the impact of international collaborations will vary depending on the subject being studied and the region where the research is being carried out.

The discrepancy between the needs of industry and the needs of U.S. research institutions is another issue that remains unresolved. Industry wants competent U.S. scientists and engineers at all educational levels who are able to work, live, and operate effectively abroad for extended periods of time. Much of the research conducted by industry is applied research. It will result in the development of new products and new markets. Agencies such as NSF, however, want globally competent scientists and engineers to go abroad to conduct cutting-edge basic research and then return to the United States to teach and mentor others and advance U.S. contributions to the global process of research and development. One question that remains is what complementary and integrative roles different agencies and institutions involved in research play in developing global competence. This raises other questions as well, such as whether the process of evaluating international programs will be the same for all participants, including academic institutions and industry, or whether NSF should develop assessment tools that apply only to agencies with similar goals and strategies.

Next Steps

In order to develop a set of essential, feasible quantitative and qualitative monitoring and assessment tools for NSF OISE programs, the following steps should be taken:

- Determine what NSF and other governmental and nongovernmental agencies here and abroad have done to assess their international science and engineering programs. Identify key elements that can be adapted to NSF program evaluations.
- Prioritize the research agendas identified in this report and the lead NSF offices that might sponsor the research needed in these agendas.
- Develop several request-for-proposals based on these agendas that explore the development of monitoring and assessment tools at the individual, institutional, and scientific-research levels of analysis.
- Work with other agencies to develop a common set of evaluation standards.

For the full version of this report, visit www.sigmaxi.org/programs/global.

Elizabeth Kirk is a consultant on issues relating to science, technology, security and science policy. She produced this report while working as a visiting scholar at Sigma Xi, The Scientific Research Society, on an NSF grant focusing on the development of a globally engaged U.S. scientific, technical and engineering workforce.

¹ National Science Foundation, *Investing in America's Future: Strategic Plan, FY 2006–2011* (Arlington, VA: National Science Foundation).

² See NSF's OISE Web site—www.nsf.gov/OISE—for a full description of all OISE programs

IV. Evaluation Case Study: The RISE Program*

By Robert Gutierrez

In 2008, the German Academic Exchange Service (DAAD) commissioned the Institute of International Education (IIE) to conduct a second evaluation of the RISE (Research Internships in Science and Engineering) Program and its newer internship program, RISE Pro, that focuses on providing career-building experience by placing recent graduates, master's and Ph.D. students at a German company for the summer. The brief summary below provides an overview of the key findings from data and feedback collected during the course of this six-month evaluation.

The purpose of the comprehensive evaluation was to assess recent and longer-term impacts of the program on its participants. The evaluation required a multi-phase approach that involved a series of individual surveys targeted at each cohort between 2004 and 2008. For RISE, the scope of the evaluation included pre- and post-assessment surveys of U.S. and Canadian undergraduates (interns) and German Ph.D students (mentors) who participated in the program during the summer of 2008. In order to gauge longer-term impacts of RISE, a separate survey was also administered among alumni interns of the program who participated in previous cohorts dating back to the inception of the program in 2004.

A number of program areas were assessed, including, among other areas:

- Motivations for intern and mentor participation;
- Personal and professional impacts of the program;
- Impact on academic and career path in the science and engineering fields;
- Impact on intercultural and international research skill sets; and
- Effectiveness of program administration and placement.

Overall, the positive outcomes and impact of the program serve as strong indicators of the RISE program's success over the past four years. Based on the findings from this evaluation, RISE will likely remain a unique and valuable fellowship program that will continue to build on its early successes, providing lasting academic and professional opportunities for future North American and German participants.

Key Findings:

Why do participants apply and what do they hope to gain from their experience?

Interns:

Most interns were motivated to apply to the RISE program primarily because:

- They wanted to participate in an internship program that promised hands-on practical research (98 percent responding)

* This chapter is excerpted from "Evaluating the DAAD's Research Internships in Science and Engineering (RISE) Program: A Final Report," prepared for the German Academic Exchange Service (DAAD) by the Institute of International Education and released January 12, 2009.

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- They wanted the opportunity to work and travel abroad (97 percent)
 - They felt it would increase their global competence (96 percent)
 - It took place during the summer months (91 percent)

Academic obligation or degree requirement was not cited as a key reason for participating: 57 percent of interns said they would not, in fact, receive any academic or internship credit, while 28 percent did not know whether they would receive credit from their home institution for their participation in RISE.

