Telementoring: Designing On-line Mentoring Environments for High School Women in Science and Technical Courses

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Anytime that I had a problem I could send her an email, and I would come back the next day and there it was waiting for me! I wasn't sure what I wanted to do with my life -- to go into engineering, or physics. My telementor really helped me know that everyone feels this way. 11th Grader, Brooklyn, NY

I am really interested in archaeology and most people think I'm a freak because I'm interested in digging up old stuff... My [telementor] made me feel so good about myself because she let me know that it was great to have a passion for something...From hearing the way she is excited about her own work, she let you know that you shouldn't let things stand in the way of your passion. 10th Grader, Loretto, TN

For many young people, life after high school is a gaping question -- a world into which they are thrown without much support or guidance. For girls who express an interest in science or engineering, the supports are fewer, and possible female role models or other means of guidance are often beyond reach. Funded by the National Science Foundation, the *Telementoring Young Women in Science, Engineering, and Computing* project has addressed this issue by creating a national Internet-based mentoring program which links high school girls with female professionals in technical and scientific fields. Central to the project's goals is the belief that *ongoing* electronic communication with successful women engineers and scientists can provide girls with validation and advice rarely found in traditional educational settings. The project has developed a range of on-line environments where young women can safely discuss strategies for overcoming obstacles and fears, and gain access to sound career advice and expert domain knowledge. Through this work, we have learned a great deal about the social surrounds and scaffolding that are necessary to facilitate these kinds of on-line exchanges and to support the development of meaningful on-line relationships.

Who Are the Participants?

In it's three years, the *Telementoring* project has reached 20 high schools and close to 400 students in seven states including New York, Alabama, Tennessee, Iowa, Colorado, New Mexico and Nevada. The mentors in this project are professional women, at all career levels, working in a variety of scientific and technical fields and hail from all regions within

the United States as well as Australia, Canada, England, and Japan. Mentors are recruited through professional women's associations, postings to electronic listservs for scientists and engineers, and corporations. Student participants are high school women in science and computing courses at schools that have adequate Internet connectivity, including many schools participating in the Department of Energy's Adventures in Supercomputing program (a national computational science program). A range of urban, rural and suburban locations are represented in this group of mentors and students, as well as a diverse population which includes Native Americans, Pacific Islanders, Asians, African-Americans, Anglos, and Latinas. Overall, this diversity has played a key role in the design of on-line discussion spaces, activities, and supports that are at the heart of the *Telementoring* project. .

Telementoring On-line Discussion Formats

From the outset, *Telementoring* has developed from the premise that merely getting people on-line is not enough; to fully utilize the strengths of on-line communication, attention and care have to be paid to building and maintaining a sense of community on-line. The array of communication formats that are available on the Internet afford many opportunities to design on-line mentoring experiences that invite diverse learners to express and develop multiple points of view. The power of discovery lies in being able to build one's own meanings, and to debate and discuss one's ideas with others. With these strengths in mind, the program has evolved three types of discussion formats for students and mentors to engage in on-line conversations:

• One-on-One Mentoring Relationships: Using private e-mail, high school girls are linked to women professionals who can provide: useful strategies for overcoming obstacles and fears, academic support, and career advice. They are expected to communicate twice weekly for the duration of the academic year.

• Peer Lounges: Using electronic mailing lists, each cluster of participants in the telementoring project (mentors, students, and teachers) is provided with separate mailing lists, referred to as "lounges" to engage in training experiences that help prepare them for their telementoring experiences and to learn informally from each other.

• Discussion Forums: Using group mailing lists, large group discussion forums have been developed to address topics such as the balance of family and work, self image and self-confidence, networking and professional contacts, career opportunities and options, and strategies for dealing with classroom issues. These focused discussions are moderated by experienced mentors.

One-on-One Relationships

Finding the Right Match?

Finding the right matches between mentors and students for one-on-one relationships requires balancing the need for efficiency with the need to meet participants' individual

preferences. To expedite the matching process, both prospective mentors and students complete web-based applications which probe for information about their interests, backgrounds, and matching preferences. This data is then downloaded to searchable databases to help locate appropriate matches. What makes for a good match? This fall, roughly 50% of student applicants indicated that they preferred to be matched with mentors who are in their career fields of interest, while almost one third preferred to be matched with mentors whose hobbies and interests were similar to their own. However, matching students along their stated preferences does not ensure good on-line relationships. Last year, students rated relationships most successful when mentors were flexible and personable in addressing students' concerns, regardless of whether their mentors had their preferred characteristics. Despite the use of technology to facilitate matching (e.g., web-based applications and databases), this process requires a fair amount of administrative work, including notifying respective mentors and students of matches as well as following up to ensure that communications take place.

