002

Ch

A Welcoming Learning Environment

CHAPTER TWO · A WELCOMING LEARNING ENVIRONMENT

PROJECTS IN THIS CHAPTER ILLUSTRATE ANOTHER KIND OF "INTERVENTION" AND INNOVATION IN THE EDUCATIONAL SETTING; THEY HIGHLIGHT HOW EDUCATORS CAN CREATE A SOCIAL SUPPORT SYSTEM FOR STUDENTS IN ORDER TO ENCOURAGE THEIR ENGAGEMENT OF SCIENCE AND MATHEMATICS. WE KNOW THAT EVEN NOW PARENTS, TEACHERS, COUNSELORS, AND OTHER ADULTS MAY THEMSELVES BE UNCOMFORTABLE WITH SCIENCE AND PERSONALLY UNAWARE OF SCIENTISTS AND ENGINEERS AS PROFESSIONALS. THERE MAY BE NEGATIVE MESSAGES FROM FELLOW STUDENTS ("DON'T BE SO NERDY"), FROM PARENTS ("I WAS NEVER GOOD IN MATH"), FROM COUNSELORS ("GIRLS DON'T NEED VERY MUCH MATH"), AND EVEN TEACHERS ("IT IS HARD").

WE HAVE LEARNED THAT EXPOSURE TO ROLE MODELS—ESPECIALLY "PEOPLE LIKE YOU"—HELPS STUDENTS IDENTIFY WITH A PROFESSION. EVEN BETTER, A MENTOR CAN OFFER A VOICE THAT IS PERSONAL AND INVITING. A MENTOR OFFERS INFORMATION AND FACTS THAT DISPEL STEREOTYPES AND NEGATIVE IMPRESSIONS AND PERSONALIZES THE ENCOUNTER WITH UNFAMILIAR TERRITORY. MENTORS CAN BE "NEAR-PEERS"—OTHER STUDENTS WHO ARE AHEAD IN CONFIDENCE AND SKILLS, OR JUST IN AGE AND MATURITY, OR ADULTS (PARENTS, COUNSELORS, TEACHERS, VOLUNTEERS).

IN MANY, MANY CASES, PART OF THE PROJECT AIMED TO BUILD A COMMUNITY AROUND THE STUDENTS, TRAINING EVERYONE IN NEW APPROACHES TO INCLUSIVE EDUCATION, IN AWARENESS OF TRADITIONAL BARRIERS, AND IN KNOWLEDGE OF GOOD PRACTICES. IN FACT, IT IS IMPOSSIBLE TO CHANGE THE WAY SCIENCE AND MATH ARE TAUGHT AND TO CHANGE THE SOCIAL NETWORKS WITHOUT CHANGING THE PEOPLE WHO INTERACT WITH AND INFLUENCE CHILDREN. WORKSHOPS FOR TEACHERS, COUNSELORS, PARENTS, MENTORS, AND THE WIDER STUDENT COMMUNITY ARE A MEANS TO THOSE ENDS. AN INFORMED AND COMMITTED COMMUNITY CAN DISPEL MISCONCEPTIONS THAT DISCOURAGE OR DRIVE INTELLECTUAL AND SCIENTIFIC INTEREST UNDERGROUND. AMONG MISCONCEPTIONS THAT NEED DISPELLING:

- GIRLS ARE NOT GOOD AT MATH
- GIRLS WHO ARE SMART WILL NOT BE POPULAR WITH BOYS
- SCIENTISTS AND ENGINEERS ARE NERDS
- THE WORK OF SCIENCE IS NOT FAMILY-FRIENDLY
- SCIENTISTS ARE OUT OF TOUCH WITH SOCIETY
- THE WORK OF SCIENCE IS TEDIOUS
- SCIENCE IS ONLY FOR THE TOUGH, EXTRAORDINARY STUDENT

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002
Ota
On the air with gender equity

ON THE AIR WITH GENDER EQUITY

TO ENGAGE, INFORM, AND INSPIRE LISTENERS, RADIO WAMC (ALBANY, N.Y.) WILL DEVELOP A WEEKLY SEGMENT AND FOUR REGIONAL CALL-IN SHOWS FOR NATIONAL DISTRIBUTION ON ISSUES, POSSIBILITIES, AND ROLE MODELS FOR—AND BARRIERS TO—GENDER EQUITY IN THE SCIENCES FOR GIRLS FROM KINDERGARTEN THROUGH EIGHTH GRADE. THE GENDER EQUITY SEGMENTS WILL BE INCORPORATED INTO WAMC'S AWARD-WINNING RADIO PROGRAM "51 PERCENT" (A SHOW ABOUT WOMEN'S ISSUES) AND PLAYED ON THE CALL-IN PROGRAM "VOX POP."

WAMC will create, produce, air, and distribute the weekly segments and call-in shows regionally through its 10-station network and nationally and globally via Public Radio, ABC satellites, and Armed Forces Radio—with compact disks available for stations not connected by satellite. The programs can also be heard over the Internet at the WAMC website <www.wamc.org> or at <www.ThePublicRadioStation.com>. This project could reach more than 300,000 listeners a month in WAMC's regional area alone, plus which "51 Percent" is heard over 125 radio stations nationally.

WAMC is collaborating with an advisory board of professional women nationally known for their involvement with gender equity and with the Capital Area School Development Association, a study council affiliated with the school of education at the State University of New York in Albany.

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HRD 01-14472 (one-year grant)	
Partners: Capital Area School Development Association; State University of New York, Albany.	
Keywords: dissemination, gender equity awareness, barriers, role models, radio, engagement	

002
T-grl
TechGirl: a website for middle school girls

TECHGIRL: A WEBSITE FOR MIDDLE SCHOOL GIRLS

SUPERVISED UNDERGRADUATE STUDENTS WILL DEVELOP THIS DYNAMIC, EVOLVING WEBSITE DEVOTED TO HELPING MIDDLE SCHOOL GIRLS LEARN HOW SCIENCE AND ENGINEERING BENEFIT SOCIETY AND ENCOURAGING THEM TO CONSIDER CAREERS IN THE FIELD. INCLUDED ON THE WEBSITE WILL BE

- Biographical sketches of women in different science and engineering settings and at different stages (including high school and college and at the start and peak of their careers).
- Advice on developing their careers, from choosing courses and activities in high school to picking a college and major to choosing a career.
- Challenging games, puzzles, and brainteasers (developed by college undergraduates) that expose girls to different aspects of science and engineering—for example, estimating the number of electrical devices in a home that could be powered by solar cells on the roof, given some basic information (electrical engineering); estimating the number of people who could commute into San Francisco across the four-lane Golden Gate Bridge during rush hour, knowing that in the morning there are three lanes heading in and in the afternoon three lanes heading out (civil engineering); or estimating the number of pounds gained by drinking one soda a day for a year (biology).
- Engineering Encounters, a role-playing game (analogous to the popular Oregon Trails or to the board game Life) in which girls simulate how their life could develop through high school, college, and their career. Presented with a series of choices, they choose responses that result in their life taking different paths. Playable online or from a CD, the game allows girls to assign their own values (in points) to the goals of Happiness, Fame, or Wealth; at the end of the game they can find out if they met their goals based on their game decisions.

Many young women are turned off by technical fields as not supporting goals they value, including ecology, family, and personal communications. This website will underscore the positive aspects of technical careers.

Two major programs at Arizona State University—Women in Applied Science and Engineering and the Minority Engineering Program—will collaborate on the website, after extensive feedback from middle and high school girls, their teachers and counselors, college girls in WISE, engineers who mentor for WISE, and college students in the minority engineering program. A Hispanic version will be provided.

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HRD 00-86452 (one-year grant)	
Partners: WISE; Office of Minority Engineering Programs	
Keywords: demonstration, career awareness, role models, website, engineering, computer games, Hispanic, bilingual	

002

Jt

The adventures of Josie True

THE ADVENTURES OF JOSIE TRUE

IN TESTING BETA VERSIONS OF COMPUTER SOFTWARE GAMES, MARY FLANAGAN NOTICED THAT GIRLS WERE DRAWN TO NARRATIVE SECTIONS WHILE BOYS RACED TO COMPETE FOR THE PRIZE, CLEARLY MORE CONTENT THAN MOST GIRLS WITH SOFTWARE THAT FEATURED VIOLENCE AND COMPETITION. RESEARCH HAD SHOWN THAT THE WEB HAS BECOME A PLAYGROUND FOR GIRLS BECAUSE IT EMPHASIZES CONTENT, WRITING, AND CORRESPONDENCE. BUT ON THE SHELVES OF COMPUTER STORES, MARY FLANAGAN SOUGHT BUT NEVER FOUND GAMES FEATURING "GIRLS WITHOUT BLONDE HAIR, BLUE EYES, AND ROSY CHEEKS." MOST EDUCATIONAL COMPUTER GAMES ARE DESIGNED FOR AND MARKETED TO WHITE KIDS, ESPECIALLY BOYS. SOFTWARE FOR GIRLS ENTERTAINS RATHER THAN EDUCATES—AND OFTEN FEATURES FASHIONS, MAKEUP, AND SHOPPING. "WHILE SOME MIGHT ARGUE THAT BARBIE GAMES ARE GETTING GIRLS ONLINE, WE NEED TO ASK OURSELVES JUST WHAT IT IS THAT BARBIE GAMES TEACH KIDS," FLANAGAN TOLD ONE REPORTER.

Flanagan moved from commercial software to academia so she could take risks rather than crank out game after game for boys. She saw a serious need for learning materials for nonwhite, nonmale audiences—material that was fun, pertinent, interesting, and, if possible, free. Research suggested that *girls, unlike boys, do not like gadgets for gadgets' sake. In educational software, they are drawn to strong content, a good story line, credible and inspiring "get to know" characters, and hands-on activities in a context that makes sense to them*. They are fascinated with the idea of traveling around the world, communicating with the people they meet, and meeting people who are different linguistically and culturally (often wanting to know what they eat). Girls want to use communications technology to have conversations with others like themselves. They want a *backstory*: information about characters and about what motivates them to do what they do. "And that's what *Josie* is about."

In the Josie True project, Flanagan's team is creating a user-friendly, multicultural, Web-based adventure game for pre-adolescent girls, aged 9 to 11. To provide content with which minority girls can identify, *The Adventures of Josie True* features a spunky 11-year-old Chinese American girl, Josie True. In the first game, Josie's science teacher (also an inventor) disappears and Josie sets off to find her.

