# INTRODUCING MENTORNET

## Carol B. Muller[1]

*Abstract* — *MentorNet (www.MentorNet.net), the E-Mentoring Network for Women in Engineering and Science, is a nonprofit organization focused on furthering women's progress in scientific and technical fields through the use of a dynamic, technology-supported mentoring program. Since 1998, nearly 10,000 undergraduate and graduate women studying engineering and related sciences at more than 100 colleges and universities across the U.S., and in several other nations, have been matched in structured, one-on-one, email-based mentoring relationships with male and female scientific and technical professionals working in industry and government. This paper provides an overview of the partnership of colleges and universities, corporations, government labs and agencies, and professional societies currently involved in MentorNet, and the participants in the MentorNet community and One-on-One program. MentorNet is an ongoing effort which supports the interests of all organizations working to advance women in engineering and related sciences.*

*Index Terms* — *MentorNet, mentoring, program, partnership*

## MENTORING, WOMEN IN ENGINEERING AND RELATED SCIENCES, AND MENTORNET

Mentoring is a frequently employed strategy for retention of women in engineering and science. The power of mentoring is sometimes poorly understood, and mentoring is not always effectively practiced [4], however. At its weakest, mentoring is viewed as a somewhat offhand strategy to address deficits, providing some needed encouragement and advising of weaker and less confident students: once in college, women are somewhat more likely than men to doubt their ability to succeed in scientific and technical fields, yet lack of confidence frequently influences women's decisions to persist in studies or postgraduate opportunities in these fields [3]. Mentoring appears to be a strategy that helps increase women's confidence in their abilities [2].

At its strongest, however, mentoring is understood as a powerful learning process, which assures the intergenerational transfer of knowledge and "know-how" on an ongoing basis throughout one's life [1,4]. Mentoring helps make explicit the tacit knowledge of a discipline and its professional culture. Whether or not such individuals are labeled "mentors," nearly everyone has one or more mentors in the form of more experienced guides and advisors as they grow and develop as individuals and professionals.

Both protégés and mentors learn from mentoring relationships [4]. Well-deployed mentoring can be highly effective in supporting systemic change and in creating positive, productive, equitable learning environments [1]. When mentoring is understood as a serious and powerful learning process, complete with the need to establish learning objectives, measures, and discipline to achieve results, its potential can be realized [4]. Policymakers, funders, and program developers, however, need to understand better the elements of effective mentoring and to consider how best to construct mentoring experiences that can be valuable and powerful in their transformation of individuals and organizations.

MentorNet was specifically designed to take advantage of newly emerging widespread use of Internet technologies to create mentoring opportunities where they couldn't previously exist due to constraints of time and geography. It was also designed to leverage technology in support of scale of programs that can otherwise be very time-consuming to manage well. Research-based program design, continuous improvement and feedback loops, and clever adaptation of technology-supported solutions have enabled an electronic mentoring program linking students with professionals in industry that is both scalable and cost-effective.

## E-MENTORING AS A SOLUTION

E-mentoring uses email and related electronic communications technologies to link mentors and protégés. While use of email for communications in mentoring relationships is different from face-to-face communications, email offers some particular advantages in supporting mentoring. Not only is email convenient, easy, fast, familiar, informal, and inexpensive, but its asynchronous qualities mean that valuable time is not spent in arranging logistics for meetings or in traveling to meetings. Too, email provides a medium that reduces status differences, allowing for readier, direct communication between students and professionals. Email also provides a written record of communication, and the process of writing in composing and responding to email becomes an important part of the reflective learning process.

Establishing successful mentoring programs requires considerable planning, developing needed resources, providing for recruiting of participants, matching, training, coaching and ongoing program communications, bringing relationships to closure, and formative and summative evaluation. Without some of these elements, mentoring programs often fail, or fall short of many participants'

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[1] Carol B. Muller, Ph.D., Founder and CEO, MentorNet, c/o COE, SJSU, One Washington Square, San Jose, CA 95192-0080, cbmuller@mentornet.net

expectations, making them less successful and therefore difficult to continue.

