

**REPORT ON THE
QUALITY EDUCATION FOR MINORITIES (QEM) NETWORK
WORKSHOP FOR ENGINEERING FACULTY ON THE PROFESSIONAL DEVELOPMENT AND
MENTORING OF
UNDERREPRESENTED MINORITY GRADUATE ENGINEERING STUDENTS
Baltimore, MD
MAY 13-14, 2011**

**Conducted by the
Quality Education for Minorities (QEM) Network**

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EXECUTIVE SUMMARY

OVERVIEW

On May 13-14, 2011, in Baltimore, Maryland, the Quality Education for Minorities (QEM) Network conducted a Workshop for Engineering faculty on the professional development and mentoring of underrepresented minority graduate engineering students. The purpose of the Workshop, funded by the NSF Directorate for Engineering, was to share best practices and strategies among senior faculty and administrators in engineering for mentoring underrepresented minority graduate engineering students and advising them on their academic and career development plans. Fourteen (14) participating institutions (five Historically Black Colleges and Universities (HBCUs), five Hispanic-serving Institutions (HSIs), and four predominantly white institutions) with significant enrollments of underrepresented minority graduate students in Engineering participated in the workshop. These institutions were represented at the Workshop by 40 senior engineering faculty and administrators.

Senior engineering faculty and administrators shared best practices and strategies critical to the mentoring and advising of minority graduate engineering students. Two pivotal elements undergirded the discussion:

- The commitment of senior Engineering faculty and administrators at an institution is essential to effective mentoring and advising of minority students.
- While many key elements of successful initiatives for effective mentoring and advising of minority students are applicable to the success of all students, some areas may be of greater importance to underrepresented minority students than to non-minority students. These include areas such as the cultural competency of faculty and staff; early outreach to students regarding academic preparation and STEM career options; a supportive campus climate; and access to role models.

Four Critical Areas

At the Workshop, Engineering faculty and staff discussed four critical areas:

(1) Cultural Competency of the Faculty and Staff

Cultural competency was identified over the course of the workshop as an essential skill for faculty who teach, advise, and mentor minority students. Cultural competency was defined as an ability to interact with people of different cultures, requiring an awareness of one's own cultural worldview and attitudes toward cultural differences as well as knowledge of different cultural practices and worldviews.

Faculty were urged to:

- Use cultural differences as teaching tools and assets to the learning process.
- Be aware of body language and cultural biases
- Praise students' actions and acknowledge their accomplishments
- Take time to learn students' names, including names of international origin
- Listen to students without judgment about their academic challenges
- Develop class strategies that promote collaborative learning and the integration of the perspectives of students from diverse cultures and experiences
- Develop a capability for cultural assessment

(2) Early Outreach to Students Regarding Academic Preparation and STEM Career

Options

Participants stressed the importance of early implementation of effective strategies for recruiting and retaining minorities and women in engineering through to the Ph.D. degree. Minority students may not have experiences to expose them to the variety of STEM careers available, especially in engineering. Often, minority students do not receive adequate preparation in mathematics and science, limiting their ability to pursue an engineering degree. Limited financial resources and family expectations also can deter minority students from pursuing higher education, including engineering education. Workshop participants recommended early mentoring and exposure to engineering role models; tutoring and bridge programs to address academic under preparation; engagement of families in education and career planning events; and undergraduate research experiences.

(3) Supportive Campus Climate

Participants maintained that achieving and sustaining diversity in engineering, particularly in academe, is an institution-wide concern. Student support services for minority engineering students, drawn from all areas of the institution, need to provide not only academic support and mentoring but professional development opportunities, including research experiences, attendance at professional meetings, and detailed planning for graduate school and careers. Developing a campus climate with this focus requires leadership and long-term commitment but can start with efforts by key senior faculty.

(4) Access to Appropriate Role Models

Minority and female students need to see themselves as scientists and engineers and that vision is difficult when the current workforce is predominantly White and male. Participants recognized that, in the short-term, the absence of sufficient minority and female role models in engineering will require: (a) current minority and women engineers to provide a disproportionate share of role modeling; and (b) institutions to carefully recruit, select, and train role models from the majority community.

For both groups, reward and recognition must play an integral role in sustaining the pool. Implementing and disseminating best practices in mentoring, advising, career counseling, engineering pedagogy, cultural competency, and academic leadership are essential to providing effective role models for minority and female engineering students.

Other Key Points from the Workshop Sessions

In addition to these four critical areas, participants addressed the following topics:

Effective Mentoring and Advisement Strategies

Mentoring is essential to increase the Nation's engineering talent pool. Faculty noted that underrepresented minority students progress faster and address challenges more easily as a result of effective mentoring. Best practices for mentoring minority engineering students include: early and sustained outreach in academic preparation and identification of STEM career interests; faculty and graduate student training in "cultural sensitivity" to better understand how to interact with students of different cultural backgrounds; building a strong sense of community and belonging; and ongoing guidance and preparation for graduate school and job placement.

Exploring Career Pathways and Expectations

Engineering faculty should be proactive in staying informed about and discussing career pathways and differences in expectations for careers in academe, government, and industry. Best practices that focus on the transition from the master's to the Ph.D. level need to address the concern of many first generation college students that the Ph.D. will over-qualify them for non-academic positions. Faculty were encouraged to provide students with information on opportunities available to engineering doctorates and the "real life" projects in which they are involved.

The Role of Student Support Services

Faculty asserted that student support services for graduate engineering students should not only foster academic excellence but also enhance students' quality of life. Support services need to include advising and mentoring; community building; funding for special initiatives and projects; and support for degree completion. Professional development opportunities should be offered, including workshops, dissertation support, and participation in professional conferences.

Some minority students may require assistance in building self-confidence and self-efficacy, including:

- Personal interaction and personal investment with faculty and more senior graduate students
- Experiences to hone critical thinking and problem solving skills
- Opportunities to be involved in projects that develop their skills as scientists
- Encouragement to take risks and to be prepared to learn from failure
- Special courses such as MIT's course for African American males to work on self-efficacy issues

Innovation and Entrepreneurship in Engineering

Engineering faculty were challenged to lead the way in fostering innovation as well as entrepreneurship in engineering, areas that are critical to both the profession and the Nation's competitiveness. Promising practices to stimulate innovation in engineering include a multi-disciplinary approach to business and engineering education; on campus business incubators; and programs to encourage entrepreneurship.

Preparing Doctoral Engineering Students and Early Career Faculty for Careers in Academe

To prepare more engineering doctoral students and early career faculty for successful careers in academe, the participants recommended focusing on the system and the environment to address diversity issues. Diversity in the professoriate should be considered part of a systemic approach to provide better education for all students.

Mentoring, networking, opportunities for collaboration, interactions with faculty, and developing an identity as a scientist can encourage and support a career in academe. Policy, social, and institutional issues, such as the lack of role models, can deter an individual from pursuing a career in academe in a specific discipline. Participants recommended professional development opportunities for students and faculty to meet these challenges.

Modeling and Fostering Professional Behavior/Scholarly Conduct (Licensure, Ethics, Social Responsibility, Publishing, and Professional Societies)

Engineering presents a unique context for the development of standards for professional behavior (licensure) and guidelines for engagement with society (ethics). Engineers should be aware of potential value conflicts associated with their projects as well as who the stakeholders are and the potential cultural barriers.

An engineering ethics course for research and for practice being developed by the University of Virginia and the website of the Center for Engineering Ethics and Society at the National Academy for Engineering (NAE), <http://onlineethics.org/> were identified as potential sources of information and teaching resources on engineering ethics. Senior faculty who model professional behavior also can serve to further develop professional behavior in students as well as early career faculty.

With respect to training graduate engineering students in ethics, faculty recommended including critical ethical considerations in capstone courses as well as taking advantage of "teachable moments" that highlight ethical dilemmas. They also cited involving students in community outreach so they can see the impact of engineering projects.

RECOMMENDATIONS

The following recommendations are based on presentations and discussions at the May 2011 Workshop:

- Senior faculty at engineering graduate schools with significant enrollment of underrepresented minorities and women should assume a leadership role in developing and guiding the implementation of student mentoring and professional development programs at their institutions
- Engineering schools and departments need to work with K-12 schools to ensure that mentoring, advising, and professional development programs for engineering students begin with K-12 outreach and address all levels of higher education in engineering
- Engineering faculty should be encouraged to seek external support from NSF as well as other funding sources with an interest in improving engineering education for minorities and women to design and conduct education research projects that address issues raised at the workshop and other concerns related to the underrepresentation of minorities in engineering
- Engineering schools/departments should develop and engage senior engineering faculty in preparing students to submit competitive NSF Graduate Research Fellowship applications
- Collaborations across engineering and other STEM disciplines should be encouraged to allow students in different disciplines to become more aware of the real-world applications of engineering
- Faculty who teach, advise, and mentor graduate engineering students, including minorities, should be encouraged to seek training in cultural competency and be recognized for this commitment in the promotion and tenure process
- Senior faculty should be encouraged to develop and share model courses for Ethics in Engineering at both the undergraduate and graduate levels
- Professional societies in engineering should consider establishing special interest groups to engage industry representatives in dialogue about increasing diversity in engineering as well as identifying and sharing information about emerging careers in engineering with contacts in academe
- A Listserv should be established to disseminate this report and other “best practices” recommended for recruiting and retaining underrepresented minorities in engineering graduate education

QEM plans to include a panel of recent minority Ph.D. degree recipients as well as opportunities for graduate engineering students to reflect on these recommendations and offer comments and suggestions at the proposed Fall 2011 workshop to bring ten-person faculty/graduate student teams from each of the 14 institutions represented at the May 2011 workshop.