Her search takes her across time and space: to Chicago and Paris in the 1920s. There she meets Bessie Coleman, the first African American aviatrix. Originally from Texas, Coleman relocated to Chicago, where she worked as a manicurist and as manager of a chili parlor while saving money to get her pilot's license. In the early '20s Coleman went to Paris to get her training and license because African American women were not permitted in any U.S. flight schools, and she returned to France later for training as a stunt pilot. These elements of her life story become factors in the adventure game featuring Josie.

Josie's adventures lead the user to various activities, such as correctly identifying classified objects, expanding a chili recipe (containing fractions) to serve more people, and translating U.S. dollars to French francs.

Both technical and multicultural, the game provides true and fictional ethnic heroes and role models while teaching about science and women's history. It is also designed to appeal to different learning styles. Girls who want to start an activity right away can select from a menu of options. Girls who want to follow the storyline can follow where the characters in the story lead them. Learning is embedded in the narrative.

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www.josietrue.com	
HRD 99-79265 (one-year grant)	
Partner: State University of New York, Buffalo	
The Adventures of Josie True is viewable free online at www.josietrue.com	
Keywords: demonstration, software, role models, minorities, adventure game, hands-on	

002

Pro

Profiles of women in science and engineering

PROFILES OF WOMEN IN SCIENCE AND ENGINEERING

SEVERAL BOOKS HAVE DOCUMENTED THE LIVES OF WOMEN SUCCESSFUL IN SCIENCE BY TRADITIONAL STANDARDS (E.G., NOBEL PRIZE WINNERS) AND WOMEN FOR WHOSE WORK MALE COLLEAGUES TOOK CREDIT (E.G., ROSALIND FRANKLIN, CHIEN-SHIUNG WU, AND JULIA HALL). THIS GRANT SUPPORTED COMPLETION OF *JOURNEYS OF WOMEN IN SCIENCE AND ENGINEERING: NO UNIVERSAL CONSTANTS*, A FIELD GUIDE TO 88 WOMEN IN SCIENCE IN ENGINEERING, BASED ON PERSONAL INTERVIEWS—"VOICES FROM THE FIELD."

In first-person narrative profiles, contemporary professional women speak candidly about the different paths they took to various fields of science or engineering, the discrimination they may have encountered, their work environment, their strategies for balancing family and career, and their *own* definitions of achievement and success.

These women—only some of whom are famous—come from many different racial, ethnic, and socioeconomic backgrounds. Marine science educator Judith Vergun worked 15 years as a fashion model before returning (divorced, with three children) to earn a Ph.D. in ecology, with a special interest in Native American and Native Alaskan tribal lands and areas. After graduating from the Bronx High School of Science, mathematician Bonnie Shulman spent 12 years hitchhiking, studying beat poetry, writing, and living on welfare as a single mom before returning to college at the age of 30.

Women with disabilities candidly assess the impact of these disabilities on their personal, educational, and professional lives. Biologist Jane Dillehay, deaf since birth, became dean of the College of Arts and Sciences at Gallaudet University, a college for the hearing-impaired. Psychiatric geneticist Judith Badner speaks about growing up with achondroplastic dwarfism and the ways in which dwarfism shaped her personal, educational, and professional choices. Temple Grandin, an authority on the design of livestock handling equipment and systems, has written extensively about how her autism—she thinks in pictures instead of language—has helped her understand what makes cattle afraid.

Some of the women have led lives of public service, including Rhea L. Graham (the first African American woman to serve as director of the Bureau of Mines), former surgeon general Joycelyn Elders, and Air Force Secretary Sheila Widnall. Some achieved relative celebrity, including Nobel laureate and medical physicist Rosalyn Yalow, biologist and university president Jewel Plummer Cobb, and Susan Love, surgeon, oncologist, social activist, and author of the bestseller *Dr. Susan Love's Breast Book*. Also included are profiles of young scientists just starting out in their careers, including academic scientists with eclectic interests.

This book should help dispel the stereotype of the scientist as a nerdy white male in a lab coat—as well as any notion that the path to a career in science and engineering is the same for everyone. As the subtitle suggests, there are "no universal constants."

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PARTNER: THE SLOAN FOUNDATION.	
PRODUCTS: JOURNEYS OF WOMEN IN SCIENCE AND ENGINEERING: NO UNIVERSAL CONSTANTS BY SUSAN A. AMBROSE, KRISTIN L. DUNKLE, BARBARA B. LAZARUS, INDIRA NAIR, AND DEBORAH A. HARKUS. TEMPLE UNIVERSITY PRESS, 1997.	
KEYWORDS: DEMONSTRATION, BIOGRAPHIES, ROLE MODELS, PUBLICATION, CAREER AWARENESS	

002

Hu

Putting a human face on science

PUTTING A HUMAN FACE ON SCIENCE

WHETHER A WOMAN IS WILLING TO PURSUE A CAREER IN SCIENCE USUALLY DEPENDS ON WHETHER SHE CAN PICTURE HERSELF AS A SCIENTIST WITHOUT UNACCEPTABLE CONFLICT AND CAN INTEGRATE THE ROLE OF BEING A WOMAN WITH THAT OF BEING A SCIENTIST. THE COMMON IMAGES OF SCIENTISTS DISPLAYED IN THE HALLS OF SCIENCE—"DEAD GREATS" IN CAPS AND GOWNS—REINFORCE THE POPULAR PERCEPTION OF SCIENCE AS A DRY AND DUSTY OCCUPATION DOMINATED BY ELDERLY WHITE MALES. MOST FEMALE STUDENTS HAVE FEW ROLE MODELS IN THE FIELD AND FIND IT HARD TO IDENTIFY WITH CONVENTIONAL IMAGES OF SCIENTISTS.

The PDK poster project is using visual media to challenge stereotypes. The project developed and printed 36 gallery-quality posters—co-designed by Pamela Davis Kivelson (PDK) and Inga Dorosz—that put a far livelier and more heterogeneous face on science. Instead of formal portraits of Olympian genius, the posters include images of people (especially women) involved in the joy and excitement of intellectual exploration. Thumbnail images of the posters can be viewed at the project website.

One goal of the project is to encourage scientific literacy and to promote the public's awareness and appreciation of science and technology. By humanizing the image of science and scientists, making that image less threatening and intimidating, the project hopes to help everyone see science and engineering as part of the human enterprise and its practitioners as people like themselves. It also hopes to help girls and young women see science and research as inviting, exciting, and rewarding academic and career choices.

The Stony Brook math department has developed a website that teachers can use as a study guide and that students can use to find hands-on educational activities, biographical information about the women portrayed in the posters, and other educational resources.

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www.physics.ucla.edu/scienceandart	HRD 96-22321 (one-year grant)
www.math.sunysb.edu/posterproject/www/biographies/index.html	
Partners: Alfred P. Sloan Foundation, Allied Signal, State University of New York at Stony Brook	
The 18 x 24 posters can be viewed and ordered at (www.pdksciart.com)	
Keywords: dissemination, role models, posters, website, hands-on, biographies	

002

W4

Women for women: a mentoring network

WOMEN FOR WOMEN: A MENTORING NETWORK

THIS COMPONENT OF STONY BROOK'S WISE PROGRAM MATCHES 20 UNDERGRADUATE AND GRADUATE STUDENTS WITH 55 MIDDLE SCHOOL GIRLS, WHOM THEY MENTOR. DURING THE SPRING TERM, WISE OFFERS A SEMESTER OF MENTOR TRAINING AND PREPARATION FOR VARIOUS RESEARCH PROJECTS AS A THREE-CREDIT INDEPENDENT RESEARCH COURSE. IN THE FALL, IT RECRUITS MIDDLE SCHOOL STUDENTS TO PARTICIPATE IN A MENTOR-LED CAMPUS-BASED RESEARCH EXPERIENCE DURING THE FALL AND SPRING.

University student mentors bond with their middle school protégées during a two-week summer program. During the school year mentors work with the middle school students on a science research project. Advisers at each middle school support the students and actively engage in the research. A special event in May highlights the students' research results.

Two or three mentors, working together, design each research project the middle school students later work on. Among the projects one year were the following:

Photos and fangs (dental anthropology). To learn about primates and dental and general anatomy, students section, polish, and photograph a primate tooth to study the enamel—learning darkroom techniques along the way. Teeth grow incrementally, in a growth pattern analogous to that of tree rings, and the short- and long-period lines may be imaged using several forms of microscopy.

Breeding bettas and bytes (biology, computer science). Students explore how breeding betta splendens (Siamese fighting fish, whose genetics can be easily manipulated) relates to biology, botany, zoology, evolution, ecology, genetics, geology, chemistry, art, computer science.

Making a BMW (mechanical design). Using the computer software IDEAS, students design model cars and, using a technique called "rapid prototyping," build the model in a lab at SUNY Farmingdale.

The heart of the matter (biology). Using medical equipment and anatomical models, students dissect a frog or a fetal pig to learn about the cardiovascular system and how different activities and stimuli affect the heart rate.

An investigation on horseshoes (material, engineering). Students study the forces applied to a horseshoe throughout its life span, as well as properties that affect how materials withstand environmental stress.

Lights, camera, action! (astronomy, physics). Students build a camera, take pictures, develop the film in a darkroom, and produce pictures. Along the way, they learn about the principles of light and also (using telescopes, models, and discussion) of astronomy.

Fractals (mathematics). (A fractal is an object inside of which are embedded infinitely many copies of itself.) Students learn the concepts of fractals and fractal sets, create fractal objects and discover their properties, and learn to measure distances on earth using surveying equipment and Lenart spheres.

DNA detectives (genetics, biology). Students learn basic cellular DNA concepts through lab experiments, learn techniques of microscopy and gel electrophoresis, and examine how ultraviolet radiation causes mutations in cells.

