SUMMARY REPORT  
On  
April 13-14, 2012 Workshop  

A Professional Development Workshop for Underrepresented Doctoral Engineering Students Supported through the National Science Foundation (NSF)’s Directorate for Engineering’s Graduate Research Diversity Supplements (GRDS)  

Four Points by Sheraton BWI Airport Hotel  
Baltimore, Maryland  

Prepared by  
The Quality Education for Minorities (QEM) Network  
Washington, DC  

June 2012
Quality Education for Minorities (QEM) Network
A Professional Development Workshop for Underrepresented Doctoral Engineering Students Supported through the National Science Foundation (NSF)’s Directorate for Engineering’s Graduate Research Diversity Supplements (GRDS)
Four Points by Sheraton BWI Airport Hotel, Baltimore, Maryland
Summary Report for
April 13-14, 2012 Workshop

Purpose of the Workshop
The purpose of the workshop was to provide information, guidance, and networking opportunities that support the workshop participants’ successful completion of their engineering doctoral degree programs and their transition to an engineering career.

Workshop Participants
Forty-eight (48) engineering doctoral students, whose research is being supported through the NSF Graduate Research Diversity Supplements (GRDS) Program, attended the workshop. Twenty-nine (29) participants were female and 19 were male. Based on information from the students’ registration forms, the total included 17 African Americans, three (3) American Indians, two (2) Asian Americans, 14 Caucasians, and twelve (12) Hispanics.

The table below gives the number of workshop attendees by race/ethnicity and gender.

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<th>Race/Ethnicity</th>
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<th>Female</th>
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Females represented 60% of the 48 workshop attendees, and males represented 40%. African American females were 35% or 6 of the 17 African Americans in attendance, and Caucasian females were 86% or 12 of the 14 Caucasians in attendance.

The participants represented 33 different institutions, nine (9) of which had more than one student attendee at the workshop. An alphabetical list of the participating institutions is given in the table below. The numbers in parentheses represent the number of students (two (2) or more) from the given institution.
**Participating Institutions**

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<tr>
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<td>Tufts University</td>
<td>University of Washington (7)</td>
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<td>University at Buffalo</td>
<td>University of Wisconsin-Milwaukee</td>
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<td>University of Arkansas (2)</td>
<td>Virginia Polytechnic Institute and State University (3)</td>
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<td>University of Arizona</td>
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**Day One: Friday, April 13, 2012**

**Opening Session**

In the Opening Session, Dr. Shirley McBay, President, QEM Network, welcomed the participants and congratulated them on their academic achievements thus far. She noted that the workshop was designed to reinforce the efforts of the students’ campus research mentors. GRDS broadens the participation of underrepresented students in Engineering Ph.D. programs through supplements to current NSF Engineering Directorate (ENG) research grants. Dr. McBay reminded the students that they should complete a GRDS survey and send it to QEM electronically.

The agenda for the workshop is given at Appendix A, and an analysis of the data from the GRDS survey is given at Appendix B.

Dr. Omnia El-Hakim, Program Director of Diversity and Outreach, National Science Foundation Directorate for Engineering, described National priorities and OneNSF Initiatives related to critical engineering research areas. The national priorities include:

- The National Nanotechnology Initiative and
- The National Robotics Initiative

OneNSF Initiatives include:

- Career Life Balance
- Interdisciplinary Research
- Advanced Manufacturing
- Communications and Cyberinfrastructure
- Sustainability and Clean Energy
Following the Opening Session, QEM consultants and NSF staff made presentations on various topics related to graduate student professional development. The topics discussed and the session presenters for Day One are listed below, with the page number where relevant comments can be found.

### DAY ONE, FRIDAY APRIL 13, 2012

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<td>Dr. Monica Cox, Associate Professor of Engineering Education, Purdue University, and QEM Consultant</td>
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<td>Mentoring: Respective Roles and Responsibilities: Building and Sustaining a Support Network for Degree Attainment and Career Transition</td>
<td>Dr. Martha Centeno, Senior Executive Consultant, Dodd Consulting Group, Miami, and QEM Consultant</td>
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<td>Involvement in Scholarly Activities: Publishing, Participation in Professional Engineering Societies, Presentations at Professional Meetings</td>
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<td>Dr. George Hazelrigg, Deputy Division Director, Division of Civil, Mechanical, and Manufacturing Innovation, Engineering Directorate, National Science Foundation</td>
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<td>Engineering Directorate Division-focused Breakout Discussion Groups</td>
<td>QEM Consultants (Centeno, Blake, Harris and Cox)</td>
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<td>Career-Life Balance Challenges and Opportunities</td>
<td>Dr. Wanda Ward, Senior Advisor, Office of the Director, National Science Foundation (NSF)</td>
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<td>Preparing and Implementing a Career Development Plan</td>
<td>Dr. Tequila Harris, Assistant Professor, Woodruff School of Mechanical Engineering, Georgia Institute of Technology, and QEM Consultant</td>
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<td>Developing Effective Negotiating, Communication, and Leadership Skills</td>
<td>Dr. Janet Rutledge, Vice Provost and Dean of the Graduate School, and Dr. Renetta G. Tull, Assistant Dean for Graduate Student Development, University of Maryland Baltimore County</td>
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<tr>
<td>Lessons for Life and Business</td>
<td>Dr. Calvin Mackie, Managing Partner of Channel ZerO Group LLC, Entrepreneur, Author, and Inventor</td>
<td>11</td>
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<tr>
<td>Broadening Participation in Engineering: Ways GRDS Students Can Get Involved</td>
<td>Dr. Omnia El-Hakim, NSF</td>
<td>12</td>
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Highlights of Discussions (Day One)

