004

Ch

New Dimensions in Diversity

CHAPTER FOUR · NEW DIMENSIONS IN DIVERSITY

"WHEN THOSE WHO HAVE THE POWER TO NAME AND TO SOCIALLY CONSTRUCT REALITY CHOOSE NOT TO SEE YOU OR HEAR YOU, WHETHER YOU ARE DARK-SKINNED, OLD, DISABLED, FEMALE, OR SPEAK WITH A DIFFERENT ACCENT OR DIALECT THAN THEIRS, WHEN SOMEONE WITH THE AUTHORITY OF A TEACHER, SAY, DESCRIBES THE WORLD AND YOU ARE NOT IN IT, THERE IS A MOMENT OF PSYCHIC DISEQUILIBRIUM, AS IF YOU LOOKED INTO A MIRROR AND SAW NOTHING."

—POET ADRIENNE RICH, *INVISIBLE IN ACADEME*

ONE OF NSF'S STRATEGIC GOALS AND THEMES IS "PEOPLE"—ESPECIALLY BROADENING PARTICIPATION IN SCIENCE TO INCLUDE GROUPS TRADITIONALLY UNDERREPRESENTED IN THE ENTERPRISE: WOMEN, CERTAIN MINORITIES, AND PERSONS WITH DISABILITIES. OF COURSE THESE POPULATIONS INTERSECT—HALF OF OUR POPULATION IS FEMALE, HALF OF MINORITIES ARE FEMALE, AND SO ON. JUST AS BEING FEMALE CAN POSE CERTAIN BARRIERS TO THE PURSUIT OF SCIENCE AND MATH, SO ETHNIC AND RACIAL DIFFERENCES AND DISABILITIES CAN POSE BARRIERS. BEING FEMALE AND AFRICAN AMERICAN, OR FEMALE AND NATIVE AMERICAN, OR FEMALE AND HISPANIC, OR FEMALE AND DISABLED, OR FEMALE AND "AT RISK" OR ECONOMICALLY DEPRIVED CAN POSE DIFFERENT CHALLENGES IN ACCESS TO QUALITY EDUCATION AND ENCOURAGEMENT TO REALIZE AN INTEREST IN SCIENCE AND MATHEMATICS.

MANY PROJECTS HAVE ADDRESSED THE COMPLEXITIES OF MULTIPLE DIVERSITIES HEAD ON. THEY USUALLY START BY ASSESSING THE "TARGET POPULATION" AND ITS UNIQUE CHARACTERISTICS, AND THEN DESIGNING A PROGRAM THAT WORKS FOR THAT GROUP, WHETHER IT IS ADDRESSING THE ISSUE OF LANGUAGE LEARNING AND *SCIENCE EDUCATION*, OR LIVING IN A REMOTE RURAL AREA AND *SCIENCE EDUCATION*, OR IN AN INNER CITY AND *SCIENCE EDUCATION*, OR HAVING LIMITED OPPORTUNITIES AND LIMITED FINANCIAL SUPPORT.

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INFORMAL SCIENCE EDUCATION FOR HISPANIC GIRLS

004
Lat
Latinas en ciencia

LATINAS EN CIENCIA

LOCATED IN THE HEART OF OREGON'S "SILICON FOREST," THE OREGON MUSEUM OF SCIENCE AND INDUSTRY (OMSI) IS DEVELOPING A PILOT PROJECT TO GIVE HISPANIC GIRLS EARLY EXPOSURE TO HANDS-ON SCIENCE PROGRAMS, BOTH IN AND OUT OF THE MUSEUM. *EARLY PARTICIPATION IN INFORMAL SCIENCE PROGRAMS DOES INFLUENCE CAREER CHOICES, AND OREGON'S HIGH-TECH INDUSTRIES NEED MORE HISPANIC WOMEN IN THE WORKFORCE*.

Latinas en ciencia aims to engage Hispanic girls in science and technology in grades 3–5, before they have formed a decision against that career pathway; to support Latinas' engagement with science and technology from preschool through high school; and to change the museum's internal culture so that it feels more like home for the girls. The outreach program is targeting three communities: a rural town in Washington State (White Salmon), a suburban community south of Portland (Tigard), and an urban community housing center in northeast Portland (Villa Clara Vista).

The museum will pilot an all-school assembly to draw Latinas to the program, a weekly science club to make science fun and accessible, family science nights, community programs, museum field trips, and activities to make girls comfortable with equipment such as microscopes and digital cameras. All activities will be designed to build leadership and strengthen the girls' belief in their own ability to succeed in science and technology.

OMSI will pilot various age-based science programs designed to provide Hispanic girls with continuous science and technology options from preschool through high school, with mentorship opportunities designed to bridge age gaps. For example, girls in grades 3–5 will design science

The Oregon Museum of Science and Industry based its pilot projects on lessons learned during its planning grant activities:

- Latina girls often rule out math, science, technology—and possibly school in general—by middle school. *Advocacy programs for high school girls tend to support the rare Latina girls who have already chosen to be involved in science and have exhibited a level of success. Advocacy programs that begin in middle school must work on issues of self-esteem, leadership, and reversing the notion that science is not for girls. Programs at the elementary school level should excite girls about options in math, science, and technology before barriers to these subjects are internalized*.
- The Latino community is ready to support a project to improve science opportunities for Latinas, but the Spanish-speaking population in the Portland metropolitan area is only in the early stages of creating the community networks needed to support Latina girls in this area. They do not have efficient mechanisms for communicating, sharing resources, and doing program recruitment.
- *Efforts to reach Latinas must concentrate first on the family. Latino family and culture is central to the image Latinas have of themselves and their career options. Latinas are more comfortable and confident in the museum when many Latino families are present. Parents must be comfortable with Latino programs before they will grant permission for their girls to participate*. And family expectations (for example, that girls will baby-sit their siblings) may limits girls' ability to participate in programs outside of school.
- *The ability to succeed in school and in academically based careers is greatly influenced by learning experiences that take place in the home and in preschool through primary grades*. Programs for girls in science must engage and address the learning needs of young girls before grade three science clubs and programs begin.
- Building confidence around science and technology requires familiarity, repeated opportunities, and recognition of successes. *Even highly successful girls tend to doubt their own skills in math, science, and technology. All girls need frequent acknowledgment and praise for their accomplishments and progress*.
- Role models should be provided informally and at many levels. *Girls can picture themselves five years older, but not much more. Girls in grades 3–5 are viable role models for the youngest Latinas, late elementary and middle school girls may respond best to college-age leaders and role models, and high school girls may respond best to young adults and college graduates*.
- *It is important to expose girls of all ages to successful women in STEM careers. Many children from low-income and marginalized communities, especially in rural areas, are not aware of career options beyond waitressing, logging, clerking, and teaching*.

activities for younger students and will be trained to read science books aloud to younger children, while middle school and high school girls will in turn help the younger girls in their museum science clubs. Latinas from grades 3 through 12, along with adult role models from the community, will enjoy overnight Science Camp-Ins at the museum, and middle school girls will work regularly with female museum scientists and other community mentors.

To strengthen parental support for girls engaging in the field, OMSI will hold free monthly Latino family science events, providing bilingual staff and volunteers and other Spanish-language resources. Training will be provided on how to interact with Latino children and families and how to facilitate a parent-based program fostering pre-literacy and science inquiry skills.

Work under the planning grant revealed that *Latinos in the Portland metropolitan area were uncomfortable with the museum setting*. The museum is located in a nonresidential area and first-time visitors often have trouble finding it. *Providing transportation, especially for first-time visitors, made a difference. Bilingual communication is important, and it helps to provide a small "family" room as a comfortable entry point for Latino families to gradually acclimatize to the museum space*.

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004
Max
MAXIMA: changing the way children learn science

MAXIMA: CHANGING THE WAY CHILDREN LEARN SCIENCE

USING A MULTICULTURAL, INQUIRY-BASED APPROACH TO ACTIVE LEARNING, MAXIMA, A PROGRAM AT NEW MEXICO STATE UNIVERSITY, IS EXPLORING WAYS TO TEACH MATH AND SCIENCE TO ELEMENTARY AND MIDDLE SCHOOL STUDENTS THAT WILL INCREASE GIRLS' CHANCES OF BECOMING SCIENTISTS. *ALTHOUGH LATINOS ARE THE FASTEST-GROWING POPULATION GROUP IN THE UNITED STATES, ONLY 3.5 PERCENT OF ALL SCIENCE DEGREES ARE AWARDED TO LATINOS. THIS PROJECT IS TARGETED TO LATINAS, WHO ARE THE LEAST LIKELY OF ALL TO PURSUE SCIENCE CAREERS*.

Schools involved in the project serve predominantly Latino students, most of whom get free or reduced-price lunches. Some of the children live in shantytowns with no running water or electricity. Many of their families, despite living in this country for generations, have been trapped in a cycle of poverty that only a successful education can break. And most of the elementary school teachers are Anglo-European women. This project aims to help those teachers move from the realm of good intentions to transformative action.

As a three-year longitudinal study, MAXIMA started with a cohort of about 200 girls in grade 4, whose progress it will follow through grades 5 and 6. All teachers in those grades are involved in the project, and their growth will also be followed. Girls will work both with their regular teachers and with student teachers who have taken MAXIMA's professional development seminar.

Changing teaching norms. One reason for poor academic attitudes and performance in math and science is that elementary teachers are poorly prepared for teaching science, with too little knowledge both of science content and of effective strategies for effectively teaching girls. There is agreement about the need for reform but little guidance about how the average teacher can implement substantive changes in the classroom.

Teachers tend to teach the way they were taught, and teacher education programs have had little or no impact on student teachers' personal philosophies of teaching or learning. Some student teachers resist or struggle with learning to teach for understanding or for diversity, and if student teachers feel they lack the support required to take risks during student teaching, they will fall back on the safe, traditional, teacher-centered norm to which they have become accustomed after 15 or so years of schooling.

Teachers need concrete opportunities to improve their skills and knowledge of content. They need to explore how issues of power and privilege, ethnicity, gender, and voice influence the how, when, and why of what is to be learned. They need concrete examples of how to be more gender-

sensitive and how to meet the needs of an increasingly diverse student population. In math class, for example, as students measure the carpet in the classroom, they might ask how many fathers and mothers have tape measures at home. When space is the topic, they might talk about the first Hispanic astronaut and make students aware of the names of Latino scientists, countering the constant negative images Hispanic boys and girls see of themselves on television. In a unit on architecture, they might take the time to learn and discuss how adobe homes are built. And they must learn to make sure that a shy, quiet Hispanic girl gets the attention she needs.

Summer institutes for professional development. MAXIMA focuses on preparing cooperating and student teachers to conduct hands-on, minds-on activities and on how to make them more gender-inclusive. It also emphasizes *critical discussions of how science knowledge is produced and reproduced, who are (were) the scientists, how their work affects society, and how society determines which scientific work is worth funding. This requires that teachers undergo a very different kind of professional preparation from the kind they have probably had in their content area studies*.

Each year, 36 elementary school teachers attend a two-week summer institute and receive in-school support during the school year. To promote long-lasting change, all teachers from each of the selected schools participate. Participants are immersed in hands-on, minds-on math and science activities eight hours every day, including problem-solving scenarios/learning centers.

Every second evening, teachers develop curriculum collaboratively. Teachers and student teachers work in groups of their choosing, within their school sites, to develop gender-inclusive, inquiry-based lessons. They are responsible for preparing a two-week curriculum unit for their grade level, which they will share with each other.

At the same time, participants learn how to conduct action research projects, which can be tied to the curriculum units they design. They learn to use new technologies, activities, and problem-solving scenarios. Program funding helps pay for school equipment such as kits for building bottle rockets, electricity kits with voltmeters, orange juice clocks, graphing calculators, and heart rate monitors.

To increase opportunities for professional development, student teachers are paired with workshop participants during the school year. To create a community of learners, teachers are offered release time for meetings to share ideas and concerns and to discuss curriculum or action research projects with their peers. They are encouraged to observe each other's classes.

The research component. The research team is observing classes and teachers' meetings, videotaping two classes, and using the videotapes to analyze classroom interactions. Teacher participants themselves can call up a library of video clips to compare what they planned to do in the classroom with what they see themselves doing. Student teachers will be interviewed as the year begins and end and data on students' attitudes and performance in math and science will be gathered through questionnaires, pre- and post-content unit tests of knowledge, and ethnographic interviews with a focus group of 30 students.

MODELING EFFECTIVE TEACHING

Teaching under MAXIMA emphasizes hands-on, minds-on experience in the sciences and making the curriculum more relevant to the lives of the students. Some of the strategies master teachers model in summer institutes and in methods classes for student teachers are

- Using a variety of student-centered teaching and learning strategies
- Monitoring groups for equity (who is doing the talking and using the equipment)
- Assigning tasks equally
- Taping students' learning styles
- Providing opportunities for problem solving
- Encouraging discussions of career options
- Monitoring praise and acknowledging accomplishments
- Accepting more than one right answer
- Implementing wait time and equitable turn-taking
- Encouraging peer tutoring
- Displaying images of men and women from varying ethnic backgrounds in career roles
- Praising and encouraging collaborative learning and avoiding a competitive environment
- Linking careers in science with math, engineering, and technology
- Bringing into the classroom community women successful in STEM-related careers

Early findings. *Teacher participants credit MAXIMA with giving them stronger content knowledge, more enthusiasm, and more skills and effectiveness in the classroom*. They greatly appreciate the time they spend, the community they build, and the ideas and suggestions they get in their monthly meetings, which let them learn from each other and have an active, reflective dialogue about teaching issues and challenges. Most of the teachers are becoming more skilled and comfortable with learning technologies—especially digital cameras, educational software, Internet research tools, PowerPoint, and Excel.

The project has become a recruitment project in terms of encouraging teachers to stay in the profession and to consider teaching math and science-related subject in the upper grades. New Mexico has a shortage of 1,500 teachers a year, and many of the best and brightest (often bilingual and Latino) are recruited by other states that offer higher pay. But some of the teachers involved in the project have chosen to keep working locally so they can remain active in the MAXIMA learning community.

The girls in the project generally like math, science, and technology (with some exceptions, such as division and writing up lab assignments). *Most of the girls like it best when teachers talk less and allow them to do hands-on activities or experiments; when their teachers explain difficult material to them in caring and understandable ways; and when teachers don't spend too much time explaining a concept or problem with which only a few students are struggling. Girls often prefer to work in same-gender groups*, out of impatience with boys, who tend to prefer "messing around" to working. After the institute, many teachers began implementing same-gender groups in science and math. In the first "draw a scientist" test, more than half the girls drew a scientist male in gender but with ambiguous ethnicity. *They are clearly aware of gender differences but are still forming understanding of ethnic identity*. Some did not know what ethnicity or culture meant.

A fourth grade teacher whose students got the highest science scores in the district on the science portion of the Terra Nova test (a national standardized test) credited her participation in MAXIMA as one of the main reasons her students' academic performance improved.