Mentors:

The most important motivating factors among mentors relate to the professional benefits and skills they would gain from a work or research-based relationship with a North American intern. Ranked well above all the other listed factors, the desire to gain supervisory experience was the top motivating factor for mentors' participation, reported by 83 percent of all mentors. A high percentage of mentors also agreed or strongly agreed that they wanted to secure an intern with strong qualifications (69 percent), while also choosing to participate in the program because RISE offered them the opportunity to improve their English language skills through close interaction and communication with a North American intern (68 percent).

What type of North American undergraduate student participated in RISE?

In terms of field of study and academic background, 33 percent of the 2008 interns were pursuing their degree in engineering fields, 26 percent in the field of biology, 21 percent in chemistry, and 16 percent in physics.

Did the program meet its goals and were intern expectations met?

- The vast majority of interns (87 percent) agreed that they were satisfied with the amount of practical, hands-on research that they were involved in during the internship. Overall, 77 percent of the interns felt that their expectations of the program were fully met.
- There was also strong consensus among students that they were satisfied with their relationship with their mentor or supervisor (84 percent), with how their project matched the original description and focus in the placement period (82 percent), and with the scope of their own responsibilities as interns (80 percent). Interns also agreed that they were largely satisfied with the level of rigor of their research projects (74 percent).
- For mentors, the most success and impact was seen in an intercultural context: 81 percent said it improved their ability to function in or manage a multicultural team; and 75 percent said it improved their understanding of North American cultures and lifestyles.
- Related to program administration, virtually all mentors (91 percent) found overall RISE program procedures to be satisfactory, and more specifically, that the placement process was effective and satisfactory (83 percent).

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- 89 percent of mentors would recommend the program to another potential mentor/company in the future.

What were the impacts on international capabilities for interns?

- Virtually all interns (96 percent) who have participated since the program's inception between 2004 and 2008 agreed that their participation in RISE broadened their understanding of Germany, its culture and its customs.
- 90 percent agreed that they had acquired an understanding of German professional practices and standards.
- 86 percent agreed that they had acquired an international career outlook directly because of RISE.

Specifically among the 2008 cohort:

- 91 percent of interns increased their desire to travel abroad.
- 87 percent increased their interest in world affairs.
- 77 percent learned about international business, industry and/or careers.
- 68 percent agreed they engaged in better research opportunities through RISE.

What are the longer-term impacts of the program?

Although the evaluation does not presume causality, RISE participants eventually pursue advanced degree study after their participation in the program. At the time of the survey, 40 percent were in graduate school, while 26 percent were still finishing their undergraduate degrees. Among the 2008 cohort, 66 percent of undergraduate interns said they planned to pursue a master's and doctoral degree in the future.

About one in four returns to Germany. Since their participation in the program, more than a quarter (26 percent) of alumni had returned either to visit while on vacation (17 percent) or to pursue other opportunities for work or study (9 percent). Ten percent of all alumni were living outside the U.S. or Canada at the time of the survey, some of whom were in Germany participating in the RISE Pro program, since this program attracts former RISE interns and other DAAD scholarship participants.

As far as whether they would consider returning to Germany, interns in both cohorts seemed to be in favor of either pursuing their graduate or doctoral studies in Germany or securing a job in the country: 55 percent of interns said they were considering graduate/post-graduate study in Germany, while another 34 percent were also considering working there in the future.

The full version of this evaluation is available for download at: www.iienetwork.org/?p=RISE

Robert Gutierrez is Program Manager, Research and Evaluation, at the Institute of International Education

Appendix

Program Resources

The programs listed below provide funding opportunities for American students in the STEM fields who wish to study abroad. For work study abroad funding opportunities, visit www.StudyAbroadFunding.org

IIE-Administered Programs in STEM Fields

GLOBAL ENGINEERING EDUCATION EXCHANGE

Study abroad opportunity for undergraduate (and some graduate) engineers enrolled in engineering programs at U.S. and international member institutions. Students at participating institutions can take engineering coursework in an international setting while paying tuition at home. Over 30 U.S. institutions and over 50 programs in 18 countries worldwide participate in Global E³. Participating institutions are listed on the program website.

