

Minority Student as a Scholar Program: A Research Grant Program for Minority Students at Penn State Altoona

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Abstract

This paper describes an innovative research grant program for undergraduate minority students at Penn State Altoona. The program allows teams of faculty members and qualified minority students to develop proposals for research projects in various academic disciplines including engineering. These proposals are reviewed by a committee of faculty members and based on their recommendations, research grants are awarded by the program coordinator to selected student-faculty teams. The teams work on their research projects during the time frame of 6 – 8 months. At the end of the research project, each faculty-minority student team submits a written report to the program coordinator. Once the selected students complete the research projects, their academic progress is tracked until they graduate from their respective degree programs.

This paper provides a description of the above mentioned research grant program for minority students. Several examples of engineering research projects recently completed by faculty-minority student teams are listed. Obstacles encountered in conducting this program are mentioned. Finally, the impact of the above mentioned undergraduate research program on the academic progress of the participating minority students is described.

I. Introduction

As described by Chickamenahalli & Barker¹, Madler², and Kitto³, initiatives have been taken by many universities and colleges in the past few years to improve participation of undergraduate students in research. Also, many educational institutions have increased their efforts to involve undergraduate minority students in research projects. The undergraduate research opportunities help both the faculty and the students. Students involved in research get valuable research experience and the opportunity to publish papers. Faculty members participating in undergraduate research programs get valuable research work done. The undergraduate research experiences promote interaction among students and faculty members. Professor-student interaction increases the persistence of students as described by Tinto, Love, and Russo⁴, and Tinto, Love, and Russo⁵.

This paper describes an innovative research grant program for undergraduate minority students at Penn State Altoona. The program allows teams of faculty members and qualified minority students to develop proposals for research projects in various academic disciplines including engineering. These proposals are reviewed by a committee of faculty members and based on their recommendations, research grants are awarded by the program coordinator to selected teams. The minority student(s) and the faculty member work closely on the research project during the time frame of 6-8 months. At the end of the research project, each faculty-minority

student team submits a written report to the program coordinator. Later, the team is expected to draft a paper describing the results of research and submit it to a scholarly journal for publication.

The following criteria apply towards the selection of minority students for participation in the above mentioned undergraduate research program:

1. The selected minority student must be from one of the underrepresented minority groups.
2. The minority student should be at least a sophomore at Penn State Altoona.
3. The selected minority student should have a minimum cumulative GPA of 2.5.

Every year, several faculty members from various academic disciplines within Penn State Altoona participate in this program. Under the supervision of these faculty members, minority student participants have conducted undergraduate research projects in engineering, biology, physical sciences, social sciences, and humanities. This paper, however, focuses on the research projects conducted by engineering minority students.

Examples of projects completed by the minority students during the past few years are:

1. Fuzzy Logic: Applications in Engineering (1998-1999).
2. Developing Case Studies in the Field of Statistical Quality Control (1997-1998).
3. A Study of Robotic Systems Used in Pennsylvania's Manufacturing Organizations (1996-1997).
4. A Study of the Advanced Telecommunication Technologies Used in Pennsylvania's Industrial Organizations (1995- 1996).
5. A Study of the New Developments in Laser and Fiber Optics Applications in the Manufacturing Industry (1994-1995).

Once the selected students complete the research projects, their academic progress is tracked until they graduate from their respective programs. Although no formal procedure is currently in place to assess the impact of the above mentioned undergraduate research projects on the academic progress of the participating minority students, the informal evaluation of this program has produced positive results.

II. Institutional Background

Penn State Altoona is one of 24 campuses making up the Pennsylvania State University system. It is the second largest of the 24 campuses and is a full-service residential campus located 42 miles from the research campus at University Park. Penn State Altoona became a four-year college within the Pennsylvania State University system in 1997 and offers baccalaureate degrees in eight majors. Penn State Altoona also offers associate (two-year) degrees in nine majors. Additionally, Penn State Altoona provides two years of course work for more than 160 Penn State majors. More than 3800 students attended Penn State Altoona during Fall 1999. During the 1999-2000 academic year, 239 minority students attended Penn State Altoona.