Following the workshop, participants offered the following recommendations regarding the proposed Fall 2011 Workshop:

- Replacement of the Session on *Preparing Students to Meet ABET's Engineering Criteria 2000 – Outcomes for Students* with a session on *Tools for Assessing Graduate Engineering Programs' Effectiveness*
- Addition of a third time slot for the Career Pathways sessions so each student can participate in each of the three breakouts: Careers in Academe, Careers in Government, and Careers in Industry
- Continue the session on *Networking – How to Do It and With Whom* as well as add more informal networking opportunities
- Inclusion of an overnight assignment for institutional teams to review services and programs discussed on Day One and their availability on their campus. Teams would be asked to report back on “How to Make It Happen” for programs and services not currently available on their campus
- Revision of the Day Two session on mentoring to focus on students' perspective, such as *What to Ask of, or Expect from, your Mentor*. A panel of graduate students could address this topic

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The purpose of the May 2011 Workshop for Engineering Faculty on the Professional Development and Mentoring of Underrepresented Minority Graduate Engineering Students was to share best practices and strategies from senior faculty and administrators in engineering for advising underrepresented minority graduate engineering students on their academic and career development plans.

OVERVIEW

On May 13-14, 2011, in Baltimore, Maryland, the Quality Education for Minorities (QEM) Network conducted a faculty/administrator-focused workshop designed to address the underrepresentation of minorities and women in engineering. The Workshop, supported by the National Science Foundation, was the second in a series of three workshops to increase the diversity of engineering students prepared for academic careers or the engineering workforce.

The first workshop, held on November 13-14, 2009, focused on underrepresented minority students in engineering at the undergraduate level from 15 institutions that enroll significant numbers of underrepresented minorities and women in engineering. The third, planned for November 2011, will focus on underrepresented minority students in engineering at the graduate level from 14 institutions, including many represented at the first workshop.

Institutions were invited to participate in the May 2011 Workshop based on 2009 Underrepresented Minority Graduate Enrollment Data from the American Society for Engineering Education (ASEE) Institutional Survey. Twelve (12) of the 14 participating institutions, all offering master's and doctoral degrees in engineering, were involved in the November 2009 Workshop. The participating institutions were:

City College of New York, CUNY Florida A&M University/Florida State University Florida International University Georgia Institute of Technology Massachusetts Institute of Technology Morgan State University New Mexico State University	North Carolina A&&T State University Prairie View A&M University Stanford University* Tuskegee University University of Puerto Rico at Mayaguez University of Texas at El Paso University of Virginia* * Only attended May 2011 Workshop
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Forty (40) senior engineering faculty and administrators came in three-person teams from five Historically Black Colleges and Universities (HBCUs), five Hispanic-serving Institutions (HSIs), and four predominantly white institutions (PWIs). Sixteen (16) consultants, presenters, and facilitators and two NSF Program Directors assisted QEM in the conduct of the Workshop. A list of workshop participants is at **Appendix A**.

Speakers, panelists, NSF program officers, and QEM consultants and staff served as presenters, moderators, and discussion facilitators for sessions that addressed the following topics.

<ul style="list-style-type: none"> -Effective Mentoring and Advising Strategies -Degree Attainment Data on URM Graduate Students in Engineering -Research on Best Practices for Retaining URM Graduate Students in Engineering -Exploring Career Pathways: Academe, Industry, and Government -Best Practices for Preparing Students to Meet Academic Expectations 	<ul style="list-style-type: none"> -Building Students' Networking and Negotiating Skills -The Importance of Cultural Competency in Broadening Participation of Students in STEM -Fostering Innovation and Entrepreneurship in Engineering -Resources for Developing Students as Engineering Scholars -Modeling/Fostering Professional Behavior and Professional Conduct
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A copy of the May 2011 Workshop agenda is at **Appendix B**. Biographical sketches for workshop presenters, external to QEM and NSF, are at **Appendix C**.

MAJOR THEMES FROM THE WORKSHOP SESSION DISCUSSIONS

The May 2011 workshop focused on the following major themes to assist senior engineering faculty and administrators in sharing best practices and strategies for mentoring and advising underrepresented minority graduate engineering students on their academic and career plans. The key points described below were culled from keynote presentations, plenary sessions, panel discussions, and luncheon table discussions focused on these themes. Unless noted otherwise, the word “students” refers to underrepresented minority graduate engineering students.

Theme 1: Effective Mentoring and Advisement Strategies

Mentoring was defined, generally, as one person helping another to succeed. Mentoring is a workforce, diversity, and talent pool issue. Underrepresented minority students progress faster and address challenges more easily as a result of effective mentoring. Mentoring can be:

- natural (relationships that happen naturally)
- situated mentoring based on institutional or personal arrangements), or
- supervisory (formal, facilitated mentoring).

Faculty should consider establishing a formal mentoring program for engineering students at their institution. Alumni and graduate students can mentor undergraduates.

Several institutions described effective components of their mentoring programs. The City College of New York team reported on a CCNY study that provides evidence that training graduate student mentors in counseling and faculty and graduate students in “cultural sensitivity” can increase student retention. The University of Maryland Baltimore County (UMBC)’s Meyerhoff Program involves the institution’s most research productive faculty as mentors. UMBC does not provide release time for mentoring, since mentoring is seen as part of the faculty’s job.

At the Massachusetts Institute of Technology (MIT), new faculty hires are mentored by a team of four senior faculty. MIT’s Computer Science Department has an online assessment tool for students to report experiences, publications, and complete a checklist for activities during the semester. Advisors complete a student assessment as well. The faculty review each student’s assessment and send the student their combined assessment. MIT also has a mentoring program tailored for women students.

Mentoring and career guidance for students should begin at the undergraduate level and continue through graduate school. Mentors should:

- Tell undergraduates what they need to do to prepare for graduate school and encourage them to apply for fellowships
- Inform students that a good GPA and participation in undergraduate research and senior projects are critical for admission to engineering graduate schools and for receiving fellowships
- Stimulate interest in graduate school and discuss specific career options for the master’s and the Ph.D. degrees
- Introduce students to engineering professional societies and student chapters
- Help socialize students into the department and encourage interaction among new and more advanced graduate students
- Use academic, industry, and alumni contacts to assist students in finding jobs
- Encourage students to work with faculty who will include them in publications
- Allow students to serve as students teachers or trainers
- Prepare students for modern interview methods
- Review students’ application materials and ensure that students have supplementary documents
- Teach students how to evaluate educational and career opportunities
- Encourage students to do post docs
- Provide students and mentors with information on evaluating and enhancing their mentoring relationship
- Take responsibility for setting guidelines/expectations for the relationship
- Understand that mentoring is part of a faculty member’s job
- Help students define and pursue their passions and to think independently
- Be culturally competent

Theme 2: What Data and Research Tell Us About Retention and Graduation

A comprehensive review of current data about enrollment and graduation of underrepresented minority students in engineering was presented at the Workshop and is available at [http://www.qem.org/2011%20workshops/MAY2011ENG_Faculty/FRIDAY-May13/Louis\(Data\).pptx.pdf](http://www.qem.org/2011%20workshops/MAY2011ENG_Faculty/FRIDAY-May13/Louis(Data).pptx.pdf)

Specific data highlighted included the following:

- While the number of bachelor's degrees awarded to African Americans, Hispanics, and Native Americans in engineering has changed little from 1997-2009, there has been an increase in degrees awarded to foreign and Asian American students
- More Whites and more men enroll in undergraduate engineering programs, and the Nation's engineering workforce is predominantly White and male
- Minority students are more likely than non-minority students to attend different institutions (bachelor's, master's, Ph.D.) on the pathway to a Ph.D.
- Retention/diversity programs work best in an atmosphere that is positive for all students.
- Creating a sense of community is critical to student retention. Essential elements for students include: a sense of belonging; an ability to influence and be influenced positively by the community; fulfillment of their needs, and a shared emotional connection.
- Most research on increasing the number of underrepresented minorities in STEM is conducted in the social sciences. Representatives of the Engineering disciplines need to be part of the discussion.

Theme 3: Exploring Career Pathways and Expectations

Engineering faculty should be proactive in discussing career pathways with students and specifying differences in expectations for careers in academe, government, and industry. They also should be aware of career options in engineering and current and emerging trends. Professional society websites, consulting contacts, advisory boards/industry partners, and former students were identified as information sources. Interdisciplinary centers and entrepreneurial relationships also can provide current information.