## DEVELOPING MENTORNET

The time-intensive nature of operating effective mentoring programs, including e-mentoring programs, as well as desire to provide more industrial mentoring opportunities for students, led to the creation of MentorNet (www.MentorNet.net), *the E-Mentoring Network for Women in Engineering and Science*. Tapping the emerging ubiquity of email, the Web, and related information technologies, MentorNet has built a set of systems to support a set of comprehensive programs offering online mentoring. MentorNet's centralized infrastructure is designed to serve large numbers of organizations – colleges and universities, corporations, government labs and agencies, and professional societies – allowing their respective students, alumni/ae, employees, and members to serve as mentors or be mentored, and gain from the broader diversity of participants provided by the large scale, as well as from economies of scale in operational costs.

Since 1998, when its web site first opened, MentorNet has matched nearly 10,000 undergraduate and graduate women studying engineering and related sciences at more than 100 colleges and universities across the U.S., and in several other nations, in structured, one-on-one, email-based mentoring relationships with male and female scientific and technical professionals working in industry and government. MentorNet's innovative, award-winning e-mentoring network provides mentoring opportunities that otherwise would not exist for women in engineering and science.

In 2002-03, 80 colleges and universities, 12 corporations, and 6 government labs and agencies are engaged with MentorNet, providing funding and recruiting participants. Additional grants from the federal government and private foundations also help to support the program's growth and development. More than 10,000 individuals are active in MentorNet's online community, and approximately 2,800 pairs of students and mentors were matched in 2002-03 in the One-on-One mentoring program.

MentorNet's centralized infrastructure is designed to serve expansive numbers of organizations and individuals interested in advancing women in engineering and related sciences through mentoring. Partnering organizations provide financial support for MentorNet operations and outreach to prospective participants. The considerably larger number of participants in the mentoring program resulting from having many organizations, and their students, alumni/ae, employees, or members, participate results in broad pools of mentors and protégés, leading to improved matching between mentors and protégés. In addition, having a centralized technology-based infrastructure which can serve a very large number of participants helps to achieve economies of scale, so that MentorNet services can be made available to these partnering organizations at much lower cost than if each organization were operating its own e-mentoring program.

Designated MentorNet liaisons within colleges and universities, corporations, government sites and professional societies inform professionals and students of the opportunity to participate in the MentorNet program, directing them to the MentorNet web site. Prospective participants get full information, complete online applications, and access training materials including tutorials from MentorNet's web site. MentorNet has developed and refined software programs and related systems to conduct bi-directional matching of students and mentors based on backgrounds, interests, and expressed preferences entered into a database via the online applications. A series of individualized email messages to participants throughout academic year provide direction and coaching to develop and sustain these e-mentoring relationships, using MentorNet's customized training and coaching curricula. The curricula have been developed based on research related to mentoring, common experiences of women studying engineering and science, and electronic communications.

## MENTORNET DEMOGRAPHICS, 2002-03

Demographics of participants in MentorNet's One-on-One program in 2002-03 are as follows:

- **Applicants:** 3421 students, 3197 mentors
- **Applicants Matched:** 2816 students, 2596 mentors
- **Participating Colleges & Universities:** 80
- **Number of Companies represented by Mentors:** 950
- **Companies with large numbers of mentor applicants:**
  IBM: 402
  3M: 273
  Schlumberger: 232
  Intel: 162
  Microsoft: 94
  Los Alamos National Laboratory: 60
  Motorola: 57
  Cisco Systems: 57
  Sandia National Laboratories: 45
  U.S. Department of Transportation: 41
- **Gender (matched): Mentors:** 65% female, 35% male; **Students:** 91% female, 9% male
- **Students by Degree Program:**
  5% Associates
  78% Undergraduates (43% frosh/soph; 35% juniors/seniors)
  9% Masters students
  8% Ph.D. students
- **Students by Fields of Study:**
  78% Engineering
      3% Aerospace
      9% Electrical
      23% Computer/Computer Science
      6% Chemical