Deadline: First Monday in October (spring), First Monday in March (fall, academic year)

Contact: ge3@iie.org | **Tel:** 212.984.5442

Website: www.globale3.org

WINSTON CHURCHILL FOUNDATION SCHOLARSHIPS

Funded and administered by the Winston Churchill Foundation of the United States, the Winston Churchill Foundation Scholarships offer awardees funding for graduate studies in Churchill College at Cambridge University for one year. Graduating seniors and recent bachelor's degree holders in the sciences from participating U.S. institutions are eligible for Churchill Scholarships.

Deadline: November | **Contact:** info@winstonchurchillfoundation.org | **Tel:** 212.752.3200

Sponsor: The Winston Churchill Foundation

Website: www.winstonchurchillfoundation.org

WHITAKER INTERNATIONAL FELLOWS AND SCHOLARS PROGRAM

The Whitaker Program supports international collaboration in the growing field of biomedical engineering. Available to emerging bioengineers at all levels, from graduating seniors to post-doctorate degree-holders in biomedical engineering, the Whitaker Program provides U.S. citizens and permanent residents the opportunity to undertake activities directly related to the field overseas. The award covers travel, living expenses, and tuition for fellows (partial or full, depending on the host university). Awards have included research in heart blood flow, improved prosthetic leg design, and development of affordable oral cancer screening tools. Projects occur worldwide, including countries such as Denmark, India and South Africa.

Deadline: Last Monday in January | **Contact:** whitaker@iie.org | **Tel:** 212.984.5442

Sponsor: The Whitaker Foundation

Website: www.whitaker.org

CENTRAL EUROPE SUMMER RESEARCH INSTITUTE (CESRI)

Funded by the National Science Foundation through summer 2009, with additional funding from DAAD, CESRI is for master's or PhD students in biology, chemistry, computer science, engineering, environmental science, or mathematics. CESRI supports U.S. citizens and permanent residents to spend eight weeks conducting lab research in Austria, Czech Republic, Germany, Hungary, Poland, or Slovakia. The award covers living expenses and provides a fellowship award. Funded research has focused on the decay of ancient Roman concrete, the biochemical origins of life, and the study of medical uses of carbon nanotubes.

Deadline: First Monday in February | **Contact:** cesri@iie.org | **Tel:** 212.984.5442

Sponsor: National Science Foundation, DAAD

Website: www.iie.org/cesri

IIE-Administered Programs in Any Field of Study

FULBRIGHT PROGRAMS FOR U.S. STUDENTS

The Fulbright U.S. Student Program equips future American leaders with the skills they need to thrive in an increasingly global environment by providing funding for one academic year of study or research abroad, to be conducted after graduation from an accredited university. Included in the Fulbright U.S. Student Program are English Teaching Assistantships which provide opportunities for U.S. students to assistant teach English language and conversation alongside host country English teachers in select countries in Asia, Eastern and Western Europe and Latin America.

Deadline: October

Sponsor: U.S. Department of State, Bureau of Educational and Cultural Affairs

Website: <http://us.fulbrightonline.org>

BENJAMIN A. GILMAN INTERNATIONAL SCHOLARSHIP PROGRAM

The Gilman Program, sponsored by the U.S. Department of State, Bureau of Educational and Cultural Affairs, offers scholarships for students with financial need who have been traditionally under-represented in education abroad. Over 1,200 scholarships of up to \$5,000 will be awarded this academic year for U.S. citizen undergraduates to study abroad.

Deadline: October | **Contact:** gilman@iie.org | **Tel:** 713.621.6300

Sponsor: U.S. Department of State, Bureau of Educational and Cultural Affairs

Website: www.iie.org/gilman

BOREN SCHOLARSHIPS AND FELLOWSHIPS

Funding from the National Security Education Program (NSEP) supports U.S. undergraduate and graduate students to study less commonly taught languages in world regions critical to U.S. interests. Up to \$20,000 for undergraduates and \$30,000 for graduate students depending on cost and length of program.

Deadline: January and February | **Contact:** boren@iie.org | **Tel:** 800.618.NSEP

Sponsor: National Security Education Program (NSEP)

Website: www.borenawards.org

THE LANGUAGE FLAGSHIP FELLOWSHIPS

The Language Flagship, an NSEP initiative, is designed to help individuals achieve superior-level proficiency in certain critical languages. The Language Flagship Fellowship is an award for up to two years for post-BA students to support their intensive language study at Flagship institutions in the U.S. and overseas.

