Preparing for global leadership in STEM fields: Working in an international setting

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Abstract

In our globalized world, we need professionals who can adapt to the interaction of cultures and countries. Students who are interested in pursuing careers in organizations that have a global or international focus need to be culturally competent. Cultural competence (the ability to interact effectively with people from other cultures and socio-economic backgrounds) can be achieved through interactions with colleagues and people from other cultures, and through experiences abroad. Our university's Graduate Student Development unit has added workshops on international career opportunities and preparation for working in other countries through our graduate student professional development workshop series. The Graduate School, the Office of Postdoctoral Affairs, and PROMISE: Maryland's National Science Foundation's Alliance the Graduate Education and the Professoriate (AGEP) co-sponsor these activities for graduate students and postdoctoral scholars. The PROMISE AGEP: Maryland Transformation (AGEP-T) project is dedicated to increasing the number and diversity of PhD graduates in the STEM fields (Science, Technology, Engineering and Mathematics), with a focus on developing a new generation of professors. Our goal for 2014 is to provide graduate students with more experiences that go beyond a traditional undergraduate student-based study abroad program. We seek to develop programs that open doors outside of the U.S. to provide graduate students w with groups of experiences that will lead to international job opportunities and long-term research collaborations.

Introduction

As the University of Maryland Baltimore County (UMBC: An Honors University in Maryland) began to offer more professional development programs through the Graduate Student Professional Development Unit, graduate student polls revealed that students were becoming more interested in learning more about global opportunities. Upon investigation, we learned that available Study Abroad programs were generally focused on undergraduate students. Further, many of our graduate students in engineering and other STEM fields had not had Study Abroad experiences as undergraduate students, and given the structure of graduate research programs and decreasing funding mechanisms, there were very few opportunities for graduate students to engage in international activities while pursuing an M.S. or Ph.D. Some graduate students have been able to attend international conferences, but the few opportunities have often been limited to only a few individuals. To address the growing interest in learning more about global opportunities, our graduate school partnered with the PROMISE: Maryland's National Science Foundation's Alliance for Graduate Education and the Professoriate (AGEP) for our state, to begin to develop internationally-focused activities that would serve STEM graduate students, broaden participation by including students from underrepresented backgrounds, empower graduate students to establish international relationships that could stimulate research collaborations, and foster networks that could lead to short-term or long-term career opportunities in the professoriate.

Infusing globalization into a graduate school's professional development curriculum required some investigation. Unlike having a program with courses within a department or college, The Graduate School at UMBC wanted to develop seminars that would be in line with strategic directions of various STEM professional organizations. We know that globalization is not a

singular concept, it involves economic integration, transmission of knowledge, cultural stability, the transference of policies across borders, among others. We decided that our programs should focus on transmission and transfer of knowledge, and "transnational and transcultural integration" of human activities."[1] As we seek to prepare our graduate students for an ever-changing global society, we noted that attention to trends could particularly affect our engineering and IT students. The U.S. National Intelligence Council (NIC) published *Global Trends 2015: A Dialogue About the Future with Nongovernmental Experts* in 2000,[2] and from that dialogue, The Environmental Change and Security Project from the Woodrow Wilson Center for International Scholars estimated that in the year 2015, the integration of information technology, biotechnology, materials science, and nanotechnology will generate an increase in technology investment, specially within more advanced countries.[3] In this era of technology, our students have been able to learn and share experiences about different cultures and people using online platforms; however, stronger cultural competency and transmission of knowledge can best occur through experiences abroad.

Due to these global advances in science and technology, emerging professionals within STEM fields should be able to adapt to new environments. There have been changes in the curriculums of universities, especially for engineering students, as reported in 2006 by the National Academy of Engineering (NAE). In the report, graduate students showed an increase in learning through engaging experiences, better feedback and interaction with their professors, and finally, international experiences.[4] This has been possible because the National Science Foundation (NSF), provides a great number of programs that help develop international opportunities and research for graduate students. Therefore, in partnership with the NSF, the PROMISE AGEP,[5] The Graduate School at UMBC, and UMBC's Office of Postdoctoral Affairs have developed a series of workshops that will help and inform students who would like to pursue a globally focus career in technology or engineering.