CODES: M, U		STATE UNIVERSITY OF NEW YORK, STONY BROOK
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PARTNERS: WISE, COLLEGE OF ENGINEERING AND APPLIED SCIENCES, DEPARTMENT OF TECHNOLOGY AND SOCIETY (SUNY); BRENTWOOD AND RIVERHEAD SCHOOL DISTRICTS; THE BOARD OF COOPERATIVE EDUCATIONAL SERVICES (BOCES); LONG ISLAND POWER AUTHORITY.		
KEYWORDS: DEMONSTRATION, MENTORING, RESEARCH EXPERIENCE, SUMMER PROGRAM, HANDS-ON		

002
Edg
Project EDGE: mentoring and teacher awareness

PROJECT EDGE: MENTORING AND TEACHER AWARENESS

THIS THREE-YEAR PROJECT FROM THE ROCHESTER INSTITUTE OF TECHNOLOGY (RIT) EMPHASIZED MAKING SYSTEMIC CHANGES IN TEACHERS' INSTRUCTIONAL STYLES, CONNECTING YOUNG WOMEN'S LEARNING IN STEM FIELDS WITH REAL-LIFE CAREER EXPERIENCES, AND SHARING RESOURCES AND DATA WITH OTHERS. PLANS WERE TO RECRUIT 100 HIGH SCHOOL STUDENTS, BUT BY THE THIRD YEAR 167 HIGH SCHOOL STUDENTS HAD ENROLLED (UP FROM 98 THE FIRST YEAR).

Teacher bias was addressed in summer workshops for teachers and some vice principals, following the model mentioned in Myra and David Sadker's 1994 work, *Failing at Fairness: How America's Schools Cheat Girls*. David Sadker was an instructor. Recognizing that teachers tend to be isolated from researchers (and vice versa), RIT made teachers the first line of attack against classroom inequity. Teachers were trained to use non-gender-biased teaching strategies, and several classroom observers were trained to be coders (coding teacher-initiated and student-initiated questions and interactions and the type and level of response). Becoming their own investigators—observing, videotaping, and coding teacher behavior in the classroom—helped them become sensitive to bias in their behavior with their own students.

This project gave seven local high schools an early opportunity to work in interactive distance learning technologies. RIT gave the seven schools computers and free links that allowed students to converse electronically with project staff, mentors, and each other. Both girls and teachers learned computer skills, interacting with each other and with mentors through e-mail and chat rooms. Chat rooms were held on Fridays from 11 a.m. to 12:30 on interactive First Class conference software, which had to be used in the schools. RIT's technician had to provide more training and interaction for five of the seven schools because the teachers had only marginal computer skills.

The mentoring gave students a chance to realistically view their career options. Computer interactions enabled girls to converse with RIT staff, professionals, and mentors in ways that were uninhibited by age, appearance, or subject discipline. But the project investigators also learned that early and fairly frequent face-to-face interaction gave participants more of a sense of the "real" people with whom they were conversing.

Students also interacted with mentors and role models through live, interactive teleconferencing, on a two-way audiovideo fiber-optic link capable of simultaneously broadcasting to four sites. The system allowed impressively frank student-to-student and student-to-mentor dialogues, giving the girls insights into racial, cultural, gender-based, and socioeconomic stereotyping. Because technical problems and the necessity for fixed broadcast schedules hampered this activity, in the third year the project switched to monthly face-to-face meetings at a designated school.

CODES: H, U, PD	Rochester Institute of Technology
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HRD 94-53088 (three-year grant)	
Partners: Seven high schools	
Keywords: demonstration, teacher training, gender equity awareness, distance learning, interactive, mentoring, career awareness, role models	

002
How
How to be a mentor (or mentee)

HOW TO BE A MENTOR (OR MENTEE)

MENTORING PROGRAMS HAVE BECOME POPULAR AS A WAY OF RECRUITING AND RETAINING WOMEN AND MINORITIES IN SCIENCE AND ENGINEERING. MENTORS CAN BE POSITIVE ROLE MODELS FOR STUDENTS AND YOUNG PROFESSIONALS, BROADENING THEIR HORIZONS AND PROVIDING PRACTICAL GUIDANCE. THEY CAN ACQUAINT ASPIRING PROFESSIONALS WITH THE WORK ENVIRONMENT AND HELP THEM WITH RÉSUMÉS, MOCK JOB INTERVIEWS, AND PROFESSIONAL CONTACTS. *BUT MENTORING SKILLS DO NOT ALWAYS COME NATURALLY, WHAT PASSES FOR MENTORING IS OFTEN NOT TRUE MENTORING, AND MANY WOMEN AND MINORITY STUDENTS NEVER EXPERIENCE MENTORING.*

The University of Washington's Center for Women in Science and Engineering (WISE—now the Center for Workforce Development), developed and evaluated a curriculum for training mentors and mentees. The goal was to improve mentoring practices by building on and formalizing the university's successful undergraduate mentoring program.

The project developed the Curriculum for Training Mentors and Mentees in Science & Engineering, which includes individual handbooks for students (including graduate students), faculty, and professional scientists and engineers. Graduate students helped write the curriculum, video script, and bibliography.

Four pilot sites were selected: the University of Washington, University of Michigan, Carnegie Mellon University, and Pacific Lutheran University. The curriculum materials have been adopted by 300 academic institutions, corporations, and government agencies. The materials spell out and clarify goals, objectives, and expectations for mentoring relationships; suggest topics for mentors/mentees to discuss and activities to engage in; and identify what students need to learn (such as how to publish), how mentors can help mentees, what the mentor gets out of the relationship. They stress the importance of explicitly relaying positive experiences back to the mentor, giving tips about verbal and nonverbal language. The materials are useful for women in science and engineering, but not in the liberal arts. They have been customized for organizations such as the National Park Service and have also been purchased by professional organizations and corporations.

A manual provides guidelines on what to cover in training. To provide successful training in mentoring, the trainer should have experience either in training or in mentoring (and preferably both); the training should be kept short (one to two hours); and it should be required for mentors. Male mentors may need to be made aware of gender, racial, and cross-cultural bias and ways they may be unintentionally discouraging their mentees; they may also need help dealing with female issues of confidence and inexperience. The key to successfully implementing a mentoring program is probably to build it into an existing program. For organizations with few resources, no mentoring program, and little time, portions of the training materials can be used independently.

WISE's mentoring program received the 1998 Presidential Award in Science, Engineering, and Mathematics Mentoring and the 1998 National WEPAN Women in Engineering and Science Program Award.

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www.engr.washington.edu/cwd	HRD 95-53430 (one-year grant)
Partner: Fund for the Improvement of Postsecondary Education (FIPSE); Women in Engineering Program Advocates Network (WEPAN, Inc.)	
The Curriculum for Training Mentors and Mentees in Science and Engineering is available from WEPAN (www.wepan.org) or by e-mail (wiep@ecn.purdue.edu)	
Keywords: demonstration, mentor training, mentoring, role models, career awareness, manual, gender equity awareness	

EYES TO THE FUTURE: TELEMENTORING

THE GENDER GAP IN BOTH ATTITUDE AND ACHIEVEMENT IN SCIENCE PROGRESSIVELY WIDENS FROM AGE 9 THROUGH THE SENIOR YEAR IN HIGH SCHOOL. *MIDDLE SCHOOL IS A TRANSITIONAL TIME FOR ALL STUDENTS, BUT GIRLS IN PARTICULAR HAVE DIFFICULTY ADJUSTING TO THE LOSS OF PERSONAL TEACHER RELATIONSHIPS COMMON IN ELEMENTARY SCHOOL*. EYES TO THE FUTURE (BASED AT TERC INC.) *INTERVENES WITH MIDDLE SCHOOL GIRLS OF ALL ABILITIES DURING THIS TRANSITION, BEFORE THEY HAVE CHOSEN OR RULED OUT POSSIBLE FUTURES FOR THEMSELVES*.

This multi-age mentoring program uses the Web to link middle school girls with local high school girls who have stayed interested in science and technology and with women who use STEM in their careers. The project provides urban middle school girls with enriched science experiences, a broader knowledge of possible options in high school and their careers, and personal relationships with female role models who can give them emotional and academic support.

Eyes to the Future began in 1997 as a pilot program in telementoring supported by the Arthur D. Little Foundation. Fifteen middle school girls and five high school girls communicated electronically with five adult women (a boat builder–engineer, an ecologist, a veterinary technician, a pediatrician, and a geologist). In an extended pilot project the next year in the Boston area, 15 middle school girls met weekly in after-school clubs co-facilitated by a teacher and adult mentors (an astronomer, engineer, biologist, and women in medical fields). Girls in this phase of the pilot communicated electronically but also spent about four weeks engaging in science and technology investigations, communicating about their projects with their high school and adult mentors. Selections from discussions with their mentors were included in their personal electronic scrapbooks, portions of which appeared in a collaborative electronic book.

The pilot's continued success led to the project's full implementation as a three-year NSF-funded program. The project expanded to reach middle school girls from two Somerville schools and three Brookline schools. No prior experience with technology was required. Adult mentors were from earth, space, and sea sciences, such as astronomy, ecology, marine biology, forestry, and archaeology. High school mentors were recruited from among academically talented and motivated local eleventh and twelfth grade girls.

AFTER-SCHOOL ACTIVITIES

The middle school girls met weekly in an after-school club, where they communicated electronically with their high school and adult mentors. Each team of three middle school girls, one high school girl, and one adult had its own private discussion area on the project website. Middle school girls, high school mentors, adult mentors, and teachers had their own separate discussion areas. The website also supported collaborative writing and the sharing of information about science projects. The middle school girls wrote articles about their mentors, about what science is like in high school and in the workplace, about their experiences in the program, and about what it's like to be a girl in middle school today—to post on their websites. They took on the role of investigative reporter, producing an online magazine for other girls their age.

They conducted enriched science activities and took the time to reflect and communicate about them. At after-school clubs, they engaged in earth, sea, and space sciences activities, both with and without their mentors. The third year, they designed rockets powered by balloons, explored local biodiversity, and tested various water samples to determine their pH, salinity, and chlorine content. They also explored local science institutions where their adult mentors work.

MENTORING RELATIONSHIPS

High school girls can see middle school girls' concerns from the viewpoint of someone who has "been there" recently. Carefully selected junior- and senior-year mentors can offer valuable advice about staying involved with science and math, including tips on studying, the consequences of course choices, coping with academic stress, and how to find math and science clubs and supportive teachers. They also provide assurance that they will be there to welcome the eighth graders when they arrive at the high school.

