

MENTORNET IN DEPTH: STRUCTURED MENTORING PRACTICES

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Abstract — *MentorNet (www.MentorNet.net) is a non-profit program that pairs post-secondary women students studying engineering, science and math with professionals who work in industry for one-on-one mentoring relationships conducted via email. MentorNet leverages technology and the Internet with the goal of enhancing women students' persistence in fields where they remain underrepresented and facilitating their entry into scientific and technical careers. MentorNet represents a growing, inclusive partnership among colleges and universities, corporations and professional societies, all committing volunteer labor, technical expertise, and financial support to develop the project. Year-end and long-term evaluations demonstrate the value of the program and the benefits of e-mentoring.*

Index Terms — *engineering, industry, mentoring, science, women*

THE MENTORNET COMMUNITY

MentorNet was founded in 1997 as a project to address the problem of the lack of women in scientific and technical fields. Women are underrepresented in science, technology, engineering, and mathematics (STEM) in both higher education (e.g. just 20% of engineering students in 2000) and employment (barely 10% of the U.S. engineering workforce), with negative consequences for the talent pool available for the future workforce, equal opportunity, and the disciplines and professionals in the sciences and engineering. MentorNet employs cost-effective technologies, tapping economies of scale by linking women studying science, math, engineering and technology with professionals in industry for year-long, structured mentoring relationships conducted via email.

MentorNet is the e-mentoring network for women in engineering and science. MentorNet's mission is to further women's progress in scientific and technical fields through a dynamic, technology-supported mentoring program and to advance women and society in developing a diversified, expanded and talented workforce. The vision is three-fold: to establish excellence in large-scale e-mentoring; to create the e-community of choice for women in engineering and

science through online mentoring and networking; and to leverage that community for positive social change.

MentorNet leverages technology to build large-scale impact for women and positive social change, scale which has increased over its five year history. During 2002-03, more than 2,800 undergraduate and graduate women studying engineering and related sciences at more than 80 colleges and universities across the U.S. and in several other nations, were matched in structured, one-on-one, email-based relationships with male and female scientific and technical professionals working in industry.

Mentoring is a frequently employed strategy for the retention and advancement of women in engineering and science. 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 [1]. Among other benefits, mentoring helps make explicit the tacit knowledge of a discipline and its professional culture, and with this knowledge, individuals are more likely to be successful. Both protégés and mentors learn from mentoring relationships [2]. Well-deployed mentoring can also be highly effective in supporting systemic change and in creating positive, productive, equitable learning environments. [3]

Mentoring, deliberate encouragement, and affiliation with a community have been shown to enhance women's retention, self-efficacy, confidence, and likelihood of remaining in these fields [4]-[5]. For women of color, mentoring has been shown to be the only significant predictor of success [6]. Mentoring can also serve to counter the idea that science and engineering are not friendly to women and people of color, and is key to recruiting and retaining women and minorities in science, technology, engineering and mathematics fields [7]. A well-accepted strategy to improve retention of women students in science and engineering in higher education, mentoring helps expose students to the opportunities in their fields, offers guidance and advice based on experience, and provides support, encouragement, and access to professional networks for further career development [8]. Mentoring offers one-on-one attention and assistance in "de-coding" less obvious cultural and structural elements of a field, and allows

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students access to an impartial advisor who can provide personalized support and information [9].

The power of mentoring is sometimes poorly understood, and mentoring is not always effectively practiced [10]; in particular, many well-meaning individuals have constructed mentoring programs without adequate knowledge and resources, leading some participants to conclude “mentoring doesn’t work” or “mentoring programs don’t work.” While not every single mentoring relationship within a constructed program may end up being successful or valuable, there is ample evidence that mentoring programs provide considerable benefit to many participants [11]-[14]. 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 individuals. 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 [15]-[16]. 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 [17].

Structured mentoring programs provide matching, training, coaching, and facilitation for mentoring relationships [18]. Such programs are different from naturally occurring mentoring, where a mentor and protégé form their own relationship, without the benefit or intervention of a program. Structured mentoring programs, with training of mentors and protégés and facilitation or “coaching” of the relationships increase the likelihood of satisfying mentoring relationships [19]-[22].

RECRUITING

MentorNet invites participation of colleges and universities, corporations, professional societies, and government labs and agencies, securing their commitment for one year. MentorNet recruits participants primarily through liaisons within these 80 plus participating colleges and universities, 12 corporations, 6 government labs and agencies, and 2 professional societies, as well as through collaborative relationships with organizations such as Association for Women in Science (AWIS), Society of Women Engineers (SWE), the Women in Engineering Programs & Advocates Network (WEPAN), and others, providing a strong foundation for reaching potential protégés and mentors. Designated liaisons, with the help of MentorNet, reach out to prospective participants -- undergraduate and graduate students, and professionals working in industry and government with educational backgrounds in engineering and science -- to direct them to the MentorNet web site, www.MentorNet.net. MentorNet provides recruitment materials including brochures, sample email messages, and posters.