Methods

The Graduate School at UMBC, in collaboration with the PROMISE AGEP, has developed a series of global engagement activities to prepare students for global leadership in STEM fields. These initiatives are divided in three Focus Areas: 1) Local U.S.-based workshops that discuss globalization; 2) Involving students in international conferences; and 3) Providing opportunities for graduate students to have short- term international experiences in laboratories in other parts of the world, and exposure to long- term international careers. We believe that exposing students to international settings as a workshop in their university environment will open their curiosity to collaborate later on with any of those institutions. This paper examines quantitative and qualitative data from graduate school-based seminars in 2011 and 2012. We are in the early stages of developing international workshops as part of our overall professional development series for graduate students. Our assessments examine the potential impact that our workshops (external to the academic department) have on the success and professional development of graduate students in STEM fields, as they related to exposure to international career options and networking. Several of the STEM graduate students who attended these seminars were underrepresented minority graduate students in the first and second years of their academic programs. The professional development workshops presented unique opportunities for exposure to international career options and mentors at a critical time, early in their graduate studies.

1) Local U.S.-based workshops that discuss globalization

Our first stage of programming started with awareness and cultural competence. We designed a series of seminars and workshops to broach the subjects of international awareness and inter-cultural communication among graduate students. To date, this area has included seminars with speakers from Professors Beyond Borders (a program that grew out of the International Institute of Education), faculty with projects in other countries, the Shriver Peaceworkers Fellows Program (part of the Peace Corps), the U.S. Fulbright program, and advanced graduate students from countries other than the U.S. These seminars are, combined with specific workshops on cultural competence that have promoted mentoring and interaction with people from different international institutions.

To assess these workshops, evaluation instruments in the form of surveys were distributed after each session. The surveys consisted of three sections: demographics, statements about the sessions, and comments. In the demographics sections, participants had to complete information about their gender, degree type, program, department, race/ethnicity, and immigration status in the United States. The second section of the survey consisted of ten statements, based on the content of the seminars. Using a Likert-scale, participants were given four options: Disagree, Somewhat Agree, Mostly Agree, and Completely Agree. For each statement, participants had to choose to what extend they agreed with the statement. These statements tried to evaluate how the content of the session was going to be beneficial to participants and if transfer of knowledge was possible. The final section was an open opportunity for participants to write any comment, thought, or idea they had after the session.

Our inaugural session in 2011 was titled, "Preparing for Global Leadership: Cultural Competence and Connections with and for International Students and Colleagues." The panel included students and faculty from STEM fields across campus, with representation from the following countries: Argentina, Italy, Canada, Haiti, West Africa, Mexico, China, India, and Germany. They shared experiences and answered questions regarding the following topics:

- What does it mean to be culturally competent?
- How does cultural competence play a part in mentoring students or relationships with professors in graduate school?
- How can we promote cultural competence at work?
- What kinds of things should one do to gain cultural/intercultural competence?

2) *Involving students in international conferences*;

In Focus Area 2, we have involved graduate students in projects in Central and South America through the Latin and Caribbean Consortium of Engineering Institutions (LACCEI) and the World Engineering Education Forum (WEEF). Through these organizations, and through connections with the Student Platform for Engineering Education Development (World SPEED) and their Global Development Forum, our students have actively participated in meetings in Panama, Mexico, and Colombia. We are currently planning participation for the 2014 LACCEI conference in Ecuador.

3) Providing opportunities for graduate students to have short- term international experiences in laboratories in other parts of the world, and exposure to long- term international careers.

PROMISE: Maryland's AGEP has been working with STEM faculty to share costs to send graduate students and postdoctoral fellows to conferences and to have short-term research experiences. Our underrepresented STEM minority and women graduate students postdocs are taking advantage of these opportunities. For example, UMBC has been collaborating with University in Australia researching bird songs where a female STEM student was able to analyze data that led to the recent publication of a paper in Nature Communications. To date, we have funded opportunities ranging from 1 week to 3 months in Paris, the Czech Republic, and Mexico. In 2014, we will partner with a College of Engineering in Mexico to facilitate visiting professorships, and will continue to partner with the U.S. Department of State and other organizations to expose students to global opportunities.

Results

Our results will focus on area 1, and we will report outcomes from the workshops and seminars. Data from these seminars have shown that participants have found several benefits from the initiatives developed by UMBC's Graduate Student Development Unit. The data collection process shows that the information from the seminars give professional development tools to participants that will prepare them to launch international careers and develop cultural competence.