Adult mentors provide a fresh perspective on the relevance and real-life applications of school math and science. Many middle school girls know little about STEM-related arts, trades, and professions and rarely see their current classes in the context of possible careers. They often lack confidence in their ability to succeed and know little about specific specialties, such as biology or physics. In Eyes to the Future they benefit from year-long relationships with adult mentors, learning how they chose their careers, how they use science and math at work, what schooling is needed for such a profession, and what it feels like to be a woman in these fields.

CODES: M, H, I	TERC Inc.
Joni Falk (joni_falk@terc.edu), Ron Koehler, Brian Drayton, Chris Whitbeck	
HRD 99-06153 (three-year grant)	
Partner: Arthur D. Little Foundation	
Products: Two booklets: Eyes to the Future: Guide for High School Mentors and Eyes to the Future: Guide for Middle School Students	
Keywords: education program, after-school, telementoring, teacher training, career awareness; TERC, Inc., mentoring, urban, role models, clubs, self-confidence, publication, website, real-life applications	

002
Tel
Telementoring teens

TELEMENTORING TEENS

WHEN THE EDUCATION DEVELOPMENT CENTER'S CENTER FOR CHILDREN AND TECHNOLOGY (CCT) RECEIVED FUNDING FOR THIS PROJECT IN 1994, THE NOTION OF USING THE INTERNET FOR ONLINE MENTORING WAS NOVEL. BUT CCT SPECULATED THAT THE INTERNET MIGHT BE AN APPROPRIATE MEDIUM FOR ADDRESSING ADOLESCENTS' FEARS AND OBSTACLES AND PROVIDING THEM WITH VALIDATION AND SOUND ACADEMIC AND CAREER ADVICE. IN COLLABORATION WITH THE DEPARTMENT OF ENERGY'S ADVENTURES IN SUPERCOMPUTING PROGRAM, CCT PILOT-TESTED TELEMENTORING WITH GIRLS 14 TO 19 (GRADES 9–12) IN TEN SCHOOLS IN FIVE STATES (ALABAMA, COLORADO, IOWA, NEW MEXICO, AND TENNESSEE). IT RECRUITED 216 STUDENTS (MANY OF THEM 16 AND 17), PAIRING 153 OF THEM WITH 141 ADULT MENTORS—ALL WOMEN, MOSTLY IN TECHNICALLY ORIENTED CAREERS—WHO HAD COMPLETED ONLINE TRAINING IN MENTORING.

The project intended to focus on career mentoring, but it quickly became clear that *preoccupation with conflicts about their personal lives was integral to any academic and career issues most girls had. They valued the opportunity to explore personal issues in a personal way*. Mentors helped students deal with the daunting transition from high school to college, discussing such issues as selecting college courses, balancing personal relationships and academic interests, and overcoming personal or financial obstacles that got in the way of achieving specific goals. In the best cases, telementoring allowed mentors to respond to students' specific, immediate needs and concerns. The project found that *career mentoring online requires addressing girls' immediate interests while simultaneously broadening their relatively narrow understanding of how their interests relate to the world of work*.

More than three quarters of the students found their telementoring experiences rewarding and half felt their mentors had influenced their ideas about science and technology. Mentors' perceptions varied, but 91 percent were willing to mentor again. How satisfied the mentor and protégée felt depended on how often they communicated.

Students who started with negative perceptions of women in these fields were pleasantly surprised to find that their mentors were well rounded. Many students were more inclined to pursue internships and other career-enhancing activities after telementoring, perhaps because their mentors suggested taking a more proactive role in their own career development.

Students and mentors had different perceptions of worthwhile conversations about careers in science and technology. Mentors had high expectations for such discussions, and often felt they hadn't provided consistent enough guidance; students felt they had gained insight into the exciting possibilities of lifestyles in these fields, especially when conversations about career options emerged organically from a discussion of students' and mentors' immediate interests and hobbies. A discussion of music, for example, might lead the student to recognize the importance to a music career of understanding computers.

E-mail appears to be a powerful medium for exploring the complex processes adolescents go through in defining their aspirations. What mentors regarded as casual chat, students often viewed as meaningful exchanges. Mentors wanted to affect the students' career aspirations, but they probably had more influence on their college course-taking behavior.

For many young women in the project, especially in Alabama and Tennessee, traditional values of marriage and family loomed large in their immediate futures. Mentors who could accept and work through these issues with students often found themselves exploring broader issues about life choices, which ultimately affected how students approached their career aspirations.

CODE: H	Education Development Center (Center for Children and Technology)
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www.edc.org/CCT/telementoring	
HRD 94-50042 (three-year grant)	
Partners: Department of Energy's Office of Scientific Computing; National Testbed Project	
National School Network telementoring resources and links: http://nsn.bbn.com/telementor_wrkshp/tmlink.html	
Keywords: demonstration, EDC, career awareness, telementoring, website, peer groups, self-confidence, support system	

002
met
MentorNet: e-mail and mentoring unite

MENTORNET: EMAIL AND MENTORING UNITE

E-MAIL'S POPULARIZATION LED CAROL MULLER, CO-FOUNDER OF DARTMOUTH UNIVERSITY'S WOMEN IN ENGINEERING AND SCIENCES PROGRAM, TO CREATE MENTORNET, A NATIONAL ELECTRONIC INDUSTRIAL MENTORING NETWORK FOR WOMEN IN ENGINEERING AND SCIENCE. COMMUNICATING ELECTRONICALLY REMOVES MOST OBVIOUS MARKERS OF STATUS DIFFERENCE, INCLUDING THOSE ROOTED IN GENDER AND HIERARCHY. STUDENTS OFTEN FEEL LESS INTIMIDATED OR HESITANT ASKING QUESTIONS ON E-MAIL THAN THEY MIGHT IN PERSON OR ON THE PHONE. EMAIL ALSO MAKES IT EASY TO COMMUNICATE THOUGHTFULLY AND DELIBERATELY AND PROVIDES A RECORD OF COMMUNICATION. STUDENTS CAN REFER TO THEIR MENTORS' PAST ADVICE WHENEVER THEY NEED TO, AND MENTORS CAN EASILY KEEP TRACK OF STUDENTS' CONCERNS.

A marriage of e-mail and mentoring, MentorNet allows mentoring relationships to flourish where geography, time, or financial constraints might otherwise hamper or prevent them, and it can be especially helpful for students at colleges physically distant from industries in which they are interested. Previously, many people who were willing to serve as mentors lacked the time or other resources to physically meet with a student, and many students didn't have the time to take advantage of mentoring if it required several hours out of a day. MentorNet alleviates time and travel constraints and provides operational economies of scale by offering its services to students at many universities.

MentorNet draws from a pool of volunteer industry mentors to pair male and female professionals in industry with undergraduate and graduate women in STEM. The mentorship lasts one year but often continues unofficially. Careful matches—usually based on educational background and career interests—and training in mentorship are important. Poor rapport between mentors and protégées is uncommon, but when it happens it tends to sour protégées on further mentoring.

A five-year evaluation provided strong evidence that MentorNet supports and promotes the retention of women in STEM majors and careers. MentorNet protégées felt MentorNet was a good use of their time, promoted their ability to network and seek jobs, improved their career awareness, and increased the probability of their seeking mentors in the future. Many participants felt it encouraged them to complete their academic degrees and boosted their confidence of success. Of women who responded to the survey, 53 percent of the 1998–99 protégées either continued with their 1998–99 mentor or applied for a new mentor.

CODES: U, PD	San Jose State University Foundation
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www.mentornet.net	HRD 00-01388 (three-year grant)
MentorNets' many partners (including AWIS) are listed on its website	
Keywords: demonstration, electronic mentoring, engineering, mentor training, retention, career awareness, self-confidence	

002
OPT
OPTIONS

OPTIONS

THROUGH A COMBINATION OF CLASSROOM WORK, CAREER EXPLORATION, AND HANDS-ON ACTIVITIES, THIS DEMONSTRATION PROJECT HOPES TO INTEREST 70 FRESHMAN HIGH SCHOOL GIRLS A YEAR (TEN EACH FROM SEVEN SCHOOLS) IN CAREERS IN MATH AND SCIENCE. THE GIRLS ARE EXPLORING THEIR OPTIONS IN SHELBY COUNTY, TENN., WHERE ONLY ABOUT 1 PERCENT OF THE FEMALE GRADUATES SHOW AN INTEREST IN PURSUING COLLEGE DEGREES OR CAREERS IN STEM. OPTIONS TARGETS GIRLS WITH AVERAGE TO ABOVE-AVERAGE ABILITY IN MATH AND SCIENCE.

For four years, learning communities of students, teachers, and mentors will engage in specific after-school, summer camp, and professional development activities. The first year of the program, the girls spend two days a month after school and one week during the summer completing hands-on projects led by volunteers from the Memphis Zoo, Memphis Pink Palace Museum, and FedEx. The second year, they are mentored by local women. The third they are offered paid after-school internships at local corporations and organizations.

Professional development workshops will be designed to change teachers' and counselors' attitudes and skills—in particular to train high school math and science teachers in gender-equitable teaching. The project's emphasis is to encourage girls to explore their options, but the objective of the learning communities and professional development is to increase the number of all students who enroll in science and math classes, choose math and science college majors, and pursue careers in STEM.

Everyone should benefit from the program. For educators, OPTIONS will identify factors that inhibit women's academic and career choices in science and math and will help them adopt better approaches. Girls will learn about the vast opportunities available to them and will learn to problem-solve in small groups. Corporations will be able to interact with educators in the design and evaluation of industry-specific intern programs to prepare the next generation of workers and to generate enthusiasm for that work. And everyone will benefit from the increased emphasis on science and math classes and career opportunities.

Says one participant, who plans to become a pilot, "I don't see a lot of women in math and science careers, but I don't think society's stopping us."

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HRD 01-20860 (three-year grant)	
Keywords: demonstration, project-based, teacher training, gender equity awareness, mentoring, internships, career awareness, industry partners, after-school, professional development, problem-solving skills, self-confidence	

002

com

Community-based mentoring

COMMUNITY-BASED MENTORING

IN 1990, THE ASSOCIATION FOR WOMEN IN SCIENCE (AWIS) ESTABLISHED A FORMAL MENTORING PROJECT WITH FUNDING FROM THE ALFRED P. SLOAN FOUNDATION. AN NSF GRANT HELPED AWIS EXPAND THAT PROGRAM BY ESTABLISHING COMMUNITY-BASED MENTORING PROGRAMS FOR UNDER-GRADUATE AND GRADUATE WOMEN AT 12 SITES NATIONWIDE. LOCAL CHAPTERS COLLABORATE WITH LOCAL CHAPTERS OF OTHER NATIONAL SCIENTIFIC ORGANIZATIONS TO OFFER A SETTING WHERE PROFESSIONAL MENTORS AND STUDENT PROTÉGÉES CAN EXCHANGE INFORMATION.