Getting Ready: On-line Preparation in the Lounges

Many young women who come to the program have limited interaction with adults outside their immediate family and teachers, and often they are unprepared to ask for help in a way that is useful to them. At the same time, mentors who come to a project expecting to help students find guidance and support often forget that the student may have very different experiences and expectations than their own. Helping and preparing the mentors and students to see each other as individuals with differing strengths, interests and histories is critical to developing successful mentoring relationships.

A key element in the *Telementoring* Project is on-line training for both mentors and students. Trainings take place via electronic mailing lists known as "peer lounges" that support asynchronous communication among clusters of participants. Though these trainings vary significantly in their content, they each provide, through modeling by an on-line facilitator, a way of communicating via email that is clear, includes evidence of an individual's personality, and is acknowledging and supportive of individual differences. Facilitators identify common pitfalls, such as misunderstandings due to differences in ways of expressing ideas, or due to lack of visual cues that are often taken for granted. For mentors, the trainings incorporate a series of scenarios that engage participants in responding to a hypothetical student situation. One such scenario is as follows:

During the interview, the interviewer asked the student if she wished to talk to a mentor about a variety of topics, one of which was self-esteem. The young woman responded:

"Self-image and self-confidence, I don't have any of that so I don't think that would be very important to me."

- How would you respond to this young woman? - What would you say first?
- How DOES one help build self-confidence and esteem? Should you address it at the moment the young person brings it up? What happens if you wait?

There are several ways to approach this discussion. You can role play, think of your own experiences or young women you have met, previous mentoring experiences, or anything that you find helpful. The point is to help each other build viable strategies for addressing these issues on-line with students.

Students also participate in on-line trainings where issues such as family status, academic choices, religion, ethnic background, economic concerns, personal histories, and regional issues are raised. With each of these topics comes the potential for bias or disagreement, but by providing a forum where individuals can share this information in an environment that supports variety--and identifies it as a key factor for success--both mentors and students can become aware of, and more comfortable with, each others' differences.

Starting and Sustaining the Relationship

To initiate the relationship, mentors and students exchange on-line personal biographies that include descriptions of their hobbies, academic pursuits and work histories. Thereafter, how does an on-line relationship unfold? Interviews with students revealed that they are primarily interested in getting an inside view of their mentors' personal lives and daily activities. This might include specific discussions about where the mentor travels for work, how she manages to take care of her child, how she might write manuscripts as part of her job, or play a musical instrument for fun. Overall, students and mentors who developed a level of intimacy and personal presence through shared text tended to have more frequent communication and in-depth relationships.

This does not mean that students don't move beyond personal issues to discuss academic or career concerns. Rather, evidence from on-line correspondences indicates that this kind of personal information often provides openings for students to explore career options and other life choices. For example, one student, an avid horseback rider, was matched with a scientist who also rides horses. They used this mutual interest to talk about the student's broader interests in science, which eventually allowed the mentor to help the student develop strategies for locating an internship in veterinary medicine.

On-line Group Forum Discussions

Large group discussions are designed to complement one-on-one relationships by providing opportunities for students and mentors to collectively discuss issues and engage in problem-solving around conflicts they confront in planning for their futures. Central to large group discussions is the use of on-line scenarios where participants could respond to a hypothetical situation that resonates with their own lives. Scenarios are designed to be multifaceted and complex and to capture some of the competing concerns that students often face, such as one about making college choices:

> This scenario is meant to inspire an honest and open exchange of ideas and opinions on making difficult choices about life after high school. No ideas are stupid. Here's the scenario:
>
> Maria was accepted to a university out of state that has many courses she would like to take. Yet she is considering going to the local community college since it is affordable and she thinks she could transfer to a four year college down the road. Deep down, the real deal is that Maria is conflicted about what to do since she would like to go away for college but at the same time she is not sure she is ready to leave her family and her hometown. (continued)

Her friend Karyl is a junior year student and is interested in an environmental engineering program at a top college. The only problem is that she is not positive she wants to pursue engineering exclusively (she likes the performing arts) and there do not seem to be many other interesting courses that she could take at this college.

