

# ***Mentoring Undergraduate Engineering Students***

*What the research tells us.....*



Susan Staffin Metz  
Principal Investigator, ENGAGE  
Stevens Institute of Technology

QEM Network Workshop, Nov 13-14, 2009

# engage

## Engaging Students in Engineering

- National Science Foundation funded project
- Retention of undergraduate engineering students, particularly women
- 30 engineering schools over 5 years
- \$2.5 million project
- Implement strategies that research indicates improves engagement and retention in engineering

# Faculty-Student Interaction/Mentoring



## **ENGAGE Research Strategy #1:**

Improve faculty-student interaction and mentoring

*Two of the most significant factors affecting engineering student engagement, retention, and academic performance are the quality and extent of students' interactions with engineering faculty. Positive student learning outcomes are correlated with faculty discussion with students about the nature of engineering work and affirmation of students' ability to successfully perform such work.*

Dr. Norman Fortenberry

Director, CASEE

National Academy of Engineering

# Defining Terms



- *Mentoring* is a developmental partnership through which an experienced person shares knowledge, skills and perspective to foster the personal and professional growth of someone less experienced (1).
- *Faculty -Student Interaction* is based on the idea of faculty's manner toward students – either open or closed, responsive or non-responsive which research suggests, has an impact on student achievement (2,3).

# Why does “mentoring” impact academic persistence?

- Affects student self-efficacy.  
A critical element of motivation and persistence is an individual learner’s perceptions of self-efficacy (Bandura, 1997).
- What is self-efficacy?  
A person’s perception of their ability to reach a goal.
- How does self-efficacy differ from self-confidence?  
Self-efficacy is “domain specific”.

# What affects self-efficacy and what can be done?

## **External factors can enhance or diminish self-efficacy.(2)**

- Support systems
- Classroom “climate”
- Curriculum structure

## **What can faculty do?**

- Interact with students in and out of the classroom
- Maintain a positive classroom climate
- Avoid negative or intimidating messages
- Be approachable and encourage students

## **What can students do?**

- Attend office hours
- Prepare thoughtful questions re: career or major
- Keep at it!

# Mentors Come From Many Sources



In addition to faculty.....

- Academic advisor
- Classmates
- Parents
- Relatives
- Teachers
- Professionals
- Other?

# MentorNet

[www.mentornet.net](http://www.mentornet.net)



## *Student Perceptions of the Value and Need for Mentors as they Progress Through Academic Studies in Engr. & Science (2008)*

- Surveyed MentorNet students and postdoctoral scholars
- 33% response rate: 2206
- 70% female
- 11% URM (African American, Hispanic, Native American)
- 53% undergraduate
- 989 engineering students (45%)

# Primary Mentoring Roles



- Survey questions – qualitative and quantitative data- focused on mentoring roles:
  - Psychosocial
  - Role Modeling
  - Academic/Career

# Role Modeling Factor



## **Survey question:**

*In order to complete your degree successfully, how important is it to have someone who can do each of the following for you?*

- Serves as a role model
- Shares history of her/his career with you
- Shares personal experiences as examples from which you can learn

# Psychosocial Mentoring Factor



- Respects you as an individual
- Serves as a consistent source for advice and support
- Provides opportunities for you to ask questions w/o fear of affecting your grades or career options
- Encourages you to talk openly about anxiety and fears that detract from your academic work
- Understands how your background (gender/race/ethnicity) may affect your experiences as a student in your field of study

# Academic/Career Factor



- Conveys interest in hearing about your ideas
- Helps you explore a range of possibilities when you face decision points
- Encourages you to prepare for the next steps in your academic program or career
- Explores career options with you
- Helps you overcome insecurities about your abilities as a scientist or engineer

# General Findings



- 98% of respondents reported that having a mentor was important to them.
- 90% of respondents reported having support in *Role Modeling* area.
- 50% engineering students reported “no support” (biology next with 20%)
- Most important support people: “formal faculty advisor” and “a relative or family friend”
- Psychosocial support: Study groups/students
- Academic/Career support: Faculty (not advisor)

# General Findings



- 40% of respondents were not encouraged by anyone to find a mentor.
- 40% of those with mentors reported having more than one mentor.
- Undergrads were most interested in support with study and job attainment skills.
- Students with a GPA of B+ or lower were more likely than students reporting higher GPAs to indicate that all 3 mentoring roles were important to them.
- Engineering students were more likely to report support in the Academic/Career area.

# Underrepresented Minority (URM) Findings

- Undergraduate URM were more likely to consider all three mentoring roles (psychosocial, role modeling, academic/career) important than non-URM.
- URM were more likely to report that they **did** have support from someone who “respects them as an individual and services as a consistent source of advice and support, and provides opportunities to ask questions (psychosocial).
- Only 20% of respondents considered it important to have a mentor of their own race. However, those who reported this as important were more likely to be URM and females.

# Gender Findings



- Undergraduate females were significantly more likely than males to consider all three mentoring roles (psychosocial, role modeling, academic/career) important than males.
- Only 20% of respondents considered it important to have a mentor of their own gender. However, those who reported this as important were more likely to be female.
- Females (undergraduates and doctoral students) are more likely to lack mentoring support than males in all categories, particularly psychosocial category.

# What does the research suggest?



- Mentoring from a variety of sources is important to students' persistence in engineering.
- Improved faculty/student interaction is important to students' persistence in engineering.
- Mentoring is a shared responsibility:
  - Faculty
  - Student
  - Engineering School

# References



1. Reily, M. (2004). *Giving Much, Gaining More: Mentoring for Success*. *AWIS Magazine*, Association for Women in Science (AWIS.org).
2. Vogt, C.M. (2008). Faculty as a critical juncture in student retention and performance in engineering programs . *Journal of Engineering Education*, 97 (1): 27-36.
3. *Creating a Culture for Scholarly and Systemic Innovation in Engineering Education (2009)*. American Society for Engineering Education.  
[http://asee.org/about/board/committees/EEGE/upload/CCSSIEE\\_Phase1Report\\_June2009.pdf](http://asee.org/about/board/committees/EEGE/upload/CCSSIEE_Phase1Report_June2009.pdf)
4. Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
5. Pintrich, P.R., D.A., Smith, T. Garcia, and W.J. McKeachie. (1991). *A manual for the use of the motivated strategies for learning questionnaire (MSLQ)*. Ann Arbor, MI: University of Michigan Press.
6. MentorNet (2008). Students' perceptions of the value and need for mentors as they progress through academic studies in engineering and science. Retrieved October 26, 2009 from  
<http://mentornet.net/documents/files/evaluation/studentperceptions.completereport.pdf>
7. *New Directions in Engineering Excellence (2008)*. National Academy of Engineering, Washington, DC. [www.nae.edu/casee-equity](http://www.nae.edu/casee-equity)
8. SWE-AWE-CASEE ARP Resources – *Mentoring and Women in Engineering*. *SWE-AWE CASEE Overviews*. Retrieved November 4, 2009, from <http://www.AWEonline.org>.