One-on-one mentoring offers a unique personal experience, but matching professional mentors and student protégées takes considerable time and effort. Small groups can offer the comfort of individual mentor–student interactions and facilitate peer interactions as well. Large-group activities allow students and mentors to network effectively and sample a broad range of advice and backgrounds, among both peers and more experienced scientists.

The activities graduate students found most useful in a 1993 survey reflect their interest in career opportunities: professional conferences, lectures and seminars, and luncheons with guest speakers give graduate students a chance to network with more established scientists and learn about their fields of interest. Also useful were small discussion groups, which most graduate students preferred to one-on-one mentoring, because discussion groups give them a chance to share problems and concerns with their peers and have their experiences validated. Graduate students' preference for group events and group mentoring reflect their interest in exchanging professional advice and concerns with other women scientists rather than in solidifying a tentative commitment to a scientific career.

AWIS compiled resource packets on the six topics students said they considered most important in group programs: career opportunities and options, selection of academic course work, research opportunities, professional contacts and networking, self-image and self-confidence, and balancing work and family. Mentoring helped participants resolve the women/scientist dilemma. Often women cannot see themselves pursuing science because they see conflict between the roles of scientist and the traditional roles of wife and mother. Most (94 percent) of the students said they planned to get married and 77 percent planned to have children. It was important that these students meet women who were managing and transforming those roles to meet their needs.

It will take years to learn if mentoring reduces women's attrition rate in science, but as a result of the AWIS mentoring project, the percentage of graduate students who reported being committed to or certain of a career in science increased from 84 percent to 89 percent. The percentage of women of color reporting themselves as committed to, or certain of, science careers rose from 70 percent to 82 percent, while the percentage for white women remained relatively constant, 82 percent to 88 percent. Overall, *minority women seem to have been more tentative in their initial commitment to scientific career than white women, and the AWIS mentoring project may have been more critical to their retention*.

CODES: U, PD	Association for Women in Science
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www.awis.org/mentoring.html (where you can find links to the project's many partners)	
HRD 94-53754 (one-year grant)	
Publications: Mentoring Means Future Scientists, A Hand Up: Women Mentoring Women in Science, and Grants at a Glance.	
Keywords: demonstration, mentoring, conferences, community-based, seminars, role models, career awareness, resource center, retention, self-confidence, research experience	

002

X

age

Mentoring through cross-age research teams

MENTORING THROUGH CROSSAGE RESEARCH TERMS

UNDER CONSERVATIVE ATTITUDES PREVALENT IN RURAL AREAS, GIRLS ARE RARELY ENCOURAGED TO STUDY MATH AND SCIENCE OR TO PURSUE CAREERS IN STEM. THIS CROSS-GENERATIONAL MENTORING PROJECT—WHICH SERVED EIGHT EXTREMELY RURAL, ECONOMICALLY DISADVANTAGED COUNTIES IN CENTRAL MICHIGAN—CHANGED MANY GIRLS' ATTITUDES ABOUT CAREERS IN STEM AND OPENED MANY ADULTS' EYES TO HOW GIRLS ARE TREATED IN THE CLASSROOM AND HOW MUCH MORE THEY ARE OFTEN CAPABLE OF DOING.

In a two-year period, more than 500 girls from grades 5 through 12 joined undergraduate and graduate women, parents, teachers, and research professionals on 70 research teams. Women on the team provided mentoring, encouragement, and academic support for their younger "colleagues" as they all worked together on a common research project. Adults who helped supervise and mentor girls gained confidence in themselves and learned a lot about encouraging girls to continue in science.

A fall kick-off event brought research teams and professionals together. Mornings, teachers and research professionals met to discuss logistics. Girls and their parents came in the afternoon, to hear and ask questions of a panel of professional women, who talked about how they prepared for their careers and what it was like to be a woman in their field. Then the teams got acquainted and decided what to research.

Research topics covered fields from math, physics, engineering, and aeronautics to geology, health sciences, and microbiology. Most projects had a very practical aspect: One group invented and tested an electric bicycle; another looked at recycling plastics; one studied the physical fitness, dietary habits, and sedentary recreational activities of fourth through tenth graders; one tried to identify substance abuse in students in grades 6 through 12, compared with national norms; one studied the reading habits of junior high students. Some took on additional topics such as the orbits of astronomical objects and the movement of spaceships between and around them.

The girls learned about college, did original research with a professional researcher, and developed poster presentations about their findings, which they presented at a research exposition. In the process, they learned about statistical analysis, scientific method, and how to make a professional presentation. Many surfaced as leaders on their Odyssey of the Mind and Science Olympiad teams. Many of the girls have since entered college, are pursuing STEM-related majors, and attribute much of their confidence and success to their involvement in the research projects.

The project was *revitalizing for teachers. It was the first real research experience many elementary and student teachers had ever had—and their first exposure to equity-based programs*. Several male participants learned that their communication styles were not particularly encouraging to girls and ended up carrying new behaviors back to their own classrooms. To reach other classroom teachers, the project acted as a test site for Operation SMART, which trained a consultant from the Science/Mathematics/Technology Center to work with teachers in grades 3–5.

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HRD 95-54494 (one-year grant)	
Partners: College of Graduate Studies (CMU), Central Michigan Science/Mathematics/Technology Center, local school districts	
Keywords: demonstration, rural, multi-generational, underprivileged, career awareness, gender equity awareness, research experience, teamwork approach, mentoring, self-confidence, parental involvement, field trips	

002
RSE
RISE: research internship in science and engineering

RISE: RESEARCH INTERNSHIP IN SCIENCE AND ENGINEERING

SOCIAL SCIENCE RESEARCH SUGGESTS THAT *ROLE MODELING IS MOST EFFECTIVE WHEN THE MODEL IS PERCEIVED TO BE "MOST LIKE" THE PERSON HERSELF. THIS UNIVERSITY OF MARYLAND INTERVENTION HELPS NEW UNDERGRADUATES SEE THEMSELVES IN ANOTHER UNDERGRADUATE—AND LOOK AHEAD TO THE POSSIBILITY OF BEING A GRADUATE STUDENT AND A FACULTY MEMBER*. THE EXTERNAL FACTORS THE PROJECT ADDRESSES INCLUDE THE ISOLATED AND "CHILLY CLIMATE" OF SCIENCE, THE UNDERSUPPLY OF WOMEN TO SERVE AS MENTORS AND ROLE MODELS, AND THE CRITICAL MASS OF FEMALE STUDENTS AND FACULTY NEEDED IN STEM DEPARTMENTS.

RISE offers a hands-on introductory program for freshmen and an enhanced team research experience for upper class students. The idea is that the first experience will excite and prepare entering freshmen women, who then move on to an extended research internship involving close contact with successful women scientists and engineers.

Upper class students participating in all-women research teams are mentored either by faculty women or by advanced (undergraduate or graduate) students, women who are paid and trained to significantly mentor or teach undergraduate women. The setting for student teamwork and mentoring is the research program of the faculty member involved.

RISE supports faculty women by paying them and training them to be involved in the project (so their efforts don't become a shadow job). Mentoring of undergraduates involves work they want to do anyway—their own research—so they continue to make progress in their own research and on the tenure track while supporting younger women. Built into the project is significant recognition for faculty from their deans and the provost.

The entire research team (the faculty member, RISE fellows, and up to four RISE participants) take part in training: workshops in mentoring, teamwork, and enough basic social psychology to help them understand why the intervention should work. *The chief internal barrier to success and persistence in STEM is students' underestimation of their own abilities (what the literature calls "self efficacy"). Mentors can help by affecting young women's sense that they can "do science."*

This project could bring some of the advantages of a single-sex learning environment (epitomized by women's colleges) into the more mainstream higher education of the College Park campus. Many features of the program—role model hierarchies, mentor training, all-female research teams, and the notion of a two-level program—are replicable.

CODE: U	UNIVERSITY OF MARYLAND
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HRD 01-20786 (THREE-YEAR GRANT)	
KEYWORDS: DEMONSTRATION, RESEARCH EXPERIENCE, INTERNSHIPS, ROLE MODELS, INTERVENTION, BARRIERS, SELF-EFFICACY, HANDS-ON, TEAMWORK APPROACH, MENTORING, BARRIERS, TEACHER TRAINING	

002
Bcc
Building bridges for community college students

BUILDING BRIDGES FOR COMMUNITY COLLEGE STUDENTS

GENERALLY, STUDENTS AT COMMUNITY COLLEGES ARE LESS LIKELY THAN OTHER COLLEGE STUDENTS TO EXPERIENCE RESEARCH AND MENTORING THAT LEAD TO RESEARCH-BASED SCIENTIFIC CAREERS. VALENCIA COMMUNITY COLLEGE'S BRIDGES PROGRAM HELPED PREPARE 22 YOUNG WOMEN FOR UPPER DIVISION SCIENCE STUDIES AND CAREERS AND HELPED THEM MAKE INFORMED COURSE SELECTIONS AND CAREER CHOICES.

BRIDGES is an acronym (for building and replicating an innovative demonstration model to facilitate gender equity in sciences) but it also means the bridge the community college provides between high school and university-level studies for millions of students each year—especially students from nontraditional populations.

Ten students were selected (on the basis of their personal motivation and career goals) from Apopka High School in Orange County, Fla. Twelve students (ranging in age from 17 to 29) were selected from Valencia. The women were racially and ethnically mixed and from different backgrounds; their career choices ranged from medicine, nursing, and veterinary medicine to chemical and biological research.

The project developed a 10-week course in research methods, offering lectures and labs in three subjects: biochemistry (with labs in protein and DNA electrophoresis, DNA and restriction enzyme mapping, and enzyme kinetics), biology (with labs in microscopy, histology, and anatomy and a tour of the electron microscopy lab at Orlando Regional Medical Center), and chemistry (labs in the use of high-performance liquid chromatography and various types of chemistry computer software). A slightly modified version of the course is now an important part of Valencia's science curriculum.