Focusing on the transition from the master's to the Ph.D. level, faculty noted that many first generation college students do not consider pursuing the Ph.D. degree or fear that the Ph.D. will over-qualify them for positions. In response faculty recommended:

- Exposing students and their parents early to opportunities in engineering and their requirements

- Helping students and their families be aware of the variety of careers open to those with a Ph.D. degree
- Including a mentoring plan with graduate school application packages
- Making Ph.D. programs in engineering more flexible in assisting students with difficulties or life balance issues
- Collaborating with industry to help identify thesis projects that address real world issues and involve diverse teams

Several faculty participants felt inadequate preparation of undergraduate students in mathematics and statistics was the major challenge to engineering students' meeting academic expectations at the graduate level. They did not think that GRE scores in mathematics were reliable predictors of student performance in graduate school. They recommended bridge programs and tutoring for students without adequate mathematics preparation.

Theme 4: Meeting Academic Expectations: ABET EC2000 Outcomes for Students and The Role of the Student Support Services Office

ABET accreditation is focused on student academic outcomes and on the acquisition of technical and professional skills for professional practice. Engineering Criteria 2000 (EC2000) is focused on undergraduate institutions and emphasizes quality of teaching. Accreditation criteria are responsive to changes that are reshaping engineering education, including an increase in non-traditional students, a more diverse student population, globalization, generational shifts in students' interests and attitudes, and distance education.

Student support services for graduate engineering students should not only foster academic excellence but also students' quality of life. Support services should include: advising and mentoring; community building; funding for special initiatives and projects; and support for degree completion. Professional development opportunities also should be offered, including workshops, dissertation support, and participation in professional conferences.

Theme 5: The Importance of Cultural Competency

Cultural competency was identified as an essential skill for faculty who teach, advise, and mentor graduate engineering students, including minorities. Cultural competency was defined as "an ability to interact with people of different cultures. It requires: an awareness of one's own cultural worldview; attitudes toward cultural differences; knowledge of different cultural practices and worldviews; and cross-cultural skills." Faculty were urged to:

- adapt their teaching to match their students
- be mindful of language and body language
- be aware of biases
- develop their capability for cultural assessment

Building student self-confidence and self-efficacy also is a concern for faculty. Faculty participants indicated that to build self-confidence and self-efficacy, students need:

- personal interaction and personal investment with faculty and more senior graduate students
- experiences to hone critical thinking and problem solving skills
- opportunities to be involved in projects that develop their skills as scientists
- encouragement to take risks and be prepared to learn from failure

MIT has offered a specific course for African American males on self-efficacy.

Theme 6: Innovation and Entrepreneurship in Engineering

Fostering innovation and entrepreneurship in engineering is critical both to the profession and to the Nation's competitiveness. At the Workshop, engineering faculty were challenged to lead the way in education and innovation. Students are interested in careers outside academe and global pressures have stimulated great interest in entrepreneurship. More African Americans and Hispanics choose entrepreneurship, and more small business start-ups are located in urban areas with high concentrations of minorities.

Some institutions are taking a multi-disciplinary approach to business and engineering education representatives from New Mexico State University indicated NMSU has a business incubator on campus and Florida International University described the Kaufman Entrepreneurial Institute on their campus. The University of Puerto Rico at Mayaguez also has a program to encourage entrepreneurship. NSF is considering funding initiation of entrepreneurial initiatives. It was noted that NSF's Small Business Innovation Research (SBIR) Program assists entrepreneurs in moving from research/innovation to small business start-up.

Theme 7: Resources to Support the Development of Students as Engineering Scholars

Dr. Omnia El Hakim, Program Director of Diversity and Outreach, Directorate for Engineering, provided information on NSF funding opportunities to support graduate engineering students including:

- Graduate Research Diversity Supplement (a new initiative): DCL 11-13, FAQs NSF 11-14
- Graduate Research Fellowship Program
- IGERT Program
- Small Business Postdoctoral Diversity Fellowship Program
- Alliance for Graduate Education and the Professoriate
- NSF Office of International Science and Engineering
- International Research Experiences for Students (IRES)
- East Asia Pacific Summer Institutes
- International Research Fellowship Program
- Pan American Advanced Studies Institutes
- Partnerships for International Research and Education (PIRE)
- Centers for Research Excellence in Science and Technology (CREST)
- HBCU-UP/RISE

Participating faculty commented on the rigors of preparing a competitive Graduate Research Fellowship (GRF) application and suggested that engineering faculty be prepared to assist students with the application. They also recommended that faculty serve on GRF review panels to familiarize themselves with the process as well as to contribute the perspective of smaller institutions and MSIs to the panel discussion.

Theme 8: Preparing Doctoral Engineering Students and Early Career Faculty for Careers in Academe

Faculty considered factors that encourage/limit the participation of minority doctoral students and minority early career faculty in careers in academe. More attention needs to be paid to the system and the environment to address diversity issues. Diversity in the professoriate should be considered part of a systemic approach to provide better education for all students.

Mentoring, networking, opportunities for collaboration, interactions with faculty, and developing an identity as a scientist can encourage and support a career in academe. Performance, recognition, and competence form the basis of an identity as a scientist. Policy, social, and institutional issues can affect personal career choices. For example, the lack of role models can deter an individual from pursuing a career in academe in a specific discipline. Professional development experiences for students and faculty can assist with solutions to these challenges.

Theme 9: Modeling and Fostering Professional Behavior/Scholarly Conduct (licensure, Ethics, Social Responsibility, Publishing, and Professional Societies)

The engineering disciplines present a unique opportunity for the development of standards for professional behavior (licensure) and guidelines for engagement with society (ethics). At the Workshop, panelist Rachele Hollander, National Academy of Engineering (NAE), described engineering ethics as an evolving field of inquiry and practice. Engineering ethics includes professional behavior (micro level), anticipatory ethics (macro-level), and research ethics that combines micro and macro issues. She stated that engineers need to be aware of value conflicts as well as line conflicts (Where do you draw the line?) associated with their projects as well as who the stakeholders are and the cultural and institutional barriers involved.

Panelist Garrick Louis, UVA, described his efforts to provide ethics training for research and practice for engineering students at UVA. With UVA support, he is developing a course on ethics for engineers. He noted the importance of institutional support for such efforts. He recommended resources on NAE's Center for Engineering Ethics and Society website: onlineethics.org

Panelist Phyllis Nelson, CSU-Pomona, focused on faculty modeling professional behavior as an effective strategy for developing professional behavior in students as well as early career faculty. Faculty can model professional behavior by:

- Effective mentoring of junior faculty
- Encouraging ideas, although not fully developed
- Allowing for students' underdeveloped communication skills
- Modeling a balanced approach to professional responsibilities

Faculty asserted that an ethics course is needed for undergraduates. At the graduate level, they recommended including critical issues in capstone courses as well as taking advantage of “teachable moments.” They cited involving students in outreach so they can see the impact of engineering projects.

PRE-SURVEY OF WORKSHOP PARTICIPANTS

QEM conducted a pre-workshop survey of participating faculty to determine the level of their involvement (very often, fairly often, or occasionally) in providing various professional development support for underrepresented minority and women graduate students in engineering. Forty (40) participants (100 percent) responded to the survey. The five activities in which faculty very often engage are:

- 1) communicating with students outside of class (77%);
- 2) providing students with positive messages about their abilities (71%);
- 3) providing hands-on research opportunities (51%);
- 4) fostering scholarly conduct/professional behavior (56%); and
- 5) advising on transition from Master's to Ph.D. programs (41%).

Over 90 percent of the engineering faculty indicated that they communicate with students outside the classroom (93%) and provide students with positive messages about their abilities (91%) very often or fairly often. Approximately one-third of the faculty members engage only occasionally in building students' networking and negotiating skills (34%) and fostering innovation and entrepreneurship (34%). Follow-up activities will include a six-month survey of senior faculty to determine changes in their level of involvement as well as to get an update on developments/changes implemented on campus since the May 2011 Engineering Faculty Workshop.

WORKSHOP EVALUATION SUMMARY

Thirty-eight (38) of the 40 workshop participants (95.0 percent) completed the Workshop Evaluation Questionnaire. Eighty-nine (89) percent gave the workshop an overall rating of excellent or very good. Ninety-four (94.7) percent of the respondents said they had a better understanding of the issues affecting retention and degree attainment of graduate engineering students from underrepresented groups, and 97.3 percent strongly agreed or agreed that best practices were clearly presented. However, asked if they could easily incorporate best practices and strategies at their institution, 73.7 percent strongly agreed or agreed. Participants also were asked which of the suggested strategies from the workshop they were most likely to implement on their return to campus. The Workshop Evaluation Summary, including responses to this question, is given at **Appendix D**.

RECOMMENDATIONS

Recommendations based on presentations and discussions from the May 2011 Workshop:

- Senior faculty at engineering graduate schools with significant enrollment of underrepresented minorities and women should assume leadership for developing and guiding the implementation of a mentoring and professional development program at their institutions.
- Mentoring, advising, and professional development programs for engineering students should begin with K-12 outreach and address all levels of higher education in engineering.
- Engineering faculty should be encouraged to seek external support from NSF as well as other entities with an interest in improving engineering education for minorities and women to design and conduct research projects that address issues raised at the workshop and other concerns related to the underrepresentation of women and minorities in engineering.
- Engineering schools/departments should develop and engage senior engineering faculty in training on preparation of competitive NSF GRF applications.
- Collaborations across engineering and other STEM disciplines should be encouraged to allow students in different disciplines to become more aware of the real world applications of engineering.
- Faculty who teach, advise, and mentor graduate engineering students, including minorities, should be encouraged to seek training in cultural competency and to be recognized for this commitment in the promotion and tenure process.
- Senior faculty should be encouraged to develop and share model courses for ethics in engineering at both the undergraduate and graduate levels.
- Professional societies in engineering should consider establishing special interest groups to engage industry representatives in dialogue about increasing diversity in engineering as well as identifying and sharing information about emerging careers in engineering with contacts in academe.
- The NSF Directorate for Engineering should be encouraged to partner with the Social, Behavioral, and Economic Sciences (SBE) Directorate to support research on practices that address the underrepresentation of minorities and women in engineering.
- A Listserv should be established to disseminate this report and other recommended “best practices” for recruiting and retaining underrepresented minorities in engineering graduate education.