       7% Civil/Environmental/Construction
       7% Industrial/Management
       8% Mechanical/Mechanics
       7% Biomedical/Biotechnology/Biochemical
       2% Materials/Textiles/Ceramic
       6% Other
   11% Biological Sciences/Biochemistry
   2% Mathematics, Applied Mathematics
   1% Physics
   4% Chemistry
   3% Geology/Environmental Sciences
   1% Other

- **Diversity by Ethnicity** (voluntary self-identification):

| Ethnicity | Students | Mentors |
|---|---|---|
| White / Caucasian | 59% | 75% |
| Asian/Asian-American | 23% | 14% |
| African, African American | 12% | 4% |
| Spanish, Hispanic, Latino | 5% | 6% |
| American Indian or Alaskan Native | 1% | 1% |
| Native Hawaiian, Pacific Islander | 1% | 0% (2) |
| No response | 4% | 4% |

## MENTORNET PARTNERS, 2002-03

Participating colleges and universities in 2002-03 are:

Adirondack Community College
Boston University
Bucknell University
Burlington County College
California Institute of Technology
California Polytechnic State University, San Luis Obispo
Cambridge University
Carnegie Mellon University
Clark Atlanta University
Clarkson University
Colgate University
College of Alameda
Collin County Community College
Colorado School of Mines
Community College of Rhode Island
Cornell University
Dartmouth College
De Anza College
Ewha Womans University
Fort Valley State University
Georgia Institute of Technology
Grantham University
Hampton University
Harvey Mudd College
Hawaii Community College
Hochschule Bremen
Honolulu Community College
Howard University

Iowa State University
Kansas State University
Kapiolani Community College
Kauai Community College
Kettering University
Leeward Community College
Lehigh University
Linköping Institute of Technology
Massachusetts Institute of Technology
Maui Community College
Michigan State University
Michigan Technological University
Milwaukee School of Engineering
Morgan State University
Muskingum College
New Hampshire Technical Institute
North Carolina Agricultural and Technical State University
North Carolina State University
North Dakota State University
Ohlone College
Pace University
Pennsylvania State University
Portland Community College
Portland State University
Purdue University
Rochester Institute of Technology
San Jose State University
Schenectady County Community College
South Bank University
Stanford University
Stevens Institute of Technology
Texas A&M University, College Station
Texas Woman's University
Tougaloo College
University of California, Davis
University of California, Santa Barbara
University of California, Santa Cruz
University of Cincinnati
University of Colorado
University of Hawaii at Manoa
University of Hawaii, Hilo
University of Illinois, Urbana-Champaign
University of Kentucky
University of Louisville
University of Maryland, Baltimore County
University of Maryland, College Park
University of Maryland, Eastern Shore
University of Michigan, Ann Arbor
University of Missouri, Rolla

University of Pennsylvania
University of Southern California
University of Tulsa
University of Vermont
University of Wisconsin, Madison
Westchester Community College

MentorNet corporate sponsors in 2002-03 are:

- Alcoa Foundation
- AT&T Foundation
- IBM Corporation
- Intel Foundation
- Cisco Systems
- Schlumberger
- 3M Company
- EMC Corporation
- Google
- Microsoft Corporation
- Motorola
- SAP Labs

MentorNet government partners in 2002-03 are:

- U.S. Department of Transportation
- Lawrence Berkeley National Laboratory
- Lawrence Livermore National Laboratory
- Los Alamos National Laboratory
- NASA Ames Research Center
- Sandia National Laboratories

One sponsoring professional society – The International Society for Optical Engineers (SPIE) – also supports MentorNet in 2002-03, but this kind of partnership will be phased out in 2003-04. A new Affiliated Partnerships program will engage professional societies and other nonprofit organizations in association with MentorNet, forming cooperative agreements for mutual benefit; Affiliated Partners will help to promote the MentorNet program among the organization's members, without providing direct financial support.

(Other details of MentorNet program delivery, experiences of students, mentors, and organizational representatives, and evaluation strategies and findings are all addressed in complementary papers in these *Proceedings*.)