Valencia's faculty examined existing courses for possible gender bias, and a mentoring program paired high school and college participants on the basis of their academic goals and extracurricular interests. Pairs worked as lab partners in the research methods course and maintained regular contact outside the lab. Valencia sponsored three informational seminars, at which noted female scientists from the science faculty and the local community spoke to the group about their work, their educational backgrounds, and the demands of juggling career and family. Students were in touch not only with these scientists and their mentors but also with counselors who gave the students useful advice about careers, financial aid, and university transfer procedures.

An education specialist interviewed students by phone throughout the semester to monitor the success of the mentoring program and students' opinions about the projects. Students who completed the research methods course were paid a stipend and awarded a framed certificate.

CODE: U	Valencia Community College
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HRD 95-55734 (one-year grant)	
Partners: University of Florida, Orange County Public Schools, American Association of Women in Community Colleges (Valencia chapter)	
Keywords: demonstration, community college, curriculum, mentoring, research experience, career awareness, minorities, role models	

002

Wze

WISER lab research for first-year undergraduates

WISER LAB RESEARCH FOR FIRST-YEAR UNDERGRADUATES

HIGH DROPOUT AND SWITCH RATES AMONG UNDERGRADUATE WOMEN INTENDING TO MAJOR IN THE SCIENCES AND ENGINEERING DEPLETES THE POOL OF INTERESTED, QUALIFIED, AND PREPARED STUDENTS—FURTHER EXACERBATING THE PROBLEMS OF WOMEN'S UNDERREPRESENTATION IN THESE FIELDS. THE PERIOD OF HIGHEST ATTRITION AT PENN STATE AND OTHER INSTITUTIONS IS THE FIRST YEAR, ESPECIALLY THE FIRST AND SECOND SEMESTERS AND THE SUMMER TRANSITION TO THE THIRD SEMESTER. BECAUSE RESEARCH PLACEMENTS AS A RETENTION DEVICE TYPICALLY COME TOO LATE IN STUDENT CAREERS FOR MAXIMUM EFFECT, IN 1996 PENN STATE INITIATED WISER, AN UNDERGRADUATE RESEARCH PROGRAM FOR FIRST-YEAR STUDENTS IN SCIENCE AND ENGINEERING. OVER FIVE YEARS, WISER PLACED ABOUT 250 FRESHMAN WOMEN IN RESEARCH LABS IN THE SCIENCES AND ENGINEERING.

WISER is for both gifted and average students entering science and engineering. WISERs' SAT scores follow a standard bell curve: 95 percent have cumulative scores of 1400 or less; 74 percent, 1300 or less—refuting the notion that undergraduate research experiences are suitable only for the academically gifted or that only such students will apply. Some faculty and administrators resisted first-year student placements, predicting dire consequences, if not the program's outright failure. But most of the faculty was supportive—even excited—at the prospect of young students in the lab. Those who participate tend to keep accepting WISERs and recommend the program to other faculty.

Faculty members receive up to 30 applications, interview as many students as they have time for, and give their first through third choices to the WISER administrator. Applicants may apply to as many as three labs and state their first three choices after their interviews. The WISER office matches the student and faculty, trying to give everyone her or his first choice. About a third of the applicants—mainly those in the life sciences—cannot be placed. The project emphasizes placements in engineering and the physical sciences, where women are more likely to be both isolated and underrepresented at every stage.

WISER is an adaptation of the research component of a more comprehensive retention initiative, the Women in Science Project (WISP) at Dartmouth College. After Penn had decided on research placements as an intervention, it learned that a model for such a program already existed at Dartmouth College, initiated by Carol B. Muller and Mary Pavone. WISP incorporates formal mentoring, e-mentoring, a newsletter, tutoring, scientific poster sessions, advising, and paid research placements, which sometimes take place in off-campus locations such as hospitals. It was a much more ambitious and comprehensive program than Penn State was prepared to offer. Could the research placement component be separated from WISP's integrated approach and still have a positive effect?

Dartmouth is a small, elite, private, teaching-oriented university, and Penn State is a large, multisite, state-affiliated, research-oriented university—yet Dartmouth and Penn State's main campus share certain features: a high residential (not commuter) student population, a paid staff to administer STEM retention programs, staff adept at collaborative (not competitive), cross-discipline projects, and the institution's acknowledgment that it could not keep blaming the poor retention of undergraduate students in STEM on K–12 schools.

And Dartmouth administrators were generous and trusting in handing off material that could be considered proprietary. With the WISP administrators' permission (and diskette), Penn copied WISP's timetable, its student handbook describing research opportunities, and its application form. This alone allowed Penn to get the program up and running in weeks rather than months or years.

Many Penn State students come from small or rural school districts where they are highly visible and often sought out because of their academic talent. *The assertive behavior needed to successfully negotiate a research placement at a competitive institution such as Penn State is considered rude or even foreign to rural values, especially for women. So rural women (and some men) can miss out on unparalleled opportunities to fast-track their careers. The strength of the WISP application and selection process was that it used a format familiar to students: writing applications and going to interviews to which they were invited*.

Preliminary data show a 50 percent reduction in dropout and switch rates among WISERs, compared with their matched cohorts, at least during the first three semesters when retention of science and engineering students is most at risk.

Unlike the Dartmouth program, WISER offers almost nothing in the way of support services beyond the initial matching of faculty and student. It is up to the student to make her way through an interview, to negotiate a satisfying research experience once placed, and to maintain contact with the faculty member after the two-semester placement has ended.

Interestingly, a spin-off of the program at Abington College, a two-year branch campus of Penn State that is becoming a four-year institution, has returned to the Dartmouth model of high ancillary support activities—with great success. Abingdon values a retention program that directly benefits a few undergraduate students daily more that it values a one-day K–12 program that benefits hundreds of girls. Dissemination to the Abington College site has produced perhaps *the most interesting outcome of all. It has stimulated new research activities among the faculty, brought recognition to faculty already doing research, and helped integrate adjunct faculty*.

CODE: U	Pennsylvania State University, University Park
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HRD 96-32186 (one-year grant)	
Partners: Pennsylvania Space Grant Consortium, Penn State at Abington-Ogontz	
Keywords: education program, retention, research experience, engineering, physical sciences, intervention, mentoring, electronic mentoring, internships, rural	

SUPPORTING WOMEN IN GEOSCIENCE

002
Geo
Supporting women in geoscience

TO INCREASE THE NUMBER OF WOMEN COMPLETING GRADUATE STUDIES IN EARTH SCIENCES, *IT IS IMPORTANT TO OFFER ENCOURAGEMENT AT THREE CRITICAL TRANSITION POINTS: AS THEY ENTER COLLEGE, WHEN THEY ARE SENIORS ABOUT TO GRADUATE, AND IN THE EARLY YEARS OF GRADUATE SCHOOL*. BY NURTURING FEMALE LEADERS IN GEOSCIENCE WHO CAN SERVE AS ROLE MODELS TO YOUNG WOMEN ENTERING UNIVERSITY IN LATER YEARS, THIS UNIVERSITY OF ARKANSAS PROJECT AIMS TO INCREASE THE NUMBER AND VISIBILITY OF WOMEN IN THE EARTH SCIENCES.

Project activities designed to improve their self-confidence and self-reliance include mentoring and the development of a support network of peers that can be used throughout the women's careers in geoscience. The project also emphasizes developing the skills needed for success, such as written and oral communication, team-building and leadership, and good study habits and organization. Project activities include a weekend field trip for entering female geoscience majors; a 10-day field experience for senior undergraduate and graduate women; *a mentoring ladder in which freshmen are guided by upperclasswomen who are counseled by graduate students, who in turn are supported by a faculty member*; scholarly seminars given by female students of all levels; attendance at national meetings and a role-model lecture series that brings prominent female geoscientists to campus.

The activity that has had the broadest impact to date is the role-model lecture series. Three women are brought to campus each semester to give the Friday afternoon colloquium in the department of geosciences. The students decide whom to invite and handle bringing the speakers to campus. Each speaker has said she came because the request came from the students themselves, so it was an opportunity to be a role model and interact with female students. So far the students have chosen only professors—but professors at different stages of their careers (assistant, associate, full) and at different types of institutions (public, private, research oriented, and comprehensive). Speakers have lunch with the undergraduate and graduate women, give a formal scientific talk in the afternoon, and are guests at a reception for the whole department that evening. Both the luncheons and receptions are well attended.

Conversation at the lunches—sometimes quite lively—ranges from the relevant scientific discipline to the realities of finding jobs for two-career couples and the difficulties of balancing careers and family. *Many of the students are surprised and relieved to discover that the speakers also faced, and sometimes still face, challenges similar to their own. Differences in perspective between full professors and junior women newer to academe enlighten and encourage the students. After these discussions, the students clearly feel they can and will pursue graduate studies, despite any earlier misgivings*. For several students, direct contact with a speaker during her visit has led to e-mail exchanges about graduate school.

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HRD 00-96333 (one-year grant); formerly HRD 99-79305	
Keywords: demonstration, role models, geosciences, self-confidence, mentoring, peer groups, field trip	

002
Fell
Undergraduate research fellowships

UNDERGRADUATE RESEARCH FELLOWSHIPS

A 1996 STUDY OF *FIVE UNIVERSITIES KNOWN FOR RETAINING WOMEN AND STUDENTS OF COLOR IN THE SCIENCES REPORTED THAT CERTAIN PRACTICES WERE COMMON TO THE FIVE INSTITUTIONS: UNDERGRADUATE RESEARCH OPPORTUNITIES, HIGH LEVELS OF FACULTY–STUDENT INTERACTION, AND AN EMPHASIS ON UNDERGRADUATE EDUCATION*. FUNDING CUTS HAVE REDUCED THE NUMBER OF FELLOWSHIP AWARDS AVAILABLE FOR UNDERGRADUATE RESEARCH, HOWEVER, SO INDIANA UNIVERSITY'S UNDERGRADUATE RESEARCH FELLOWSHIP PROGRAM FOR WOMEN IN THE SCIENCES PROVIDED RESEARCH EXPERIENCES FOR UPPER-DIVISION UNDERGRADUATE WOMEN WHO HAD SHOWN INTEREST AND POTENTIAL IN THE SCIENCES.