QEM recommends that the Fall 2011 workshop proposed by QEM to bring ten-person teams from each of the 14 institutions represented at the May 2011 workshop include opportunities for graduate engineering students to reflect on these recommendations and offer comments and suggestions at the workshop.

- Each ten-person team is to consist of the three senior faculty who participated in the May 2011 workshop and seven underrepresented minority graduate engineering students (3 master's and 4 doctoral, including at least 3 female students, when possible). The institutional teams will engage in joint activities to ensure that students have access to an array of resources as well as informed guidance and mentoring in support of their professional development and scholarly pursuits.
- Based on feedback from the May 2011 workshop, the proposed Fall 2011 workshop will include a session, "Tools for Assessing Graduate Engineering Programs and Student Outcomes" as well as a panel of recent minority Ph.D. degree recipients.

Other topics will include the requirements for completing a master's and/or doctoral degree in engineering or materials science; how to succeed in graduate school and secure support for graduate study; the ethical conduct of engineering research; the role and importance of research, publishing, conference attendance, and mentoring; and how and with whom to network. The proposed workshop will examine requirements for success in academe, industry, and government and place special emphasis on the critical transition from master's to doctoral degree programs in the fields represented.

APPENDICES

APPENDIX A

Alphabetical List of Participants, NSF Staff, Consultants, Presenters, and QEM Staff

QUALITY EDUCATION FOR MINORITIES (QEM) NETWORK Workshop for Engineering Faculty on the Professional Development and Mentoring of Underrepresented Minority Graduate Engineering Students May 13-14, 2011

Dr. Samuel Miller Allen
Professor
Department of Materials Science
and Engineering
Massachusetts Institute of Technology

Dr. Gilda Barabino
Professor and Associate Chair for
Graduate Studies
Department of Biomedical Engineering

Dr. Joseph Barba
Dean
Grove School of Engineering
City College of New York, CUNY

Dr. Gerson Beauchamp
Professor
Department of Electrical and
Computer Engineering
University of Puerto Rico at Mayaguez

Dr. Joanne Bechta Dugan
Professor
Department of Electrical and Computer
Engineering
University of Virginia

Dr. Victor Breedveld
Associate Professor
School of Chemical and Biomolecular
Engineering
Georgia Institute of Technology

Dr. Eric Butcher
Associate Professor
Department of Mechanical
and Aerospace Engineering
New Mexico State University

Dr. Pablo Caceres-Valencia
Professor
Department of Mechanical Engineering
University of Puerto Rico at Mayaguez

Dr. Cesar Carrasco
Associate Professor and Chair
Department of Civil Engineering
University of Texas at El Paso

Dr. José Cedeño
Associate Professor
Department of Electrical and Computer Engineering
University of Puerto Rico at Mayaguez

Dr. Guangming Chen
Associate Professor
Department of Industrial, Manufacturing,
and Information Engineering
Morgan State University

Dr. Muhammad Dawood
Assistant Professor
Klipsch School of Electrical and
Computer Engineering
New Mexico State University

Dr. George Dulikravich
Professor
Department of Mechanical and
Materials Engineering
Florida International University

Dr. Eric Freudenthal
Associate Professor
Department of Computer Science
University of Texas at El Paso

Dr. Rafael Gutierrez
Associate Professor
Department of Industrial, Manufacturing,
and System Engineering
University of Texas at El Paso

Dr. Ziaul Huque
Professor
Department of Mechanical Engineering
Prairie View A&M University

Dr. Shamsuddin Ilias
Professor
Department of Chemical Engineering
North Carolina A&T State University

Dr. Manoj Jha
Associate Professor
Department of Civil Engineering
Morgan State University

Dr. Steven Jiang
Associate Professor
Department of Industrial and Systems
Engineering
North Carolina A&T State University

Dr. William Johnson
Professor and Chair
Department of Materials Science
and Engineering
University of Virginia

Dr. Marc Karam
Associate Professor
Department of Electrical Engineering
Tuskegee University

Dr. Nirmala Khandan
Professor
Department of Civil Engineering
New Mexico State University

Dr. Leslie Kolodziejcki
Professor
Department of Electrical Engineering
and Computer Science
Massachusetts Institute of Technology

Dr. Jumoke Kemi Ladeji-Osias
Associate Professor
Department of Electrical and
Computer Engineering
Morgan State University

Dr. Stephanie Luster-Teasley
Associate Professor
Department of Chemical Engineering
North Carolina A&T State University

Dr. Eduardo Miranda
Associate Professor
Department of Civil and Environmental
Engineering
Stanford University

Dr. Primus Mtenga
Associate Professor
Department of Civil and
Environmental Engineering
Florida A&M University-Florida State
University

Dr. Norman Munroe
Associate Professor
Department of Mechanical and
Materials Engineering
Florida International University

Dr. Gregory Murphy
Associate Professor and Chair
Department of Electrical Engineering
Tuskegee University

Dr. Neville Parker
Herbert Kayser Professor of Civil Engineering
and Director, CUNY Institute for
Transportation Systems
City College of New York, CUNY

Dr. Lijun Qian
Associate Professor
Department of Electrical and
Computer Engineering
Prairie View A&M University

Dr. Patricio Vela
Associate Professor
School of Electrical and Computer
Engineering
Georgia Institute of Technology

Dr. Michelle Rambo-Roddenberry
Assistant Professor
Department of Civil and Environmental
Engineering
Florida A&M University-Florida
State University

Dr. Mark Weatherspoon
Associate Professor
Department of Electrical and
Computer Engineering
Florida A&M University-Florida State University

Dr. Paul Reynolds, Jr.
Professor
Department of Computer Science
University of Virginia

Dr. Sheldon Weinbaum
CUNY Distinguished Professor of Biomedical
and Mechanical Engineering
City College of New York, CUNY
160 Convent Avenue
New York, NY 10031

Dr. Sheri Sheppard
Professor
Department of Mechanical Engineering
Stanford University

Dr. Kuang-Hsi Wu
Professor
Department of Mechanical and Materials Engineering
Florida International University

Dr. Seth Teller
Professor
Department of Electrical Engineering
and Computer Science
Massachusetts Institute of Technology

Dr. Yonggao Yang
Interim Department Head and
Associate Professor
Department of Computer Science
Prairie View A&M University

Consultants, Presenters, and Facilitators

Dr. Stephanie Adams
Associate Professor
Department of Mechanical Engineering
Virginia Commonwealth University

Dr. Michael Christie
Instructor and Undergraduate Advisor
Department of Biomedical Engineering
Florida International University

Dr. Gilda Barabino
Professor and Associate Chair for
Graduate Studies
Department of Biomedical Engineering
Georgia Institute of Technology

Dr. Eugene DeLoatch
Dean
School of Engineering
Morgan State University

Dr. M. Brian Blake
Associate Dean for Research and Professor
College of Engineering
University of Notre Dame

Dr. Lisa Frehill
Director of Research, Evaluation and Policy
National Action Council for Minorities
in Engineering (NACME)

Dr. Cynthia Jackson Hammond
Provost and Vice President for
Academic Affairs
Coppin State University

Dr. Michael Milligan
Executive Director
ABET, Inc.

Dr. Rachelle Hollander
Director, Center for Engineering, Ethics,
and Society
National Academy of Engineering

Dr. Phyllis Nelson
Professor
Department of Electrical and
Computer Engineering
California State Polytechnic University Pomona

Dr. DiOnetta Jones
Associate Dean for Undergraduate Education
and Director, Office of Minority Education
Massachusetts Institute of Technology

Dr. Imelda Olague
Instructor and Coordinator of the
NSF/NMSU Bridge to the Doctorate Program
Department of Civil Engineering
New Mexico State University

Dr. Yang Li
Assistant Professor
Department of Materials Engineering
University of Puerto Rico at Mayaguez

Dr. Percy Pierre
Professor
Department of Electrical and Computer Engineering
Michigan State University

Dr. Garrick Louis
Associate Professor
Department of Systems and
Information Engineering
University of Virginia

Dr. Janet Rutledge
Vice Provost and Dean of the
Graduate School
University of Maryland, Baltimore County

NSF STAFF

Dr. Omnia El Hakim
Program Director of Diversity and Outreach
Directorate for Engineering
National Science Foundation

Dr. Malathi Srivatsan
AAAS Fellow
National Science Foundation

QEM STAFF

Ms. Althea Burns
Associate and Conference Coordinator

Dr. Shirley McBay
President

Ms. Laura-Lee Davidson
Associate and Internship Coordinator

Mr. Jai Smith-Avery
Project Assistant

APPENDIX B

QUALITY EDUCATION FOR MINORITIES (QEM) NETWORK WORKSHOP FOR ENGINEERING FACULTY ON THE PROFESSIONAL DEVELOPMENT AND MENTORING OF UNDERREPRESENTED MINORITY GRADUATE ENGINEERING STUDENTS

Four Points by Sheraton BWI Airport • 7032 Elm Road • Baltimore, MD 21240

MAY 13-14, 2011

AGENDA

Purpose:

To share best practices and strategies for advising underrepresented minority graduate engineering students on their academic and career development plans.