1) *Local U.S.-based workshops that discuss globalization;*

The results obtained from the seminars and workshop show that students are interested in having opportunities abroad; however, they do not know where to begin. The desire for the Graduate School and the PROMISE AGEP to provide students with information started in 2011, where the seminar "Preparing for Global Leadership: Cultural Competence Connections with International Grad Students & Colleagues" allowed participants to understand how being culturally competent provides a role in mentoring and in forming relationships with professors and peers. Faculty and graduate student panelists noted that cultural competency is needed at several levels. The following bullets denote some of the panelists' comments:

- Regarding cultural competency in general: "There is no such thing as "one time" cultural competency. Cultural competency comes from every day exposures to symbols, cultures and systems." –Faculty member
- Regarding cultural competency in engineering programs: "Areas of medicine, engineering, and health have different levels of importance in the United States and also other countries. One of the challenges is that some faculty have not received training in cultural competency." –Faculty member
- Regarding cultural difference in Latin America: "There are many differences between the United States and Mexico. For example, in Mexico, individuals greet each other with a kiss, however this is not done in the United States." –Graduate student
- Regarding being open to cultural differences: "It is a mistake to assume that you know who people are and how they act; one must be constantly exposed to culture to learn about culture. There is a need for constant dialogue with yourself and others about culture- how do elements of culture change over time and some things about culture that do not change. Haiti was known as a country divided by class and race. After the earthquake, a survivor said, 'we are all white -dusty white'. Race, gender, and backgrounds have been dissolved." –graduate student

The comments in Table 1 below, describe sentiments of a subset of graduate students who attended this 2011 seminar, and indicate their awareness of the challenges of working in international settings. The students also expressed that they learned how dangerous it is to assume things about other cultures, and how culture is constantly being developed, and how challenges such as communication barriers don't have to prevent building cohesive relationships with international colleagues.

Table 1. Qualitative assessment: Comments provided by underrepresented minority (URM) graduate students who attended the seminar "Preparing for Global Leadership: Cultural Competence, Connections with International Grad Students and Colleagues."

Academic Department	**Subsets of Comments from URMs in STEM**
Chemical Engineering	"We are constantly faced with new cultures and having to understand how people interact with each other, from the microcosm of the laboratory culture to moving from one country to another."
Mechanical Engineering	"Faculty members who were aware of the challenges of beginning an academic career in a different country provided their own expertise on what it means to be culturally competent or at least seek to become of aware of multiple cultures of students."
Computer Sciences	"The fundamental nature of cultural competence was defined as an ongoing learning process which is relative to location and population. Exposure to different cultures can come from listening about the experiences of individuals. It is also an important aspect to becoming more knowledgeable and conscious aware about a culture. Thus, communication is a helpful skill to build cultural competence for both local and international connections."
Systems Engineering	"I learned from this panel discussion how dangerous it is to assume things about other cultures, and how culture is constantly being developed, anywhere and everywhere around us. Different languages may present communication barriers at first, but that should not prevent building cohesive relationships with international students. One takeaway from this is to be sure to ask a question first about cultures to those within the specific ethnic groups to avoid building a culture full of friction."
Engineering Management	"I found this program to be enlightening. As an engineer, I know how important it is to be able to work with people from diverse backgrounds and perspectives. Hearing and learning from the other international students allowed me to understand their struggles as American. We live in a world that relies on global partnerships. Understanding everyone may not be possible, but at least attempting to come to a common ground is crucial to our success. I am interested in traveling overseas, and I must understand different customs of other countries."

In 2012, the PROMISE AGEP collaborated with Professors Beyond Borders, an action network of academics and professionals from the Institute of International Education, who engage with real-world problems that impact quality of life in diverse communities. Following their mission of offering academics of the global community, we developed the seminar "Professors Beyond Borders," where we hosted a panel of representatives from different countries who shared their experiences teaching abroad for those who are interested in launching an international career as a professor. This second seminar was designed to focus on international careers in the professoriate, and the primary topic focused on working in university settings in different countries. Speakers for the second panel included faculty from Spain, Nigeria, Colombia, and France. We partnered with the university's Office of International Education Services, and one of their directors served as the moderator for the program.

This seminar included students from several disciplines, including 15 STEM students. While the number of STEM "in-person" attendees is small, students who attended the seminar discussed their opinions with students who did not attend through our "Professors Beyond Borders" online discussion group. The responses from the online discussions reflected the sentiments of the 15 STEM graduate students who attended this seminar in person. Figure 1shows that 93% of the participants felt that the seminar gave then important information; in addition, Figure 2 shows that 60% of the students who attended the seminar gained a more comprehensive understanding of international university setting.