Presentation by Dr. Monica Cox, Associate Professor of Engineering Education, Purdue University, and QEM Consultant
Topic: Staying on Track—Getting a Doctorate in Engineering: Sustaining Positive Attitude, Assertiveness, and Persistence

Dr. Cox emphasized that success is no accident. She urged participants to identify strategic relationships regardless of disciplinary boundaries and to find partnerships outside their institutions. Participants also were urged by Dr. Cox to keep a research journal and to link their ideas (especially from classes) to potential research questions. She noted that the students should identify alignments between their ideas and significant local, national, and international initiatives to develop future funding ideas.

Dr. Cox recommended that participants create short- and long-term plans for their research, teaching, and service. These might include the students’ goals for the year; resources needed to reach these goals; resources available at their institutions; and leveraging of current resources. She gave several examples of enterprises in which the participants might engage in the future (e.g., as managers, inventors, leaders, course developers, authors, proposal writers, administrators, and entrepreneurs).

In selecting a mentor, Dr. Cox advised the students to:
• Identify someone with whom they are compatible;
• Identify areas in which they might be weak, and open to constructive criticism;
• Look for mentors at academic conferences, at professional development meetings, or even on the Internet; and
• Find their “bad day” buddies (persons with whom they can talk when having a “bad day.”

She emphasized the importance of students maintaining both academic and personal balance as they pursue their goals. Dr. Cox also discussed the expectations of Engineering Ph.D.s and pointed out that expectations involve both traditional and non-traditional skills. Traditional skills include: translating theory to practice, problem solving, conducting research, modeling tools for decision-making, and writing proposals. Non-traditional skills include: leadership, accountability, independent thinking, collaborating with diverse teams, mentoring, managing people, understanding the needs of customers, and being innovative.

Presentation by Dr. Martha Centeno, Senior Executive Consultant, Dodd Consulting Group, Miami, and QEM Consultant
Topic: Mentoring: Respective Roles and Responsibilities: Building and Sustaining a Support Network for Degree Attainment and Career Transition

Dr. Centeno provided an overview of mentoring. She characterized the mentoring relationship as ongoing and featuring learning, dialogue, challenges, and nurturing. She
noted that mentoring for doctoral students is focused on Ph.D. attainment and preparation for careers. At this stage the mentor is an advisor, supporter, tutor, supervisor, trainer, sponsor, and role model. The students’ roles are to know their strengths and weaknesses and to be proactive in the mentoring relationship.

Dr. Centeno emphasized the importance of developing and following a scholarly productivity plan and developing professional networks. She provided information on these as well as time management strategies. Dr. Centeno also recommended that students use a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis to guide their planning and suggested that mentors could be particularly helpful in discerning opportunities and threats. Early career faculty should select mentors as well, especially a senior faculty member in their department and a research mentor.

Dr. Centeno was asked for advice regarding the development of nurturing skills. She responded that listening is critical as well as paying attention to detail. Mentors should listen to what students are saying and observe their body language. They also should recognize and overcome cultural bias that might influence their attitude toward a particular student. Students should examine their own biases and expectations.

Presentation by Dr. M. Brian Blake, Associate Dean of Engineering, Research, and Graduate Studies, Professor of Computer Science, University of Notre Dame, and QEM Consultant

Topic: Involvement in Scholarly Activities: Publishing, Participation in Professional Engineering Societies, Presentations at Professional Meetings

Dr. Blake discussed the motivation for being involved in scholarly activities, and offered a number of motivating factors, including the following:

• Recognition that the best way to understand one’s work is to articulate it in a format that outsiders can understand;
• The opportunity to receive feedback regarding activities that might enhance one’s scholarly directions before and after graduation;
• Opportunities to have the community and potential employers get a preview of one’s work; and
• The realization that publishing one’s dissertation is not enough.

Dr. Blake noted that new faculty candidates at his institution (Notre Dame) have 12-20 published papers but emphasized that quality, not merely the number of papers, is the key to success in publishing papers.

In discussing where, when, and what to publish, Dr. Blake made the following suggestions: In Year 1, focus on survey papers, review papers, and abstracts; in Years 2-4, focus on presentations, workshop papers, and conference papers; and in Years 5-6, focus on doctoral consortia, journal papers, book chapters, and the dissertation. He cautioned that book chapters are acceptable but are not as well-regarded as journals and are not always refereed. Dr. Blake also discouraged co-authoring/editing books as a
student or as an assistant professor. He advised the participants not to be afraid to share their work, to make a publication plan, and to concentrate on the quality of publications while continuing to be productive.

Presentation by Dr. George Hazelrigg, Deputy Division Director, Division of Civil, Mechanical, and Manufacturing Innovation, Engineering Directorate, National Science Foundation

Topic: Proposal Development

Dr. Hazelrigg gave a detailed presentation on NSF Proposal Development. He began by noting that scientific research must be methodical, repeatable, and verifiable. “Methodical” means one can specify in advance of the research a method to accomplish one’s objectives. “Repeatable” means that the research is not a random event (it can be repeated), and “Verifiable” means there is tangible evidence of the research results.