FRIDAY, MAY 13

AM

- 8:00 *Registration and Continental Breakfast* *Solarium/Crane BC*
- 8:30 Opening Plenary Session: *Crane BC*
Welcome, Purpose, and Introductions
Shirley McBay, President, QEM Network
- Broadening Participation in Engineering*
Opening Remarks: Omnia El Hakim, Program Director of Diversity and Outreach
Directorate for Engineering (ENG), National Science Foundation (NSF)
- 9:15 Keynote Presentation: *Effective Mentoring Strategies for Enhancing the Success
of Underrepresented Minority Graduate Students in Engineering*
Keynote Speaker: Percy Pierre, Professor of Electrical and Computer Engineering
College of Engineering, Michigan State University
2008 AAAS Lifetime Mentor Award Recipient and NACME Founder
Introduction of Speaker: Laura-Lee Davidson, QEM Network
- 10:00 Plenary Session:
*What the Data Tell Us about the Pipeline for, and Degree Attainment of, Engineering
Graduate Students from Underrepresented Minority Groups*
Presenter: Garrick Louis, Associate Professor, Department of Systems and Information
Engineering, University of Virginia, and QEM Consultant
- 10:30 *Break* *Solarium*
- 10:45 Panel Session: *What Research Tells Us about Best Practices for the Retention
and Degree Attainment of Engineering Graduate Students
from Underrepresented Groups* *Crane BC*
Panelists:
Janet Rutledge, Vice Provost and Dean of the Graduate School
University of Maryland, Baltimore County
Lisa Frehill, Director of Research, Evaluation and Policy, NACME
Moderator: M. Brian Blake, Associate Dean for Research and Professor
College of Engineering, University of Notre Dame, and QEM Consultant
- 11:30 Plenary Session: *Exploring Career Pathways: Meeting Academe/Government/Industry
Expectations*
Presenter: Stephanie Adams, Associate Professor, Department of Mechanical Engineering
School of Engineering, Virginia Commonwealth University, and QEM Consultant

Noon/PM

- 12:00 *Luncheon: Roundtable Discussions:* *Chesapeake Ballroom*
Preparing Engineering Students to Meet Tomorrow's Challenges
- Pedagogy for Engineering Education
 - Understanding Career Options
 - Challenges to Moving from Master's to the Ph.D. to Career
 - Building Self-Confidence and Self-Efficacy
 - Fostering Scholarly Conduct/Professional Behavior
- See Table Assignment Sheet (Each Table will have a discussion facilitator and a note-taker)
- 1:30 Report Back from Table Discussions *Crane BC*
Facilitator: Phyllis Nelson, Professor, Electrical and Computer Engineering, and
Co-Director, Center for Macromolecular Modeling and Materials Design
California State Polytechnic University Pomona, and QEM Consultant
- 2:30 Panel: *Preparing Students to Meet Academic Expectations – Best Practices*
- ABET's Engineering Criteria 2000 (EC2000) Outcomes for Students
- Role of Student Support Services in Student Success
Panelists:
Michael Milligan, Executive Director, ABET, Inc.
DiOnetta Jones, Associate Dean for Undergraduate Education and
Director of the Office of Minority Education, Massachusetts Institute of Technology
Moderator: Althea Burns, Associate, QEM Network
- 3:15 *Break* *Solarium*
- 3:30 Plenary Session: *Building Students' Networking and Negotiating Skills* *Crane BC*
Presenter: M. Brian Blake, University of Notre Dame, and QEM Consultant
- 4:15 Plenary Session: *The Importance of Cultural Competency in Broadening the Participation
of Minority Students in STEM Fields*
Presenter: Cynthia Jackson Hammond, Provost and Vice President for Academic Affairs
Coppin State University

Group Discussion: "Acquiring Cultural Competency"
Facilitator: Imelda Olague, *Bridge to the Doctorate* Program Coordinator
New Mexico State University
- 5:30 *Break*
- 6:00 Working Dinner *Crane A*
Fostering Innovation and Entrepreneurship in Engineering
Keynote Speakers: Eugene DeLoatch, Dean, School of Engineering
Morgan State University

Malathi Srivatsan, AAAS Fellow
Division of Industrial Innovation & Partnerships (IIP)
Directorate for Engineering (ENG), NSF
Introduction of Speakers: Laura-Lee Davidson, Associate, QEM Network
- 7:30 *Adjournment*
- Overnight Reflection: *Please give additional thought to topics discussed on Day One in preparation for
Tomorrow's Opening Session*
-

SATURDAY, MAY 14

AM

- 8:00 *Breakfast Buffet* *Solarium/Crane BC*
- 8:30 Group Discussion: Further Thoughts and Comments Based on Day One *Crane BC*
Facilitator: Althea Burns, Associate, QEM Network
- 9:30 Plenary Session: *Identifying/Securing Resources to Support the Development of Students as Engineering Scholars* *Crane BC*
Presenters: Omnia El Hakim and Malathi Srivatsan, NSF
- 10:30 *Break* *Solarium*
- 10:45 Plenary Session: *Preparing Doctoral Engineering Students and Mentoring Early Career Faculty for Careers in Academe* *Crane BC*
Speaker: Gilda Barabino, Professor and Associate Chair for Graduate Studies
Georgia Institute of Technology
Introduction of Speaker: Laura-Lee Davidson, QEM Network
- 11:15 Panel Session: Modeling and Fostering Professional Behavior/Scholarly Conduct
(*Licensure, Ethics, Social Responsibility, Publishing, and Professional Societies*)
Panelists: Garrick Louis, University of Virginia, and QEM Consultant
Phyllis Nelson, CSU Pomona, and QEM Consultant
Rachelle Hollander, Director, Center for Engineering, Ethics, and Society
National Academy of Engineering
Facilitator: M. Brian Blake, University of Notre Dame, and QEM Consultant

PM

- 12:15 *Working Luncheon: Developing Effective Mentoring and Advisement Strategies to Support Underrepresented Engineering Graduate Students*
Presenter: Stephanie Adams, Virginia Commonwealth University and QEM Consultant
Group Discussion of the Topic
Facilitator: Yang Li, Assistant Professor, Materials Engineering
University of Puerto Rico at Mayaguez
- 1:45 Closing Plenary Session:
Next Steps
Overview of November 2011 Workshop for Underrepresented Minority Master's and Doctoral Students in Engineering
Shirley McBay, QEM Network
- Closing Comments*
NSF Program Officers, Workshop Consultants, and Participants
- 2:30 *Adjournment*

APPENDIX C

Biographical Sketches of Workshop Participants

ADAMS, Stephanie

Stephanie Adams is Associate Dean for Undergraduate Studies and Associate Professor, Department of Mechanical Engineering, in the School of Engineering at Virginia Commonwealth University. In 2003, Dr. Adams received a prestigious CAREER Award from the National Science Foundation (NSF) to support her goal of designing, developing, and validating a model for the facilitation of effective teaming in the engineering classroom and for the enhancement of learning. She served as an American Association for the Advancement of Science (AAAS)/NSF Science and Engineering Fellow, during 2006-2007, with the Division of Engineering Education and Centers in the Engineering Directorate at NSF.

Dr. Adams previously served as Director of the Advocates for Minority Engineering Student Success Program at North Carolina State University; as Minority Engineering Program Director at Texas Tech University; and as a recruiter for the National Consortium for Graduate Degrees for Minorities in Engineering and Science (GEM) at the University of Notre Dame. She is the author or co-author of a variety of publications and a frequent presenter at workshops and conferences regarding her research on collaborative and active learning, engineering education and pedagogy, and undergraduate student mentoring. Dr. Adams received the B.S. degree in Mechanical Engineering from North Carolina A&T State University, the M.S. degree in Systems Engineering from the University of Virginia, and the Ph.D. degree in Interdisciplinary Engineering from Texas A&M University.

BARABINO, Gilda

Gilda Barabino is Professor and Associate Chair for Graduate Studies in the Department of Biomedical Engineering at the Georgia Institute of Technology and recently served as the inaugural Vice Provost for Academic Diversity. Dr. Barabino began her career in industry as a Research Process Engineer at Rohm and Haas Company and then joined the chemical engineering faculty at Northeastern University, rising to the rank of Professor and serving as Vice Provost for Undergraduate Education. Her research interests include investigation of the influence of fluid mechanical forces on cell and tissue behavior; growth and development in the context of sickle cell disease; and cartilage and bone tissue engineering.

Dr. Barabino has an extensive record of leadership and service in the chemical and biomedical engineering communities. She also currently directs the NSF-funded Minority Faculty Development Workshop and serves as Principal Investigator on the NSF ADVANCE Leadership Award, "Cross-Disciplinary Initiative for Minority Women Faculty," an initiative designed to enhance the socialization of tenure-track minority women into academic careers in engineering. Dr. Barabino is a Fellow of the American Institute for Medical and Biological Engineering and the Biomedical Engineering Society. She received the B.S. degree in Chemistry from Xavier University of Louisiana and the Ph.D. degree in Chemical Engineering from Rice University.