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Partners: The Las Cruces Public School District (serving an urban community) and the Gadsden Independent Public School District (serving a rural community); Mesilla, University Hills, and Valley View elementary schools and Zia and Lynn middle schools; the New Mexico Commission on Higher Education.	
Keywords: demonstration, teacher training, inquiry-based, Hispanic, Latina, constructivism, gender equity awareness, professional development, hands-on, problem-solving skills, research study, gender differences	

004

Rmd

Role models change Hispanic girls' job aspirations

ROLE MODELS CHANGE HISPANIC GIRLS' JOB ASPIRATIONS

TO REVERSE THE TREND IN MATH AND SCIENCE AVOIDANCE THAT CLOSES OFF YOUNG HISPANIC WOMEN'S CAREER CHOICES, THE ES MIJA (ENGINEERING, SCIENCE, AND MATH INCREASE JOB ASPIRATIONS) PROJECT TARGETED 63 HISPANIC GIRLS WITH A SUPPORT SYSTEM TO PROMOTE THEIR RETENTION IN ADVANCED MATH AND SCIENCE COURSES AND TO EXPAND THEIR CAREER OPTIONS. IN PARTNERSHIP WITH THE UNIVERSITY OF TEXAS AT SAN ANTONIO, THE INTERCULTURAL DEVELOPMENT RESEARCH CORPORATION (IDRA) DESIGNED THE MODEL PROJECT TO TARGET SIXTH GRADE GIRLS AND SOME SEVENTH AND EIGHTH GRADERS.

During the year students attended an Expanding Your Horizons conference, participated in monthly ES MIJA Circles and Family Math/Science sessions, attended a summer institute, and visited wetlands and an aquarium in Corpus Cristi.

On average, the girls increased their belief that math and science were useful and that they were good students. Their grades in math and science and their math scores on standardized state tests improved. Surprisingly, their belief that math and science are interesting, that teachers think they are good math students, and that parents think they are good science students *declined* somewhat—*but their level of awareness changed considerably. They were less inclined to believe there are right and wrong answers and are more inclined to believe they could do what they want to do, if they tried hard enough and paid attention*.

Most important, they were able to interact with Hispanic professional women who spoke to and did hands-on activities with the girls, especially an architect who brought in tools, sat on the floor with the girls, got them to draw a floor plan for their ideal house, and made them realize that this kind of career was not beyond them. The confidence of a withdrawn student with limited English went up tenfold after a project to make windmills. She not only did one of the best projects but was willing to speak up, to say something would not work, and was accurate about why. *Cooperative hands-on projects made the girls see that although not all ideas will work, everyone should have a chance to express her ideas*. They became more patient and appreciative of each other.

One teacher reported being criticized by other teachers for "not doing real science," but the project teachers came to realize that making the girls aware that math and science are part of their everyday lives, and motivating them to consider taking advantage of that professionally, was an important preliminary step to successfully teaching them "content."

Participating parents learned firsthand that playing games made it easier to learn math and would sometimes continue playing the games when they got home. Seeing parents interact with other parents, the girls became motivated to interact themselves. One parent said it was "like an awakening." Parents were proud that they had made time for their children—which often meant taking time off from work—and had given them this opportunity.

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KEYWORDS: DEMONSTRATION, INDUSTRY PARTNERS, PARENTAL INVOLVEMENT, HISPANIC, RETENTION, HANDS-ON, ROLE MODELS, SELF-CONFIDENCE, FIELD TRIPS, CONFERENCE	

004
Lim
Biographical storytelling empowers latinas in math

BIOGRAPHICAL STORYTELLING EMPOWERS LATINAS IN MATH

GIRLS AND YOUNG WOMEN LOST TO MATH AND SCIENCE IN THEIR ADOLESCENCE ARE DEPRIVED LATER OF OPPORTUNITIES FOR HIGHER INCOME AND FULFILLMENT. THE RESULTING INEQUITIES ARE ESPECIALLY SERIOUS FOR LATINA STUDENTS. THIS COLLABORATION BETWEEN DETROIT'S SCHOOL OF THE AMERICAS (A BILINGUAL PUBLIC SCHOOL) AND EASTERN MICHIGAN UNIVERSITY BRINGS BOTH RESEARCH AND SCHOOL-SYSTEM RESOURCES TO BEAR ON THE PROBLEM.

The research design, which includes experimental and control groups and pre-and post-testing, will help answer the question *Can poor girls in grades 6 through 8 in a bilingual school develop positive attitudes toward science and math through a combination of transactional writing and storytelling? The storytelling by positive role models explores the lives of women scientists, especially Hispanic women in science. Research shows that*

- *Language is important in teaching math to girls*
- *Linguistic minority students benefit from bilingual math instruction, especially when math teaching stresses communication*
- *Mexican American students learn better through humanized knowledge than through abstract knowledge*
- *Personalized instruction raises Latino scores in math more than standard instruction does*
- *Writing facilitates math teaching and learning for underachievers and their teachers, corresponding to other powerful learning strategies*
- *Minority students benefit from studying the achievements of women and minority scientists and mathematicians*

To recruit Latina women into technical fields, it makes sense to promote math through culturally relevant literacy and storytelling. Hence this project to document the effect of integrating transactional writing (Rose 1989) and biographical storytelling (Daisey 1996) into sixth and eighth grade math classes at an urban middle school populated with Latino students.

In 10 four-hour after-school workshops, 12 teachers will learn through modeling to integrate math concepts, transactional writing, issues related to Latina success in math, oral storytelling, and biographies of Latino mathematicians and local high school Latinas successful in math—as well as Hispanic folk tales about math concepts. They will learn the *five-step learning cycle: engage, explore, explain, elaborate, and evaluate*. Research will focus on poor attitude and lack of achievement.

*The idea behind **transactional writing for mathematics** (TRM), or writing to learn, is that the best way to master a field is to write about it. Writing is therapeutic for struggling or underprepared students (reducing math anxiety, boredom, and frustration, for example) and lets strong students be creative*. Using a split-page format, the student solves problems and writes on the left side of the paper, and the teachers comment on errors (and reasons for errors) on the right side of the paper. Both the math and the English/Spanish teacher write comments, and students revise each exercise. *As a result, students become more competent in both language and math, do not feel threatened by technical mistakes, and concentrate more on what they are exploring—revising as many times as necessary to clarify math concepts using language*.

The idea behind **biographical storytelling** is to provide a vicarious introduction to diverse female scientists and mathematicians through biographical reading and storytelling, so girls may realize that what seemed simply the way things are could actually be a social construct, advantageous to some and detrimental to others. *By telling biographies, girls are encouraged to choose rather than simply inherit a story: the storytelling itself affects their imaginations, attitudes, construction of knowledge, and memory of information. And hearing different biographies encourages teachers to have visions of their students that their students may not yet have of themselves*.

DRAW A LATINA AT WORK

Teachers in the project schools often describe the challenge Latino students present. Every year on career day, Latinas in different professions came to school and made dynamic presentations. Students read stories with strong minority characters in sixth grade language arts class. Posters in classrooms and hallways showed famous Latinas in diverse careers. After two years, none of this seemed to have been enough to influence the pictures the eighth graders drew when asked to "draw a Latina at work." Despite teachers' best efforts, "nothing sunk in." *But experiencing a year of biographical storytelling made a remarkable difference in their post drawings*, as this table shows.

WHAT STUDENTS DREW	BEFORE THE PROJECT	AFTER THE PROJECT
Factory/domestic/migrant worker	72%	13%
Semiskilled worker (secretary or clerk)	18%	13%
Professional/technical worker (teacher, scientist, etc.)	8%	70%
Pop singer	2%	4%

After storytelling, fewer students portrayed factory and domestic workers and more students portrayed professional workers. Over and over, *students in an eighth grade class that engaged in biographical storytelling said they had not realized they could aspire to the lives and careers portrayed in the biographical stories they were discussing in class*.

A bilingual sixth-grade math teacher explained that for many Latina students their role model is their mother, but when they heard biographical stories, they realized that they could choose other role models. This teacher was a role model for Latina students; she has heard Latinas talk about how their teacher has both a career and a family, and how maybe they did not need a boyfriend right away. *Ever aware that one encouraging comment from a teacher could change a student's life path, she feared that many girls would be overcome by the pressure to conform to society's expectation and would drop out of school before graduation—but she saw "light bulbs come on" during storytelling. There is a long road between grasping an idea and achieving a goal, but it is no small task to have Latino middle school students realize what is possible for them. Stories have the power to make a difference in their thinking*.

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Useful site: www.sacnas.org/bio/index.html (biography project of the Society for the Advancement of Chicanos and Native Americans in Science, or SACNAS)

Keywords; education program, research findings, transactional writing, storytelling, Hispanic, Latina, bilingual, role models, Mexican-American, after-school, workshops, teacher training, biographies

004

L2

Integrating math and science with Lego Logo

INTEGRATING MATH AND SCIENCE WITH LEGO LOGO

COMBINING LEGO STRUCTURES WITH LOGO PROGRAMMING LANGUAGE ALLOWS CHILDREN—AND TEACHERS—TO CREATE MACHINES OR CREATURES THAT RESPOND TO COMMANDS THEY PROVIDE BY PROGRAMMING A COMPUTER. LEGO LOGO ACTIVITIES THAT INTEGRATE MATH AND SCIENCE WERE THE CENTERPIECE OF PROJECT SAME (SCIENCE AND MATH EQUITY), AN INITIATIVE TO REDUCE EDUCATIONAL INEQUITY, ESPECIALLY FOR HISPANIC GIRLS. THIS UNIVERSITY OF CALIFORNIA AT SANTA CRUZ PROJECT REACHED ABOUT 250 CHILDREN AGED 10 TO 14, IN GRADES 6 THROUGH 9.

In a two-week summer workshop for students and teachers, 48 girls and eight teachers from three schools participated in a Lego Logo lab and a hands-on math design workshop. Working in small collaborative groups—with teachers forming their own cohort—students and teachers learned the Lego Logo design system one week and constructed a final product the next week, for a final technology design fair. In the math design workshop, they carried out various paper engineering and visual math projects and built backdrops and other structures to integrate into their Lego Logo projects. They also visited the labs of four women on Santa Cruz's natural sciences faculty, who talked about the research they were doing.

The idea was that the teachers in the workshop would integrate Lego Logo into their regular class work, with the girls serving as peer experts, but there was strong interest at each school site for more advanced Lego Logo activities—for example, building bridges, area calculators, and shaking tables. A Santa Cruz High School teacher integrated Lego Logo into her ninth grade biology courses. Projects included a composter with automatic temperature regulation.

To encourage Hispanic parents to participate, bilingual assistants were on hand for a series of five Saturday morning parent–daughter math and science workshops and a six-week parent math review class. The theme of the math-and-science workshops was earthquakes, a theme explored with Lego Logo and hands-on activities, with guest speakers from the geology and physics departments. Hands-on interactive activities were also featured in the math review courses, which were designed to help parents learn ways to help their children with math assignments.

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Keywords: demonstration, hands-on, role models, bilingual, parental involvement Hispanic, math skills, field trips, teacher training	

004

Una

Una mano al futuro: making science accessible to Latinos

UNA MANO AL FUTURO: MAKING SCIENCE ACCESSIBLE TO LATINOS

THE ASSOCIATION FOR WOMEN IN SCIENCE (AWIS) WILL DEVELOP A GUIDE TO MENTORING (UNA MANO AL FUTURO) AIMED AT THE LATINO COMMUNITY. STUDIES SHOW THAT STUDENTS ARE MORE LIKELY TO PURSUE SCIENCE IF THEY HAVE MENTORS, LEARN IN A SUPPORTIVE ENVIRONMENT, AND HAVE OPPORTUNITIES TO EXPLORE POTENTIAL CAREERS. WITH A FOCUS ON REACHING LATINAS IN HIGH SCHOOL, THE GUIDE WILL PROVIDE RESOURCES TO HELP THE GIRLS AND THEIR PARENTS, TEACHERS, AND COMMUNITY CREATE AN ENVIRONMENT IN WHICH THE GIRLS CAN EXPLORE THEIR INTEREST IN SCIENCE AND TECHNOLOGY CAREERS.

For 10 years, AWIS has been establishing and improving community mentoring programs for pre-college, undergraduate, and graduate students, with funding from the Sloan Foundation, NSF, and the NEC Corporation. Earlier projects built on the knowledge and success of the Sloan mentoring program and produced the publication *Creating Tomorrow's Scientists: Models of Community Mentoring*. AWIS will edit and revise its award-winning mentoring books (*A Hand Up: Women Mentoring Women in Science* and *Mentoring Means Future Scientists*) and will produce Spanish-language editions with online companion materials in both English and Spanish.

In developing materials and disseminating them to the Latino community, AWIS will work with two partners: ASPIRA, a nonprofit organization committed to Latino youth issues, and Minority Women in Science. Through its 76 local chapters, AWIS will distribute materials and help plan community-based events to reinforce the material's message.

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004
Cad
Hispanic girls learn computer-assisted design—and English

HISPANIC GIRLS LEARN COMPUTER-ASSISTED DESIGN—AND ENGLISH

ALTHOUGH CARSON CITY IS NEVADA'S CAPITAL, IT IS A RURAL COMMUNITY WITH A POPULATION JUST OVER 50,000, MUCH OF IT POOR OR NEARLY POOR. ITS MAIN INDUSTRY IS GAMING, BUT IN RECENT YEARS MANY BUSINESSES WITH HIGH-TECH NEEDS HAVE RELOCATED TO THIS PART OF NEVADA, WHERE THEY HAVE DIFFICULTY ATTRACTING QUALIFIED PERSONNEL.

A conversation with a student led technology teacher Anita Brooks to create a program to integrate Hispanic girls into the world of computer technology. A senior enrolled in Brooks's computer-aided drafting class at Carson High School told Brooks that for students like her, for whom English was a second language, learning to use a computer was like earning a third language. Language problems kept the student from being able to apply concepts she understood, despite two hours of work outside the class for every hour of class work. "Sometimes she would just put her head down and cry," says Brooks. Through the Carson City School District, Brooks proposed a small experimental project to recruit Hispanic teenage girls into the computer-aided design (CAD) programs that would prepare them for high-tech jobs.

Carson City GREATS (girls really enjoy advanced technical skills) was launched in September 1999, just as the high school opened its new High Tech Center. The director of the high school's School-to-Careers program arranged for five local businesses to provide internships for five students each semester. Interns worked 90 hours a semester, earning either $6 an hour or half a credit for participating in the project. Girls were to be recruited from CAD courses, but because no girls had signed up for those courses, the bilingual teacher's aide recruited students from the English as a Second Language (ESL) program. Recruitment meant selling the program to the girls' parents, many of whom believed that a woman's place is in the home, a future that did not call for advanced computer classes. She persuaded the parents that the girls needed to study if they were to have a better life.

The girls also enrolled in the school's AutoCAD course and were given remedial instruction in English/language art and math, if needed. In addition to all their other classes, the girls were enrolled in a geographic information systems (GIS) class at 7 a.m. in the High Tech Center's spatial analysis/GIS/CAD technology lab. All instructions and demonstrations were in English, which the aide then translated into Spanish. Lab assignments were given in English. The aide attended a two-day training session in GIS, which made her more confident and productive in the classroom.

The results of the research and education activities were startling. It was assumed that perhaps eight to ten Hispanic girls would be interested in the program, but those estimates were far surpassed. Not only did the girls learn skills that could help them land high tech jobs, but also their confidence levels soared, they became more proficient in English, and during the summer they improved their math, raising their scores on state math proficiency exams. A program through which students could learn in both languages empowered the girls to learn that they had far more ability than they thought they had—which opened the door to more learning. Enrollment in high technology classes increased substantially in 2000–2001.

