

2006-2470: CHALLENGES AND OPPORTUNITIES IN WORKING WITH MINORITY/OVERSEAS REU STUDENTS

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Challenges and Opportunities in Working with Minority/Overseas REU Students

Abstract

This paper describes our experience recruiting and hosting a Hispanic REU student for an Environmental Engineering research project. The paper describes challenges related to language, culture, and technical background, and provides suggested strategies for addressing the challenges and improving the REU experience. While the paper focuses on a Hispanic student from Puerto Rico, the strategies may be applicable to other situations, such as minority or foreign exchange students or foreign or minority graduate students.

Introduction

The engineering and science fields historically have been underrepresented in women and in several minorities.¹ Underrepresented minorities include Blacks, Hispanics, American Indians, Alaska Natives, and Native Hawaiians or other Pacific Islanders. While the percentage of minorities in science and engineering generally has improved since the early 1990s, the gap continues to be significant, especially for blacks and Hispanics.²

Many universities, government agencies, and non-profit agencies carry out significant efforts to increase minority representation at the undergraduate and graduate levels.³ An effective means for attracting talented minority students to graduate school is via undergraduate research experiences.⁴ The National Science Foundation's (NSF's) Research Experiences for Undergraduates (REU) program is an excellent vehicle for promoting undergraduate research, and NSF strongly encourages the involvement of underrepresented minority students.

The author, advisor to the REU student discussed in this paper, was American-born to Argentine parents, and spent 14 years living in Argentina as an adolescent and young adult. This life experience provided him with fluency in Spanish and with familiarity with Latin American and Hispanic culture, potentially enabling him to become an effective REU advisor and role model for Hispanic students.

The following sections describe our experience in recruiting and hosting a Hispanic REU student from Puerto Rico. We describe the recruitment process, research project, language and cultural issues, results of the REU experience, and strategies for improving the REU experience.

Student Recruitment

Our recruitment objectives were twofold. We were interested in recruiting minority students into our NSF-sponsored REU program. However, we also wanted to increase the pool of Hispanic applicants to our graduate program. The REU recruitment was normally arranged by the NSF-funded center's outreach coordinator; however, we used a special approach to recruit Hispanic students.

Our approach was to directly enter contact with the associate dean for engineering research from a well-known engineering school in Puerto Rico. We explained our recruitment interests to him, and found him very receptive. He offered to post our REU fliers, and, more importantly, to circulate a Spanish-language e-mail describing the REU opportunity and some research projects. The e-mail was written in Spanish to suggest that our environment would be friendly to Spanish speakers.

We also discussed our interest in recruiting Hispanic students for our graduate program, and offered to visit the school and make a presentation on our department. The associate dean told us that most of their departments were active in research and would not be receptive to presentations intending to “capture” their top students. They preferred research collaborations with other universities, potentially involving graduate-student exchanges. He recommended the REU process as the best instrument for recruiting talented undergraduate students from his institution. We also discussed potential collaborations between his institution and ours.

Three undergraduate engineering students from Puerto Rico responded to the REU advertisement, all with very good credentials. A female student was initially offered the REU, but ultimately declined. The position was then offered to a male Junior in chemical engineering. The student had good grades, previous research experience, and strong recommendations.

Research Project

The REU research was on microbial fuel cells (MFCs), devices that can produce electrical power from biochemical oxygen demand (BOD) in wastewater.⁵ The REU research compared MFC power output for a variety of electrode and proton exchange membrane (PEM) materials. Several MFC configurations were tested, and the relative importance of biofilm growth versus suspended growth was assessed. The oxygen diffusion coefficient was determined experimentally for several PEM materials. The REU student was also asked to determine the theoretical energy available from a conventional wastewater treatment plant.

The project was a good fit for this REU student, who had previously carried out research in sustainable fuels and was very interested in MFCs and sustainable energy research. The REU student’s chemical engineering background was favorable for this type of “environmental process” research. The only difficulties were found when dealing with more “civil” types of problems, such as estimating the power available from a municipal wastewater treatment plant based on BODs, per-capita flows, and per-electron energies available in BOD. The student also had some difficulties with numerical methods, as he had not taken a numerical methods course yet.