## FUTURE PROSPECTS: CHALLENGES AND OPPORTUNITIES AHEAD

Over the last five years, MentorNet has developed, tested, and improved an interlocking set of well-developed systems and processes to support e-mentoring on a large-scale for women students in engineering and related science paired with professionals working in industry and government. High levels of satisfaction among participants and external recognition have accompanied the growth of the program. Measurements of results indicate that significant value accrues to both students and mentors, with outcomes including those most likely to support retention.

The lagging economy of the last three years, however, has provided challenges to MentorNet's continued growth and development, and could jeopardize future program offering

. The financial model of support has been heavily dependent upon grants from corporations, foundations, and the federal government. With the severe downturn in the economy, losses in investments, and more limited charitable contributions focused on combating terrorism and disaster relief in general, funds available to support MentorNet during the last three years have been much more limited, and MentorNet's initially strong financial position has been weakened. After experimenting with a variety of fee structures for institutions of higher education, in 2002, MentorNet made the difficult decision that it could only continue working with those institutions which provided a modest fee for services. Not only do these fees from participating colleges and universities make a reasonably substantial contribution to the operating budget, but also create a situation in which these institutions are more likely to be those which engage more fully with the opportunities available and demand greater accountability. In addition to turning to required fees from all participating colleges and universities, MentorNet took steps in the second half of 2002 to reduce expenses, freezing compensation levels, eventually laying off staff; the operating budget for 2003-04 is less than two-thirds of that originally planned for the prior year. To survive into the future, MentorNet now needs to engage significantly more partnering organizations in its programs to achieve the economies of scale that will sustain the organization. An awareness campaign, coupled with a 15% reduction in 2003-04 fees for those institutions of higher education and new corporate sponsors paying by June 15, 2003 are efforts underway designed to increase participation.

Programmatically, on the horizon for 2003-04, MentorNet is working on "MentorNet Release 3.0," a set of revised systems for applications, matching, and coaching, which will collectively give students more choice in selecting mentors, allow year-round one-on-one matching, avoid delays in getting students started in a mentoring relationship once they have signed up, and increases efficiency. Another expanded feature of the existing MentorNet program may be "MentorNet ACE – Academic Career E-Mentoring" which (pending final funding decision) would allow graduate students interested in academic careers to be paired in one-on-one e-mentoring relationships with tenured faculty members.

As we look farther afield, both the Girl Scouts of America and the American Association for the Advancement of Science's Science'sNextWave have initiated discussions with MentorNet about possible partnerships which could lead, respectively, to a one-on-one e-mentoring program pairing high school girls with women undergraduates majoring in engineering and related fields, and to a new web portal offering one-on-one e-mentoring focused specifically on the needs of scientists and engineers of color.

## CONCLUSION

Mentoring can be a powerful strategy to ensure the successful intergenerational transfer of knowledge and "know-how" within organizations and professions. MentorNet harnesses the power of the Internet and related technology-based tools to support large-scale mentoring, creating mentoring opportunities for women studying engineering and related sciences in undergraduate and graduate programs. The future is uncertain… will interest translate into scale and a sustainable financial model in challenging times so that MentorNet continues to grow and thrive, or is the novelty of the approach and a new paradigm for organizations to "outsource" such a mentoring service too challenging to be sustained? At stake may be a future vision for an e-mentoring network for *all* in engineering and science, building mentoring, networking, and learning relationships, breaking down barriers to access and success based on status, prestige, and wealth.

## ACKNOWLEDGMENT

## REFERENCES

[1] Clutterbuck, D. (2001). *Everyone Needs a Mentor*. Chartered Institute of Personnel and Development

[2] MentorNet (2002). *2000-01 MentorNet Evaluation Report*. http://www.mentornet.net/Documents/About/Results/Evaluation/00-01/00.01.YearEnd.Eval.Report.appendices.pdf

[3] Seymour, E. and Hewitt, N. (1997). *Talking About Leaving*: *Why Undergraduates Leave the Sciences*. Westview Press, Boulder, CO.

[4] Zachary, L. (2000). *The Mentor's Guide*. San Francisco, Jossey-Bass Inc.