Dr. Hazelrigg gave the following Do’s and Don’ts for proposal developers:

Do’s:

- Have a strategic plan;
- Build on your strengths;
- Differentiate your proposal from your Ph.D. thesis work and other sponsored work;
- Perform a thorough literature search and conduct exploratory research before writing the proposal; and
- Read the NSF Grant Proposal Guide (GPG).

Don’ts:

- Rush;
- Wait until the last minute (one month) to contact NSF program directors;
- Make the proposed work (research and education) too broad;
- Make the proposed work too narrow;
- Ask for too much (or too little) funding; and
- Ignore rules in the NSF Grant Proposal Guide (GPG) and miscellaneous items (Violation of GPG rules will result in a return of the proposal without review.)

Dr. Hazelrigg emphasized that reviewers want to know four things:
(1) What the proposal is about (the research objective);
(2) How will you do it (the technical approach);
(3) If you can do it (you and your facilities); and
(4) Is the research worth doing (intellectual merit and broader impacts).

He reminded the group that NSF looks for proposals that are: (1) innovative and push the frontiers of knowledge; (2) contribute to national needs and priorities; (3) go beyond general research margins; and (4) integrate research and educational goals; NSF does not support (except as incidental to the goals of the award) developmental efforts; computer
programming; design projects; or commercialization.

**Engineering Directorate Division-Focused Breakout Discussion Groups**

Following Dr. Hazelrigg’s presentation, the workshop participants broke into four Engineering Division–focused discussion groups. Each breakout session was led by a QEM consultant (Drs. Centeno, Blake, Harris, and Cox). The breakout sessions included brief discussions by students of their Graduate Research Diversity Supplements (GRDS)-supported research; how to get research results published; how to become actively involved in professional organizations; and strategies for building a support network.

**Group Led by Dr. Martha Centeno, QEM Consultant**

Dr. Centeno challenged the students to prepare eight (8) papers, seven (7) of which should list them as first author. She noted, preferably, the papers should be published in journals. Some students expressed interest in knowing how to select the right journal. Dr. Centeno advised them to check the journal’s reputation, its impact factor, and its publication guidelines. She also recommended asking research professors and mentors about journal selection.

To achieve their publishing goals, Dr. Centeno urged the students to carefully balance their time and negotiate responsibilities with their advisor. Several students asked for advice on overcoming the challenge of not speaking English as a first language. Dr. Centeno suggested these students ask their peers, who are native English speakers, to review their work. A number of students reported their peers were very willing to assist in this area.

Dr. Centeno recommended that at this point in their careers students should carefully choose their professional society activities. Attending dinner meetings and providing laboratory tours for pre-college students add little time but still provides service to the society. Serving as a reviewer for articles in society publications can provide valuable experience and exposure to the profession as well. Dr. Centeno expressed her preference for choosing a professional society based on research foci rather than on gender issues. She advised students to start building professional networks at small conferences and to prepare, prior to the conference, copies of their biographical information and a research abstract. Dr. Centeno noted that professional networks can provide support, research affinity, contacts with industry, access to funding sources, and insights about other academic institutions and departments.

**Group Led by Dr. M. Brian Blake, QEM Consultant**

At the start of this breakout session, Dr. Blake asked each student to give his/her name, institution, and the type of research in which he/she is engaged. He also asked whether the student had published a paper or was planning to publish soon. The students listed research areas in several engineering fields. The areas included: invisible lighting communication; identification of strategies to maximize energy resources; nanowires;
lowering power consumption and reducing impediments; biogenesis; and water and energy models.

Four students reported they had published at least one paper. One student stated he/she had recently presented a paper at a conference for which he/she was the first author.

The group also discussed early career opportunities, including postdoctoral appointments and serving as Visiting Assistant Professors. Dr. Blake noted that expectations are higher for postdocs than for visiting professors. He urged the students to learn to be good teachers and emphasized that assessing good teaching usually comes down to demonstrated caring for students. Dr. Blake suggested that initially new faculty should teach sections of a particular course as a member of a team.

**Group Led by Dr. Tequila Harris, QEM Consultant**

The students in this group were further along in their programs (3-5+ years) and were expected to have a better idea of how to proceed with their research and achieve the overall goals.

Dr. Harris asked the students to think about their research in specific terms (e.g., what are they measuring, and what are they testing). They also should think about what gap their research fills and what contributions it makes to the field. Dr. Harris assisted the students in identifying and expressing the gaps their research aims to fill. She noted that they might have to go outside their specific interest/field to find funding or research opportunities. Dr. Harris encouraged the students to learn how to present their research/proposals by describing their goals, objectives, and expected benefits simply and quickly.

She told the students to give presentations at professional meetings and to discuss professional advancement opportunities and professional societies with their mentor/advisor. Dr. Harris cautioned the students that mentors and advisors are not necessarily the same, and students should be clear about their expectations for each.

**Group Led by Dr. Monica Cox, QEM Consultant**

Dr. Cox asked the students about their thoughts on publishing. Some students remarked that the number of publications mentioned by Dr. Blake (10-12) was very high. They wondered about the quality of the publications and how one gets the extra data for so many publications. Dr. Cox gave an example of a student who had built up her research portfolio by volunteering to serve on several research teams at the same time.