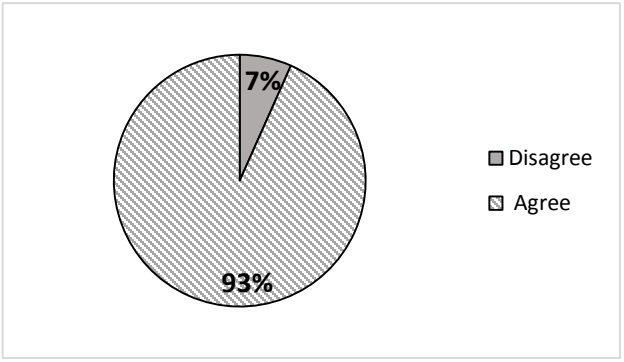

Figure 1. Percentage of STEM students who attended the seminar agree that the information provided was useful.

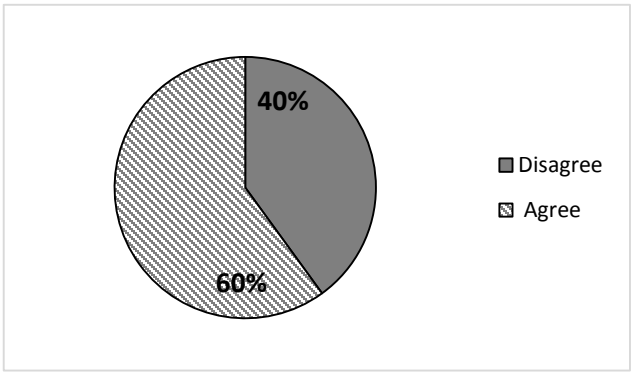

Figure 2. Survey from the seminar "Professors Beyond Borders" shows that students who attended it, gained a more comprehensive understanding of university international settings.

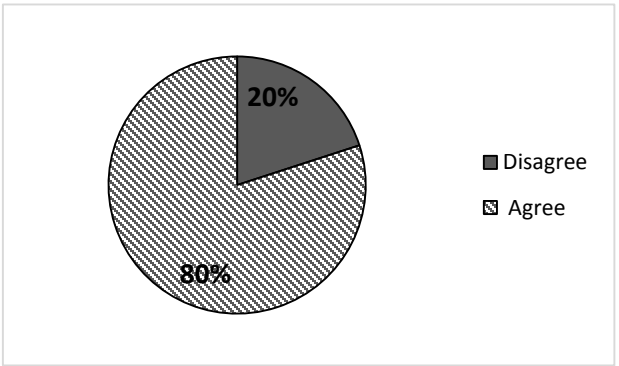

Figure 3: Responses from question: "I feel more confident about becoming a professor beyond borders, if the opportunity is present," from the Professors Beyond Borders Seminar, 2011.

For the purpose of the PROMISE AGEP, and the mission of "Professors Beyond Borders," participants were asked if they would want to become a professor beyond borders if the opportunity presented itself. Participants had to assess whether or not the workshop influenced their confidence to assume an international role if they ever received an opportunity. Since 80% of the participants noted that they would consider an international faculty position given the opportunity (Figure 3), our next plan of action was to create networks that would facilitate professorial career opportunities in countries other than the U.S.

Discussion

Graduate student development involves not only the interaction with peers and mentors, but it also includes developing relationships with people in their own fields, many of whom are international students who have already lived and worked outside of the United States. The outstanding need for cultural competence and information about international professional and academic opportunities pose a challenge to graduate programs. Based on the results from the workshops and other initiatives carried out by our graduate school, it is clear that there is a need for more information that can be provided to graduate students to stimulate interest in taking their careers to the international arena. Graduate students at our university do not have access to much information regarding international opportunities, or academic careers in other countries. The types of workshops offered by the graduate school are, in many instances, the sole source of information for graduate students who are interested in developing cultural competence for their careers. For this reason, The Graduate School at UMBC will continue to facilitate discussions on globalization, and encourage more interaction between students within laboratories. Graduate students often experience feelings of isolation, and programs sponsored by the PROMISE AGEP have even been used to open lines of communication and build relationships between underrepresented students and international students. As a result of some of the AGEP's and Graduate School's seminars, more STEM students from underrepresented backgrounds are beginning to show interest in expanding their experiences to include a global career. Furthermore, data show the outstanding interest of several graduate students in international projects. Presenting at international conferences or becoming a visiting scholar at international institutions can be excellent opportunities to build the career of any student or scholar. Graduate programs should take into account this interest and include some changes in some aspects of their curricula, so students are more prepared to assume international professional roles.