The girls' comfort zone expanded and, deciding they needed a support group outside the classroom, they started a lunchtime club that would meet weekly to discuss such concerns as how to achieve their career goals without alienating their families. They invited speakers and took field trips, to expand their career horizons, but they also wanted to help Latinas who had just immigrated. For the club to be formally sanctioned on the Carson High School campus, they had to present their club's mission and goals to the entire student council. Twenty of the girls attended the meeting, one presented their proposal, and after asking many questions, the student council unanimously approved the club. Speaking up for themselves before students who barely knew they attended the same school was a monumental achievement for these girls, who had to articulate their desires and answer questions on the fly. They opened lines of communication with the majority population that had not existed before, and in so doing they took the first step in attaining their dreams and broke ground for many girls to come after them.

GREATS gave these girls a true sense of the possible. Before, they had been disenfranchised from learning. Now they are standing up for themselves and asking more from themselves, their counselors, their peers, and their teachers. They are signing up for classes they never would have considered before. They view college as a viable option, which it was not before. And they are advocating for each other as well as for themselves.

The project brought national recognition to the flexibility and untapped resources of GIS as a multilingual tool for teaching. Carson High School and its instructor have become information resources for other institutions interesting in instituting a similar program. The Nevada State Department of Education funded an additional year of the program through the Technology Leadership Challenge Fund. During the summer of 2000, the Carson City GIS Department was a mentoring agency for 10

MASTERING ENGLISH AND TECHNOLOGY

Week 1. No technology content was presented. To break up potential cliques and encourage the girls to be mutually supportive, the class engaged in icebreakers, including a game of human bingo that required the girls to learn pieces of life information about one another. *These lighthearted activities promoted a safety net for the girls and cemented their desire to continue with the class.* After assessments in computer and English proficiency, instruction began.

Week 2. The girls learned basic Windows and printing instructions, then took pictures of each other with digital cameras, opening images from floppy disks and printing the images out—as a way to engage their interest and get them experimenting with file navigation on the network, saving, and document printing.

Weeks 3–9. The girls learned analysis concepts of geographic information systems using ArcVoyager software. Some concepts almost defied translation. Gross national product, for example, is a difficult concept even for native speakers of English. After many tears and much tenderness—with other students helping to translate—the girls experiencing discomfort agreed to remain in the class. *After completing each unit, students were required to apply what they learned with a small project of their own—so the teacher could tell if they really understood what they were doing or were just reading and parroting what they read or saw in the lessons*. During this phase the students were all highly motivated and ready to work, diligently completing all of the assignments and coming in during their breaks to get extra help from the aide.

Week 10. During the first nine weeks, some of the students showed tremendous improvement in verbal and written skills. (One student, who spoke no English when the class started, beckoned the instructor for assistance and said, "Ms. Brooks, I have confusion in my heart," articulating the need for help and showing the courage to seek it in her own words.) But many of the girls, despite becoming more English and technology literate, still refused to speak English outside the classroom. This concerned the staff, because on the job they would have to be able and willing to speak English. Several days were set aside to discuss the girls' concern, and *the girls admitted anxiety about making mistakes in English, concern about being laughed at in the classroom by the Hispanic boys*. Not all the boys would laugh but enough did that they felt humiliated in English-only classes and preferred speaking Spanish. After long discussions about career and cultural issues, the girls were encouraged to get past prior hurts and to start practicing their English skills. To show good faith, the non–Spanish-speaking teacher offered to give a 10-minute lecture in Spanish if they would agree to do three of their four GIS presentations in English.

Weeks 11–18. The girls progressed to ArcView, standard software for the GIS industry, and became responsible for relating what they had learned to a new project. They were learning skills that required they query or narrow down their data. Once they understood the new tools, they were instructed on how to create a layout, show and describe the results of their work, and present their findings. They found this graphic part of the curriculum very satisfying.

ELLIS (English language software). In addition to regular classwork, the girls were encouraged to come in during study period or on their own time to use the English language software procured with the NSF grant. ELLIS is an interactive multimedia platform with microphone and headphones. The students may tape themselves and then hear themselves speaking. Visuals show specifically where points of articulation are so students can see how they should be enunciating. The software provides regular comprehension tests and gives girls feedback on their progress. The aide is there to help with software mechanics, but the students drive their own progress. *Their English skills, both written and spoken, improved markedly.*

girls, who got field experience gathering data for use in Carson City's geographic information system. The girls became a valuable resource for the city agency while amassing valuable workplace skills.

This account is drawn partly from a story by Teri Vance in The Nevada Appeal, *February 12, 2000*.

CODE: H	CARSON CITY (NEVADA) SCHOOL DISTRICT
VALERIE DOCKERY (VDOCKERY@CARSON.K12.NV.US), ANITA BROOKS, GREGORY MARANGI	
HRD 99-08730 (ONE-YEAR GRANT)	PARTNER: CARSON CITY GIS DEPARTMENT
KEYWORDS: DEMONSTRATION, HISPANIC, LATINA, INTERNSHIPS, COMPUTER-ASSISTED DRAFTING (CAD), INDUSTRY PARTNERS, RURAL, BILINGUAL, CLUB, COMPUTER SKILLS, ENGLISH, SUPPORT SYSTEM, ACHIEVEMENT, SELF-CONFIDENCE, FIELD TRIPS, MENTORING	

004
peer
Student-peer teaching in Birmingham, Alabama

STUDENT-PEER TEACHING IN BIRMINGHAM, ALABAMA

IN URBAN DISTRICTS THAT ARE PREDOMINANTLY AFRICAN AMERICAN, MAKING CLASSROOMS GIRL-FRIENDLY MAY BE ONLY A SMALL PART OF WHAT NEEDS TO HAPPEN. FIRST, THE DESPERATE NEEDS OF AFRICAN AMERICAN BOYS AND THE LOW NUMBER OF STUDENTS TAKING ADVANCED SCIENCE MUST BE ADDRESSED. BUT A COMPREHENSIVE STRATEGY FOR INCREASING THOSE NUMBERS OFFERS AN OPPORTUNITY TO INTRODUCE ISLANDS OF SUPPORT FOR MATH AND SCIENCE ACTIVITIES GIRLS WILL ENJOY.

In Birmingham, where more than 90 percent of the students are African American, the Russell Mathematics and Science Center (RMSC) provided outreach to students and in-service training programs for middle and upper elementary school teachers and for adult leaders of girls' organizations. RMSC is a five-year project of the Alabama School of Fine Arts (ASFA), where nearly half the students major in math and science.

In the project's most original training and development activities, *every ASFA student did outreach—presenting a lesson or activity to outside students or adults. RMSC built "presenting" into the curriculum*. Three days a week, teacher–student teams—a teacher–coach and five to seven highly trained and motivated high school students—presented science lessons and labs at after-school sites run by Girls, Inc.

To present a lesson on the basics of electrical circuits, they took strings of Christmas tree lights that kids in the class could cut up and work with in various ways—allowing students to safely handle circuit principles using cheap materials. *The presenters (mostly girls) had to master the material to field questions from the audience, had to think on their feet, and had to pay close attention to girls in the audience to engage their interest in the subject. This peer-to-peer teaching was a hit all over Alabama and developed in the presenters a calm and poise that paid off when they interviewed for scholarships and awards.* Some of them left the math/science program with more than $75,000 apiece in scholarship offers. Over three years, the students presented modern, hands-on science and math instructional demonstrations to more than 800 teachers and 4,500 students a year.

Teachers and students spent most of a year designing a Math and Science Day at a new theme park. They wrote original problems to fit specific rides (calculating and graphing changes in the roller coaster's speed, for example), designed written materials, and advised the theme park on the day's structure. Math and science activities were conducted at every major ride, where a team of RMSC students helped students trying to solve the problems.

In an important series of teacher training workshops on African American scientists, teachers were presented with a biographical sketch of an African American woman and then did lab activities based on the woman's specialty—providing a kit so the teachers could reproduce the lab for 30 students back in their own school. For nutritionist Flemmie P. Kittrell, for example, students determined the iron content of cereals by using a magnet to remove iron filings from iron-fortified cereals; they also determined the protein content of various foods using a biuret solution.

Girls Inc. recruited 100 students for a four-week all-day summer camp. RMSC conducted the exploratory morning programs, designed to build the girls' skill, confidence, and self-esteem: an 80-minute math activity, a short break, and an 80-minute science activity.

CODES: M, H, PD	ALABAMA SCHOOL OF FINE ARTS
MICHAEL J. FRONING (ASFAMS@AOL.COM), BARBARA NUNN	
HRD 96-19214 (THREE-YEAR GRANT)	
PARTNERS: RUSSELL MATHEMATICS AND SCIENCE CENTER, GIRLS INC.; VISIONLAND; AND THE UNIVERSITY OF ALABAMA PSYCHOLOGY DEPARTMENT	
PRODUCT: A BOOKLET OF PROBLEMS FOR THE OUTDOOR MATH AND SCIENCE CLASSES AT VISIONLAND.	
KEYWORDS: EDUCATION PROGRAM, AFRICAN-AMERICAN, TEACHER TRAINING, AFTER-SCHOOL; GIRLS, INC., HANDS-ON, SELF-CONFIDENCE, INFORMAL EDUCATION, ROLE MODELS	

004

Day

Improving science in a Dayton magnet school

IMPROVING SCIENCE IN A DAYTON MAGNET SCHOOL

DUNBAR MAGNET HIGH SCHOOL SPECIALIZES IN THE HEALTH SCIENCES. LOCATED IN DAYTON, OHIO'S, INNER CITY, IT SERVES A STUDENT BODY THAT IS 80 PERCENT MINORITY—MOSTLY AFRICAN AMERICAN. IN 1992, WRIGHT STATE UNIVERSITY (WSU) UNDERTOOK *A MODEL PROJECT TO INCREASE THE NUMBER OF HIGHLY MOTIVATED, ACADEMICALLY COMPETENT YOUNG WOMEN AT DUNBAR WHO WOULD GO ON TO EARN BACCALAUREATE (AND HIGHER) DEGREES IN THE SCIENCES*.

During the school year, the project revised and updated Dunbar's science courses; co-taught (with Dunbar's science teachers) a college-level introductory biology course to facilitate the transition to college (students earning a C or better were eligible for four hours of college credits); offered a course on the health science professions to interest girls in health science–related careers; educated girls about career opportunities and requirements; and *developed collaborative activities between Dunbar science teachers and WSU faculty to reduce the science teachers' sense of isolation*. WSU science faculty and graduate and medical students participated extensively in these activities. Most of the student participants were minority students.

During the summer, selected high school girls from the Dayton area worked as apprentices and had a chance to do seven weeks of research under the close supervision of faculty mentors. Students who had completed a year of math, biology, and chemistry could apply, with preference given to students from economically disadvantaged families who knew no local scientists. Afternoons, students heard presentations by scientists from WSU and the private sector or went on field trips to private research and development laboratories, where they interacted with women and minority scientists.

To strengthen the students' academic background, WSU faculty gave lectures on working with fractions, ratios, and percentages; working with logs and antilogs; performing calculations using mole, molarity, and titrations; understanding the concept of pH and buffers; plotting XY data and finding the best fit using linear regression; and calculating correlation coefficients.

To strengthen the teaching skills of in-service and preservice teachers, the project offered a seven-week summer program to update their knowledge of modern research tools and techniques. The project tried to integrate activities of the teacher participants and student apprentices into a close working relationship with laboratory personnel, including undergraduate and graduate students. Teachers were helped to design simple classroom experiments.

On Fridays, students, teachers, and faculty mentors gathered for informal lunches at which women and minority scientists from the private sector gave talks about their own family and educational background and how they became interested in science. Toward the end of the summer program, parents were invited to hear participants give oral presentations about their accomplishments. Participants also had to submit written reports, with tables and figures, to gain insight into workplace requirements. By summer's end, *all of the students who participated planned to go on to college and to major in math or science*.

CODES: U, H, PD	WRIGHT STATE UNIVERSITY
PREM P. BATRA, NOEL NUSSBAUM, RUBIN BATTINO	
HRD 92-53433 (ONE-YEAR GRANT)	
PARTNERS: DUNBAR HIGH SCHOOL, DAYTON PUBLIC SCHOOL SYSTEM	
KEYWORDS: DEMONSTRATION, AFRICAN-AMERICAN, CURRICULUM, CAREER AWARENESS, RECRUITMENT, RESEARCH EXPERIENCE, FIELD TRIPS, MENTORING, TEACHER TRAINING, PARENTAL INVOLVEMENT	

004
Turn
Turnage scholars program

TURNAGE SCHOLARS PROGRAM

THIS COMPREHENSIVE REGIONAL EXPERIMENTAL PROJECT FOR GIRLS AND WOMEN IS A COLLABORATION BETWEEN THE HISTORICALLY BLACK ELIZABETH CITY STATE UNIVERSITY (ECSU) AND THE ROANOKE RIVER VALLEY CONSORTIUM—FIVE RURAL, ECONOMICALLY DISADVANTAGED, PREDOMINANTLY AFRICAN AMERICAN PUBLIC SCHOOL SYSTEMS. TO OVERCOME MESSAGES OF SCIENTIFIC INFERIORITY THAT MANY STUDENTS RECEIVE BECAUSE OF RACE, GENDER, OR SOCIOECONOMIC STATUS, IT AIMED TO CHANGE SOCIAL, ACADEMIC, AND SCIENTIFIC CLIMATES SO THAT GIRLS' AND WOMEN'S APTITUDE AND INTEREST IN STEM COULD FLOURISH AND AT THE SAME TIME TO LEARN MORE ABOUT HOW INFRASTRUCTURE IN STEM INTERACT WITH GENDER. IT WOULD ACHIEVE THESE GOALS THROUGH STAFF DEVELOPMENT, INNOVATIVE PROGRAMS FOR EIGHTH GRADE GIRLS, MORE PARENTAL INVOLVEMENT IN THE GIRLS' EDUCATION, AND PARTNERSHIPS BETWEEN BUSINESS AND INDUSTRY.

The project trained 300 educators—200 teachers, 50 administrators, 25 counselors, and 25 staff members—in more gender-equitable teaching, in new approaches to multidisciplinary teaching of math and science, and in alternative methods of assessment.

For eighth grade girls there were after-school clubs, a Saturday academy (providing valuable activities for children who had nothing to do and nowhere to go on Saturday), a residential summer enrichment institute at ECSU, and alumni scholars. The girls learned about fitness, nutrition, entrepreneurship, and goal setting. Guest experts demonstrated how to use a stethoscope and spoke about everything from what it takes to be a good nurse to what it takes to start and maintain a business. Simulations, labs, experiments, and other hands-on activities helped them learn the scientific method and the basics of research, including Internet research. They sought answers to such questions as "Can sound be heard in space?" and "What percentage of gum is sugar?" They viewed videos in the *Breakthrough* video series, including "The Path of Most Resistance" (chronicling the rewards and challenges people of color confront in choosing a life in math or science), learned about career planning, reported on African Americans in STEM, and completed career action plans. Field trips and other occasions offered lessons in etiquette and proper mealtime behavior. Parental involvement was encouraged throughout.

In the four-week summer enrichment institute, the girls studied a different theme each week: population ecology/environmental science; space science/astronomy/physics; architectural design and drafting/geometry; and living creatures/biological sciences. They took field trips to the Marine Science Center in Virginia Beach, to the Air and Space Center in Hampton, and to Hampton University.