Language and Cultural Issues

The student was bright, highly motivated, and very enthusiastic about the proposed research project. However, shortly after starting the project, we found ourselves faced with language and cultural challenges for which we were not well prepared. On the other hand, we were pleasantly surprised at some positive cultural exchanges between the host students and the REU student. We describe these below.

The REU's spoken English needed improvement, and the mentor, a graduate student who worked with the student on a day-to-day basis, did not speak any Spanish. This led to frequent misunderstandings and miscommunications, and caused frustrations for the REU and graduate student advisor. In some instances, miscommunications may have been due to different terminologies used by civil and chemical engineers.

The advisor, as mentioned previously, was fluent in Spanish, but suggested that the student try to speak in English as much as possible to improve his language skills. The advisor did not anticipate the zeal with which the student would take his advice. From then on, the student would only talk to the advisor in English. Thus, the advisor's Spanish speaking abilities were rendered essentially useless to the student and mentor.

The student was more comfortable with body contact than most people in the mainland United States. He often asked to have his picture taken while giving a hug or shoulder squeeze, especially with female graduate students. None of this seemed inappropriate, but some students may have felt uncomfortable.

The student also had problems with an apparently rigid and intolerant roommate. The roommate was bothered by the student's speaking to Spanish on the phone, playing Spanish-language music, and other "different" lifestyle choices. The student ultimately switched rooms and stayed with another REU student who was more tolerant and appreciative of cultural differences.

The lab members seemed to enjoy the student's presence. Some of them spoke some Spanish and practiced speaking it with the student, learning some Puerto Rican slang. They exchanged music, discussed food, movies, sports, and politics. This cultural exchange was most likely the greatest benefit for the host lab members, who all were native-English-speaking Americans.

Results of REU Experience

Despite the language difficulties and cultural differences, the student worked well, with increasing independence, and ultimately carrying out a high quality research project. He seemed happy with the experience, and expressed interest in applying to Notre Dame for graduate school. On his own initiative, he submitted an abstract to the AIChE annual conference, which he eventually presented in the student poster session. Given the final outcome, we believe the REU experience was a great success, and would like to repeat it in the future. We currently have received four applications from the same department.

Strategies for Improving the REU Experience

Based on our experience, we developed several strategies that we believe could improve our REU program for future Hispanic students from Puerto Rico. The strategies may also be applicable to other minority or overseas students. These include:

- Having an advisor with sensitivity to the student's specific culture, and with appropriate language skills.
- Screening the REUs English language skills ahead of time. If necessary, pairing the REU with a grad student mentor with appropriate language skills.
- Suggesting that the REU to communicate in English as much as possible, but making sure they comfortable using their native language, when needed.
- Starting research with well-defined projects to build up confidence and establish good communication procedures and good research habits.
- Screening roommates for potential conflicts with minority students.
- Briefing other students in the lab on the REU and their customs, so they are not surprised or uncomfortable with situations that may arise.
- Briefing with REU student about potential cultural differences. They will not necessarily be asked to refrain from acting according to their culture, but will be made aware of possible misperceptions.

Summary and Conclusions

We successfully recruited a Hispanic REU student from Puerto Rico. Language and cultural differences presented some challenges, but did not prevent a successful REU experience. We devised several strategies for minimizing these challenges, which we will use in the future. Implementing our strategies could provide better REU experiences and lead to increased minority representation in the engineering field, as well as a positive experience for students from the host institution.

References

1. Olsen, Kristen. National Science Foundation NSF 99-320, January 15, 1999. <http://www.nsf.gov/statistics/databrf/sdb99320.htm>. Accessed in January, 2006.
2. National Science Foundation, Division of Science Resources Statistics, 2004 "Women, Minorities, and Persons with Disabilities in Science and Engineering", NSF 04-317 (Arlington, VA, 2004).
3. Johnson, MJ, SD Sheppard, 2004. "Relationships between engineering student and faculty demographics and stakeholders working to affect change", Jour Engineering Education 93(2), 139-151.
4. Zydny, AL, JS Bennett, A Shahid, and KW Bauer, 2002. "Impact of undergraduate research experience in engineering", Jour of Engineering Education 91(2), 151-157.
5. Rabaey, K., and W. Verstraete, 2005. "Microbial fuel cells: novel biotechnology for energy generation". Trends in Biotechnology 23(6), 291-298