Deadline: January | **Contact:** flagship@iie.org | **Tel:** 800.618.NSEP

Sponsor: National Security Education Program (NSEP)

Website: www.flagshipfellowships.org

DAAD Programs

RISE – RESEARCH INTERNSHIPS IN SCIENCE AND ENGINEERING

RISE is a summer internship program for American and Canadian undergraduates in the fields of biology, chemistry, physics, geology and engineering. RISE interns work directly with doctoral students in research groups at top German universities and institutions and can expect to gain serious hands-on research experience. A pro-rated monthly scholarship will be provided for a period of 6-12 weeks between May and August. Knowledge of German is not required for most positions.

Deadline: January 31 | **Contact:** rise@daad.de | **Tel:** 212.758.3223

Website: www.daad.de/rise

RISE PROFESSIONAL

RISE professional gives graduating seniors, recent graduates, master's and doctoral students in the fields of biology, chemistry, physics, geology and engineering a unique opportunity to gain practical, career-building experience working in a German company for the summer. DAAD and the host country provide a pro-rated monthly scholarship for a period of 6-16 weeks between May and September. German language requirements vary for each internship.

Deadline: January 31 | **Contact:** rise-pro@daad.de | **Tel:** 212.758.3223

Website: www.daad.de/rise-pro

UNDERGRADUATE SCHOLARSHIP

Highly qualified undergraduate students (currently second and third year students and will be in their third and fourth year during their stay in Germany) are invited to apply for these scholarships funding a 4-10 month period of study, senior thesis research and/or internships in Germany. Scholarships are available either as part of an organized study abroad program or as part of an individual, student-designed study abroad semester or year. Preference will be given to students whose projects or programs are based at and organized by a German university.

Deadline: January 31 | **Contact:** schenkl@daad.org | **Tel:** 212.758.3223

Website: www.daad.org/?p=undergrad

STUDY SCHOLARSHIP

Study Scholarships are awarded to highly-qualified graduating final-year undergraduate students or those who have recently received an undergraduate degree. The scholarship can be used to support a year of independent study in Germany or a full master's degree program at a German university. Applicants in all academic fields are welcome to apply. Applicants in the arts, humanities and social sciences should have a good command of German.

Deadline: November 15 (November 1 for applicants in music, visual arts and performing arts)

Contact: kim@daad.org | **Tel:** 212.758.3223

Website: www.daad.org/?p=gradstudy; www.daad.org/?p=gradstudy_arts

About IIE

The Institute of International Education is a world leader in the international exchange of people and ideas. An independent, nonprofit organization founded in 1919, IIE has a network of 20 offices worldwide. IIE designs and implements programs of study and training for students, educators and professionals from all sectors with funding from government and private sources. Programs that IIE administers for the U.S. Government and other sponsors, such as the Fulbright U.S. Student Program, the Benjamin A. Gilman International Scholarship Program, the David L. Boren Scholarships and Fellowships, the Language Flagship Fellowships, the Whitaker International Fellows and Scholars Program, and the Central Europe Summer Research Institute, send U.S. students abroad in growing numbers, preparing a new generation for global citizenship. The Institute is a resource for educators and institutions worldwide, publishing IIEPassport: Academic Year Abroad and Short Term Study Abroad and operating www.IIEPassport.org, the search engine for study abroad programs, as well as www.StudyAbroadFunding.org. IIE conducts policy research, program evaluation and provides advising and counseling on international education and opportunities abroad. IIE's annual survey of student mobility is published annually in the Open Doors Report on International Educational Exchange (www.opendoors.iienetwork.org), supported by the Bureau of Educational and Cultural Affairs of the U.S. Department of State.

www.iie.org

About the IIE Network

IIE Network is IIE's membership association, with over 1,000 member institutions, including universities, 2- and 4-year colleges, national and international exchange agencies and educational not-for-profit organizations around the world. Each IIE Network designee is an important link in a network of over 4,500 individuals with a commitment to the internationalization of their institutions. As an IIE Network member, campus professionals receive targeted membership services to help recruit and advise international students and Americans studying abroad, network with other professionals in the field, and stay current on new developments in international education.

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