She advised the students not to be afraid to publish negative results (what does not work) and should gauge which publications are related to their fields. Dr. Cox emphasized that the hardest part of publishing a paper is getting started with the writing. According to Dr. Cox, students should understand that they have to write to different audiences and should practice writing at least 30 minutes a day. She cautioned the students not to cut
and paste a conference paper into a journal paper, and not to assume their documents/manuscripts are perfect with no changes necessary.

**Presentation by Dr. Wanda Ward, Senior Advisor, Office of the Director, National Science Foundation (NSF)**

**Topic: Career-Life Balance Challenges and Opportunities**

Dr. Ward began her presentation by framing the broad issues that have catalyzed the recent NSF Career-Life Balance (CLB) Initiative, including the Nation’s diminishing global competitiveness in science and engineering. She presented data showing the significant underrepresentation of women, especially minority women in STEM. While women are exceeding their male colleagues in Ph.D. attainment, they are not entering academic careers or achieving the rank of full professor at a comparable rate. NSF’s CLB Initiative is implementing policies and programs that take the family-life situation into account.

According to Dr. Ward, the agency-wide NSF CLB initiative spans pathways across higher education and career levels, with initial implementation in NSF CAREER and postdoctoral programs. Expansion is planned to NSF’s ADVANCE and Graduate Research Fellowship (GRF) programs. The current focus is on deferred project start dates for child birth/adoption; no-cost extensions for parental leave; support for replacement research technicians; virtual panels; and education and training in CLB for NSF program officers and reviewers. Dr. Ward also reported that NSF is working with higher education institutions, federal agencies, and STEM professional societies to communicate and foster best practices in CLB.

Follow-up comments included the suggestion that a CLB institutional plan be required for proposal submission similar to the postdoctoral mentoring plan. Dr. Ward noted that CLB success would depend on a change in academic culture.

**Presentation by Dr. Tequila Harris, Assistant Professor, Woodruff School of Mechanical Engineering, Georgia Institute of Technology, and QEM Consultant**

**Topic: Preparing and Implementing a Career Development Plan (CDP)**

Dr. Harris noted that the purpose of the CDP is to provide a framework for planning and monitoring the steps being taken to receive a doctoral degree in engineering and to begin an engineering career. She advised the students to think critically about their imminent and future goals and be able to answer the following questions about themselves:

- What are you passionate about? (This will help keep you focused.)
- Why are you pursuing a doctorate? (This will motivate you to meet your milestones.)
- What type of working environment do you enjoy? (This will help you decide where you will begin your career and thus aid the decisions you make or goals you seek while completing your degree.)
Dr. Harris also discussed how students can identify promising postdoctoral opportunities. She suggested that they know the professional development opportunities offered by and resources available at the institution, including equipment and facilities. Dr. Harris urged the students to be specific in defining their goals, to provide viable solutions/milestones to achieve these goals, to revisit their CDP often, and to update it as needed.

**Concurrent Breakout Discussion Groups (Career Development Plans)**

This breakout session featured students’ discussion of their Career Development Plans (CDP) and feedback from QEM consultants and their peers. Students shared and received advice on the following career development questions:

1. **Who should be asked to write letters of recommendation for the student?**  
   **Response:** A member of the student’s dissertation committee, his/her advisor, and an active member of the student’s professional society.

2. **How can students gain exposure and experience in different career sectors?**  
   **Response:** Internships and fellowships can offer exposure and experience.

3. **What should students take into consideration in making initial career choices?**  
   **Response:** In industry, ensure that publishing is not neglected; in a postdoctoral appointment, keep focus on research, not on teaching; and ensure that you corroborate classified research experiences.

4. **What can students do to improve their communication skills?**  
   **Response:**  
   - Take a writing course in the Business School;  
   - Use peer practice sessions to address presentation skills;  
   - Use video to practice presentation skills; and  
   - Learn the basic software tools for writing and citations.

5. **What guidance can be offered for productivity in research and publications?**  
   **Response:** Divide broad ideas into tractable questions.

6. **Should doctoral students focus on participation in large or small conferences?**  
   **Response:**  
   - Doctoral colloquia are good choices;  
   - Funding to participate may be available from professional societies and/or honor societies; and  
   - Practice poster presentations and have a brief “take away” piece available.
Presentation by Dr. Janet Rutledge, Vice Provost and Dean of the Graduate School, and Dr. Renetta G. Tull, Assistant Dean for Graduate Student Development, University of Maryland Baltimore County

Topic: Developing Effective Negotiating, Communication, and Leadership Skills

Dr. Rutledge addressed building communications skills, including speaking, writing, listening, and being aware of non-verbal cues. She and Dr. Tull engaged students in a brief communications exercise in which two-person teams worked to replicate an assigned drawing. One student verbally described the shape while the second student followed the description to draw the picture. Dr. Rutledge described specific strategies for improving communication, including active listening, doodling, taking notes, asking questions, re-phrasing what is said, and being aware of non-verbal cues.

She discussed communication with an advisor/mentor and recommended that students understand their professional relationship to him/her. Dr. Rutledge gave examples of advisor/mentor actions that indicate appreciation for good work as well as actions that could mean he/she is not pleased with the effort.

Dr. Rutledge advised that, when networking, students know what they want and why they want it and understand what is important to the other person and what they realistically can provide. She urged students to prepare in advance for negotiations and to recognize that they see only a portion of the professional and personal activities of their advisor/mentor.