BLAKE, M. Brian

M. Brian Blake holds the rank of Professor in the Department of Computer Science and Engineering and serves as Associate Dean of Engineering for Research at the University of

Notre Dame. His research interests lie in the investigation of automated approaches to sharing information and software capabilities across organizational boundaries, sometimes referred to as *enterprise integration*. Dr. Blake has received grants from both the National Science Foundation and the National Institutes of Health in support of his research and education efforts. He has published broadly in a number of professional journals.

Over his career, Dr. Blake has received several awards, including “Best Transaction Paper of 2003” from *IEEE Transactions on Education*; “Top 5 Most Viewed Article” from *Annals of Software Engineering*; and the “Outstanding Alumnus Award” from the School of Information Technology at George Mason University. He received the B.S. degree in Electrical Engineering from the Georgia Institute of Technology, the M.S. degree in Electrical Engineering from Mercer University, and the Ph.D. degree in Information and Software Engineering from George Mason University.

DELOATCH, Eugene

Eugene DeLoatch is Dean of the School of Engineering at Morgan State University. Prior to assuming this position in July 1984, Dr. DeLoatch served as Professor and Chairman of the Department of Electrical Engineering (1975-1984) at Howard University. In recognition of his commitment to attaining and promoting excellence in engineering through research and education, Lafayette College awarded him an Honorary Doctor of Engineering degree in 1998.

Dr. DeLoatch served as President of the American Society for Engineering Education (ASEE) in 2002-2003; as an appointed member and Secretary of the Board of Directors of the Maryland Science, Engineering, and Technology Development Corporation (TEDCO); and as a member of the National Research Council’s Board of Engineering Education. In addition, he is a co-founder of the Annual Black Engineer of the Year Program. Dr. DeLoatch received the B.S. degree in Mathematics from Tougaloo College, the B.S. degree in Electrical Engineering from Lafayette College, and both the M.S. degree in Electrical Engineering and the Ph.D. degree in Bioengineering from the Polytechnic University of Brooklyn.

FREHILL, Lisa

Lisa Frehill is Director of Research, Evaluation and Policy at the National Action Council for Minorities in Engineering, Inc. (NACME). Most recently, Dr. Frehill served as Research Director of the Commission on Professionals in Science and Technology (CPST), where she was the Principal Investigator on several projects funded by the National Science Foundation related to the science and engineering educational pipeline and workforce. Her work focuses on how gender and ethnicity impact access to careers in STEM. Dr. Frehill is the author of numerous articles and technical reports, including NACME’s “The New American Dilemma,” which documents the persistently low rate of minority participation in engineering.

Dr. Frehill has led several program evaluation projects related to human resources in STEM, including developing guidelines for evaluating faculty and graduate student programs. She also served as Associate Professor of Sociology at New Mexico State University, where she was Principal Investigator of the ADVANCE: Institutional Transformation Program. Dr. Frehill received a bachelor’s degree in industrial engineering from General Motors Institute (now Kettering University), and both the M.A. degree in Sociology and the Ph.D. degree in Sociology, with a minor in Systems Engineering, from the University of Arizona.

HAMMOND, Cynthia Jackson

Cynthia Jackson Hammond is Provost and Vice President for Academic Affairs at Coppin State University. Dr. Hammond joined Coppin in 2010 and began several new academic initiatives designed to enhance retention and graduation rates, including the establishment of the Center for Undergraduate Research. She previously served as Dean of the School of Education and Human Performance at Winston Salem State University (WSSU). Dr. Hammond served on the faculty at the University of Louisiana in Monroe and held tenured professorships at both California State University, Dominguez Hills and Delaware State University. She also served as Assistant Dean for the School of Education at the University of North Carolina at Charlotte.

Dr. Hammond's experience and expertise is in curriculum design and assessment. She is member of the National Council for Accreditation of Teacher Education's Board of Examiners and has served as a consultant for teacher education programs in every region of the United States and in Guam. Additionally, she has worked to support males entering teacher education by arranging strong mentoring for males in the community and in academe. At WSSU, Dr. Hammond began *Real Men Teach*, a support program for male college students, to provide an opportunity for aspiring male teachers to become professionally prepared by developing their personal and academic strengths to become Teacher-Leaders. Dr. Hammond received a bachelor's degree in Communications Arts and English from Grambling State University; a master's degree in Communications and an Education Specialist degree in Educational Counseling from the University of Louisiana at Monroe; and the Ed.D. degree in Developmental Education, with a dual focus in Curriculum and Instruction and Student Services, from Grambling State University.

HOLLANDER, Rachelle

Rachelle Hollander is Director of the Engineering Center for Engineering, Ethics, and Society (CEES) at the National Academy of Engineering (NAE). Dr. Hollander also is a senior research scholar at the Institute for Philosophy and Public Policy at the University of Maryland, College Park. For several years, she directed science and engineering ethics activities at the National Science Foundation (NSF). Dr. Hollander has been instrumental in the development of the fields of research ethics and professional responsibility, engineering ethics, and ethics and risk management. She is currently principal investigator on two NSF-funded workshop grants and a grant to enhance the NAE Online Ethics Center (www.onlineethics.org) in CEES.

In 2006, Dr. Hollander received the Olmsted Award "for innovative contributions to the liberal arts within engineering education" from the American Society of Engineering Education's Liberal Education Division. On retiring from the NSF in 2006, she also received special acknowledgment for her professional contributions at the Association for Practical and Professional Ethics Annual Meeting and the American Association for the Advancement of Science (AAAS) Annual Meeting. Dr. Hollander is a Fellow of the AAAS and a member of the Electorate Nominating Committee of the Section on History and Philosophy of Science. She served as a Visiting Professor in the Science and Technology Studies Department at Rensselaer Polytechnic Institute and a Visiting Scholar in the Department of History of Science, Medicine, and Technology at The Johns Hopkins University. Dr. Hollander received the B.A. degree, summa cum laude, from Goucher College, and both the M.A. degree and Ph.D. degree in Philosophy from the University of Maryland, College Park.

JONES, DiOnetta

DiOnetta Jones is Associate Dean for Undergraduate Education and Director of the Office of Minority Education at the Massachusetts Institute of Technology (MIT). Ms. Jones plays a critical role in ensuring that the Institute develops and supports the overall success of all students, particularly those from underrepresented minority groups. Prior to this appointment, she was the Director of Diversity Programs for the College of Engineering at Cornell University. Ms. Jones also previously served as Director of Education, Training and Outreach at the National Consortium for Graduate Degrees for Minorities in Engineering and Science, Inc. (GEM). Before GEM, she was Statewide Associate Director for California's Mathematics Engineering and Science Achievement (MESA) Schools Program at the University of California, Berkeley.

Ms. Jones has received extensive recognition for her work in promoting diversity in engineering education as well as for mentoring, coaching, and advising. In 2010, she received the "Infinite Mile Award for Leadership" from MIT and the Office of the Dean for Undergraduate Education for the integral role she played in bringing together over 70 representatives from 17 different institutions to discuss "Working Together: conversations about improving the college experience and academic success of underrepresented minority students." Ms. Jones holds several national positions, including Director for Diversity Advancement for the Women in Engineering ProActive Network, Inc. (WEPAN); and Member of the Massachusetts' Governor's Diversity Subcommittee on STEM. She received the B.A. degree in Communications from Northwestern State University and the M.A. degree in Educational and Counseling Psychology from the University of the Pacific. She also has completed post-graduate course work in Education Administration and Theology.

LOUIS, Garrick

Garrick Louis is Associate Professor of Systems & Information Engineering and Associate Professor of Environmental Engineering at the University of Virginia (UVA). Before coming to UVA in 1997, Dr. Louis was a Green Design Post-doctoral Fellow at Carnegie Mellon University, a Warren Weaver Fellow in the Global Environment Division of the Rockefeller Foundation, and a faculty member at the State University of New York. He founded and directs the Design-in-Action Network that provides technical assistance to sanitation projects in rural communities. Dr. Louis also is the faculty sponsor for the UVA chapter of "Engineering Students Without Borders." He received an NSF CAREER Award and a 2000 NSF Presidential Early Career Award for Scientists and Engineers (PECASE) in recognition of his achievements in research and education.

Dr. Louis' research on sustainable infrastructure examines ways to assure sustained access to infrastructure-based services (water, sewage, solid waste, and energy) to communities, particularly low-income urban settlements, rural areas, and indigenous lands. He has developed a two-semester graduate course, Environmental Systems Management, taught in collaboration with faculty and students at selected universities in different countries. As a shared, year-long environmental project, students must solve a local sanitation service problem in one of the participating countries. Dr. Louis received the B.S. degree in Chemical Engineering from Howard University; the M.S. degree in Chemical Engineering from Rensselaer Polytechnic Institute; and the Ph.D. degree in Engineering and Public Policy from Carnegie Mellon University.

MILLIGAN, Michael K. J.