CODES: M, H, U, PD	Elizabeth City State University
James A. McLean, George Thigpen, Sandra C. Hardy, Cheryl Lewis, Patricia Dobbin	
HRD 95-55817 (three-year grant)	
Keywords: demonstration, after-school, Saturday academies, science clubs, gender equity awareness, constructivism, parental involvement, industry partners, African-American, rural, staff training, summer institute, hands-on, career awareness, field trips	

PROJECT PRISM

004
PrSm
Project PRISM

TO KEEP GIRLS AND ETHNIC MINORITY STUDENTS—ESPECIALLY NATIVE AMERICAN STUDENTS—IN THE STEM PIPELINE, AND TO RECRUIT MORE WOMEN AND ETHNIC MINORITY PRACTITIONERS INTO THE STEM WORKFORCE, THIS COLLABORATIVE DEMONSTRATION PROJECT AIMS TO PROMOTE SUSTAINABLE REFORM ON GENDER AND CULTURAL ISSUES IN SECONDARY MATH AND SCIENCE CLASSROOMS. AMONG OTHER THINGS, IT AIMS TO DEVELOP A UNIVERSITY COURSE FOR TEACHERS AND STUDENT TEACHERS TO HELP THEM IMPROVE THEIR COMPUTER SKILLS AND TEACHING ABILITIES AND INTRODUCE THEM TO ISSUES OF GENDER, CULTURE, AND SCIENCE.

The project's target population is student teachers at Washington State University and Lewis-Clark State College and teachers, counselors, and administrators from eight school districts, five of which serve the Colville Confederated Tribes and CCT secondary students. The project aims to make secondary teachers and counselors more committed to inclusive teaching and curricula and more aware of how gender and cultural issues affect students'—especially girls' and Native Americans'—learning and persistence in STEM classrooms.

Teachers and counselors will participate in interactive in-service development opportunities involving gender, culture, and education. A summer institute will focus on reform in STEM classrooms and curricula. Faculty learning communities will support participants in revision and reform efforts.

All faculty development components will be designed and developed by teams of secondary and university faculty in cooperation with CCT personnel and a CCT advisory council. The project will produce and disseminate manuals detailing what goes on in the faculty in-service workshop, the summer institute, and teaching and curricular reform.

CCT students will learn about STEM careers and the schooling needed for them through field trips, hands-on projects, career planning, and community service projects. The project should add to the knowledge base about which intervention strategies are effective with Native American students, especially girls.

CODES: PD, M, H, U	WASHINGTON STATE UNIVERSITY
SANDRA C. COOPER (SCOOPER@MATH.WSU.EDU), JUDY L. MEUTH	
HRD 01-20884 (THREE-YEAR GRANT)	
PARTNERS: LEWIS-CLARK STATE COLLEGE; COLVILLE CONFEDERATED TRIBES (CCT)	
KEYWORDS: DEMONSTRATION, TEACHER TRAINING, GENDER EQUITY AWARENESS, CURRICULUM, FIELD TRIPS, HANDS-ON, COMMUNITY SERVICE, CAREER AWARENESS, MANUAL, NATIVE AMERICAN, PROFESSIONAL DEVELOPMENT	

004

Feed

Feed the mind, nourish the spirit

FEED THE MIND, NOURISH THE SPIRIT

OVER TWO SUMMERS, 46 NATIVE AMERICAN AND ALASKAN NATIVE GIRLS FROM HIGH SCHOOLS ALL OVER THE COUNTRY GATHERED AT CLARKSON UNIVERSITY, IN POTSDAM, N.Y., FOR A FOUR-WEEK RESIDENTIAL PROGRAM IN MATH AND ENGINEERING DESIGNED TO EMPOWER AND PREPARE THEM TO MAKE INFORMED CHOICES ABOUT COLLEGE AND CAREERS IN SCIENCE, ENGINEERING, AND TECHNOLOGY. THE PROJECT WAS A PARTNERSHIP WITH THE AMERICAN INDIAN SCIENCE AND ENGINEERING SOCIETY.

To show math's relationship to and application in engineering, the math-intensive, hands-on curriculum emphasized major principles in mechanical, civil, and environmental engineering. Classes were held daily in math, computers, logic, problem solving, engineering, and entrepreneurship. The math teacher moved students adroitly from a review of algebraic concepts through geometry and trigonometry functions to calculus—without the girls fully realizing it, so they were not intimidated by the materials.

Cooperative learning was stressed during problem-solving, which integrated math and computers, engineering projects, and entrepreneurship (involving a business plan and a PowerPoint presentation).

- For *mechanical* engineering, the girls worked in pairs to design, build, and demonstrate a model tram that could traverse a sloped string and return to the starting point (40 feet, round trip). They had to accommodate energy and material constraints and were restricted to a one-minute climb.
- For *civil* engineering, three-person teams had to build and demonstrate the load capacity/weight of a 2-foot truss-design model balsa wood bridge, using a computer design program to save time. They competed to build the lightest bridge that would support the heaviest load—after choosing between a Pratt, Howe, or K-Truss or creating their own design.
- For *environmental* engineering, one group studied the environmental review checklist prepared by the St. Regis Mohawk tribe and submitted to the State Department of Transportation in connection with one of two bridges on the Akwesasne reservation that DOT had identified for replacement. They performed a site visit and queried authorities and people affected by the bridge replacement. The *end result was that DOT redesigned the bridge to include a pedestrian walkway*.

Enrichment and leadership classes were held evenings and some weekends, when they went on field trips (one year to Toronto, Ontario, and the next to New York City for the July 4 fireworks), to the theater, to amusement parks, to Native American cultural events, and so on.

The personal development component nurtured students to unexpected levels of accomplishment. When students feel good about themselves and their existence, they are more inclined to succeed academically. Caring staff willingly gave each student time and consideration and the students responded accordingly. Students came to recognize that they were performing well beyond their own expectations and assumed an "I can do this" attitude. Tests administered before and after the camp showed an average 40-point gain in 1997 and 18 in 1998.

CODES: H	CLARKSON UNIVERSITY
JULIUS P. MITCHELL, SUZANNE BENALLY	
HRD 97-10429 (ONE-YEAR GRANT)	
PARTNER: AMERICAN INDIAN SCIENCE AND ENGINEERING SOCIETY (AISES)	
KEYWORDS: DEMONSTRATION, NATIVE AMERICAN, ALASKAN, SUMMER PROGRAM, MATH, ENGINEERING, HANDS-ON, COOPERATIVE LEARNING, PROBLEM-SOLVING SKILLS	

004

N'rich

Math enrichment for Native American girls

MATH ENRICHMENT FOR NATIVE AMERICAN GIRLS

THE MEGA PROJECT (FOR MATHEMATICS ENRICHMENT GIRLS ACADEMY) ENGAGED 26 NATIVE AMERICAN HIGH SCHOOL GIRLS IN SMALL-GROUP COOPERATIVE LEARNING AT A FOUR-WEEK SUMMER MATH ACADEMY AT TURTLE MOUNTAIN COMMUNITY COLLEGE IN NORTH DAKOTA. FOR FOUR WEEKS, GIRLS IN GRADES 10–12 STUDIED ALGEBRA, TRIGONOMETRY, AND CALCULUS IN A LIVELY MATH ENVIRONMENT. THE GOAL: TO PREPARE THEM TO MATRICULATE INTO COLLEGE STEM COURSES.

The math dealt with everyday applications in the students' Native American Ojibwa (Chippewa) culture, with an emphasis on problem-solving activities, data analysis, and mathematical modeling. *Instruction followed the "rule of three" stressed in elementary math reform: every major topic was presented geometrically, numerically, algebraically—and, in this case, culturally*.

Instructors doubled as role models: math professor Bob Megginson is one of only 12 Native Americans in the country with a doctorate in math, and co-instructor Martha Aliaga is a young Latina statistics professor, with whom the girls could relate. (*With role models, younger is better.*) The girls also read biographies of real-life women in STEM careers, from the book *She Does Math!*

The girls were given and learned to use a TI-82 graphing calculator—learning as well such math tools as Mathematica and Lotus 1-2-3. Using computer spreadsheets, they analyzed data they collected in field trips to local cultural sites. Problem solving in teams of two or four, they tried different ways of measuring the four cement Peace Towers. At the native site Anishnabaug they measured the diameter and height of selected trees using surveying equipment. They discovered the relationship between the diameter and the mass of rocks using regression analysis. They managed to solve a tremendously difficult problem about filling a swimming pool with water, when they realized the importance of time and the rate at which the pool is filled. *Students will tackle tough math problems if they see math as an everyday tool with real-life applications*.

With graphing calculators in hand, they made house drawings, complete with round windows and an inclining roof. They wrote fictitious business plans for businesses they thought could survive in the area, using word processing and spreadsheet programs to create a loan application and apply for a $5,000 loan. They became members of the American Indian Science and Engineering Society (AISES), entitling them to four issues of *Winds of Change* magazine.

Follow-up activities one Sunday a month and a summer camp the second year had to compete with opportunities for girls to make money—a priority on a reservation with high unemployment. Although the girls earned $100 a week participating in the project, the tribe's job program paid more, so 17 girls dropped out the second summer.

But the nine girls remaining attended the second summer session, which emphasized probability and statistics applications, starting with the visual representation of data: relative-frequency histograms, stem-and-leaf diagrams, empirical distribution functions and ogives, box-and-whisker diagrams, and scatter plots. Once students had some visual notion of the concepts of central tendency and dispersion, they were taught the numerical measures of those concepts through sample means and sample standard deviations, then proceeded to analyze bivariate data correlation (both as a numerical measure and as a concept) and linear regression. At that point, the notion of probability was introduced as an intuitive extension of the idea of relative frequency. Permutations and combinations were presented, with strong emphasis on the intuitive ideas of these concepts and the differences between them.

The project will provide strong follow-up for these bright students, staying in touch with them through high school, graduation, and college. *To keep them improving and taking higher and higher math courses, everybody—the school, the principal, and their parents—must keep asking, "How are you doing? What classes are you taking?" That is how the next Ph.D.'s will come*.

CODES: H, I, U	TURTLE MOUNTAIN COMMUNITY COLLEGE
SUNIL R. KARNAWAT (KARNAWAT@GIIZIS.TURTLEMOUNTAIN.CC.ND.US)	
HRD 95-54495 (ONE-YEAR GRANT)	
KEYWORDS: DEMONSTRATION, NATIVE AMERICAN, COOPERATIVE LEARNING, MATH, PROBLEM-SOLVING SKILLS, REAL-LIFE APPLICATIONS, PARENTAL INVOLVEMENT, ROLE MODELS, FIELD TRIPS	

004
Sis
Sisters in science

SISTERS IN SCIENCE

SISTERS IN SCIENCE WAS AN INTERGENERATIONAL PROGRAM TO FOSTER MORE POSITIVE ATTITUDES TOWARD STEM AMONG FOURTH-GRADE AFRICAN AMERICAN, ASIAN, AND HISPANIC GIRLS AT TWO ELEMENTARY SCHOOLS IN PHILADELPHIA'S INNER CITY—THROUGH GREATER COLLABORATION AMONG SCHOOLS, PARENTS, AND THE COMMUNITY. GIRLS WHO WERE MOTIVATED TO BEGIN WITH WERE MENTORED BY ROLE MODELS AT TWO LEVELS: BY UNDERGRADUATE WOMEN AT TEMPLE UNIVERSITY AND BY RETIRED AND ACTIVELY WORKING WOMEN IN STEM.

In the project's first stage, cooperative learning projects (centered on the urban environment) were emphasized for an hour a week in two mixed-gender classrooms in two model schools. Many of the fourth grade girls also participated in a weekly after-school program, which was co-facilitated by elementary education students at Temple University and a corps of intergenerational volunteers. The after-school program extended classroom activities with field trips, experiential service projects, and artistic experiences that promoted environmental awareness (for example, making paper from recycled paper). *Whereas traditional curriculum tries to transfer answers from teachers to students, the SIS curriculum posed questions to the girls, who, through a process of inquiry, became a community of learners*.

In July, about 65 percent of the girls spent two weeks in a summer camp, exploring the city rivers, taking field trips to area environmental agencies, creating model rivers, and designing plans to prevent the rivers from becoming polluted—*returning often to four themes: systems, models, scale, and constancy/change*. In studying city rivers, for example, students learned about the water cycle (systems), about the three states of matter (liquid, solid, and gas—a lesson fundamental to understanding constancy and change), and about models and scale (by creating their own model rivers). Asking "How do city rivers get clean so that people can drink the water?" they learned lessons in problem solving, technological literacy, participatory citizenship, and communications. Finally, they shared what they learned with their families and other elementary school students.

At first the after-school program met every other week. Changing midyear to a weekly schedule increased the girls' enthusiasm and improved attendance so much that the project was expanded so fifth graders could participate the next year. Although the girls had started the project with positive attitudes toward science, they exhibited a statistically significant (.01) increase in scores on a science attitude survey, higher scores on the math attitude survey, and higher scores on tests of math and science skills.

As a vehicle for Temple University's undergraduate elementary education students to become involved in schools before their student-teaching experience, the project was formally incorporated into the College of Education's science and math methods courses, and students got credit for participating.

Acknowledging gender-related differences in learning style, the SIS program *aimed to create a more positive learning climate for minority girls—for example, making it possible for them to manipulate materials. It also sought to increase the knowledge base and understanding of parental influence on female interest in science and math. It dispelled the myth that parents are unwilling to be involved in educational initiatives*. Although both schools are located in neighborhoods plagued by extreme poverty and limited education and employment opportunities, parents became more involved in their daughters' science and math instruction, both in school and out—and their children's interest and enthusiasm increased as a result. *Involving parents clearly strengthened and sustained the impact of the intervention*.

The project would have benefited from more intensive training of teachers (in the constructivist approach to teaching), more teacher responsibility for implementing activities independent of the project director, and more attention to the transportation needs of older volunteers and flex-time opportunities for working women.

THE PROGRAM EXPANDED

The original project was expanded into a two-year intervention involving 540 girls in fourth and fifth grade in six urban schools. The objective was still to increase the math and science literacy of fourth grade minority girls, to extend the program into fifth grade as the initial cohort advanced in school, to strengthen teacher's professional development, and to get volunteers and families more involved in science and math education for Philadelphia's children.

Teachers participated in an intensive two-week summer workshop in professional development before project activities began and in monthly curriculum planning meetings to familiarize themselves with gender equity issues and useful teaching strategies. *Teachers appreciated a workshop in which project directors worked and talked with them, rather than talking at them. A practicum originally developed by Sisters in Science—which later* *became a collaborative effort with the NSF-funded Collaborative for Excellence in Teacher Preparation—has become a permanent feature of Temple University's preparation for elementary teaching*. Third-year majors in elementary education work at the six project schools (and teach once a week) under a master fourth-grade teacher who has attended the summer Sisters session. Sisters in Science has become a known factor in the Philadelphia public school system. In honor of her work creating the program, in 2000 the Girl Scouts gave a Take the Lead Award in Science and Technology to principal investigator Penny L. Hammrich.

