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Mary Anderson-Rowland, Arizona State University

MARY R. ANDERSON-ROWLAND, PhD, is the PI of three academic programs and a fourth program for transfer students. An Associate Professor in Industrial Engineering at Arizona State University, she was the Associate Dean of Student Affairs in the Fulton School of Engineering at ASU from 1993-2004. She received the ASEE Minorities Award 2006, the SHPE Educator of the Year 2005, and won the National Engineering Award in 2003, the highest honor given by the AAAES. In 2002 she was named the Distinguished Engineering Educator by the Society of Women Engineers. A SWE and ASEE Fellow, she is the Chair of PIC IV and a frequent speaker on career opportunities in engineering, especially for women and minority students.

Dana Newell, Arizona State University

DANA C. NEWELL is the Director of the Center for Engineering Diversity and Retention at Arizona State University. She also serves as the Associate Director for Student Outreach and Retention Programs for the Ira A. Fulton School of Engineering at ASU. Ms. Newell received her Bachelors degree in 1993 from the University of Arizona in Applied Mathematics. She received her Masters degree in 1996 in Higher Education Administration, Student Services. In her five-year tenure at ASU, she has won many awards including Outstanding Supervisor of the Year and Outstanding Program for the WISE Program from the ASU Commission on the Status of Women.

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Mary R. Anderson-Rowland and Dana C. Newell
Arizona State University

Abstract

In the fall of 2003, a National Action Council for Minorities in Engineering (NACME) Program was begun in the Ira A. Fulton School of Engineering at Arizona State University (ASU). The funding for this program was part of 13 five-year block grants given to colleges and universities by NACME that fall. This paper looks at the over all ASU NACME program: its successes, areas in which improvement is desired, and the best practices that have developed during the three years. The purpose of the NACME program is to graduate underrepresented students and to encourage them to go on to graduate school. The paper includes the summary of the semester evaluations submitted by the students and a summary of the retention of the students.

I. Introduction

Since 1974, NACME (the National Action Council for Minorities in Engineering) has provided leadership and support at the national level to increase the representation of successful African American, American Indian, and Latino women and men in engineering and technology, math- and science-based careers. NACME is a leader, but works closely with many other organizations to achieve their aim.¹ NACME is widely known as the nation's largest private source of scholarships for underrepresented minority women and men in engineering. Over 15% of all minority engineering graduates since 1974 have received scholarship support from NACME and are now leaders in government, industry and academics.²

In 2003 NACME embarked on a new NACME Success Strategy. Although NACME had worked with certain universities over the years, in an effort to dramatically increase the representation of African American, American Indians, and Latinos (underrepresented minorities) in the critical field of engineering, NACME selected key institution to participate in a new scholarship program. This program not only supports the success of individual students, but also builds the participating institutions' capability to improve their minority enrollment and degree-completion rates.² In 2003, Arizona State University, through its Ira A. Fulton School of Engineering (which includes computer science and construction), became one of the first 13 new "Block Grant" program schools, selected from over 110 applicants. ASU was very pleased with this distinction since we are not yet a minority institution, although we are nearing 20% URM students at ASU and have 19.5% URM students in the Fulton School of Engineering.³ NACME now has a total of 44 institutional partners in this program.⁴

The NACME grants are helping the institutions recruit, admit, educate and graduate successful minority engineering students. The institutions are serving as models of best practices in developing a "culturally competent" campus that welcomes and supports the achievement of all

students. NACME is disseminating lessons learned through their website, special publications, and meetings across the nation.⁴

The general guidelines for the NACME scholarships include that the scholarship students should be in a cohort of at least 10 students, that the student be an underrepresented minority student (URM), be a U.S. citizen or permanent resident, have financial need, be enrolled in engineering or computer science, and show academic ability. At the end of the freshman year, the NACME Scholar should have at least a 2.5 GPA; by the end of the sophomore year, a 2.6 GPA; by the end of the junior year, at least a 2.7 GPA; and by the time the student graduates, at least a 2.8 GPA. A dilemma with NACME scholarships and retention records is whether the students are selected after they have completed some college work so there is a pretty good idea if the student will be retained to graduation (up to 30% of freshmen may either drop out of school or change majors after one semester of engineering college work) or to assist first semester freshmen when the threat of attrition is very high.

The primary goal of the NACME and the ASU NACME Scholars Program is to graduate more underrepresented minority students with engineering and computer science degrees. In the ASU NACME Scholars Program, a secondary goal is to encourage more NACME Scholars to not only graduate in engineering and computer science, but to go on for a technical graduate degree. This is a difficult goal to accomplish since all of the NACME students have financial need and a large carrot to continue in engineering is the expectation of a good salary with a Bachelor's degree, which is not the case with most college Bachelor's degrees. The students are very motivated to complete the degree, get a job with relatively high salaries upon graduation, be able to pay off loans, and be able to afford a comfortable living. They are concerned that graduate school will mean even more debt and a longer time to wait until they are financially comfortable.