Upper division participants did 40 hours of research during the summer of 2001 and 10 hours a week during the fall and spring semesters—interacting with faculty who served as mentors and role models. Introducing more undergraduate women to lab work is expected to help retain women in the sciences, build their confidence in their scientific abilities, and make them more competitive for graduate school and the job market.

The program provided training in scientific research and lab skills, as well as in presentation and communication skills, to upper-division women students in the sciences. Lab researchers presented their lab research and experiences at an event organized by the Women in Science Program and presented posters on their research at WISP's annual Women in Science Research Day. They could also compete for three monetary awards to be used for attending or presenting their research at national or regional conferences.

Other factors important to the retention of women in the sciences include frequent contact with faculty in classrooms and laboratories, faculty concern for individual students, and an interactive (rather than competitive) classroom environment. Bloomington's WISP program has had considerable success with research internships, mentoring, and support networks for retaining women in the sciences. This project also provided mentoring opportunities, peer support networks, and role models for women science students, starting in sophomore year. Upper-division mentors were matched up with sophomore students interested in pursuing science majors.

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dev
Training graduate students to develop undergraduate research projects

TRAINING GRADUATE STUDENTS TO DEVELOP UNDERGRADUATE RESEARCH PROJECTS

MOST TEACHER TRAINING OF GRADUATE STUDENTS EMPHASIZES CLASSROOM INSTRUCTION. GRADUATE TRAINING RARELY ADDRESSES THE NEED TO DEVELOP SKILLS IN DESIGNING AND SUPERVISING UNDERGRADUATE PROJECTS. STONY BROOK, WHICH RECEIVED AN NSF RECOGNITION AWARD FOR INTEGRATING RESEARCH AND EDUCATION, HAS A LONG TRADITION OF RESEARCH COLLABORATION BETWEEN UNDERGRADUATES AND FACULTY.

In this project, it found that *the best way to train graduate students in how to supervise science and engineering research is to require every Ph.D. student to develop one teaching module based on his or her research as an integral part of the Ph.D. program. This forces the students to explain the social and scientific context of their research in terms freshmen can understand; to identify a research project that can be completed in two to three weeks, one outcome of which is important to the project; and to define and develop an educational experience—all of which are important to the professional growth of scientists in training*.

In a one-year project, Hanna Nekvasil (in Geosciences) designed a two-semester seminar on the design and supervision of undergraduate research projects. Graduate students were trained to develop and direct short undergraduate research projects and got experience doing both. The interdisciplinary modules in applied research could be repeated by undergraduates in subsequent years. The idea was partly to help women going on in academia to understand the integral relationship between teaching and research, to foster the skills needed to carry out these activities, and to enlarge women's social and intellectual community by fostering collaborations between disciplines and with high-tech R&D scientists.

The course, which met weekly, yielded six projects, five of which were implemented in the hands-on course for freshmen, Introduction to Research. The projects involved hands-on research involving synthetic lavas, exercise's ability to attenuate the human body's response to stressors, DNA fingerprinting, pollution and environmental policy, and the chemistry of photosynthesis.

Undergraduates were able to carry out projects in areas of science with which they were unfamiliar and to which they would not otherwise have been exposed as undergraduates. One in seven students said they planned their intended major from their participation in these projects. They learned about research topics, methodologies, and skills, benefiting greatly from various hands-on experiences and from the collaborative approach to research. They greatly preferred the team project approach to doing research by themselves.

Pairs of graduate students from different disciplines (in new and emerging fields) learned to design research modules and supervise teams of five to six undergraduates, considering such factors as the undergraduates' science backgrounds, how much time they had to spend on the project, and available facilities and materials. They gained skill in promoting an inquiry-based, problem-solving approach to teaching and strategies for encouraging frequent interaction and collaboration among team members. And they valued the chance to work with graduate students from other disciplines.

The project brought home the mutual benefits of graduate–undergraduate interactions, the need for graduate students to be placed in instructional roles (yet the difficulty of finding time to do so), and the difficulties of providing undergraduates with research experiences. For this reason, Nekvasil developed a new required course that places undergraduate geology majors (both male and female) with graduate geochemistry students. Each graduate student becomes primary instructor in the optical identification of minerals for a small group of undergraduate students.

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Partners: Center for Biotechnology, Collaborative Laboratories, Symbol Technologies, Inc.	
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AWSEM: NETWORKING GIRLS AND WOMEN IN OREGON

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AWSEM: networking girls and women in Oregon

IN OREGON, HIGH-TECH CORPORATIONS HAVE SURPASSED THE TIMBER INDUSTRY TO BECOME THE STATE'S NUMBER ONE EMPLOYER. ALARMINGLY, THESE SAME COMPANIES ARE CURRENTLY FORCED TO HIRE OUTSIDE THE STATE FOR 50 PERCENT OF TECHNICIANS AND 90 PERCENT OF ENGINEERS. AND WOMEN, WHO MAKE UP 45 PERCENT OF THE WORKFORCE, CONSTITUTE ONLY 16 PERCENT OF SCIENTISTS, 10 PERCENT OF COMPUTER SCIENTISTS, AND 4 PERCENT OF ENGINEERS. STUDIES ATTRIBUTE THIS UNDERREPRESENTATION TO LACK OF ENCOURAGEMENT, SUPPORT, AND ROLE MODELS FOR GIRLS IN SCIENCE, ESPECIALLY DURING THE MIDDLE SCHOOL YEARS. GIRLS AS TALENTED AS BOYS IN MATH AND SCIENCE, AND AS EXCITED ABOUT SCIENCE IN CHILDHOOD, BEGIN TO LOSE INTEREST IN MATH AND SCIENCE AROUND THE AGE OF 12. THEY DROP OUT OF MATH AND SCIENCE CLASSES, CLOSING THE DOORS ON MANY CAREER OPPORTUNITIES. THIS LOSS OF TALENT IS A QUIET CRISIS IN AMERICA.

AWSEM (advocates for women in science, engineering and mathematics) developed a model of advocacy and curriculum to encourage girls to pursue their early interests in the sciences. It began in 1994 as a project of the Saturday Academy, a community-based effort that in 1996 received the Presidential Award for Excellence in Mentoring for its support of students from groups underrepresented in science and engineering. AWSEM brings together parents, educators, and women professionals in science-related fields to kindle and support young women's interest in STEM. Regional networks of community leaders work together to dispel pervasive negative attitudes about girls, women, and science; to create local networks of public and private institutions that give young women more science opportunities; and to establish a vertical mentoring system that links middle and high school girls with female college students, teachers, parents, and professionals—to establish sustained contact between young women and science practitioners.

The AWSEM model of advocacy assumes that the most effective way to encourage girls in the sciences is to create meaningful interactions between girls and role models in a wide variety of careers. Girls meet peers with similar interests in after-school clubs where they do fun, hands-on science projects, get to know college women in STEM disciplines, and get to work with experienced women professionals, from aeronautic engineers to zoologists. AWSEM's slogan: "*Making connections between inquiring young minds and accomplished community professionals to solve real problems*."

AWSEM maintains a network of 18 after-school science and math clubs in the Portland metropolitan area where middle and high school girls meet with each other and with college-age women to pursue their interests in science. It tries to locate these clubs in schools serving high minority and low-income populations, and schools with high dropout rates—typically getting outside funding to support the clubs. Monthly site visits to local science institutions such as the Oregon Regional Primate Research Center allow girls to spend their day working with groups of women professionals, getting a hands-on introduction to the excitement and diversity of science careers and the women who pursue them.

AWSEM supports regional advocacy efforts with products, curriculum, and information. It held training for teachers and group leaders, with special sessions on robotics engineering to help them help girls explore computer-controlled Lego robots in their clubs and classes. AWSEM's website features hands-on science and math activities, gender equity research, and links to career information and other science sites.

Participating in AWSEM has changed many girls' and parents' attitudes toward STEM careers and courses as well as their behavior. The girls' grades, activities, TV habits, and plans for education reflect a heightened interest in STEM and STEM professionals. The undergraduates and professionals who mentor benefit from the support network that develops among them when they work together on a project. In developing the interactive site visits, the leadership teams learn how to communicate their careers and subjects to a lay audience of students.

THE M.A.D. SCIENTISTS CLUB

In April 1996, after a monthly meeting of the Lane County Regional Gender Equity Committee, two members were reflecting on how—despite math and science's clear importance to girls' self-esteem, education, and careers—girls were opting out of the more difficult math and science classes at a greater rate than boys. These girls and their parents seemed unaware of the lifelong implications of this action.

"These girls need an advocate," said Mary H. Thompson, publisher and co-author of a series of books on women and science. "Who do you think has the greatest vested interest in a young girl's welfare and future?"

"Their mothers!" said Marjorie DeBuse, director of the Lane County Saturday Academy and mother of a young daughter.

Thus began The M.A.D. (mothers and daughters) Scientists Club program.

Using seed money allocated from the Saturday Academy's NSF-funded AWSEM program, Marjorie added The M.A.D. Scientists Club to the U of O Talented and Gifted Institute's Super Summer program. Mary developed the curriculum and took the first group of mothers and daughters through hands-on science activities, discussing issues the girls were encountering that made it difficult for them to admit to liking their math and science classes.

The M.A.D. Scientists Club brings fourth and fifth grade girls and their mothers (or another significant adult woman) together to do hands-on science experiments and activities, to learn about women scientists throughout history, and to be introduced to gender-related issues that can reinforce positive attitudes about math and science in the girls and their mothers. The program consists of an organizational meeting, six science sessions, and an optional "Mom Talk."

Sessions are coordinated by a trained facilitator who provides the curriculum and helps organize the science activities. Sciences covered are chemistry, structural engineering, physics, astronomy, mathematics, and geology/paleontology. Activities in The M.A.D. Scientists Club are drawn from *The M.A.D. Scientists Club Facilitator's Manual* and Mary Thompson's *The Scientist Within You: Experiments and Biographies of Distinguished Women in Science*.

Mothers enjoy the opportunity to get away on a special outing with their daughter, spending time together learning about science in a comfortable learning environment (especially when science has intimidated them or left a bad taste in their mouth), watching their daughter get excited about science activities, getting involved with other moms, and learning how many doors science can open for their daughters and how to help their daughters grow.