APPLICATIONS

Interested students and professionals visit the MentorNet web site, and if eligible and interested in participating in the One-on-One Mentoring Program, complete online applications, providing information about their intended majors/disciplines, career interests/sectors of employment, and demographic information, as well as preferences for being matched by gender, alma mater, particular topics of interest or concern, and other criteria. When prospective students or mentors complete HTML on-line applications, the information is sent to a MentorNet server where, using a Perl script, it is automatically reformatted and entered into the MentorNet Microsoft SQL Server database.

MATCHING

In former years, 1998-2003, students and mentors were matched through a bi-directional matching program that sorts through the database, and identifies optimal pairings of mentors and students to maximize good matches [23]. In 2002-03, MentorNet piloted a ‘self-matching’ scheme that allowed 470 students to search a database of available mentors, and to select the best match for themselves. This new system still relies upon the bi-directional matching algorithm that takes into account backgrounds and preferences of the students and mentors, but it allows the student to view the group of potential mentors that meet the student’s requirements, and then gives the student the chance to read about each mentor and make the final decision. This pilot was well received, and MentorNet will move to a year-round matching scheme that allows mentors and students to sign up anytime during the year, and for students to search for a mentor at any time.

COACHING AND TRAINING

Training Materials

Training has been identified as an important component of conducting a successful relationship [24]. Based on the increasing numbers of students and mentors participating in MentorNet, we determined that a web-based training format in the form of interactive case studies would allow us to fulfill the training component of a structured e-mentoring program in a cost effective and scaleable manner.

Most mentors and student-protégés need some type of training to be able to establish and develop successful e-mentoring relationships. Prospective participants may go through MentorNet’s web-based training materials including the Mentor’s Guide and the Student’s Guide, and engage in web-based interactive case studies to help them learn more about the experience of engaging in e-mentoring. We developed the tutorials based on the educational levels of the students, with the knowledge that students address particular issues at different points along their educational paths. The

five educational levels for which we developed both a student and a mentor version of the tutorials are:

- Community college students
- Lower division undergraduate students (1st years and sophomores)
- Upper division undergraduate students (juniors, seniors, and 5th year seniors)
- Master's students
- Doctoral students and post-doctoral fellows.

Coaching

In addition to training, we have found that having regular contact with and 'coaching' the e-mentoring pairs with discussion suggestions serve as both an educational component and as reinforcement for the pairs to stay in contact. Once a match is made, email is sent to both the student and the mentor to announce the match, and MentorNet begins coaching the pair. MentorNet's coaching "curriculum" consists of a set of about 15-25 email messages sent to each participant approximately every one to two weeks during the academic year (the duration of their mentoring relationship). Messages vary from mentor to student, and vary depending upon the level of the student (levels noted above). The messages are designed to assist the development of the mentoring relationship, which typically progress through several stages, to consider the natural ebb and flow of the academic year (for example-holidays and exams), and to consider the kinds of issues which are known to be of particular interest and importance to women in engineering and science.

DATA ACCESSIBLE TO PARTNERS

All participating sponsors and campuses have access to a password protected area of the MentorNet web site which allows them to view real-time data about the participants at their individual institutions, including the names, emails, and application information provided by participants. They can also view general information about the individuals with whom the students/mentors are matched. For instance, information about the pair provided includes the campus, education level, and major of each student, and the employer and geographic location of each mentor. Partners can also view the numbers of participants from all other campuses and sponsors, as well as a history of the participants at their individual institutions.

To enable convenient access to reporting information for all our partnering organizations, MentorNet seeks to improve the Partners Community to provide up-to-the-minute information. Many improvements have been made through the past five years, including online campus renewals, materials ordering forms, and information about MentorNet community participation by individuals at the partners institutions (those not enrolled in the One-on-One mentoring program).

MENTORNET'S INTERNAL SYSTEMS

Over the years, MentorNet has created highly automated systems in order to allow the MentorNet program to scale in size and capacity, while maintaining its quality service and personal attention. The applications and matching process are fully automated to communicate dynamically with the database, and mentors and students can access and update their information at any time through the MentorNet Community web site.

Systems have also been created to allow for coaching emails to be sent automatically to each pair throughout their relationship based on the date that each match begins. By designing an interactive internal system, MentorNet has been able to grow in scale, and does not anticipate limiting participation in the future.

EVALUATION

MentorNet has been well evaluated since inception in 1997. For more information about MentorNet's evaluation, please see Muller, C.B., & Barison, S.J., in the 2003 WEPAN Conference proceedings.

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