Even if the girls said they wanted to become a doctor, they were often unaware that they needed to take science classes. Their attitudes did not match their understanding of how science courses fit into their eventual career path. Year 1 results were positive; it is too early for longitudinal results (and the project did not include a control group or random sampling). It became evident that because parental behavioral expectations have such important long-term implications for girls' interest and achievement in math and science, and because positive female role models are also important, program interventions must make a conscious effort to provide support for collaboration among schools, parents, and the community as ideas for useful strategies are developed, implemented, and evaluated.

CODE: E, U, I, PD	Temple University College of Education and Center for Intergenerational Learning
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HRD 95-53426 (one-year grant) and 96-19021 (three-year grant)	
Partners: School District of Philadelphia; retirees from area chemical companies; 21st Century Mathematics Center for Urban Schools; Collaborative for Excellence in Teacher Preparation	
Products: a marketable set of activities to be published as a book	
Keywords: demonstration, career awareness, environmental science, curriculum, after-school, multi-generational, industry partners, African-American, Asian-American, Hispanic, role models, mentoring, cooperative learning, mixed-gender, field trips, hands-on, intervention, parental involvement, teacher training, gender equity awareness	

004
Mgrl
Minority girls in the system

MINORITY GIRLS IN THE SYSTEM

A THREE-YEAR RESEARCH AND ACTION PROJECT CALLED GIRLS IN THE SYSTEM (SUSTAINING YOUTH IN SCIENCE, TECHNOLOGY, ENGINEERING & MATHEMATICS) IS CONDUCTING FIVE SUMMER DAY CAMPS TARGETED TO UNDERPRIVILEGED GIRLS, ESPECIALLY MEXICAN AMERICAN AND NATIVE AMERICAN GIRLS IN GRADES 3–8.

The project is a partnership between the Sahuaro Girl Scout Council (which has significant experience working with girls and minorities) and five departments of the University of Arizona (math, ecology and environmental biology, materials science and engineering, mining & geological engineering, and women's studies). The idea is to get a sense of where the girls are and what influences their decisions and at the same time to move them forward. Each side stretched to accommodate the other's interests, to *strengthen the crucial link (for this target population) between informal and formal education*. The project emphasizes home–community connections, stronger links between informal and formal educators; and links between program components:

- Girls-only (and sometimes mixed-gender) after-school programs and summer programs co-led by Girl Scout troop leaders (informal educators) and regular and student teachers (formal educators)
- Twice-a-year academies for the professional development of informal and formal educators, designed to foster collaboration (by planning how to transform what they learn as adults into a setting with girls), promote mentoring, and integrate gender equity
- Workshops to make parents aware of the importance of math and science courses to their daughters' career decisions and earning power and to make them aware of resources to strengthen their daughters' education
- Mini-grants to initiate adult study groups, events, and presentations
- Research to add to the sparse knowledge base on STEM education for Mexican American and Native American girls

The Girl Scout Council recruits girls, obtains all permissions, and incorporates the informal inquiry-based curriculum into six-week after-school scouting sessions during the year, some of them held on the Tohono O'Odham reservation near Tucson.

The summer camp was set up with six activity areas, each led by one or two adults, preservice teachers and Girl Scout leaders together. Each camp centers on a theme: solar power, rockets, water world, or solving a mystery. Throughout the camp, the girls rotate among stations, working in small groups. Parents came to see what they had done on Friday, *but parents dropping kids off at camp also often stayed to play math games with their children*. Each camp starts and ends with a Girl Scout team-building activity. Native American participants quickly picked up the Girl Scout songs, games, and group exercises.

TEACHERS' ACADEMIES: LEARNING, NOT INSTRUCTION

The project offered academies for professional development twice a year to improve teachers' knowledge of content. Many who attended had missed out on hands-on learning and appreciated the experience, for themselves and their students. *Taking apart and analyzing a telephone and a computer keyboard—activities that emphasized both construction and destruction—advanced their sense of engineering. Formal and informal educators had often never had a chance to test hypotheses, to see their designs work, or to experiment with a home technology such as a microwave oven to increase their understanding of physics. They saw how experiential education could deepen their understanding*. Building a river system really *showed* water's action in making canyons and deltas. Building a tin-can telephone, they tested the difference in performance between Styrofoam and plastic cups and between wire, thread, and fishing line.

They also learned to hold back on "teaching" as "instruction"—and on asking girls the discouraging question, "Are you sure that will work?"—and instead to ask probing questions, to get kids to think about what might happen and thereby to own the activity and desire to learn, to respond to learning cues ("teachable moments"), to not answer their own questions, to be co-participants more than authority figures, and to let the children realize that they too can possess knowledge. Teachers tend to do too much instead of letting kids experiment. Even the principal investigators differed on how much "help" girls need to avoid frustration. *Educators have trouble putting aside their educator and letting girls experience learning, so girls get discouraged and stop participating*.

For the solar power camp, some girls made solar ovens, some explored solar trackers and navigation, and some explored insulation, insulating cardboard "houses" with their choice of various materials (feathers, lard, straw, foil, air, Styrofoam, newspaper, etc.) and testing them by placing hot and cold water bottles inside and recording temperatures over time. *Campers were so enthusiastic about studying solar power that turnout was heavy on Parents' Day*.

For the rockets camp, the girls built rockets using water or air propulsion. Most dramatic were those made from bottles and launched 50 feet into the air using an air pump. Second most dramatic were small rockets with an engine of water and Alka-Seltzer mixed in a plastic film container—which soared up to 15 feet. The mixed-gender water camp explored the concept of buoyancy and other properties of water by making and testing boats. The mystery camp explored activities detectives use in solving mysteries.

After-school troop-based programs also dealt with themes, such as fragrances (exploring the chemistry of perfume, lip balm, and soap) and the senses; various kinds of engineering (for mining engineering, the girls had to extract the yolk from a hard-boiled egg with as little damage to the yolk and eggwhite as possible); math (reducing or enlarging images of themselves and of a piece of furniture); communication (designing a communication system using vibrations); and density (which ended with analyzing the properties of root beer floats).

As part of structural engineering, one troop experimented with adobe. To learn what makes a strong structure, the girls broke into groups to see who could produce the best adobe brick using such ingredients as local soil, sand, cement, grass, and water. The next week the girls chose one brick to copy and all worked together to produce 20 bricks each. Later the girls and their parents used the bricks to construct a bridge in the school cafeteria.

The target, 40 girls per camp, was not quite reached, but there was little attrition: those who came kept coming. Over time, *the girls grew in science and communication skills and self-confidence and were more willing to take risks and make mistakes, to provide answers and lead activities, to recognize and change experimental variables, to estimate, to problem-solve in small groups and to arrive at a consensus about how to work on problems—practicing the social skills needed for collaboration. Many girls reported how much they enjoyed getting dirty, taking things apart, learning to measure, using tools, and thinking about math*.

Some summer camps were mixed-gender to allow educators to study gender interactions with a view to improving their own practices. They found that *girls' experiences were very different in mixed-gender and girls-only settings in terms of access, visibility, leadership, and willingness to be active. In small groups, girls tended to work better with girls only, as boys tended to take over. When the genders did work well together, the boys may have made things more competitive, sometimes became more aggressive during group games, and were more likely to cause behavior problems, if only to get more attention (albeit negative). But gender is not the only important factor: color, ethnicity, and poverty may also affect girls' learning. A girl exposed to robotics may want robotics for Christmas, even though there may be no computer in her home*.

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PARTNERS: SAHUARO GIRL SCOUTS COUNCIL (TUCSON); SOUTHWEST INSTITUTE FOR RESEARCH ON WOMEN

KEYWORDS: EDUCATION PROGRAM, AFTER-SCHOOL, SUMMER CAMP, HANDS-ON, TEACHER TRAINING, MENTORING, GENDER EQUITY AWARENESS, PARENTAL INVOLVEMENT, GIRL SCOUTS, HISPANIC, MEXICAN-AMERICAN, NATIVE AMERICAN, UNDERPRIVILEGED, INFORMAL EDUCATION, MIXED-GENDER, PROFESSIONAL DEVELOPMENT, RESEARCH STUDY, INQUIRY-BASED, SELF-CONFIDENCE, COMMUNICATION SKILLS, EXPERIENTIAL LEARNING

004
Eyh
Enhancing
Expanding
your Horizons

ENHANCING "EXPANDING YOUR HORIZONS"

EVERY YEAR, AT EXPANDING YOUR HORIZONS™ (EYH) CONFERENCES HELD ACROSS THE NATION, GIRLS PARTICIPATE IN HUNDREDS OF HANDS-ON WORKSHOPS DEMONSTRATING HOW MATH AND SCIENCE ARE USED IN VARIOUS OCCUPATIONS, AND ENTHUSIASTIC WOMEN VOLUNTEERS—GRADUATE AND UNDERGRADUATE STUDENTS AND PROFESSIONALS—CONVEY THE MESSAGE THAT "SCIENCE IS WOMEN'S WORK." MIDDLE-SCHOOL GIRLS WHO ATTEND THE CONFERENCES EAT MEALWORMS, CREATE WEB PAGES, EXAMINE THE EARS OF CATS AND DOGS, BUILD ROBOTS, AND MAKE TOWERS OUT OF STRAW. THEY LEARN THAT LIQUID NITROGEN ICE CREAM IS "EXTREMELY COOL." THEY CONNECT WITH STEM PROFESSIONALS AT WORKSHOPS LIKE "IS VETERINARY SCIENCE FOR YOU?"

Designed by women scientists and educators in San Francisco's Math/Science Network in 1974, EYH became the organization's flagship program for encouraging girls' interest in STEM. Dating from 1979, the Fargo–Moorhead EYH conference, coordinated by North Dakota State University (NDSU), is one of the oldest and largest, drawing 800 to 900 participants a year. Right after the conference, participants indicate a strong interest in math and science but then return to environments that may not support that interest. Long-term evaluations showed that the *conference influences their attitudes about taking math and science courses in high school but—as a one-day experience with no follow-up activities—has no discernible long-term effect on their career choices*. This grant supported several follow-up programs in North Dakota.

EYH emphasizes outreach to non-European ethnic groups and to economically depressed communities. Under the NSF grant, *by visiting schools on Indian reservations NDSU increased the number of Native American participants sixfold (from 11 in 1994 to 68 in 1995 and 1996)*.

The project mailed newsletters to all EYH participants, containing information about area women scientists and courses needed for various careers. Those who expressed a strong interest in math and science were invited back the next year to an Enhanced EYH (EEYH). In 1995 and 1996, 47 students from seventh and eighth grade participated in longer, smaller, more rigorous workshops and heard women talk about what made their work as scientists interesting.

Immediate evaluations of the Enhanced EYH program were positive. A longitudinal survey of EYH participants' changing interest in math and science shows that parental *encouragement is important in maintaining high interest*. As a result of this grant, EYH has a permanent home in NDSU's Continuing Education.

After the conference, the project tried three ways of staying in touch with participants electronically: a listserv, a Web page discussion group, and an e-mail mentoring group. Only the mentoring program had any success, because most of these rural students didn't have easy access to computers.

EYH also conducted four-day science workshops on campus for high-school girls and supported 17 college students in campus laboratories for a summer. These women later led EYH workshops and helped with the EEYH program.

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HRD 94-50017 (three-year program)	
Partners: American Indian Science and Engineering Society, Math-Science Network	
Keywords: demonstration, hands-on, conferences, minorities, underprivileged, Native American, parental involvement, engagement	

004
SAT
Saturday workshops for middle school girls

SATURDAY WORKSHOPS FOR MIDDLE SCHOOL GIRLS

TO LEARN WHETHER AND HOW SCIENCE, MATH, AND ENGINEERING WORKSHOPS AFFECT MIDDLE SCHOOL GIRLS' ATTITUDES, INTEREST LEVEL, AND KNOWLEDGE OF STEM, THIS MODEL PROGRAM PROVIDED EIGHT HANDS-ON WORKSHOPS FOR 35 GIRLS (77 PERCENT MINORITY) FROM THREE DENVER MIDDLE SCHOOLS WITH SIZEABLE HISPANIC, AFRICAN AMERICAN, AND ASIAN AMERICAN POPULATIONS. THEY COMPARED EVALUATION RESULTS FOR THOSE GIRLS WITH THOSE FOR A CONTROL GROUP OF 24 GIRLS FROM SIMILAR BACKGROUNDS WHO DID NOT PARTICIPATE IN THE WORKSHOPS.

Saturday workshops held at the University of Denver over a nine-month period included various biology and chemistry experiments as well as robotics sessions. Parents of the girls were involved in three of the Saturday workshops and had separate sessions on adolescent development and educational planning, as well as some exposure to STEM activities. Undergraduate student mentors in engineering, biology, and chemistry helped the girls with their projects, and the girls also talked with women mentors in STEM-related careers.

Results from the first year suggested that all of the girls, regardless of group, were persistent in how they approached problems and had high perceived ability and interest in math and science. Because their levels of ability and interest started at a high level, they did not change, *but the girls who took the workshops did know more than the control group about career options in STEM, about what courses they should take in high school as a foundation for science, engineering, and math degrees*, and about how long it takes to complete such degrees. So the program was effective in providing knowledge to girls who were already interested in the subject.

One unexpected result was the positive impact mentoring middle school girls had on the undergraduate student mentors. Another was increased parental involvement the second year, after the project was able to satisfy requests for more parental involvement in hands-on activities—which made it easier for the girls to talk to their parents about their projects. Parental enthusiasm for STEM careers increased—some parents even began to consider STEM careers for themselves—as did the amount of dialogue between parents. Parents also wanted to know more about adolescent development and STEM careers.

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HRD95-53379 (one-year grant)	
Partners: Cole Middle School and School of the Arts, Hill Middle School, and Smiley Middle School	
Keywords: demonstration, hands-on, minorities, workshops, saturday program, parental involvement, role models, career awareness, research study, mentoring	

004
AsA
The after-school ASSETS project

THE AFTER-SCHOOL ASSETS PROJECT

PILOTED IN 1995, THE ECOLOGY-BASED RIVERGIRLS CAMP WAS ATTENDED BY 45 AFRICAN AMERICAN, NATIVE AMERICAN, AND HISPANIC GIRLS ENTERING SEVENTH AND EIGHTH GRADE IN INNER-CITY ST. PAUL SCHOOLS. MANY OF THE GIRLS CAME FROM LOW-INCOME SINGLE-PARENT FAMILIES. THE SCIENCE MUSEUM OF MINNESOTA DEVELOPED AN AFTER-SCHOOL PROGRAM AS AN EXTENSION OF THE FOUR-WEEK CAMP.

The ASSETS project (after-school success exploring technology and science) enabled 24 of the girls who participated in RiverGirls to engage in two 12-week after-school program sequences that gave them more hands-on experience with science, technology, and tools—and a chance to develop positive relationships with peers and role models who reflected their own cultural identities. The girls' parents were invited to participate in their daughters' museum experience, so they could learn to support their daughters' math and science education.

CODES: M, I	Science Museum of Minnesota
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Keywords; education program, museum, after-school, hands-on, role models, parental involvement, underprivileged, informal education, ecology	

004

swt

Sweetwater girl power

SWEETWATER GIRL POWER

SWEETWATER UNION HIGH SCHOOL DISTRICT, THE LARGEST SECONDARY DISTRICT IN CALIFORNIA, IS LOCATED IN SOUTHERN SAN DIEGO, ALONG THE BORDER WITH MEXICO. IN COLLABORATION WITH UNIVERSITY, BUSINESS, AND COMMUNITY PARTNERS, SWEETWATER DEVELOPED A PROJECT TO BRING ABOUT SYSTEMIC CHANGE THAT WOULD HELP UNDERREPRESENTED MIDDLE SCHOOL GIRLS (MOSTLY ETHNIC MINORITIES) PREPARE FOR TECHNICALLY CHALLENGING CAREERS.