To develop a comprehensive set of activities, we also sponsored a session with the Shriver Peaceworker Fellows program which featured Peace Corps volunteers who were returning to university for graduate study. The Shriver Peaceworkers shared their experiences working and living abroad for extended periods of time. Speakers included panelists who had served in Africa, Mauritania, Madagascar, Ecuador, Spain, and Costa Rica. To facilitate international opportunities, and to capitalize on the strength of cohorts, The Graduate School at UMBC and the PROMISE AGEP were able to collaborate with a National Science Foundation Engineering Research Center to sponsor a group of graduate students, postdocs, and alumni, to attend an international conference as a group. The collaboration connected students with research opportunities in Mexico and provided them with opportunities to participate in professional development opportunities provided by the Latin and Caribbean Consortium of Engineering Institutions (LACCEI). Students also participated in the World Student Platform for Engineering Education Development (SPEED) and leadership training at the World Engineering Education

Forum in Colombia. In 2014, The Graduate School at UMBC plans to continue this trend by providing graduate students (in a cohort that consists primarily of underrepresented graduate students in engineering and information technology) with a 2-week summer experience in Ecuador. Several of these students will be current and former fellows of the Louis Stokes Alliance for Minority Participation (LSAMP) Bridge to the Doctorate (BD) Program. The experience for the BD Fellows and other students will include cultural studies, a visit to a university, mentoring undergraduates, presentations of research, discussions of career opportunities, and participation in the 2014 LACCEI conference which will be held in Guayaquil, Ecuador.

To develop the networks, we have first decided to focus on Latin America. Our students are being connected to faculty in Argentina, Colombia, Ecuador, and Mexico. To facilitate the development of the network, we've now partnered with the university's Career Development Center, and have developed a panel on "Preparing for Global Career Opportunities" which will allow participants to learn about opportunities outside of the U.S. from representatives from different organizations and countries. In addition to hosting speakers from universities in other countries, representatives from the U.S. Fulbright Scholar Program, and the U.S. Department of State with discuss postdoctoral research opportunities. Further, we are working with a university in Latin America to have students pre-interview for short-term engineering Visiting Faculty positions. This model has also been shared with a university in the Caribbean, and the Office of the Chancellor is interested in funding some of these STEM-based Visiting Professorships.

Implications and Future Work

Developing projects for graduate students interested in international careers is a complex process. The actual implementation of these initiatives should involve a detailed process of analysis and design of the strategies. An exhaustive assessment of the current needs of students should be carried out in order to determine the topics and content that will be most useful for students. This assessment phase will also help determine the resources that should be allocated to develop these programs. Further, students should receive regular communication about international opportunities, and the requirements that they need to fulfill before applying to these opportunities. International conferences are an important part of a strong academic resume. Gaining entry to these conferences is competitive, and terms for acceptance are rigorous. Graduate programs should not only encourage graduate students to participate in international conferences, but they should also provide them with tools and preparation, so that students can submit competitive and high-end papers, posters, or proposals. This plan includes preparing graduate students to present before international audiences, and training them to understand professional cultural differences in different countries.

To facilitate opportunities for STEM graduate students across campuses, and to work within the structure of graduate-level research schedules and facilities, we developed a series of small activities, ranging from 1 hour to 2 weeks that foster either international awareness or direct engagement. Through the PROMISE AGEP, we're developing this model as we partner with academic STEM departments, the university's department of International Education Services, and the Career Services Center.

Acknowledgements

The global leadership initiatives are co-sponsored by The Graduate School at UMBC, and PROMISE: Maryland's Alliance for Graduate Education and the Professoriate, the National Science Foundation's AGEP program for the state of Maryland. Collaborative plans were developed with assistance from leaders of the following entities at UMBC: The Shriver Center, International Education Services, and the LSAMP Bridge to the Doctorate program. The authors acknowledge the support of NSF Award #1309290, Collaborative Research: AGEP - T: PROMISE AGEP Maryland Transformation.

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