II. The ASU NACME Scholars Program

The ASU NACME Program differs from some NACME programs in that first semester freshmen are admitted at the beginning of their college career, so there is no screening for past college persistence. The NACME students are admitted first-come, first-served, as long as they qualify for the program. For entering freshmen, the student must have a GPA of 3.0, be a full-time student in engineering or computer science in the Fulton School of Engineering, have financial need as defined by FAFSA, submit a personal statement of purpose, and submit two letters of recommendation. In the first year of the program, only freshmen minority students were admitted. In the second year of the program, all students who qualified for NACME, regardless of ethnicity, were admitted to the NACME program in order to comply with the University legal counsel.⁵ The Scholarships for non-minority students in the NACME program are supported by the Fulton School of Engineering. During the third and now fourth year of the program, new NACME students are admitted at all levels. Most of the non-minority students who have applied for NACME scholarships are women and Asian men and these numbers have been low.

First semester freshmen attend a two semester hour credit Academic Success class. This class has been discussed in detail.⁶ The students then meet for an hour every other week during the second semester of the freshmen year. In the sophomore and subsequent years, the students meet

six times each semester. After the freshmen first semester in-classroom setting, refreshments are served to the NACME scholars in a conference room setting. The program has to be made flexible since some students are in their third or fourth year of the NACME program and other students are in their first year of the program.

II. Freshmen First Semester Program

Although the freshman two-credit Academic Success Class remains basically the same as when the program was begun, there have been several notable changes. After three years, the course text, "Engineering Success, Second Edition," written by Peter Schiavone⁷ was changed to "The Engineering Student Survival Guide, Second Edition," by K. Donaldson.⁸ The change was made since the book is written in a very interesting style and format and directly addresses the survival of URM and women. The text has been well accepted by the instructors and the students.

The Individual Student Presentations (affectionately known as ISPs), which were introduced in the first year of the program in response to a reluctance of the students to speak in class, are now a cherished part of the class. When the students are asked what parts of the first semester NACME Program should be kept, almost always the list includes the ISPs. The sophistication of the Power-Point presentations increases every year and every year it is getting harder to limit the students to a 10 minute presentation. This past fall students requested that they present a second ISP. Due to class time limitations, we were only able to accept one additional presentation. Since the ISPs were designed to introduce the students to each other, we were taken by surprise this past fall when a student gave his presentation on a friend, who was "more interesting than himself." We will close that loophole with more exact directions in the future.

The class team projects have remained basically in tact through the first three years. A problem with the assignment for the students has always been that it is open-ended and the students would rather have exact directions on how they are to carry out the research project. Beginning in the third year we gave more guidance to the project. Instead of a general problem they could solve in a week with a total of seven volunteer engineers and a budgets of \$100K (excluding travel, lodging, and meals), we asked the students to focus on helping with the results of Hurricane Katrina in New Orleans. This put some flesh on the bones for the students and they were better able to design a hypothetical solution with their resources. This past fall, we gave even more guidelines, and will probably continue to do so. As part of their report and presentation, the students report on each of their majors. In addition to the history of their profession, they are to talk about two famous engineers in their field, including at least one URM person and a woman. Listening to information about other engineering fields continues to be valued by students who are not yet sure about their engineering field.

Each fall one of the NACME meetings required for the freshmen to attend is the Diversity Evening With Industry (DEWI) banquet and career fair sponsored by the Coalition of Engineering Minority Societies/Society of Women Engineers (CEMS/SWE). The freshmen NACME students are given free tickets to attend and attendance is mandatory. This experience is invaluable to these freshmen in having to dress up and learn how to exchange information with industry representatives. After this experience, most of the students are able to participate meaningfully in career fairs and to present themselves well in interviews.

The major change in the programming of the NACME project occurred in January 2005, when the Guaranteed 4.0 Plan by Donna O. Johnson⁹ was introduced to the NACME students.¹⁰ In Fall 2005 the first new freshmen class was presented with the Plan. The results of this 4.0 Plan were dramatic with the freshmen with a significantly improved first semester GPA.¹⁰ At the center of this program is a detailed time management plan. A Check List for the Detailed Time Management Schedule was developed and reported, as well as the assignments that support the 4.0 Plan.^{10, 11}

II. The NACME Program

The spring semester program for the freshmen has been reported¹⁰ and continues generally the same although the topics for each semester vary depending on the demand of the students. Usual topics covered are the Guaranteed 4.0 Plan (discussed at the beginning of each semester for all NACME students with NACME students sharing what about the program has helped them most), resume writing, graduate school given by a panel of graduate students, information on internship and research programs within the Fulton School of Engineering, and a special speaker from industry with an advanced degree.