Many of the girls come from homes in which neither parent has a high school diploma. They knew few if any STEM role models and often spoke English as a second language. To capture their interest, Girl Power stressed high-interest, project-based learning. Girls at 11 schools participated in 48 after-school club activities (including an archaeological dig, robot-building, a website competition, an investigation of forensics and other science and math activities, and visits to college campuses, the zoo, and tide pools). Over two years, 85 girls attended special summer classes, and 165 students took part in nine intersession classes. BE WiSE, an organization of local women in science, put on overnight events for 11 middle school girls at local science venues.

Girls from eight sites came to a math/science expo to compete in hands-on events (building catapults, paper towers, or hot-air balloons), a trivia game about women in math and science, and a math/science spelling bee. Women from the local science and business community served as judges, and the girls were given career and other information by local law enforcement agencies, Sea World, and Sky Hunters (which educated them about raptors).

Teachers were offered professional development workshops in up-to-date math and science content, gender equity strategies for the classroom (GESA), hands-on science and math, and counselor training. More than 120 new teachers, 94 veteran teachers, and 12 counselors participated in professional development. Fifteen teachers completed gender equity training, with follow-up peer coaching. A workshop on reducing math anxiety in the classroom was popular.

Everyone benefited. Parents appreciated hearing how science and technology classes could help their daughters prepare for success in the world of the future. The project's strongest outreach to the community was through the San Diego Science Alliance. An Expanding Your Horizons conference is planned for 2002.

Trying to effect systemic change in a district the size of Sweetwater with a small three-year program was highly ambitious and optimistic, especially at a time when state, district, and media were pushing for literacy and a decreased emphasis on science. The project evaluation recommends providing continued professional development in gender equity and effective instructional strategies; providing a more energetic push for reform at higher

STRATEGIES FOR NURTURING GIRLS' INTEREST IN SCIENCE

The Girl Power program stressed four general ways to encourage girls' interest in math, science, and technology classes:

- **Model equity in the academic environment.** This can be done by hanging posters that feature as many girls as boys (and as many women as men), by treating girls equally, by featuring information on careers and colleges, and by making evident math and science's real-life applications. In an equitable environment, teachers use more hands-on lessons, more cooperative groups, and more relevant examples. Teachers and counselors may need extra training.
- **Use appropriate teaching strategies.** The most important strategy for encouraging girls is to include hands-on activities in which boys and girls can participate equally. Girls should get equal hands-on time, for example, rather than simply record information while the boys do all the manipulation. Teachers should call on students randomly, to be sure girls and boys are called on equally and get equally complex questions.
- **Infuse gender equity into the curriculum.** In providing examples, tell how specific women have contributed to science, at the point in the curriculum that is relevant to their accomplishments.
- **Make assessment equitable.** Girls should see models of what is expected and should be allowed some options for how to demonstrate their competence.

(more visible) levels of authority; recruiting teams of at least two committed change agents at each targeted school; and recognizing the successes those change agents achieve with ongoing rewards and public recognition.

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KEYWORDS: EDUCATION PROGRAM, TEACHER TRAINING, MENTORING, SCIENCE CLUBS, HANDS-ON, SUMMER CAMP, PARENTAL INVOLVEMENT, AFTER-SCHOOL, INDUSTRY PARTNERS, MINORITIES, ROLE MODELS, PROJECT-BASED, PROFESSIONAL DEVELOPMENT, GENDER EQUITY AWARENESS, CAREER AWARENESS, WORKSHOPS, JOB SHADOW, RESEARCH EXPERIENCE	

THE GREEN PROJECT

IN MARCH 1998 A GROUP OF ENVIRONMENTAL SCIENTISTS, MIDDLE SCHOOL CURRICULUM SPECIALISTS, MATHEMATICIANS, MIDDLE SCHOOL TEACHERS, LANGUAGE ARTS SPECIALISTS, AND COMPUTER TECHNOLOGY SPECIALISTS FROM TWO UNIVERSITIES, THREE MIDDLE SCHOOLS, AND AN ENVIRONMENTAL RESEARCH ORGANIZATION LAUNCHED THE GREEN PROJECT (GIRLS READY FOR ENVIRONMENTAL EDUCATION NOW). TO ENCOURAGE MIDDLE SCHOOL GIRLS' PARTICIPATION IN STEM, THE PROJECT PROVIDED SUSTAINED ENRICHING EXPERIENCES FOR SEVENTH AND EIGHTH GRADE GIRLS OF COLOR FROM LOW-INCOME HOMES ON LONG ISLAND. THE SCHOOLS INVOLVED SERVED LOW-INCOME FAMILIES—MOSTLY AFRICAN AMERICAN, SOME HISPANIC.

The project developed interdisciplinary curricula around community-based, environmental social-justice research, with an emphasis on girl-friendly teaching practices and advanced technology. Ecological problems abound in low-income areas, which tend to be close to manufacturing sites, with minimal organized cleanups. On Long Island, where groundwater is drinking water, water is an issue. Once the aquifer is polluted, that water is gone.

Girls' summer camp. To explore stereotypes and self-images, the girls drew what they thought scientists, doctors, engineers, mathematicians, and social scientists might look like; described what they saw themselves doing 20 years later; and discussed negative messages they got about themselves from their family, the media, and society.

They explored Long Island, with field trips to see the animals, plants, and ecosystems in the Pine Barrens (a special fire-climax ecosystem), the Riverhead Foundation Marine Mammal Rehabilitation Facility (a mammal rescue center), Caumsett State Park (to see a coastal freshwater pond and to collect specimens on the beach), Jones Beach (to observe nesting areas and protection strategies for the endangered piping plover and to do an exercise on distilling fresh water from saline water), and to tidal wetlands. They analyzed samples and learned to read maps.

On day 5 they reviewed the negative messages from day 1 against their new self-images. Girls created raps about women in science and watched a video to heighten their awareness of socially constructed, media-influenced notions of beauty and appropriateness.

After-school clubs. Some schools formed reading clubs, and girls read a common list of books, to facilitate discussions of what they were learning about themselves and science. One club read several environmental mysteries and some young adult environmental novels. Sisters in Science, an after-school science club, examined the location of traffic warning signs near its school, where several accidents had involved pedestrians. They plotted the placement of traffic signs, studied legal and technical issues, and made a report to the school.

Parent/daughter technology workshops. At Saturday sessions, girls learned basic computer and Internet skills. In four workshops parents and daughters collaborated on projects, the idea being to break negative stereotypes. Facilitators were technically proficient women from diverse ethnic backgrounds who demonstrated that computers are not just a "guy thing."

Teacher training. Several workshops were devoted to making teachers aware of how stereotypes affect their behavior toward students. *In one exercise, teachers were provided with an excerpt from a conversation in the teachers' lounge. Based on that paragraph, they were asked to write down and discuss any assumptions they made about the child in question and his ethnic and socioeconomic status, home, and school life. After that discussion, they were given a one-page profile of the child, which proved many of their shared assumptions false. Follow-up discussions explored how conscious and unconscious assumptions affect teachers' interactions with students.*

To improve teachers' knowledge base and change the way they presented science, the project offered two week-long training sessions a year, introducing teachers to problem-based experiential learning, gender-friendly teaching, and interdisciplinary approaches to local environmental themes. *Making them more comfortable with technology increased the likelihood they would use technology in class.* (Some didn't know how to use a mouse.) The workshops improved their computer skills; introduced them to geographic information software (GIS), digital cameras, and global positioning systems (GPSs); showed them how to convert GPS locations to GIS mapping software; and taught them how to use the Internet for problem-based activities. *Teachers valued most what they learned about GIS.*

Facilitators from Hofstra and the New York Institute for Technology *modeled interactive, experiential ways of reaching curricular objectives—emphasizing the psyches of adolescent girls from minorities and low-income neighborhoods as well as different learning styles and cognitive processes.* Every day started with a summary of the day's schedule and time to reflect on the process and to ask questions. The Citizens Environmental Research Institute (CERI) showed them how to help make data relevant to their students using GIS—for example, in tracking trends in pollution, reinforcing visually and statistically the prevalence of pollutants locally. CERI conducted one session on how to grow cultures, using a kitchen microwave to disinfect lab equipment.

School teams presented projects on such topics as the consequences of spraying for mosquitoes carrying the West Nile virus. Teachers from one school role-played a public hearing on the placement of a petrochemical plant in a low-income Long Island neighborhood (drawing on articles discussing a similar real-life scenario from "Cancer Alley" in Louisiana).

Teachers were encouraged to incorporate social and community advocacy into project-related lessons but they varied in how fully they integrated such activities. Some class activities were thin in both content and requirements for higher-order thinking and some teachers resisted using the GIS technology and making changes in the classroom. But some teachers clearly benefited from the training, and so did their students. In some classes students discovered, for example, that breast cancer rates were not evenly distributed across the state by race or income and that traffic enforcement around a school serving mainly low-income minority children was not commensurate with enforcement around a school serving upper-income children. As educators, said one teacher, "what we do, how we do it, and who we do it with can and does make a difference in environmental awareness."

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Keywords: education program, after-school, Saturday camp, summer camp, underprivileged, teacher training, gender equity awareness, field trips, clubs, workshops, computer skills, experiential learning, African-American, Hispanic, real-life applications, environmental science, parental involvement	

004
Xsci
A training model for extracurricular science

A TRAINING MODEL FOR EXTRACURRICULAR SCIENCE

THE TOP PROGRAM PRIORITY OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE (AAAS), A FEDERATION OF SCIENTIFIC AND ENGINEERING SOCIETIES, IS TO IMPROVE STEM EDUCATION FOR YOUTH—AND TO HELP ENSURE THAT THE GREATER PUBLIC (INCLUDING WOMEN, MINORITIES, AND PEOPLE WITH DISABILITIES) SEES SCIENCE AS PART OF THEIR EVERYDAY LIVES. THIS AAAS PROJECT DEVELOPED A PASS-THROUGH TRAINING PROGRAM FOR DELIVERING HANDS-ON EXTRACURRICULAR SCIENCE ACTIVITIES TO MINORITY GIRLS AGED AGE 5 TO 17.

Adapting a training model long used by organizations such as the Girl Scouts, the project targeted community leaders, undergraduate women in STEM majors, and parents interested in encouraging their daughters to take advanced math and science. AAAS staff conducted inquiry-based science and math activities and provided information on STEM careers to 84 staff and volunteers and to 104 parents in seven community-based organizations serving African American and Hispanic students. They trained 120 African American and Hispanic college-age students as mentors and workshop leaders in community-based organizations.

Two products emerged from this project. The 20-page booklet "Stepping Into the Future" (1996) offers one-page profiles of 17 African Americans in science and engineering, describing the kind of work they do and how and where they grew up, often ending with career advice for young people. *In Touch with Girls and Science* (1995), available in both Spanish and English, is an activity book for use with K–12 students in both formal and informal settings, from classrooms to community groups. It contains hands-on activities to spark girls' interest in science and math—on topics such as electricity and magnetism, our environment, and math in everyday life—as well as mentoring tips, suggestions for motivating girls, references, and resource lists. Other titles in the *In Touch* series cover magnetism, electricity, math, preschool science, and community service learning. Nearly all of the activities use inexpensive, easily obtainable materials.

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HRD 94-50597 (one-year grant)	
Publications: Stepping Into the Future: African Americans in Science and Engineering; In Touch with Girls and Science.	
Keywords; demonstration, hands-on, trainer training, inquiry-based, community-based, African-American, Hispanic, mentoring, biographies, role models, career awareness, bilingual, problem-solving skills	

004
HSg
Bringing minority high school girls to science

BRINGING MINORITY HIGH SCHOOL GIRLS TO SCIENCE

"*IT'S NOT SO MUCH THAT GIRLS ARE NOT NECESSARILY TAUGHT DON'T DO SCIENCE, BUT SCIENCE IS LIKE THROWN IN BOYS' FACES LIKE, HEY, YOU WILL BE AN ENGINEER AND MAKE LOTS OF MONEY, WHATEVER, BUT GIRLS DON'T HAVE IT THROWN AT THEM IN THAT WAY. AS SOON AS I WAS IN THE PROGRAM, IT WAS HEY! THIS IS WHAT I WANT TO DO. A LOT OF GIRLS WHO ARE NOT EXPOSED JUST DON'T KNOW WHAT SCIENCE AND ENGINEERING ARE ABOUT, SO THERE IS NO REASON FOR THEM TO CHOOSE IT.*"

This pioneering project from George Washington University used computer technology and cooperative learning in a university setting to motivate minority high school girls to keep studying subjects needed for STEM careers. Each year, 25 girls from grades 9 or 10 were selected from the greater Washington, D.C., area to take part in a 10-month program to learn computer skills. Six high school science teachers were selected as mentor/participants.

Working in teams, students and teachers developed computer-aided multimedia instruction in science and technology. The idea was that interacting with female scientists and university professors (role models for careers in science and engineering) in a university setting would raise the minority girls' sights toward higher education. As they developed skills and confidence in using computers to conduct research, the students also learned about academic and career opportunities available to them and developed a peer network of other young local minority women interested in science and technology.

From 1989 through 1993, 100 girls and 20 high school science teachers participated. The girls flourished in cooperative (as opposed to competitive) environments, craving teamwork and interdependence. Exposure to role models, reliance on peer group mentoring, and living in a university setting had a profound effect on these young women. A 1996 follow-up study comparing the girls who participated in the project with a similar population of girls who did not found that *the project did raise the participants' confidence level and ability to deal with the chilly climate females often encounter in the classroom and workplace*.

CHARACTERISTICS OF EXEMPLARY PROGRAMS FOR YOUNG WOMEN OF COLOR

Among other positive outcomes from this project was a two-day working conference of experts convened in 1991 to identify the characteristics of exemplary programs for young women of color and to produce guidelines for future program planners. Project directors Rachel Heller and Dianne Martin catalogued the essential characteristics of exemplary programs, ranked below in order of importance.

1. follow-up
2. high expectations
3. role models
4. career counseling
5. fun
6. mentoring
7. parental involvement and training
8. partnerships
9. bridge program for pre-college to college
10. cooperative learning environment
11. strong evaluation criteria
12. replicability
13. career-oriented field visits
14. use of computers to improve skills and confidence
15. teacher training for middle and high school teachers
16. student professional development
17. effective participant recruitment efforts
18. bridge activities for grades K–12
19. focus on student interests and past experiences
20. community involvement
21. professional involvement
22. open-ended activities
23. doing "real science"

Follow-up was rated the most important characteristic of an exemplary program, regardless of program design or setting. Learning doesn't happen and then turn off. Participants may have thoughts a few weeks later and want to ask questions or share their thoughts. This doesn't mean a program must go on and on and never die, but the participants need to know they have a way of getting back to you, or getting together, at least for a short time.

Women of color are much more likely than their male counterparts to have been victims of the "tyranny of low expectations." An effective program for young minority women must give special emphasis to high expectations and rigorous standards. One benefit of this kind of program is that it fosters women's self-confidence, mental toughness, and resiliency, preparing them for adversity.