III. Description of Selected Projects

During the academic year 1995-1996, a student-faculty team was selected by the Coordinator of Minority Student as a Scholar Program to conduct a research project titled “A Study of the Advanced Telecommunication Technologies Used in Pennsylvania’s Industrial Organizations”. The team consisted of Dr. Sohail Anwar, Program Coordinator of the Penn State Altoona associate degree program in electrical engineering technology (2EET) and Alan A. Lopez, a third semester 2EET minority student. The objectives of the project were:

1. To enable the student participant to develop a comprehensive understanding of the following issues associated with the development of the information superhighway:
 - (a) What technologies are being used to develop the advanced telecommunication networks of the future?
 - (b) How are the industrial organizations in Pennsylvania responding to the challenge of developing advanced telecommunication networks of the future? Which one of the technologies identified in 1(a) is being used or will be used for this development and to what extent?
2. To conduct an assessment of the training needs emerging in Pennsylvania’s industrial organizations involved in utilizing advanced telecommunication networks. What technologies will the engineers/technicians of these industrial organizations need to comprehend in order to develop/utilize advanced telecommunication networks of the future?

The project was conducted during the time period of December 1995 – April 1996. A research report was presented to the Coordinator of the Minority Student as a Scholar Program in August 1996. Alan Lopez was a highly motivated student and the project increased his interest in electrical engineering technology. Upon completion of the project, he decided to continue his studies in engineering technology. He spent two more years at Penn State Altoona as a junior and then as a senior in the BSEMET (Bachelor of Science in Electro-Mechanical Engineering Technology) program. He completed the BSEMET program in May 1998 and is currently working as an engineer in a company in New Jersey.

A technical paper titled “Modern Data Communication Technologies and Their Industrial Applications: A Tutorial for Industrial Technologists” was presented by the above mentioned student-faculty team at the 30th Annual Conference of the National Association of Industrial Technology (NAIT), Atlanta, Georgia, October 8-11, 1997.

During the academic year 1996-1997, a student-faculty team was selected by the Coordinator of Minority Student as a Scholar Program to conduct a research project titled “A Study of the Robotic Systems Used in Pennsylvania’s Manufacturing Organizations.” The team consisted of Dr. Sohail Anwar and Samuel Harriat, a third semester 2MET minority student. The objectives of the project were:

1. To enable the student participant to develop a comprehensive understanding of the design, operation, applications, and limitations of the currently available industrial robotic systems.

2. To enable the student participant to develop an understanding of the technologies being used to develop the future industrial robotic systems.
3. To develop a knowledge base regarding the types and the applications of the robotic systems being used in Pennsylvania's manufacturing organizations.
4. To conduct an assessment of the training needs emerging in Pennsylvania's manufacturing organizations involved in utilizing robotic systems.

The project was conducted during the time period of December 1996-April 1997. The research report was presented to the Coordinator of Minority Student as a Scholar Program in September 1997.

During the academic year 1997-1998, a student-faculty team was selected by the Coordinator of Minority Student as a Scholar Program to conduct a research project titled "Developing Engineering Case Studies in the Field of Statistical Quality Control." The team consisted of Dr. Sohail Anwar and Samuel Harriat, who at that time had advanced to the junior year in BSEMET program. The objectives of the project were:

1. To develop engineering case studies in the field of statistical quality control (SQC).
2. To use the above mentioned engineering case studies for teaching the course titled *Quality Control, Inspection, and Design (EMET 350)*, a required senior-year course for the Penn State baccalaureate degree electro-mechanical engineering technology majors.
3. To develop a partnership with several industrial organizations in Central Pennsylvania which would allow student participant to develop an in-depth understanding of the industrial applications of SQC.

The project was conducted during the time period January 1998-May 1998. Upon completion of the project, a research report was submitted to the Coordinator of Minority Student as a Scholar program. Samuel Harriat was a motivated student. He completed the BSEMET program with good academic grades.

During the academic year 1998-1999, a student-faculty team was selected by the Coordinator of Minority Student as a Scholar Program to conduct a research project titled "Fuzzy Logic Applications in Engineering". The team consisted of Dr. Sohail Anwar and Andrew Costea, a third semester 2EET minority student. The objectives of the project were:

1. To create a research data base useful for small and medium business and industrial organizations. This database will provide current and comprehensive information regarding state-of-the-art applications of fuzzy logic in business and engineering processes/systems.
2. To select an industry based problem in collaboration with local business and industrial organizations and demonstrate the application of fuzzy logic to effectively solve this problem.