Dr. Rutledge concluded by citing characteristics of a leader in academe and barriers to achieving that success. The characteristics included publishing in top journals; receiving research funds from respected sources; receiving scholarly awards and recognition; and being an innovator in teaching. Dr. Rutledge advised students to find their professional and personal happiness, to take immediate steps if they are not happy, and to understand that “we can have it all but maybe not all at one time.”

Presentation by Dr. Calvin Mackie, Managing Partner of Channel ZerO Group LLC, Entrepreneur, Author, and Inventor

Topic: Lessons for Life and Business

Dr. Mackie described his early experiences with education and engineering as a student, as a professor, and as an entrepreneur. While attending a college recruitment fair in New Orleans, Dr. Mackie approached recruiters for the Georgia Institute of Technology (Georgia Tech), but was directed to recruiters from Morehouse College after he expressed an interest in majoring in engineering. He later earned, through a dual degree program between Morehouse College and Georgia Tech, a Bachelor’s degree in Mathematics from Morehouse and a Bachelor of Mechanical Engineering degree from Georgia Tech; and both a Master of Science and a Ph.D. degree in Mechanical Engineering from Georgia Tech.
Dr. Mackie described how he was able to succeed academically despite starting his college education in a remedial reading course. He told the group that he grew up in a home with no books. He also shared his experiences and those of his family as a result of Hurricane Katrina. He noted that because of Katrina, many of his New Orleans relatives had to move into his home, and he had to take care of them. Prior to Katrina, Dr. Mackie was a tenured Associate Professor of Engineering at Tulane University. However, he lost his position after Tulane decided to discontinue its engineering program because of the damage caused by Katrina. Dr. Mackie said because of hope he was able to overcome these barriers and become an entrepreneur.

**Presentation by Dr. Omnia El-Hakim, NSF, at Working Dinner**

**Topic: Broadening Participation in Engineering: Ways GRDS Students Can Get Involved**

Dr. El-Hakim introduced engineering research themes critical to the Nation’s challenges and used a “Systems Dynamics Model” to depict the impact of the Nation’s growing population of underrepresented minorities; the imminent retirement of Baby Boomer engineers; and Underrepresented Minorities (URMs) attrition in attainment of engineering degrees. She described the NSF Engineering Directorate’s Broadening Participation Research Initiation Awards in Engineering (BRIGE) and Graduate Research Diversity Supplements (GRDS) programs and their role in addressing these dynamics. She reviewed BRIGE achievements in engaging more URMs in K-12, undergraduate, and graduate engineering programs and noted that the GRDS program has served both women and URMs.

She cited steps for improving these efforts, including broadening participation workshops and efforts at the departmental level; targeting recruitment and retention of minority faculty; efforts at community colleges; and career-life balance policies at universities. Dr. El Hakim noted that the workshop participants will have an opportunity to make specific suggestions for what GRDS students can do now to broaden participation in engineering.

**Day Two: SATURDAY, APRIL 14, 2012**

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<td>ENG Division-focused Breakout Discussion Groups</td>
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<td>Strategies for Building Research and Outreach Collaborations with Engineering Doctoral Students and Faculty at Minority-serving Institutions</td>
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Reports on Key Points from Breakout Groups’ Discussion of Broadening Participation Strategies and Requirements for Successful Implementation of these Strategies

At these breakout groups, the students discussed strategies they can use to help further diversify the pool of potential engineering students. Student recorders were selected to report the results of the breakout groups to the full group. The breakout groups also examined requirements for successful implementation of these strategies (e.g., having a clearly defined target audience; estimating time and resources required; and identifying measures of success and potential funding sources).

Breakout Group I

Strategies Suggested by the Group:

• Begin in middle school
• Conduct visits to K-12 schools by underrepresented minority engineers
• Establish partnerships with K-12 teachers
• Work with broadening participation experts
• Provide financial information to students earlier and make it available at a designated web site
• Volunteer with ongoing diversity-focused programs on campus
• Engage majority/minority teams in diversity-focused activities

Breakout Group II

Strategies Suggested by the Group:

• Define engineering careers
• Conduct Science Exploration Day
• Provide support for minority-focused professional society chapters
• Become involved in existing diversity-focused programs
• Change institutional policy to provide pay for tutors
• Legitimize graduate student time spent with undergraduates and faculty time spent with graduate students (Dr. Brian Blake noted that some programs provide mentors with Technical Assistance (TA) credit.)
• Have more accountability for outreach and education efforts at NSF-funded research centers

Breakout Group III

Strategies Suggested by the Group:

• Conduct summer camp programs for students interested in engineering
• Provide prospective students with day trips to industries
• Promote early exposure to careers in engineering, e. g., the children’s book, *Engineering Elephants* by Emily Hunt and Michelle Pantoya
• Develop a “Future Engineer” kit for pre-college students
• Send engineering students to do outreach at their former high schools
• Take full advantage of industry requirements/incentives for employees to volunteer
• Invite K-12 teachers to spend time in engineering research laboratories (as in the Georgia Institute of Technology Georgia Intern Fellowships for Teachers (GIFT) Program)
• Evaluate broadening participation efforts

**Breakout Group IV**

**Strategies Suggested by the Group:**

• Conduct seminars regarding engineering for high school students
• Visit high schools to talk with students and teachers about engineering
• Invite guidance counselors to participate in engineering outreach activities
• Make parents aware of available funding for students
• Conduct day trips to industrial sites related to engineering for pre-college students
• Bring high school students to a university to take Advanced Placement courses

**ENG Division-focused Breakout Discussion Groups**

The students discussed their revised Career Development Plans with QEM Consultants.