Parental involvement differs from project to project, but this was a residential project that included many Hispanic girls. *Most Hispanic parents were not about to buy into a program that had their daughters staying overnight, so the project had to create an environment that would validate Hispanic parents' opinion that young girls should not stay away from home and yet would allow the girls to participate*. It created a late-evening parent pickup, to accommodate parents' concerns.

Nothing happens in a vacuum. This project worked with minority girls who were going to be sophomores and juniors, but students don't stay one way forever. They grow and their needs change. *Bridge programs are important for transitions, helping take students to the next level*.

In an increasingly complex world, *partnerships* are more important than ever. Most projects need to work with a variety of local groups, because they need help with funding, mentors, expertise, site visits, and so on.

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www.student.seas.gwu.edu/~suleiman/girls	HRD 91-53447 (three-year grant)
Partners: GWU's Department of Engineering and Computer Science; IBM; GWU-ITV. A videotape describing the project was produced in conjunction with GWU-ITV.	
Keywords: demonstration, information technology, cooperative learning, minorities, computer skills, mentoring, teamwork approach, self-confidence, role models, peer groups, conference, parental involvement, Hispanic, best practices	

004

Cos

GEMS: high school girls learn cosmetic science

GEMS: HIGH SCHOOL GIRLS LEARN COSMETIC SCIENCE

BECAUSE INNER-CITY GIRLS FROM LOW-INCOME FAMILIES ARE RARELY EXPOSED TO WOMEN IN SCIENCE, IT'S HARD FOR THEM TO SEE STEM AS RELEVANT TO THEIR LIVES. THE GEMS PROJECT (GIRLS IN ENGINEERING, MATH, AND SCIENCE) *TAPS INTO HIGH SCHOOL GIRLS' NATURAL INTERESTS, USING A MULTIDISCIPLINARY APPROACH TO A HIGH-INTEREST PROBLEM: COSMETIC DESIGN. TO HELP THEM UNDERSTAND THAT A CAREER IN STEM IS POSSIBLE FOR THEM, THE PROJECT SHOWS THEM THAT STEM IS ALREADY IN THEIR LIVES—THEY NEED ONLY EMBRACE IT. WORKING SIDE BY SIDE WITH COLLEGE SCIENCE FACULTY ON REAL PROBLEMS, THE PARTICIPANTS ARE PAID WELL, COUNSELED, AND INTRODUCED TO FINANCIALLY SUCCESSFUL FEMALE ROLE MODELS.*

For four summer weeks, 40 girls come onto the Rutgers University (Camden) campus for three and a half hours a day, to experience anthropology and biography lectures and discussions, luncheon seminars, and experiments in the labs of women science faculty. Participants are from an urban, largely minority population of African Americans, Latinas, and Vietnamese in Camden, N.J. *The project recruits girls earning B grades on the regular college-bound (but not the enriched "honors" or "tech prep") academic track—girls midrange in achievement but with enough maturity, interest, and support to succeed. Grades are used because standardized tests tend to underpredict this population's performance*. These girls normally work during the summer—85 percent of their families are on welfare—*so they are paid a stipend of $12.50 an hour, linking STEM work concretely with economic stability*.

Lectures, discussions, workshops, and lab activities introduce girls to STEM career options. The girls and their families learn what they have to do to enter the higher education system. Project activities aim to boost their self-confidence, convince them that a STEM-related identity is compatible with their identities as women, and engage them in activities that *appeal to their cognitive styles while also introducing them to new ways of thinking*.

Small groups meet in labs for almost two hours a day, four days a week, working on *cosmetic design projects—chosen because the topic generates energy and comfort and is of personal interest. To combat any implicit message of gender stereotyping, before each lab the girls meet first as a large group for a session in "context setting"—anthropological on days 1 to 4 and biographical on days 5 to 11*, to make clear science's relevance in their lives and to give them a broader view of themselves across time and place.

In the anthropology session, *they learn about traditional African and Latin American uses of body ritual and facial and body decoration*—for example, the elaborate facial designs in rites of passage for Yanamamo women in Brazil and the red-ochred plaits that identify Masai—and learn how in these cultures one develops one's "paint" as a rite of passage, developing and making visible a strong personal identity. They learn about forms of ornamentation relevant to group membership, status, and gender role. *Each girl is asked to mentally stand outside her world before she begins assessing the possibilities available to her*. The last morning, they paint their faces to reflect what they know about themselves.

Stories are histories told in a personal way and speak directly to GEMS' cognitive learning style by relating material in intimate, anecdotal, nonthreatening ways. In biography sessions the girls read, view, and discuss the lives of successful women scientists, including Elizabeth Blackwell, Alexa Canady, Mae Jemison, Lynda Jordan, Madam C.J. Walker, Maria Villa-Komoroff, and Chien Shiung Wu. Each student completes a self-assessment of her personality traits to see how she might fit into a STEM career. The girls meet minority women scientists, reflecting on their own goals and ways to foresee and work beyond obstacles to meeting those goals.

Lab experiments (integrating biology, chemistry, biochemistry, and psychophysics) allow them to see how scientists work. All experiments revolve around cosmetics—not how to use them, but how to produce them. In small work groups they learn through discovery about lab safety, microbiology (bacteria), body chemistry (the body's reaction to acids, bases, and pH), hair composition (in relation to dyes and relaxers), polymer chemistry (in relation to hair), and product components (analyzing product composition through chromatography). They actually manufacture lotions and lip balms.

Using spectroscopy, they learn which lipsticks do and do not change when applied to each girl's lips. They measure their own pH, create a solution to match their skin's pH level, alter the pigment's pH, and seek the pigments that change the least for a given pH level (and are thus the most likely to retain their appearance). They select bio-pigments from lipsticks, change the pH, look at the ensuing change, and identify the least reactive of the pigments. As a group, they systematically compare the spectra of each of the eight initial pigments with those of their eight altered versions. In doing so, they learn some basic principles and methodologies of biochemistry. Through discovery learning, they predict what each analysis predicts for each class of lipstick wearer and what action they would therefore take as designers.

The project had planned to mentor 98 girls for two weeks but decided to mentor fewer girls for a month, to give them time to build strong relationships with new people. Most of the girls have never met any women scientists when they start the project. Girls work together in groups of 10, supervised by an undergraduate mentor and a scientist mentor. *Having mentors closer and further in age makes it easier for the girls to see science as a life path for themselves*.

At lunch seminars, they get acquainted with women at various stages of their careers, from high school to undergraduate and graduate school to professional level. *During the school year, the emphasis is on continued mentoring and on community activity: engaging families and other community members in career-planning meetings, making ministers more aware of girls' options, hosting science fairs, providing academic and career counseling, and sponsoring talks by professional and business women, community leaders with charisma and high credibility*.

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Futurebound: minority women in community colleges

FUTUREBOUND: MINORITY WOMEN IN COMMUNITY COLLEGES

TO ADDRESS THE SHORTAGE OF WOMEN IN ENGINEERING, FACULTY AT THE UNIVERSITY OF ARIZONA (UA) AND PIMA COMMUNITY COLLEGE (PCC) ARE RECRUITING STUDENTS WITH THE PROMISE OF RESEARCH INTERNSHIPS, MENTORING, AND SEMINARS. TO START, THE FUTUREBOUND PROGRAM GAVE 45 PCC STUDENTS ONE-ON-ONE MENTORING TO HELP THEM WITH THEIR TRANSFER TO SCIENCE AND ENGINEERING PROGRAMS AT UA.

Nationally, *community colleges are a key entry point into higher education for women and minorities*. This partnership between a university and a community college will develop a comprehensive program to enroll, retain, and graduate more women—especially Hispanic and American Indian women—in tracks leading to BS and graduate degrees in astronomy, biosciences, chemistry, physics, engineering, and related fields. The target group is students underrepresented in science.

Currently only 18 percent of UA engineering students are women, and minority women make up less than 10 percent of the enrollment of most engineering programs. Women—especially minority women—have few mentors and role models in the field and encounter discrimination, pay inequities, childcare problems, and hostile and discouraging environments. This project will build on previous activities by

- Extending previous collaboration between UA and PCC science departments on research internship programs, to highlight the efforts of women (especially minority) students
- Furthering project partnerships between departments in the College of Science and the women's studies department (Southwest Institute for Research on Women)
- Integrating community college–level programs into UA's Women in Science and Engineering (WISE) K–12 and university programs
- Attending more to differences within groups and fields
- Identifying and initiating strategies for long-term institutional change

Futurebound will still rely on WISE for mentoring, peer advising, and career workshops for high school and college students. It will also build on an existing NIH bridge program at Pima CC that offers PCC transfer students in the biomedical sciences a research experience the summer before their transfer to UA.

PCC aims to recruit more female students, strengthen their preparedness and widen their knowledge of career choices, and offer them more mentoring, academic advice, and financial support. It will better coordinate minority and support programs and will improve instructional and support programs by providing more interactive learning, a classroom climate more conducive to learning, and better outreach to high school science teachers.

UA will try to improve student motivation, performance, and financial support, and will foster the use of existing units serving minority and women undergraduates. With the Graduate College and the Women of Color Consortium, it will try to get more women engaged in graduate studies. It will monitor progress by comparing the target group's grade point averages and progress toward BS degrees and graduate work with those of all PCC science and engineering students.

By addressing the needs of minority women and the many intersecting issues that affect women and minorities, and by identifying strategies that encourage these populations to study science and engineering, Futurebound aims to develop a model to encourage more community college students generally to move on to four-year academic institutions.

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Keywords: demonstration, support system, mentoring, community college, research experience, Hispanic, Native American, seminars, engineering, internships, recruitment, retention, role models, career awareness	

004

Leco

Learning communities

LEARNING COMMUNITIES

IN STUDYING WHY 60 PERCENT OF AFRICAN AMERICAN STUDENTS—BUT ONLY 12 PERCENT OF CHINESE STUDENTS—AT THE UNIVERSITY OF CALIFORNIA'S BERKELEY CAMPUS FAILED FRESHMAN CALCULUS, MATHEMATICIAN URI TREISMAN HAD TO THROW OUT MOST TRADITIONAL HYPOTHESES (WEAK ACADEMIC BACKGROUND, POOR MOTIVATION, LOW INCOME, AND LITTLE FAMILY SUPPORT). TO HIS SURPRISE HE LEARNED THAT THE *KEY DIFFERENCE BETWEEN AFRICAN AMERICAN AND CHINESE STUDENTS WAS THE WAY THEY INTERACTED WITH EACH OTHER AND THE UNIVERSITY. AFRICAN AMERICAN STUDENTS DID NOT STUDY TOGETHER; THEY WORKED HARD, BUT THEY STRICTLY SEPARATED THEIR SOCIAL AND INTELLECTUAL LIVES. CHINESE STUDENTS FORMED STUDY GROUPS AND HAD STUDY MATES. THEIR ABILITY TO FORM COMMUNITIES AND TO COLLABORATE WAS A KEY TO THEIR SUCCESS.*

Treisman's work at Berkeley provided the foundation from which two initiatives emerged: the Emerging Scholars program at the University of Texas at Austin and the freshman interest group (FIG) or learning community. The Emerging Scholars program is usually associated with math, and most FIGs are also discipline-oriented. The University of Wisconsin at Stevens Point (UWSP), a regional university with an enrollment of about 8,500, introduced the FIG initiative in 1996–97, and its success was not universal. Among the 1,500 first-year students who enrolled that year, the single STEM-related FIG attracted no women. There was a need for a learning community that targeted women—hence this UWSP project, which distills features from both the Emerging Scholars program and the FIG.

The students most at risk of failure at the university, and most in need of social and academic scaffolding, are the students who arrive at the university with the least cultural capital: those from poor or working-class families, those who are first-generation college students, those who are academically underprepared or have yet to establish firm career goals. Women in Science is a women's learning community designed to provide scaffolding for those students and to counteract the feelings of isolation in male-dominated introductory math and science classes that lead many women to opt out of science.

The Women in Science learning community is interdisciplinary: All women interested in STEM are eligible. It is culturally diverse: The urban areas of Wisconsin and surrounding states have large African American populations, central Wisconsin is home to various Native American nations, and several Hmong communities have grown up in the area. It includes both resident and commuter students, as most UWSP students work to support their education. *Those who also commute to school face such demands on their time—and have such weak ties to the university—that they can begin to drop out almost without realizing it is happening*.

The project enhances classroom instruction with a technology workshop (survival training, to combat technophobia) early in the first semester, mentor-led study groups and peer tutoring, a family open house, and STEM-related student employment. A cohort of first-year students takes several common courses, including a women's studies course with a women-in-science theme; writing and English courses, with the women-in-science theme reflected in reading and writing assignments; and a second-semester environmental history course taught by a female history instructor. *Student schedules are arranged so that all participants who enroll in a STEM course during their first semester are assigned to the same section, to counteract feelings of isolation*. The curriculum is rounded out with field trips, guest speakers, and career information. Students learn about gender issues from guest speakers and are exposed to female role models—senior educators and computing professionals who teach them about their field of expertise. A gender issues workshop is given for STEM faculty, with at least one well-known guest speaker invited to draw and engage a good audience.

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KEYWORDS: EDUCATION PROGRAM, AFRICAN-AMERICAN, NATIVE AMERICAN, HMONG, MENTORING, PEER GROUPS, STUDY GROUPS, WOMEN'S STUDIES, FIELD TRIPS, CAREER AWARENESS, GENDER EQUITY AWARENESS, ROLE MODELS, TEACHER TRAINING, CALCULUS, MATH	

STUDYING STUDENTS STUDYING CALCULUS

What did "studying math" mean for the Black and Chinese students [Uri Treisman studied at Berkeley]? For the Black students it meant this: You wake up in the morning. You go to class. You take notes. You get your homework assignment. You go home. You do your homework religiously and hand in every assignment on time. You put in six or eight hours a week of studying for a calculus course, just what the teacher says, and what happens to you? You fail. An important point here is that the Black students typically worked alone. Indeed, 18 of the 20 students never studied with their classmates. The same pattern occurred among many of the blue collar Whites and rural students.

What about the Chinese students? They studied calculus for about 14 hours a week. They would put in 8 to 10 hours working alone. In the evenings, they would get together. They might make a meal together and then sit and eat or go over the homework assignment. They would check each others' answers and each others' English. If one student got an answer of "pi" and all the others got an answer of "82," the first student knew that he or she was probably wrong but could pick it up quickly from the others. If there was a wide variation among the answers, or if no one could do the problem, they knew it was one of the instructor's "killers."

It was interesting to see how the Chinese students learned from each other. They would edit one another's solutions. A cousin or an older brother would come in and test them. They would regularly work problems from old exams, which are kept in a public file in the library. They would ask each other questions like, "How many hours did you stay up last night?" They knew exactly where they stood in the class. They had constructed something like a truly academic fraternity, not the more typical fraternity: Sigma Phi Nothing.

The Black students, on the other hand, [were not aware of] what other students in the class were doing. They didn't have any idea. For example, what grades they were going to get. The exams were like a lottery: "I got a B," or, "I got a C." They had no idea where they stood relative to their classmates. Moreover, these same students were getting A's in "Study Skills," and F's in the calculus class. What they were taught in "Study Skills" [did not] help them in calculus.