The above mentioned project was conducted during the time period December 1998-May 1999. A research report was submitted to the Coordinator of Minority Student as a Scholar Program in September 1999. The minority student participant in this project, Andrew Costea, is a highly motivated student. The project increased his interest in the field of engineering technology. He intends to pursue the BSEMET program after completing the 2EET coursework.

IV. Research Methodology

The research methodology used for each of the above mentioned research projects consisted of the following steps:

1. A literature search was conducted by the minority student participant to gather state-of-the-art information regarding the research topic.
2. After all the relevant information regarding the research topic was collected and analyzed, a questionnaire consisting of questions regarding the research topic was developed by student-faculty team in consultation with the members of Penn State Altoona Industrial Advisory Committee.
3. The questionnaire was mailed to the appropriate contact persons in randomly selected industrial and business organizations in Pennsylvania.
4. Data collected from the questionnaire was analyzed.
5. In order to obtain first-hand information regarding the research topic, several on-site visits were taken to various industrial and business organizations in Pennsylvania.
6. Information gathered from on-site visits was analyzed by the student-faculty team.
7. The analysis carried out in steps 4 and 6 above was reported in the final research report to the Coordinator of Minority Student as a Scholar Program.

V. Follow-Up Activities

After the completion of some of the research projects conducted by student-faculty teams, presentations regarding the research projects were made at the annual conferences of professional organizations such as the Pennsylvania Academy of Science (PAS) and the National Association of Industrial Technology (NAIT). In addition, a manuscript related to the fuzzy logic project (conducted in 1998-1999) is in preparation and will be submitted soon to a scholarly journal for publication consideration.

The minority students who participated in the research projects are either working in industry as engineers or continuing their academic studies. Although no formal assessment procedures are in place yet, informal evaluation of the Minority Student as a Scholar Program indicated that the minority students who completed the research projects learned valuable research skills which proved very helpful to them later in their academic studies and in their professional careers.

VI. Obstacles

Several obstacles were encountered by the minority student participants as they conducted the research projects. These obstacles include:

1. Minority Student as a Scholar Program requires the faculty-student teams to complete the research projects in 6 months. This time limitation places a heavy strain on the minority students' academic schedules who are already taking full academic loads during the semester and cannot find adequate time to perform research.
2. Most of the student participants do not have data analysis skills when they start working on the projects. They have to learn these skills as they go along.
3. No academic credit is granted to students for participating in this program. Because of this problem, many qualified minority students do not participate in the program.

VII. Impact

The impact of this program is measurable in several dimensions. Benefits of the program include:

1. One-to-one discussions between the participating faculty member and the participating minority student.
2. Minority student participant gains important interpersonal communication skills as he/she has to visit business and industrial organizations and interview contact persons there to conduct the research project.
3. Student participant gains valuable technical knowledge by conducting literature search, industry visits, and discussions with engineers and other technical professionals.
4. Student gains important data analysis skills.

VIII. Conclusions

This paper provides a description of an innovative research grant program for minority students. Several examples of engineering research projects recently completed by faculty-minority student teams are listed. Obstacles encountered in conducting this program are mentioned. Finally, the impact of the above mentioned undergraduate research program on the academic progress of the participating minority students is described.

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Sohail Anwar obtained a Ph.D. in Industrial and Vocational Education from the Pennsylvania State University in December 1995 and an M.S. degree in Electrical Engineering from the University of Texas at Arlington in May 1982. He completed additional graduate coursework in control theory and applied mathematical sciences at the University of Texas at Arlington during 1982 – 1984. Since August 1992, Sohail has been working as an assistant professor of engineering and Department Coordinator of Electrical Engineering Technology at Penn State Altoona. Since 1996, he has also been serving as an invited professor of electrical engineering at IUT Bethune, France. He is the Subscriptions Editor of the *Journal of Engineering Technology (JET)* and an associate editor of the *Journal of Pennsylvania Academy of Science*.