You are eavesdropping on Maria and Karyl's phone conversation:

What do they talk about?
How might Maria and Karyl decide on where to go to school? What choices do they have?
What did mentors take into account when deciding what to pursue after high school?

This scenario is posted by a mentor facilitator to the electronic mailing list set aside for these large group discussions. The scenario is designed to initiate conversation and it is the mentor facilitator's job to invite students and other adult mentors to share their ideas in response to the larger theme of choosing colleges. The most striking aspect of these discussions is the extent to which mentors and the young women touch on a broad range of issues in response to a somewhat focused discussion topic on college choices. Last year, topics discussed included conflicts with parents, career issues, relationship issues, peer pressure issues, and attitudes towards mathematics, very often in the context of one message. This discussion environment, with the help of skilled mentors, proved to be the kind of space that supported the integration of multiple ideas and concerns. This kind of integrated thinking is rarely fostered, let alone allowed, in classroom settings. One telling example was that of a student who replied to the conversation about the college scenarios in this way:

> Hey everybody,
> This is gonna be quick because I'm really tired. I'm not really sure
> where I'm going. Maybe Lehman college, maybe Long Island University, maybe
> the University of the Arts in Philly. The only thing I'm sure of is that
> I'll be getting my degree in music. I might also get my degree in music
> therapy. I wanted to do engineering, but I hate math. I'm kind of confused
> to say the least. I have college problems and high school problems and
> boyfriend problems, and can anyone tell me if they stop soon? I feel like
> a slacker sometimes. Well it's time for bed so,
> Later! J

A critical factor in the success of these discussions is the presence of skilled adult facilitators who can affirm, validate and highlight important issues that are raised by students and other adults in the forum. Successful facilitators are those who are able to deal with the multiplicity of issues that students raise in relation to making choices about their futures. This involves responding to the personal issues that students raise as well as the more academic ones, as was the case of one mentor who responded to the above message:

Hi J,
Glib answer:
boyfriend problems stop when you ditch boyfriend
high school problems stop when you graduate from high school
college problems stop when you get out of college
So yes, in about 4 years, these problems will probably be over,
unless you forget to ditch boyfriend!

Actually, you don't sound like a slacker, you sound like you have a dream, having music in your career, whether as a musician or a therapist (or other ways which you might discover in your future.) Having a dream is a good place to start, because you can think about your choices in the context of that dream. Good things happen to those who actively pursue their dreams, I think they turn out to be happier people for it.

So ask yourself how the programs available at Lehman, Long Island University and University of Arts in Philly fit in with your music interests. Tell us about it, we'd like to know! If there's other college issues on your mind, you can dump those here too. Maybe some other participants might have similar college questions, or suggestions. Get some sleep! (Mentor)

Evaluating Success

Only time will tell what kinds of long term career and academic choices the young women in the program will make. At the high school level, young women are trying on many different roles and ideas for their futures which may or may not include science and engineering at the hub. Nonetheless, preliminary data from interviews and surveys is beginning to shed light on how *Telementoring* effects young women in their transition from high school to college or work. Many of the young women who enter the program with specific interests in engineering, science or computing report gaining a set of practical strategies for selecting courses, deciding on colleges, and exploring further studies in these fields. Those students who are less certain about careers in science and engineering often speak of gaining a new level of confidence in their own abilities and developing a broader view of what science and engineering is about (e.g., that scientists also write and have fun). Perhaps most significant, nearly all students speak of the benefit of having an adult to talk to who does important work and has a passion for what she is doing, broadening their sense of possibilities and options that they might not have considered. And mentors also report benefits from participating in the program, including the opportunity to do the outreach they value and to revisit career issues through the eyes of younger women.

Carefully constructed on-line environments like those in the *Telementoring* project enable young women to flexibly explore personal, affective, and academic issues in the larger context of their lives and in the company of diverse people with different experiences. Yet such a program does not run itself. Bringing together diverse groups to explore life choices on-line is a complex social process that requires adequate training, on-line facilitation, and administrative support. With care and planning, Telementoring can become the missing link for many young women in the mathematics, science and technology pipeline.