Perhaps the biggest challenge for the NACME Programming is that due to student schedules, it is impossible for the cohorts of students that begin the NACME program each year to meet in their own group. Typically two meetings of NACME students are each held six times during the semester after the freshmen year. In these two meetings, one a repeat of the other, students attend who have been in the NACME Program for one to four years. Some of the NACME students went through the freshmen NACME year, but some did not. Therefore the programming needs to be a mixture of new topics for students who recently joined the NACME program and refresher topics for students who have been with the program several years. Although the topic may be the same, the assignments are given at different levels, depending on where the student is in her/his academic program.

III. Evaluations of the NACME Program

After three years, how are we doing with the NACME program? Much analysis and evaluation data have been reported.^{5, 6, 10, 11, 12} We now given general evaluations of the first three years. Since retention is a major goal of the NACME program, the retention/graduation rates are given in Table 1 for the first three years of cohorts.

NACME Cohort Retention					
Cohort	n	One Yr. ES	One Yr. ASU	Currently ES	Currently ASU
2003-04 Freshmen	21	9 = 42.9%	15 = 71.4%	10 = 47.6%	17 = 81.0%
2004-05 Freshmen	10	9 = 90%	10 = 100%	8 = 80%	10 = 100%
2005-06 Freshmen	10	10 = 100%	10 = 100%	10 = 100%	10 = 100%
2005-06 Non-freshmen	7	5 = 71.4%	5 = 71.4%	5 = 71.4%	5 = 71.4%
2005-06 Senior	1	graduated	graduated	graduated	graduated
Total/Average	49	69.4%	82.7%	69.4%	87.8%

TABLE 1. NACME COHORT RETENTION. (ES = ENGINEERING SCHOOL)

The one year retention rates for entering freshmen were much better for the second and the third cohort than the first cohort. The primary reasons that students have not been in school the fall after their freshmen year are: low grades, planned mission trip, unsure of major, and being homesick (transferred to engineering program near home). In two cases, students were out of school for a semester or more and later returned to engineering. In another case a student was out of school for a time and then returned to a major other than engineering.

A factor in a student's one year retention is the first semester GPA. The GPAs of the first three freshmen cohorts in the Academic Success Class were compared¹⁰ and here we compare the first four freshmen class to give a better idea of how we did the first three years. While the students in the first three Academic Success Classes were predominantly NACME Scholarship students, the NACME Scholarship students were a minority in the fourth Academic Success Class. The majority of the minority students in the class apparently did not have financial need and so were not eligible for the NACME Scholarship. They took the class however because they had attended the Summer Bridge Program hosted by the Minority Engineering Program (MEP) and were advised to attend the Academic Success Class. They were advised to take the Academic Success Class because the first semester GPA of those from the 2005 MEP Summer Bridge Program had much higher GPAs than those 2005 Summer Bridge students who did not attend the Academic Success Class. The 2006 MEP Summer Bridge students in the Academic Success Class other than NACME Scholars were scholarship winners from the 2006 MEP Summer Program and attendance in the Success Class was a condition of the nominal book scholarship of \$100.

Although good grades do not ensure that a student remains in engineering, they do encourage the student to stay. Table II displays the GPAs at the end of the first semester for the students completing the Academic Success Class for each of the first three years.

Cohort	n	GPA avg.	< 2.0	< 2.6	> 3.0
I. Fall 03 (all min.)	21	3.04	2 (9.5%)	5 (23.8%)	15 (71.4%)
II Fall 04 (all)	14	2.85	0 (0.0%)	5 (35.7%)	5 (35.7%)
Fall 04 (min. only)	10	2.73	0(0.0%)	4 (40.0%)	2 (20.0%)
III Fall 05 (all)	18	3.63	0 (0.0%)	0 (0.0%)	17 (94.4%)
Fall 05 (min. only)	15	3.54	0 (0.0%)	0 (0.0%)	14 (93.3%)
IV Fall 06 (all)	20	3.23	2 (10.0%)	2 (10.0%)	14 (70.0%)
Fall 06 (min. only)	17	3.17	2 (11.8%)	2 (11.8%)	11 (64.7%)

TABLE II. GPAs AT END OF FIRST SEMESTER FOR STUDENTS COMPLETING THE ACADEMIC SUCCESS CLASS

It would appear that the Guaranteed 4.0 Plan presented to cohorts III and IV has had an effect of increasing the first semester GPA. The two students who did not do all of the required assignments relative to the 4.0 Plan are the only two students in the class who had a GPA less than 2.76 and did not do well in there other classes. Of the six students in cohort IV who had a GPA less than 3.0, three had GPAs of 2.93. In cohort III, only one student had a GPA less than 3.0 and that a 2.96. In cohort III, all of the students did the required 4.0 Plan assignments. The 2006 Summer Bridge MEP Program students who did not attend the Fall 06 Academic Success Class had a full grade lower average, which is consistent with past years.