Michael Milligan is Executive Director of ABET, Inc. (formerly known as the Accreditation Board of Engineering and Technology), the premier accrediting organization for applied science, computing, engineering, and technology education worldwide. An experienced educator, engineer, team leader, scientist, project manager, and researcher, Dr. Milligan has been charged with developing a comprehensive strategic vision for ABET. He brings to ABET broad experience in business, government, and academe. Most recently, he led an Aerospace Corporation team of scientists, engineers, and support staff charged in the development of an environmental satellite for the National Oceanic and Atmospheric Administration at NASA Goddard Space Flight Center. Dr. Milligan also served as the Deputy Department Head and Associate Professor in the Department of Electrical Engineering at the United States Air Force (USAF) Academy.

During his career with the USAF, Dr. Milligan completed the Junior, Intermediate, and Senior Officer levels of the Professional Military Leadership School and attained the highest level of certification (Level III) from the Department of Defense Program Management in Systems Engineering, Research, and Development. He is a registered Professional Engineer in the State of Colorado; a senior member of ABET's largest member society, IEEE (the Institute of Electrical and Electronics Engineers); and is a member of Tau Beta Pi, the Engineering Honor Society. Dr. Milligan received the B.S. degree from Michigan State University; the M.S. degree from the University of Massachusetts at Lowell; and the Ph.D. degree from The University of Texas at Austin, all in Electrical Engineering. In addition, he holds an MBA degree from Western New England College.

NELSON, Phyllis

Phyllis Nelson is Professor of Electrical and Computer Engineering at California State Polytechnic University, Pomona, Co-Director of the Center for Macromolecular Modeling and Materials Design, and Director of the Advanced Technology Partnership Institute. Dr. Nelson's research interests include organic computing, complex systems, and interactive architecture; molecular dynamics simulations of the optical properties of solids; and optical spectroscopy of lanthanoid ions in solid hosts, solid-state lasers, photonic devices and systems, and LED-based lighting. She served previously as Senior Development Engineer in the Electrical Engineering Department at the University of California-Los Angeles.

Dr. Nelson also worked as Senior Scientist for Phraxos Research and Development Corporation where she participated in the development of novel electromagnetic materials and structures. Earlier, she was a member of the technical staff of TRW, Inc., where she worked on superconductive electronics. Dr. Nelson has published numerous scholarly papers in her field. She received the B.S. degree from California State Polytechnic University, the M.S. degree from the California Institute of Technology, and the Ph.D. degree from the University of California-Los Angeles, all in Electrical Engineering.

PIERRE, Percy

Percy Pierre is Professor in the Department of Electrical and Computer Engineering at Michigan State University (MSU). Dr. Pierre also directs programs to recruit, retain, and graduate students in the MSU College of Engineering, with an emphasis on underrepresented groups. His specific research interests are in the area of applications of stochastic models in engineering systems.

Dr. Pierre is recognized as the first African American to earn a doctorate in electrical engineering and, during his career, has served in a series of administrative posts in government and higher education. These include service as a White House Fellow in the Office of the President from 1969-70; Dean of the College of Engineering at Howard University in Washington, DC, from 1971-77; Assistant Secretary of the Army for Research, Development and Acquisition from 1977-81; President of Prairie View A&M University from 1983-89; and Vice President of Research and Graduate Studies at Michigan State University from 1990-95.

In 1973, Dr. Pierre chaired the National Academy of Engineering (NAE) Committee on Minority Engineering and later helped implement the recommendations of this Committee. He assisted in organizing and obtaining initial funding for several minority engineering organizations, including the National Action Council for Minorities in Engineering (NACME) and the National Consortium for Graduate Degrees for Minorities in Engineering and Science (GEM). Dr. Pierre's awards and honors include membership in the National Academy of Engineering; the 2008 Lifetime Mentors Award of the American Association for the Advancement of Science; and the NACME Founder's Award. He received both the B.S. and M.S. degrees in Electrical Engineering from the University of Notre Dame and the Ph.D. degree in Electrical Engineering from The Johns Hopkins University. Dr. Pierre also completed post-doctoral studies at the University of Michigan.

RUTLEDGE, Janet C.

Janet C. Rutledge is Vice Provost and Dean of the Graduate School at the University of Maryland, Baltimore County (UMBC). Dr. Rutledge also is a faculty member in the Computer Science and Electrical Engineering Department. Before coming to UMBC, she served as Program Director for the Graduate Research Fellowship Program at the National Science Foundation (NSF). At NSF, Dr. Rutledge also served as Program Director in the Division of Engineering Education and Centers, where she chaired the NSF-wide coordinating committee for the Faculty Early Career Development (CAREER) Program.

Dr. Rutledge also served on the faculty in the Electrical Engineering and Computer Science Department at Northwestern University, with an adjunct appointment in the Department of Communication Sciences and Disorders. Her primary research areas are modeling and compensating for the effects of sensorineural hearing loss and other communication disorders. Dr. Rutledge has been actively involved in many organizations, including serving on the IEEE Engineering in Medicine and Biology Administrative Committee and on the IEEE Committee on Engineering Accreditation Activities. The Rensselaer Alumni Association has recognized her several times for her service on their behalf. Dr. Rutledge received the B.S. degree in Electrical Engineering from Rensselaer Polytechnic Institute and both the M.S. and Ph.D. degrees in Electrical Engineering from the Georgia Institute of Technology.

APPENDIX D

Quality Education for Minorities (QEM) Network Workshop for Engineering Faculty on the Professional Development and Mentoring of Underrepresented Minority Graduate Engineering Students Four Points by Sheraton BWI Airport • Baltimore, MD • May 13-14, 2011

WORKSHOP EVALUATION SUMMARY

Number of Respondents: 38 (out of 40 participants - 95.0%)

Overall Workshop Ratings

(Percentage out of 38 respondents, where 1 respondent = 2.6%)

	Excellent	Very Good	Average	Fair	Poor	Did Not Respond
Organization	65.8%	31.6%	2.6%	0	0	0
Clarity of goals	52.6%	34.2%	7.9%	5.3%	0	0
Usefulness of assistance offered	42.1%	47.4%	10.5%	0	0	0
Potential Usefulness of materials provided	52.6%	39.5%	5.3%	0	0	2.6%
Length of workshop	42.1%	44.7%	10.5%	2.6%	0	0
Overall Rating of Workshop	55.3%	34.2%	10.5%	0	0	0

Evaluating the Workshop Experience

(Percentage out of 38 Respondents, where 1 respondent = 2.6%)

1. I have a better understanding of the issues that affect retention and degree attainment of graduate engineering students from underrepresented groups.		2. The best practices and strategies suggested were clearly presented.	
Strongly agree	52.6%	Strongly agree	52.6%
Agree	42.1%	Agree	44.7%
Neither agree nor disagree	0	Neither agree nor disagree	0
Disagree	5.3%	Disagree	2.6%
Strongly disagree	0	Strongly disagree	0
Did not respond	0	Did not respond	0
3. I can easily incorporate the best practices and strategies at my institution.		4. I have a better understanding of the role cultural competency plays in the retention of minority students in STEM fields.	
Strongly agree	23.7%	Strongly agree	57.9%
Agree	50.0%	Agree	36.8%
Neither agree nor disagree	23.7%	Neither agree nor disagree	5.3%
Disagree	2.6%	Disagree	0
Strongly disagree	0	Strongly disagree	0
Did not respond	0	Did not respond	0

**Evaluating the Workshop Experience
(Percentage out of 38 Respondents, where 1 respondent = 2.6%)**

5. The opportunity to discuss relevant issues with peers was useful to me.	
Strongly agree	63.2%
Agree	34.2%
Neither agree nor disagree	2.6%
Disagree	0
Strongly disagree	0
Did not respond	0

Which of the suggested strategies from the workshop are you most likely to implement when you return to your institution? Why do you think this strategy will be effective for your students?

Respondent #1: Understanding diversity/cultural competency.

Respondent #2: Providing ethics lessons. Focusing on cultural differences including those of the faculty. Providing networking suggestions to students and mentoring them to focus on various options for the future.

Respondent #3: Creation of URM mentoring seminar, curriculum development to educate faculty on diversity/mentoring and support -- present weekly at faculty lunch; cultural competency exam for faculty; "Why Go to Grad School" presentation to share to undergraduates; nice to see overview of variety of funding opportunities.

Respondent #4: Engaging senior well-funded faculty in diversity efforts; implementing formal mentoring program for graduate students.

Respondent #5: The mentoring program/strategies are of particular interest to me, and I expect that incorporation of these strategies will help underrepresented minority groups better adjust and feel part of the graduate and research environment at of college of engineering.

Respondent #6: Incentivizing policies and behaviors to broaden participation.

Respondent #7: Promoting networking is an area not addressed for our graduate students in my institution. I see the great potential in it and I will implement a roundtable discussion to expose the students and fellow faculty members to networking.

Respondent #8: Peer mentoring and dissertation house; graduate student success seminars.

Respondent #9: Tutoring of graduate students in the most problematic courses. I will propose that post-doc and research faculty be asked to provide tutoring for grad students for "extra" compensation.

Respondent #10: Of all of the topics, the one of mentoring resonated with me the most since I believe that is the easiest and most effective method to address representation in STEM.

Respondent #13: Cultural competency; mentoring; ethics.