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www.awsem.org	www.alphaci.com/mads/4-progr/progr.htm (MAD Scientists Club)	HRD 94-50030, HRD 97-14862 (three-year grants)
Partners: Portland State University, Oregon Graduate Institute, Oregon University System, Oregon State Department of Education, Women in Technology International (WITI), Oregon Robotics Tournament and Outreach Association, Solar Energy Association of Oregon, Expanding Your Horizons, the Institute for Science, Engineering, and Public Policy, and countless local organizations.		
Materials available from AWSEM website: Action Kit; Directory of Practitioners: Role Models for Young Women; Passport to Science; Site Visit Handbook; and Curriculum Guide.		
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WB

WISE beginnings

WISE BEGINNINGS

FIRST-YEAR COLLEGE STUDENTS OFTEN BELIEVE THAT INTRODUCTORY SCIENCE CLASSES ARE DESIGNED TO ELIMINATE STUDENTS NOT GOOD ENOUGH TO DO SCIENCE. *SOME FACULTY ALSO BELIEVE THAT STUDENTS LEAVE SCIENCE EARLY BECAUSE THEY LACK CERTAIN ATTRIBUTES OF ABILITY OR CHARACTER, AND THAT THEIR LEAVING IS PART OF A NATURAL WEEDING-OUT PROCESS. BUT STUDIES REPEATEDLY SHOW THAT MANY STUDENTS WHO LEAVE THE SCIENCES ARE INTELLIGENT AND STRONGLY MOTIVATED BUT DISCOURAGED BY THE COMPETITIVE CULTURE AND THE BELIEF THAT A DEPARTMENT IS MAKING EARLY NEGATIVE JUDGMENTS ABOUT THEIR ABILITIES. THE CHILLY CLIMATE IN MOST SCIENCE CLASSROOMS—AND THE WAY SCIENCE IS USUALLY TAUGHT—ESPECIALLY LEADS MANY WOMEN TO LEAVE SCIENCE FOR MORE CONGENIAL ACADEMIC FIELDS.*

Brown University initiated the successful Women in Science and Engineering (WISE) program to improve the environment for undergraduate women studying science. It launched WISE Beginnings to provide strong support during that year when undergraduate women are first exposed to college-level science and form their opinions about whether or not to become scientists.

More than 300 students participated in facilitated study groups for introductory chemistry, engineering, physics, and calculus courses. The first year of the program, students of color facilitated most of the study groups, to address the dearth of women of color in the WISE program and in the sciences generally. In its third year, the study groups became open to all students. WISE developed a comprehensive training program on group facilitation for study group leaders (using the supplemental instruction model of group facilitation). It also created events for first-year science students for orientation day and for WISE Day, at the beginning of the second semester.

On the Women in Science website, first-year students could read: "One important thing to remember as you are going through introductory science courses is that everyone has a different learning style. The way your course is taught may not be conducive to the way you learn. It is important to try to find study techniques that fit your learning style. Also, the college grading system is very different from the high school one. Medians on exams here are often low, but this does not necessarily reflect any change in intelligence, or ability to do science." Advice on the website aimed to dispel common first-year myths about college science.

Nearly a quarter of the undergraduate population became involved. More than 50 science faculty worked actively often in collaboration with students, to make their courses to more accessible to all students, including traditionally underrepresented groups. Provided with guidance on reforming science education, *many faculty were persuaded that by shifting the pedagogical focus away from a competitive, "weeding out" model to a cooperative, welcoming, stimulating model the sciences would retain more talented students. Science classes had previously tried to engage students in competition, but students often respond more positively to an atmosphere of cooperative learning—small groups of students working together to solve problems, complete a task, accomplish a common goal, ask questions, discuss ideas, learn to listen to others' ideas, offer constructive criticism, and so on*.

Some professors now find it useful to talk to classes about the weeding-out theory, explaining that any weeding out that goes on goes on during the admissions process, and that they expect all their students to do well. When a professor expresses high expectations for a class, students often have more confidence in their own abilities and perform better. To address grade anxieties, some instructors stress that performance in introductory courses is not necessarily an indicator of future performance or ability—that students could earn low grades in introductory science courses because of a weak high school science background or problems making the transition to the college environment, among reasons that might have nothing to do with science ability. By encouraging apprehensive students to take a course on a pass/fail basis, they allow students to explore a subject of potential interest without having to worry as much about the grade—and to base decisions about their future on how much they are learning and their interest in the subject matter instead of on how good a grade they earn in an early course.

To move toward collaborative work, instructors increasingly designed more cooperative and discovery-oriented introductory courses that explore interesting topics yet cover the basics. To personalize large, impersonal classes, they began encouraging more study groups—formal and informal, in class and out. They began to adopt the student-as-learner model, with the teacher as coach. They tried to help students develop the skills in critical thinking and group work that scientists use every day in research and to see that science is not static.

Engineering 3, for example, was a team-taught introductory course that typically weeded out significant numbers of women and students of color, *who found it too boring or difficult. The group that overhauled the course found that instructors were teaching to the "top" of the class (students who already excelled in AP physics and AP calculus and were proficient in computer programming) and ignoring the less well prepared majority of students in the middle and at the bottom*. They split off an advanced class for students already familiar with much of first-year engineering and, for the rest of the students, developed 10 hands-on labs closely connected to the weekly lecture. They encouraged collaborative work, introduced two design contests to make things interesting, assigned students to homework study groups based on dorm location, gave out class e-mail addresses to make communication easier, prepared a course handbook on basics and tips for working productively, and established an ombudsperson position (filled by a junior or senior engineering student) to give the instructors ongoing feedback and to address student concerns. The traditional stream of student complaints about the course ended.

As a result of these efforts to encourage study groups and to change the way science was taught, the retention rate for women in science at Brown increased significantly, from 59.9 percent in the class of 1994 to 67.4 percent in the class of 1996.

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www.brown.edu/Administration/Dean_of_the_College/homepginfo/equity	HRD 94-53676 (one-year grant)
Useful links: www.brown.edu/Administration/Dean_of_the_College/homepginfo/equity/Equity_handbook.html www.brown.edu/Administration/Dean_of_the_College/homepginfo/equity/toc_wisb.html www.brown.edu/Administration/Dean_of_the_College/homepginfo/equity/sme_links.html	
Keywords: demonstration, study groups, cooperative learning, self-confidence, exploration-based, hands-on, retention	

002
wisp
WISP: Dartmouth's support program

WISP: DARTMOUTH'S SUPPORT PROGRAM

IN 1993, DARTMOUTH LAUNCHED AN INNOVATIVE MODEL PROGRAM TO ENCOURAGE NEW STUDENTS WITH HIGH INTERESTS IN STEM TO RETAIN THOSE INTERESTS, BY IMPROVING THEIR EXPERIENCE IN STEM COURSES, ESPECIALLY THEIR FIRST YEAR. DARTMOUTH'S COMPREHENSIVE WOMEN IN SCIENCE PROJECT (WISP) PROVIDED EARLY HANDS-ON RESEARCH EXPERIENCES, MENTORING, ROLE MODELING, TUTORING, ACCESS TO INFORMATION AND ADVICE, A NEWSLETTER, SCIENTIFIC POSTER SESSIONS, AND THE CHANCE TO BUILD A SENSE OF COMMUNITY IN THE SCIENCES. MENTORING, IN WHICH WISP PIONEERED, TOOK MANY FORMS: FORMAL AND INFORMAL, FACE TO FACE AND ELECTRONIC, AND WITH PEERS, UPPERCLASSWOMEN, AND PROFESSIONALS IN INDUSTRY.

As interns, first-year students spent up to ten hours a week for two terms working with science faculty members (or researchers in nearby industrial or government laboratories) assisting in ongoing research projects—opportunities usually reserved for upper-class science majors preparing for graduate work. NSF funding helped cover stipends to ensure the participation of economically disadvantaged students. Interns were given a student guide written by a former intern. At year's end they could present their work in poster sessions at Dartmouth's annual science symposium. In 11 years, 787 first-year women participated in research internships and 219 faculty and researchers volunteered as WISP intern sponsors. (Graduate students and post docs often served as supervisors and "assistant sponsors.") All of Dartmouth's science departments, including the medical school, participated, as well as such off-campus institutions as the Veterans Administration Research Center and the U.S. Army Cold Regions Research and Engineering Laboratory.

Realizing that they wanted to share information and advice with younger students, two junior science majors initiated WISP's peer mentor program in 1992. Over the years this student-directed program has touched the lives of close to 1500 Dartmouth women.

WISP also pioneered an e-mentoring program that paired undergraduate and graduate women in STEM with industrial scientists and engineers, using mainly e-mail to communicate and build relationships. WISP developed the industrial e-mentoring program so that experienced mentors could help young women connect their classroom studies to the world of work. *The mentors most available to women on rural college campuses are those in the academic profession, but many students eventually seek employment in business and industry. Expansion of the Internet and the increasing prevalence of e-mail on college campuses and in industrial workplaces diminishes the limitations of time and location and opens up new mentoring possibilities*.

Protégées and mentors alike found their telementoring relationships viable, valuable, and personally rewarding. They saw electronic communication *as an ideal medium for quick and easy communication between people in different time zones or remote locations and on different schedules. Written messages allowed protégées to express themselves more thoughtfully, to feel less intimidated, and to preserve the correspondence (because it was sometimes reassuring to go back and reread what the mentor said later)*. There were some limitations, too. E-mail could feel impersonal; conversation and the exchange of ideas may flow more easily in face-to-face or phone conversations than in asynchronous communication; and it is harder on e-mail to maintain an open, spontaneous discussion, to guide a conversation, or to correct a misinterpreted question or comment. *Clearly e-mail has to be supplemented with occasional phone calls and personal visits over meals and at the mentor's workplace*. Some mentors recommended videoconferencing for virtual face-to-face conversations, gatherings, and group discussions.

WISP's model e-mentoring program led to and became part of MentorNet, the national e-mentoring program sponsored by WEPAN and funded by the AT&T and Intel foundations.

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www.dartmouth.edu/~wisp/	HRD 93-53764 (one-year grant)
Guide to first-year research internships: www.dartmouth.edu/~wisp/student_guide.pdf Dartmouth's science teaching website: www.dartmouth.edu/~wisp/faculty/home.html	
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