

Introducing Under-represented Students to Research Through Funded Programs

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Abstract

A good source of both graduate and undergraduate students to assist with or develop “research” efforts is from programs designed to introduce under-represented students to research. Some of these programs available to students are the National Consortium for Graduate Degrees for Minorities in Engineering and Science, Inc. (GEM), Alliances for Minority Participation (AMP), and Minority Academic Career (MAC) to name a few.

In order for faculty to work with students in these types of programs, they must be aware of the students who are eligible for or in these programs. In addition, an awareness, by both students and program coordinators, of which individual faculty are interested in the mentoring program, is imperative. At New Jersey Institute of Technology, the authors not only meet the above requirements, but are also involved with programs for minority students K to 12. These efforts which have led to enrollment of students at NJIT, have raised the profile and familiarity of the faculty by students from these programs and led to mentoring involvements. Over the past three years a number of students, both graduate and undergraduate who are in various programs have worked with the authors in numerous “research” projects. These experiences have been rewarding and fulfilling to both constituencies.

Introduction

New Jersey Institute of Technology is an inner city urban institution located in Newark, New Jersey with a social, economic, and academically diverse student body consisting of 5007 undergraduate and 2830 graduate students. The undergraduate population is approximately composed of one third (women, Hispanic, and Afro-American) minority.

NJIT has a long history of outreach programs for elementary through college level students with many originating in the Department of Chemical Engineering and Chemistry over the past 30 plus years. It is therefore not unusual to find departmental faculty being involved in the development and teaching of various minority outreach programs. Some programs that the authors have developed curriculum for are:

1. Upward Bound Program in Math and Science
2. Females in Engineering: Methods, Motivation, and Experience (FEMME)
3. Chemical Industry for Minorities in Engineering (CHIME)

4. Educational Opportunity Program (EOP)
5. Undergraduate Research Experience (URE)
6. Alliance for Minority Participation (AMP)

Programs (1), (2), and (3) are elementary and high school level programs while (4), (5) and (6) are college level efforts.

These programs provide faculty recognition and exposure to students, program administrators and advisors which lead to recruits for research programs both of a graduate and undergraduate nature.

The authors believe in exposing students to experimental research projects which expose students to a laboratory type experiment, data reduction, a written document and as the capstone portion of the experience an oral report. These oral presentations may be to other students or to peer review panels in program competitions.

However, in all cases the main goal is to give the student an exposure to independent learning and allow the individuals or teams to experience what a “research” project is like.

Projects

As one would expect, the research undertakings are a function of the student’s level of educational background. Students in the junior FEMME program, a summer offering, undertake two experiments. One is the titration of an acid, actually a series of four acid strengths, with a base in order to simulate neutralization of stomach acid by an equivalent (a base) of Tums. The other experiment is a temperature measurement of a heated liquid; actually heating water from room temperature to boiling, by using a metallic thermometer (with five degree sub-units) and a conventional mercury in glass thermometer with smaller subsets.

The senior FEMME and the Upward Bound students are asked to undertake modifications of experiments in our Freshman Engineering Design (FED) laboratory. These experiences are predicated on simplifying the experimental data required and minimizing the required theoretical background. Experiments that can be undertaken are the calibration of a rotameter by the direct weight method, calibration of an air rotameter, power measurements in mixing, pressure drop in conduits or in packed towers, dynamics of emptying a cylindrical tank and fluidization of packed beds. When working with students, usually chemical engineering majors, on the undergraduate level we require more of them, but still tailor the projects to their respective capabilities. The students that have been involved in projects with the authors are of a diverse ethnic, racial and sexual background. Interestingly, most are of a minority group but not all have been associated with the college level programs described earlier. The students have had a varied experience, with all of them being involved in finding an appropriate area available to locate an undergraduate unit operations type laboratory experiment, designing or ordering equipment, siting it, installing it, operating the equipment, analyzing the data and then preparing an operational manual for the experiment. The quality of the finished product is amazing. Our FED laboratory was completed in this fashion. Several of the students, Jenny Lin and Hugo Fernandez

have gone on to undertake graduate research projects with the authors in the area of combining soil fractionation with ultrasonics. The relationship established with these students is one that is truly enjoyable and relaxed because of the interaction developed previously. Other students have graduated and moved into the industrial sector.

Without the EOP, URE and AMP programs the financial support required by the students during the semester and summer would not have been available and the students would have had to work elsewhere to support themselves. In addition, the progress achieved in developing our laboratories would never have been reached so quickly.

Conclusion

From students' comments and program administrators' feedback, the research experience of the students has been greatly appreciated and helped them develop both academically and in maturity. It has been a rewarding experience for the authors in seeing, not only the physical results for new laboratories for the department, but also helping students of all ages develop in their education. We consider ourselves extremely fortunate to be able to participate in such programs as educators.

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Biographies

DERAN HANESIAN served as chairman of the Dept. Chem. Eng., Chem., and Env. Sci. from 1975-1988 and is Professor of Chem. Eng. He came to NJIT in 1963. He received a bachelor of Chem. Eng. in 1952 and a Ph.D. in Chem. Eng. in 1961, both from Cornell Univ. Dr. Hanesian worked for DuPont from 1952-1957 and 1960-1963. He taught at the Algerian Petroleum Inst., Yerevan Poly. Inst., Armenia as a Fulbright Scholar, the Univ. of Edinburgh, Scotland, and Rutgers, the State Univ. of NJ. He was the recipient of the Robert Van Houten award for Teaching Excellence in 1977 at NJIT, the ASEE, Midlantic AT&T Foundation Award for Excellence in Instruction in Eng. in 1986, the John Fluke Award, ASEE, 1994, and the Outstanding Tenured Faculty Award, NJIT, 1994. He is a Fellow and Emeritus Member of the American Institute of Chemical Engineers and a Fellow and Life Member of the American Society of Engineering Education.

ANGELO J. PERNA received his B.S. ChE degree from Clemson University in 1957 and his M.S. degree from there in 1962. He received his Ph.D. from the University of Connecticut in 1967. He worked as a production and development engineer with Union Carbide Nuclear Company in Oak Ridge, TN, and taught at VPI, and the University of Connecticut. He is currently Professor of Chemical Engineering, Chemistry and Environmental Engineering at New Jersey Institute of Technology. In 1997, he received the NJIT award for Teaching Excellence in the Upper Division. He is a Fellow in both the American Institute of Chemical Engineers and the American Society of Engineering Education.