**Highlights of Speech by Dr. Eugene DeLoatch, Dean, School of Engineering, Morgan State University**

**Topic: Strategies for Building Research and Outreach Collaborations with Engineering Doctoral Students and Faculty at Minority-Serving Institutions**

Dr. DeLoatch noted that the students’ presence at the workshop could not have happened in the recent past, and that they are now members of a group that must be competitive on a global basis. Dr. DeLoatch told the students, “You are on the cusp of something that is changing the world dramatically.” He mentioned a number of minorities who helped set the foundation for what is happening today in engineering and designated them as Trail Blazers. The Trail Blazers included:

• Dr. Percy Pierre, the first African American to receive a doctorate in engineering;
• Dr. John Slaughter, Former Director of the National Science Foundation and Former President and CEO of the National Action Council for Minorities in Engineering (NACME); and
• Dr. Shirley Jackson, President of Rensselaer Polytechnic Institute.
Dr. DeLoatch asked “How did these people become extraordinary”? He responded by noting they not only were doing something for themselves but also for someone else. Dr. DeLoatch said he was excited that “women outnumbered men in the room.” If the U.S. is going to be a player on the global scene, according to Dr. DeLoatch, the Nation must have a diversified workforce that includes underrepresented minorities and women in significant numbers. It is because of engineers that we are improving everyday.

Dr. DeLoatch noted that Maryland is a top state for technology, but only 5% of Maryland high school graduates will go into engineering. He mentioned an effort at his institution that focused on getting more high schoolers in engineering. In this program, engineering college students and engineering “super stars” talk with high schoolers about what engineers do and encourage them to pursue a career in engineering. Dr. DeLoatch thanked the students for what they are doing now and asked them to consider other things they can do to help diversify the Nation’s engineering workforce.

Next Steps

QEM will distribute this report electronically to the workshop participants, presenters, consultants, NSF Engineering Directorate Program Directors, and the campus Principal Investigators (PIs) who are supporting the students’ research through Graduate Research Diversity Supplements.

The participating students are expected to share their revised Career Development Plans (CDPs) with their mentors and discuss any changes in the plans made following the GRDS workshop. Students also were encouraged to discuss with their mentors any recommendations the students have regarding what can be done to help broaden the participation of underrepresented groups in engineering. The strategies identified by students in the Saturday morning breakout sessions on broadening participation provide a strong basis for further discussion and action.
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April 13-14, 2012

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April 13-14, 2012

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## APPENDIX A

**A Professional Development Workshop for Underrepresented Doctoral Engineering Students Supported through the National Science Foundation (NSF)’s Directorate for Engineering’s Graduate Research Diversity Supplements (GRDS)**

Four Points by Sheraton Hotel at BWI Airport
7032 Elm Road • Baltimore, MD • 410/859-3300

APRIL 13-14, 2012

Workshop Purpose: To provide information, guidance, and networking opportunities that support the participants’ successful completion of their engineering doctoral degree programs and their transition to an engineering career.

Note: All Plenary Sessions will take place in Chesapeake Ballroom.

### FRIDAY, APRIL 13

<table>
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<tr>
<th>AM</th>
<th>Time</th>
<th>Session</th>
<th>Location</th>
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<tbody>
<tr>
<td>8:00</td>
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<td><strong>Continental Breakfast and Registration</strong></td>
<td>Chesapeake Foyer</td>
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<td>8:30</td>
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<td><strong>Welcome and Introductions</strong></td>
<td>Chesapeake Ballroom</td>
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<td></td>
<td></td>
<td>- Review of the Workshop’s Purpose and Agenda</td>
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<td>- Review of Workshop Packet Contents</td>
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<td></td>
<td></td>
<td>Shirley McBay, President, Quality Education for Minorities (QEM) Network</td>
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</tbody>
</table>
| 8:45|       | **Overview of the National Science Foundation and the Directorate for Engineering**  
|     |       | - Purpose of Graduate Research Diversity Supplements                     |                   |
|     |       | Omnia El-Hakim, Program Director of Diversity and Outreach               |                   |
|     |       | Office of the Assistant Director (OAD), Directorate for Engineering (ENG) |                   |
| 9:15|       | Plenary Session: Staying on Track - Getting a Doctorate in Engineering: Sustaining Positive Attitude, Assertiveness, and Persistence |                   |
|     |       | Monica Cox, Associate Professor of Engineering Education, Purdue University, and QEM Consultant |                   |
|     |       | Audience Questions and Comments                                          |                   |
| 10:00|      | Plenary Session: Mentoring: Respective Roles and Responsibilities; Building and Sustaining a Support Network for Degree Attainment and Career Transition |                   |
|     |       | Martha Centeno, Senior Executive Consultant Dodd Consulting Group, Miami, and QEM Consultant |                   |
|     |       | Audience Questions and Comments                                          |                   |
| 10:30|      | Refreshment Break                                                        | Chesapeake Foyer  |
| 10:45|      | Plenary Session: Involvement in Scholarly Activities: Publishing, Participation in Professional Engineering Societies, Presentations at Professional Meetings |                   |
|     |       | M. Brian Blake, Associate Dean of Engineering, Research and Graduate Studies, Professor of Computer Science and Engineering, College of Engineering University of Notre Dame, and QEM Consultant |                   |
|     |       | Audience Questions and Comments                                          |                   |
11:30  
**Plenary Session: Proposal Development**  
George Hazelrigg, Deputy Division Director  
Division of Civil, Mechanical & Manufacturing Innovation (CMMI), ENG  
*Box Lunches Available*  
Chesapeake Foyer