Table III shows the NACME Academic Success Course Evaluation for the first four years of the ASU NACME Program. Fall 05 was the first semester that the Guaranteed 4.0 Plan was introduced into the course and assignments on the 4.0 Plan were required in order for the student to earn an A in the course. Even though the Fall 05 class had the highest GPA of the four classes, their ratings of the course and the instructors were the lowest. The same instructors taught the Success Class all four years. In year four, a new text was introduced and apparently was well received by the students.

NACME ACADEMIC SUCCESS COURSE EVALUATION				
Very Good=5, Good=4, Fair=3, Poor=2, Not applicable=1	Fall 03 (14/29) 48.28%	Fall 04 (21/23) 91.3%	Fall 05 (14/20)70.0%	Fall 06 (17/21) 81.0%
Part 1: Student Evaluation of Course	4.31	4.04	3.88	4.13
Part 2: Student Evaluation of Instructor	4.44	4.51	4.21	4.44
Overall quality of the course and instruction	4.21	4.24	3.57	4.12
How do you rate yourself as a student in this course?	4.21	4.10	4.21	4.12

TABLE III. NACME ACADEMIC SUCCESS COURSE EVALUATION: FALL 03 –FALL 06.

The Fall 05 class was quite serious and appeared to be highly motivated. They were a little casual in giving their midterm presentations, but did very well on their final team presentations. The Fall 06 class was much more casual and appeared to not be very serious about their studies. Almost all of the students (17 of the 21) had been together in the Summer Bridge MEP Program which may have led to their camaraderie. The midterm presentations were very poor and we wondered if the students would be able to make a professional final presentation for the class. Surprisingly, the students dressed up, were very serious and professional, and gave excellent final team class presentations. However, for the first time not all of the students earned an A in the course. Two students did not complete the required 4.0 Plan assignments required for an A.

IV. Best Practices and Challenges

In their evaluations of the Academic Success Class, almost all students agree that the best practices of the course include the individual student presentations, the Guaranteed 4.0 Plan, and the class team project with presentations. Some of the students like the video series “Where There’s A Will, There’s an A”¹³ as a supplement to the Guaranteed 4.0 Plan and find it useful. Some students are bored with the series. Each instructor gives their life story to the students in one of the NACME course sessions. Each of the instructors has gone through some difficult, painful times in their lives. The students appreciate learning that their instructors are human, and that it is possible to get through tough times. This has made the instructors more accessible to the students and both instructors have seen an increase in students coming to them for help with issues that would have otherwise possibly been reasons to drop out of college. We have also learned that if the students have issues, then it is good to stop the class and talk them through with the students.

Another Best Practice is the use of meeting evaluations. At the end of each class or NACME session, the students are asked to complete a short evaluation including: What was the most

important thing that you learned today? What did you like most about the meeting today? What do you need to know more about? Suggestions for future meetings? and Comments and food suggestions. These responses are typed up and give back as a handout at the next meeting. Questions of common interest are answered in the handout.

The students in the NACME meetings other than the freshman fall semester give consistent high marks for the meetings. The students enjoy and appreciate the networking with other students, the refreshments, and the additional information they glean from the speakers, especially those from Career Services and from industry. The engineers from industry who speak to the students usually have a graduate degree and the students are very interested to learn how a graduate degree might benefit an engineer in industry.

A continual challenge is whether to include students in the NACME program who may be at risk academically to continue in engineering. The view of the authors is that if only those who will make it through engineering with a high probability are supported through NACME, part of the vision of NACME would be lost. A second challenge is how much cheerleading, hand holding, and gentle nudges should be given to help keep a student in engineering, both academically and interest-wise. Is there a point of “enough is enough”? Is “tough love” a good approach for the directors to use with the students?

A last challenge is to get more of the incoming freshmen underrepresented minority students into the Academic Success Class their first semester. The program is advertised through the MEP Summer Bridge Program and emails are sent out to all eligible students. However, in spite of this, many eligible students do not apply. Because of the success of students who participate in the NACME class, MEP staff plan to send letters to students who have been admitted to engineering in late spring telling of the opportunities available. Follow-up telephone calls will also be made.

V. Conclusion

We are pleased in general with our first three years of NACME. We are working with some excellent students. We agonize when any student decides to leave engineering or ASU, but we are not able to will all students to stay and to graduate. Our retention numbers, however, are quite good and several NACME students are planning to go to graduate school when they graduate.

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