Respondent #14: SBIR for innovation; international visits to improve cultural understanding.

Respondent #15: International mentoring and preparation for graduate school; providing alternate career pathways; coaching undergrads in the preparation of applications; developing a proposal to support these efforts. I am interested in preparing our students (undergrads) for success in higher tier institutions. I am interested in improving professional development opportunities for women.

Respondent #16: Cultural competency and support infrastructure for grad students.

Respondent #17: Mentoring and cultural competency. Mentoring will be effective because it will add a social support to the specific needs of the minority student.

Respondent #19: Dissertation house: our students need a lot of guidance besides their advisor in terms of their dissertations. I think such an approach might help build their confidence and improve the quality.

Respondent #20: Begin the discussion and be a champion for starting workshops and seminars in these areas.

Respondent #21: Entrepreneurship program and incubator for grad and undergrad; ways to implement retention of PhD students by setting up team building network and a person to deal with nonacademic issues.

Respondent #26: The idea of including a mentoring plan from the mentor in students' application packages will be included in our next proposal. Hold periodic meetings with mentors to share experiences and best practices.

Respondent #27: Facilitating students' preparation of career pathways using resources in packet and web resources mentioned by presenters in improving curriculum materials. Advice about mentoring strategies will help improve my own mentoring skills. Generally raising my own awareness will help me focus on next steps at my own institution. I will plan regular meetings with my colleagues who attended to brainstorm/monitor future programmatic endeavors at my home institution.

Respondent #28: Mentoring strategies within and across departments; providing networking/ career guidance counseling; creating a more supportive environment.

Respondent #30: Mentoring, because it will help to have students informed about their possibilities in graduate studies and also help to retain them once they have started.

Respondent #31: Cultural competence.

Respondent #33: I would like to make mentoring a more formalized process, for both graduate students and new faculty, or I plan to give some of the information to the instructor of our Graduate Seminar course, particularly with regard to networking and preparing for their careers. I am charged now with the responsibility to provide opportunities to students to present at workshops, etc.

Respondent #34: Networking and survival strategies for graduate students, especially conflict resolution. I will discuss with fellow faculty.

Respondent #35: I plan to work in retention and degree attainment.

Respondent #36: Pair up undergraduate minority students with graduate students. This strategy has the great potential to be successful due to somewhat continuous interaction between both advisee and advisor.

Respondent #37: Cultural competency: my institution is a designated MSI/HSI and this is very important.

Respondent #38: I like the culture discussion topic most. My department has a very diverse faculty team and our graduate students are from different countries with different cultural backgrounds. Encouraging faculty to better understand students' culture and maintain closer relationships with students will definitely help our students better along their path to career success.

Responses to “Did the workshop meet your expectations?”

Yes	No	Did Not Respond
35 (92.1%)	2 (5.3%)	1 (2.6%)

Specific things participants expected to gain from participation in the Engineering Faculty workshop:

Respondent #1: Networking; learning from success/failure stories.

Respondent #2: Past experience by other faculty and the things to look for.

Respondent #3: Are there unique considerations to take into account when mentoring URM students? Are there unique difficulties to be aware of when supporting URM students?

Respondent #4: Deeper insights and some new ideas.

Respondent #5: Strategies to enhance enrollment and retention of underrepresented minority students in graduate programs, ultimately to increase the graduation rate of these students.

Respondent #6: Concrete strategies.

Respondent #7: Share problems and solutions with fellow faculty from other institutions and taking away novel approaches and solutions.

Respondent #8: Funding opportunities; best practices in recruitment and retention.

Respondent #9: I looked forward to sharing the best practices with faculty from other institutions. I looked forward to discussions with other faculty about their experiences in mentoring good students for success.

Respondent #10: I expected the workshop to provide a broad collection of effective practices regarding the improvement of URM participation in STEM. I expect to practice the ones that seem most relevant to my institution's needs.

Respondent #13: Networking and seeing that others have similar problems and challenges and strategies for improving mentoring.

Respondent #15: Much stronger awareness of importance of mentoring; developing a network.

Respondent #17: Awareness of the issues that will enhance the participation of minorities.

Respondent #19: I expected to learn best practices related to underrepresented minority graduate student education.

Respondent #21: To hear best strategies from the institutions.

Respondent #26: Learn from more experienced professors and network with them in order to strengthen the mentoring practices at my institution.

Respondent #27: Ideas for moving forward on diversity issues at home institution. Meeting colleagues with similar interests/goals.

Respondent #28: More insight into roadblocks experienced by URM graduate students and potential routes around them.

Respondent #29: I expected to gain a better understanding about the issues affecting the development of URM graduate students.

Respondent #30: I was expecting to become aware of funding opportunities to start mentoring projects for my institution.

Respondent #31: Lots of good ideas to take back and try out. Knowledge of opportunities to fund new initiatives.

Respondent #33: How to mentor and motivate students. Why do minority students need special mentoring? What kinds of dialogue should I have with them?

Respondent #35: Proposal submission.

Respondent #36: Ways that I may adopt to increase the enrollment of minority students.

Respondent #37: New and readily implementable ideas on increasing mentoring effectiveness.

Respondent #38: Socialize with professors from other universities; network with them; seek and foster the opportunity of collaboration; listen to their successful stories.

Additional Comments:

Respondent #2: Include students. Students should also present their experiences.

Respondent #3: Some of the materials were repetitive so previewing materials in advance may reduce redundancy. However, sometimes things of importance should be stated more than once.

Respondent #4: Keep up the good work!

Respondent #5: In the Saturday morning group discussion session, it is my opinion that individuals or university groups should be allowed to present what their passions are with respect to this workshop. This should reflect which strategies would be implemented.

Respondent #6: This one was too long. Talks should be shorter. Avoid use of Saturdays as working days; we have almost no family time as it is now.

Respondent #7: If QEM workshop publishes a report on outcomes and recommendations, it will help us to take the report and convince our administrators to buy into it.

Respondent #8: Provide follow-through activities so that participants would take action after returning to their institutions. Activities could include: communicate with administrators (deans, chairs); surveys on progress made, awards achieved, etc. after having attended the workshop.

Respondent #9: The workshop was very well organized. I believe that the follow-up session with deans and faculty will be a success also. One idea, as far as the selection of department heads, is to choose from departments that have the lowest representation of URM's in their graduate programs as well as the ones with the highest representation. Everyone will benefit from the exchange.

Respondent #10: I am not so certain what role discussion in innovation and ethics plays with regards to the scope of the workshop. Less of this and more mixing in small groups would probably be better. I think that more interpersonal interaction would be better for the workshop.

Respondent #17: The workshop should reflect the long-term expectancy of the program, that is, 50% of the participants (at least) should be women.

Respondent #20: The lunch discussion questions were not specifically related to the theme of minority graduate students. The questions appeared to be general and just used to fill up time during the workshop.

Respondent #21: Excellent workshop; a long day.

Respondent #26: Evaluate individual presentations: could be useful to identify the best speakers and best presentations.

Respondent #27: More frequent breaks - sitting in the same seat for an extended period is tiring. Room with some windows for sessions also would be welcome. Especially liked the large amount of time for us to respond to presentations. Very helpful!

Respondent #28: The "reporting back from lunch" was not helpful at all; laundry lists of remarks were not stimulating. The relation of individual presentations to the overall objective of the workshop was not always clear. A stricter choreography and stronger role of panel leaders/chairs in maintaining the big picture would have been helpful. Include more short breakout sessions (30-40 minutes) to enhance interaction with as many other participants as possible.

Respondent #29: Longer breaks; more group (roundtable) discussions

Respondent #30: Day One could have been less loaded. You could drop out a couple of the talks to provide more time for interaction and break earlier before the dinner session so that the break would be at least one hour long.

Respondent #31: Excellent forum! You really opened my eyes.

Respondent #32: A good example of cultural competence was provided on the opening session Saturday morning - the confrontational approach to participants - who were present to learn and who gave up something else to participate - made a number of people uneasy and did not promote open discussion.

Respondent #33: I did not get much out of the group discussion on Saturday morning. I think it would have been better to ask institutions to take 15 minutes to discuss independently what they would like to implement at home, and then asking the group one question at a time and allow institutions to give input at will. This should result in more thoughtful responses, and would let people respond to components they are passionate about rather than a random component/question. Give examples of dialogue to have with students when mentoring them. "Say 'this,' not 'that.'" Perhaps set the scene at the beginning by asking participants why they are here - what problems do they want to resolve?

Respondent #34: Program too tight. Since most came in on Thursday, we could have moved some issues to Thursday afternoon (evening) and have more break time on Friday. I hope you will consider such an arrangement for the November follow-up. 8:30 Saturday session: Questions should be given in advance. More informative and helpful results will be achieved in such an approach.

Respondent #35: My appreciation to QEM Network for its efforts in providing mentoring and assistance in our projects.

Respondent #36: When you do a follow-up workshop, please ask all attendees to come prepared to discuss what was implemented since the last workshop.

Respondent #37: Role-playing could be explored.

Respondent #38: It would be nice if QEM workshops can help organize demonstration, discussion, tutoring on academic projects/research and achievements. Improving academic capability for HBCUs is equally important to the issues we are discussing in this workshop. HBCUs need to strengthen/enhance their academic capability, to promote them to a higher level.