**PM**

1:30  
**ENG Division-focused Breakout Discussion Groups** – (See Assignment Sheet)  
Engineering Program Officer and QEM Consultant, Co-facilitators  
**Focus:** Brief discussions by students of their GRDS-supported research  
- How to get research results published  
- How to become actively involved in professional organizations  
- Strategies for building a support network

2:30  
**Plenary Presentation: Career-Life Balance Challenges and Opportunities**  
Wanda Ward, Senior Advisor, Office of the Director, NSF

3:15  
**Refreshment Break**

3:30  
**Plenary Session: Preparing and Implementing a Career Development Plan (CDP)**  
Tequila Harris, Assistant Professor  
Woodruff School of Mechanical Engineering  
Georgia Institute of Technology, and QEM Consultant  
*Audience Questions and Comments*

4:00  
**Breakout Discussion Groups** (Students discuss their CDP drafts and obtain feedback from Engineering Program Officers and QEM Consultants)

5:00  
**Plenary Session: Developing Effective Negotiating, Communication, and Leadership Skills**  
Janet Rutledge, Vice Provost and Dean of the Graduate School  
University of Maryland, Baltimore County  
*Audience Questions and Comments*

5:45  
**Plenary Session: Lessons for Life and Business**  
Calvin Mackie, Managing Partner of Channel ZerO Group LLC, Entrepreneur, Author, and Inventor, New Orleans, LA

6:45  
**Working Dinner with Keynote Presentation**  
**Crane C**  
**Topic:** Broadening Participation in Engineering: Ways GRDS Students Can Get Involved  
**Speaker:** Omnia El-Hakim, OAD, ENG

8:00  
**Adjournment**

8:00-10:30  
**Lounge Available to Facilitate Networking**  
Carlton

*Overnight Assignment:* Students revise their CDPs based on feedback and workshop discussions
SATURDAY, APRIL 14

AM

8:15  Breakfast Buffet

8:45  ENG Division-focused Breakout Discussion Groups (with selected GRDS Students assigned to serve as Discussion Facilitators and Recorders)

**Focus:** GRDS Students discuss strategies they can use to help further diversify the pool of potential Engineering students and requirements for successful implementation of these strategies (e.g., having a clearly defined target audience; estimating time and resources required; and identifying measures of success and potential funding sources)

9:45  Plenary Session: Reports on Key Points from Breakout Groups’ Discussion of Broadening Participation Strategies and Requirements for Success

10:30 Refreshment Break

10:45 ENG Division-focused Breakout Discussion Groups

**Focus:** Students discuss their revised Career Development Plans with Consultants and Program Officers (students are expected to share their revised CDPs with their GRDS mentors when they return to campus)

NOON/PM

12:00 Buffet Lunch

12:30 Plenary Session: Strategies for Building Research and Outreach Collaborations with Engineering Doctoral Students and Faculty at Minority-serving Institutions

**Speaker:** Eugene DeLoatch, Dean, School of Engineering Morgan State University

1:30 Discussion by Participants of their Next Steps

Closing Comments from Program Officers and Consultants

2:30 Adjournment
Quality Education for Minorities Network (QEM)

Graduate Research Diversity Supplements (GRDS) Survey Report
Data Analysis
Spring 2012

Overview of the Survey of GRDS Participants

The survey consisted of five sections: (I) The Participant’s Mentoring Plan; (II) Professional Development Activities; (III) Outreach/Broadening Participation Activities; (IV) Career Plans Following Graduation; and (V) Ways to Enhance the Experiences of GRDS Students. The data in the survey reflect the responses from students who registered for the GRDS workshop held in Baltimore, Maryland, on April 13-14, 2012.

I. The Participant’s Mentoring Plan
Results of responses to questions from the survey regarding the students’ mentoring plans are given below.

Question 1: Has your GRDS Principal Investigator/Mentor discussed with you a detailed mentoring plan that clearly defines, with metrics or timelines, his/her expectations for your progress?

Response: 73% answered “Yes” and 27% answered “No.”

Question 2: How often do the two of you discuss the plan and the extent to which planned activities are occurring?

Response: 29% responded “Weekly”; 26% responded “Biweekly”; 11% responded “Monthly”; 24% responded “Each Quarter/Semester”; and 11% responded “Annually.”

Question 3: How satisfied are you with the plan presented to you?

Response: 50% of the respondents were “Very Satisfied”; 45% were “Satisfied” and 5% were “Not Satisfied.”

Question 4: Were you provided an opportunity to suggest changes to the plan?

Response: 89% responded “Yes” and 11% responded “No.”

Question 5: Are you satisfied with how the Mentoring Plan is being implemented?

Response: 92% of respondents answered “Yes” and 8% answered “No.”

The students giving negative responses to Question 5 were asked to explain the steps they thought would facilitate implementation of the Plan. One student wanted more sustained
communication with his mentor through meetings and e-mails. He noted that such an arrangement would be more effective in keeping him focused since he operates on well-laid plans and clear expectations. The student stated further that he believes that an open conversation with his mentor would best facilitate the implementation of a useful Mentoring Plan.

Question 6: Are there factors/conditions that you believe are inhibiting implementation of the plan?

Response: 16% of the respondents answered “Yes,” and 84% answered “No.”

The students answering “Yes” to Question 6 were asked to describe the factors/conditions that inhibit the implementation of their Mentoring Plans. One student responded that he/she learned from the workshop that one’s advisor is not necessarily one’s mentor. The student noted it would be challenging to implement a mentoring plan without knowing the roles of mentors and advisors.

Another student, who recently became a GRDS awardee, reportedly was not aware of the specifics of the GRDS funding or how long it would last. The student remarked that when she gets back to her campus, she plans to ask her advisor about all the specifics, as well as go over her Career Development Plan (CDP) and Mentoring Plan with her mentor.

When asked whether they had discussed these factors/conditions with their mentors, all (100%) of the students responded “Yes.”

II. Professional Development Activities

Students were asked whether they had:
- Attended professional meetings/conferences
- Presented at a professional meeting/seminar
- Participated in formal professional development activities
- Written publications based on their GRDS research
- Helped to design/prepare a STEM-focused research and/or education proposal seeking external support

The responses were as follows:

Attendance at Professional Meetings/Conferences
Of 45 responses to this item, 37 respondents indicated they had attended a professional meeting/conference; twenty-seven (27) had attended 1-3 meetings and eight (8) had attended four (4) or more meetings/conferences.

Presentations at Professional Meetings/Seminars
Twenty-three (23) respondents presented at 1-3 meetings/seminars, and six (6) presented at four (4) or more meetings/seminars.

Participation in Formal Professional Development Activities
Twenty-eight (28) respondents participated in 1-3 professional development activities,
and two (2) participated in four (4) or more activities.

Publications Based on Students’ GRDS Research

Twenty-three (23) respondents have 1-3 publications, and three (3) have more than four (4) publications.

Help in the Design/Preparation of a STEM-Focused Research and/or Education Proposal Seeking External Support

Fifteen (15) respondents helped design/prepare 1-3 proposals, and two (2) helped design/prepare four (4) or more proposals.

Respondents’ Listing of Names of Activities in Which They Participated

Thirty (30) respondents listed the professional meetings at which they presented, 29 listed their formal professional development activities, 26 listed the publications that were based on their GRDS research, and 16 identified the proposals they helped design/prepare.

III. Outreach/Broadening Participation Activities

The students were asked survey questions regarding their outreach/broadening participation activities. The questions and the students’ responses are given below:

Question 1: Have you had opportunities as a GRDS student to interact with researchers from diverse racial/ethnic backgrounds or researchers from non-engineering disciplines?

Response: 82% of respondents answered “Yes” while 18% answered “No.”

Question 2: Have you had an opportunity, as a GRDS student, to be involved in training undergraduate students as research assistants?

Response: 56% of the respondents answered “Yes,” and 44% answered “No.”

Those answering “Yes” were asked to briefly describe their role in training undergraduates as research assistants.

Question 3: Have you had an opportunity, as a GRDS student, to work with undergraduate students who belong to groups underrepresented in engineering (women, members of underrepresented minority groups, students with disabilities)?

Response: 55% of the respondents answered “Yes,” and 45% answered “No.”

Respondents answering “Yes” were asked to describe their work with underrepresented students in engineering.

IV. Career Plans Following Graduation

Question 1: In which sector do you plan to seek employment following graduation?
(Please check your top priority among “Academe,” “Industry,” and “Government.”)

Response 1: 40% responded “Academe,” 38% responded “Industry,” and 22% responded “Government.”

Question 2: Do you believe when you graduate that you will be prepared to successfully transition into the employment sector checked above?

Response: 82% of the respondents answered “Yes,” and 18% answered “No.”

Those students answering “No” were asked: “What additional experiences do you believe you will need in order for the transition to be successful”? The students’ responses to this question included:

- Further experiences in writing proposals
- Additional experiences in publishing research results
- Opportunities to serve as interns in industrial or governmental settings
- A more complete picture of what being a tenure-track faculty member entails
- A clearer picture of how external funding is distributed and managed

V. Ways to Enhance the Experiences of GRDS Students

Question: Based on your experiences as a GRDS student to date, are there any specific activities that you consider essential to ensuring that GRDS students receive the guidance they need to successfully complete their degree programs and to successfully transition to an engineering-based career?

Response: 82% responded “Yes,” and 18% responded “No.”

Those students answering “Yes” were asked to describe the activities/experiences and indicate whether the activities should be undertaken by GRDS Principal Investigators/Mentors, by NSF, and/or by GRDS students themselves. Their responses included the following:

- Students should identify their goals and have a written plan to reach these goals
- Advisors should meet at least bi-weekly with students to discuss research progress and help define students’ goals
- Making the workshop a requirement for first-year GRDS recipients would help them focus on the bigger picture and their career plans
- Better communication is needed regarding GRDS funding in general
- Transparency as to how GRDS funding may be used would be greatly appreciated
- GRDS awards should be made to Principal Investigators (PIs) who can demonstrate that they have a commitment to GRDS students and have an academic plan to promote the success of both the student and the PI