Adapted from "Studying Students Studying Calculus: A Look at the Lives of Minority Mathematics Students in College," by Uri Treisman, *The College Mathematics Journal*, Vol. 23, #5, November 1992, viewable at <www.math.rutgers.edu/~greenfie/teaching/workshops/treisman.html>

004
Scit
Science in the city

SCIENCE IN THE CITY

SCIENCE IN THE CITY, AN INNOVATIVE SCIENCE, MATH, AND TECHNOLOGY PROGRAM, TARGETS GIRL SCOUTS 9 TO 14 WHO LIVE IN HOMELESS SHELTERS AND HOUSING DEVELOPMENTS THROUGHOUT CHICAGO. IT GIVES GIRLS WHO LIVE IN DIFFICULT ENVIRONMENTS A STABLE PLACE TO LEARN, MEET OTHER GIRLS, AND INTERACT WITH SUCCESSFUL WOMEN IN VARIOUS STEM CAREERS. BASED AT THE CHICAGO ACADEMY OF SCIENCES, SCIENCE IN THE CITY IS NOW BEING EXPANDED TO GIVE MORE OF THESE OFTEN PHYSICALLY AND SOCIALLY ISOLATED GIRLS THE MANY OPPORTUNITIES THE PROGRAM AFFORDS.

"I was a Girl Scout myself years ago," says principal investigator Jennifer Blitz, of DePaul University's chemistry department, "and *although I knew from a young age that I wanted to be a scientist, I also remember clearly how difficult it was at the time to find a female scientist to be a role model. While I found my models in science fiction, I think it is much more worthwhile for girls to see actual (women) scientists and learn what they do. If they can relate to a flesh-and-blood person, they might realistically feel that they can become scientists, too.*"

This project extends a successful collaboration between female scientist educators and Girl Scouts, an organization that is sometimes the only vehicle for girls in underserved neighborhoods to expand their lives. The academy's Nature Museum is an ideal informal learning institution in which the girls can explore themes experientially and at their own pace. (Science museums and other institutions that stress interactive learning help promote discovery and critical thinking because they are experience-based.)

The Science in the City program offers 12 four-hour workshops on science and environmental learning. Five badge workshops (Weather Watch, Science Sleuth, Computer Fun, Geology, and Ecology) enable Scouts to earn the hard-to-get Animals and Plants badge and Water Wonders badge.

Because few economically disadvantaged girls can go to Girl Scout camp, the program will provide a five-day summer camp experience. The girls will participate in two Science for Families Days, in which girls and adults come together to celebrate learning in hands-on activities and educational scavenger hunts. They will go on field trips, learn about science careers during a shadow day with museum staff, and learn how science affects their everyday lives.

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KEYWORDS: DEMONSTRATION, REAL-LIFE APPLICATIONS, URBAN, HANDS-ON, PARENTAL INVOLVEMENT, FIELD TRIPS, ROLE MODELS, GIRL SCOUTS, UNDERPRIVILEGED, EXPERIENTIAL LEARNING, CAREER AWARENESS, MUSEUM, JOB SHADOW	

004
TarG
TARGETS: counseling talented at-risk girls

TARGETS: COUNSELING TALENTED AT-RISK GIRLS

THE INSPIRATION FOR ARIZONA STATE UNIVERSITY'S TARGETS PROJECT FOR "TALENTED AT-RISK GIRLS" CAME FROM BARBARA KERR'S RESEARCH AND CLINICAL EXPERIENCES WHILE WRITING *SMART GIRLS, GIFTED WOMEN*—THE THESIS OF WHICH IS *THAT MOST GIFTED GIRLS ARE TOO WELL ADJUSTED FOR THEIR OWN GOOD. MANY GIFTED GIRLS DO NOT ACHIEVE THEIR OWN GOALS BECAUSE THEIR RESOURCEFULNESS AND EAGERNESS TO PLEASE CAUSES THEM TO COMPROMISE THEIR GOALS MANY TIMES IN THE COURSE OF THEIR DEVELOPMENT. THEY SABOTAGE THEMSELVES BY TAKING LESS CHALLENGING COURSEWORK THAN THEY NEED, BY STOPPING OUT OF EDUCATION OR CAREER PLANS, OR BY LOSING SIGHT OF THEIR GOALS ENTIRELY—AND OFTEN NEVER ASPIRE TO GOALS COMMENSURATE WITH THEIR ABILITIES. THEIR STRONG PRIORITIES FOR MAINTAINING RELATIONSHIPS RATHER THAN ACHIEVING THEIR OWN GOALS MAKES IT INEVITABLE THAT GIFTED WOMEN ACHIEVE LESS THAN GIFTED MEN*.

But some women do achieve their dreams and goals despite societal discouragement. For her book Kerr reviewed the biographies of 33 women judged eminent in their fields—analyzing their lives in terms of their own dreams, not by masculine standards for their professions. As teenagers these 33 women were different from the gifted girls from intact families who are typically the subject of research studies. Few of them were raised in upper middle class environments, and many of them had lost one or both parents or had a parent who was physically or mentally disabled. And though most gifted girls lead placid lives with a playful childhood followed by an involved, well-adjusted adolescence, these eminent women spent an extraordinary amount of time as girls completely alone, often reading by themselves, friendless, sometimes neglected even by their family. Many eminent women had traumatic experiences during their childhood or adolescence. They were often rejected by other people as teens and often experienced disastrous romantic lives. And while most gifted girls are noted for their social skills and charm, for their excellent social adjustment and readiness to adapt to others' needs, eminent women—as adolescents and adults—were often sharp-tempered and sharp-tongued, stubborn in their pursuits and fierce in the defense of their own ideas.

In short, *most of the eminent women Kerr studied had been talented at-risk girls. If so, perhaps the way to identify the gifted girls most likely to achieve their dreams was to look at the troubled brilliant girl who makes A's only in the subjects she cares about deeply and who struggles with many frightening and painful issues—not at the straight-A achiever on the cheerleading squad*. Kerr had discovered the rationale for this project.

The TARGETS project (talented at-risk girls: encouragement and training for sophomores) was initiated in 1992 with no funding. Kerr's team simply contacted high schools, told them the kinds of girls the project wanted to help, and trained counselors in an all-day Friday workshop filled with research-based career and lifestyle counseling techniques. NSF funding allowed ASU to expand the program.

Most career development interventions treat young women's career decisions as being made in isolation from other decisions, such as whether and when to marry or have children. To be effective, vocational planning probably has to take place within the context of life planning, including relationship decisions. And career counseling must include specific powerful interventions aimed at enhancing girls' self-esteem, self-efficacy, and other expectations of success. The women with the greatest need of this kind of intervention may be those talented in nontraditional areas such as STEM but at risk because of poverty, acting-out behaviors, low self-esteem, low self-efficacy, or lack of social support for STEM career goals. In the Southwest, many young Native American and Hispanic girls, and girls living in communities that do not support high aspirations for women, fit this category.

The TARGET intervention included an hour of assessment in the girl's home school, a two-day workshop at ASU, a follow-up one-hour visit at the home school, several pre- and post-tests (e.g., of self-esteem, confidence, personality, values, and vocational interests), and at least one follow-up letter from their career counselor four months after the workshop. The TARGETS workshop involved tests, counseling activities, a guidance laboratory, and activities aimed to raise the girls' sense of purpose, career aspirations, and career identity. Participants met counselors and women scientists who discussed their own career development and encouraged the girls. In a Perfect Future Day exercise, the girls imagined themselves 10 years older, discussed issues that emerged from the experience, and were helped to identify ways of overcoming their own at-risk behaviors as well as environmental barriers to achieving their perfect future day.

Evening and night activities were based on the Math–Science Sleepover developed by Columbia, Mo., Public Schools to encourage girls toward STEM careers (Schroer 1991). Girls spent the night at a residence hall lounge with counselors and with women mentors in nontraditional fields. The second day they worked in a science, design, or computer lab solving real problems and meeting with women faculty. *Changes in their self-esteem, self-efficacy, and hope for the future were striking, given the brevity of the intervention. Said one girl, "this was the first time an adult had taken me seriously."*

WORKSHOPS FOR GUIDANCE COUNSELORS

At the GEMS (girls into engineering, math, and science) workshop, counselors and science educators became more aware of discrimination against women and questioned themselves more about their own attitudes and behaviors. Research articles were gathered in a binder, providing participants with a wealth of information about developing math and science talent in girls and women and about gender-equitable interventions for math and science education for at-risk, minority, and gifted students. Lectures on developing talent in women and on helping adolescents at risk were combined with hands-on experiences in an industrial design studio and a mechanical engineering lab. Enrollment increased from 17 in the summer pilot to 75 in the winter.

Some of the most powerful lessons on counseling minority girls came from the girls themselves. The project investigators had assumed, for example, that girls interested in science would want to be doctors, but rural Navajo girls felt a uniform distaste, even antipathy, toward this career—fearing anatomy classes because of traditional Navajo concerns about seeing or touching the dead. They also assumed that being an accountant would hold little appeal for a lively, sociable girl with math talent, who might prefer being a clinical social worker. But this was not the case for Pima, Navajo, Hopi, and Apache girls. On the reservation, an accountant is a friendly, caring person who often makes "house calls" and who helps the family fill out difficult tax forms resulting in much-needed refunds. A social worker, by contrast, is someone who takes your children away.

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Products: GEMS Resource Guide	
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AT-r
GEOS: encouraging talented at-risk college women

GEOS: ENCOURAGING TALENTED AT-RISK COLLEGE WOMEN

A YOUNG WOMAN TALENTED IN STEM TYPICALLY ENTERS COLLEGE WITH HIGHER GRADES THAN A SIMILARLY GIFTED YOUNG MAN BUT MAY BE LESS WELL PREPARED, HER COURSE WORK HAVING BEEN LESS RIGOROUS. SHE HAS HIGH ASPIRATIONS BUT HER SELF-ESTEEM HAS BEEN DECLINING SINCE EARLY ADOLESCENCE AND IS AT ITS LOWEST POINT EVER. HAVING LOST CONFIDENCE IN HER OWN OPINIONS, SHE TENDS TO AGREE WITH OTHERS SO SHE WILL BE ACCEPTED, IS UNLIKELY TO ASSERT HERSELF IN CLASS, AND DOES NOT STAND UP WELL TO CRITICISM. A C ON HER FIRST MATH OR SCIENCE TEST MAY LEAD HER TO CHANGE MAJORS BECAUSE SHE'S NOT GOOD ENOUGH. ON VOCATIONAL PERSONALITY TESTS, SHE TENDS TO SCORE HIGHER THAN AVERAGE ON SCALES FOR BOTH "INVESTIGATIVE" (IDEA-ORIENTED AND INTELLECTUALLY CURIOUS) AND "CONFORMING" (CONFORMING AND CAUTIOUS).

With a precarious blend of high aspirations and low confidence, of intellectual curiosity and desire to conform, this typical young woman enters an environment that is indifferent, if not hostile, to her intellectual goals. The special mentors who guided her in high school have new students to nurture and in college she is likely to receive little guidance, encouragement, or support. She will be under relentless peer pressure to groom herself for a relationship, find a man, and establish a commitment. Her peers may not even know what her major is or that she was a National Merit Scholar. If she is Navajo, Hispanic, or African American, she may feel isolated, uprooted, and separated from the sources of her strength.

Why do some gifted young women survive the chilly climate of the coed American campus and graduate with their dreams intact? Those who identify with their chosen field, exhibit maturity and leadership, and have access to mentoring and guidance seem to do well. But those qualities are in short supply on the typical college campus.

GEOS (gender equity options in science) extends to at-risk college women some features of Arizona State University's TARGETS program for talented at-risk high school girls. A research-through-service project, GEOS is using results from TARGETS *to improve and expand on the model of the "counseling laboratory" approach*. Over a three-year period, 180 freshmen and sophomore women enrolled at ASU will participate—some as a control group—in multiculturally sensitive career development workshops and mentoring activities. Thirty graduate-level counselors-in-training will be trained in counseling and mentoring women talented in math and science, and 240 STEM faculty will be trained in equity issues and mentoring. (The faculty are members of the Wakonse Fellowship, a consortium of research and teaching universities founded to improve college teaching.)

Some career development workshops and seminars will take place at ASU and some at *rural camps, where the informal atmosphere encourages student–faculty interaction and the natural setting is ideal for hands-on science experiences*. Students will take a series of pre- and post-tests, will get both group and individual counseling, and will be given the results of their personal inventories and a Personal Map of the Future—suggestions for exploring careers in STEM.

The young women will also be invited to an overnight faculty–student mentoring retreat at Saguaro Lake Ranch, a Forest Service facility, where counselors and professors will share informal, woman-friendly science activities with undergraduates. *Overnight activities break down barriers to student–faculty partnerships and help build community support for young women*.

Students and faculty who participate in ASU's career development workshops and retreat will become trainers and leaders at a five-day summer STEM faculty training seminar in Michigan, with faculty GEOS teams from eight universities. Hands-on activities will include identifying examples of resilience in sand dune ecology, developing a mathematical model for water quality management in a new water treatment facility; and learning about woman-friendly technology training at an all-night technology center in the lodge of the Miniwanca educational center.

CODES: U, PD	ARIZONA STATE UNIVERSITY
BARBARA KERR (BKERR@ASU.EDU), SHARON ROBINSON-KURPIUS	
HRD 00-80706 (THREE-YEAR GRANT)	
PARTNERS: NATIONAL WAKONSE FELLOWSHIP FOR COLLEGE TEACHING KEYWORDS: DEMONSTRATION, SELF-CONFIDENCE, MENTORING, INTERVENTION, RESEARCH STUDY, CAREER AWARENESS, TEACHER TRAINING, GENDER EQUITY AWARENESS, HANDS-ON	

004
Raw
Radio series on Alaskan women in science

RADIO SERIES ON ALASKAN WOMEN IN SCIENCE

PUBLIC RADIO STATION KCAW-FM ("RAVEN RADIO") PRODUCED A FIVE-PART SERIES PROFILING FIVE ALASKAN WOMEN IN SCIENCE AND TECHNOLOGY. LIKE MANY ALASKANS, THESE WOMEN WERE TOUGH, ADVENTUROUS, AND INDEPENDENT-MINDED. THEY WERE INVOLVED IN DESIGNING THEIR OWN EXPERIMENTS AND DID RESEARCH IN THEIR OWN LABORATORIES OR IN THE FIELD.

Some of the women work in treacherous conditions. Harbor seal researcher Kathy Frost studies seals from an open skiff in Prince William Sound. Arctic biologist Lori Quakenbush studies wildlife on the Arctic Ocean, combatting polar bears and freezing conditions.

For some women scientists, "extreme" conditions are social rather than natural, so their stories include how they overcame obstacles and what kept them interested in their field. Eliza Jones, an Athabaskan linguist, is writing a dictionary of the Koyukon language from her home in Koyuku, a place with no running water, where many people still live traditional subsistence lifestyles.

Geophysicist Amanda Lynch uses the supercomputer in Fairbanks to map climate change in the Arctic. A fit, blonde 20-something, Lynch smashes all stereotypes of physicists and mathematicians, battling the glass ceiling women often face in scientific fields.

Fishery biologist Tory O'Connell is figuring out new ways to estimate fish populations. She uses a submersible to go down 800 feet below the ocean surface to count groundfish. In the O'Connell segment, producers went down in the submersible to demonstrate to listeners how applied science can be both satisfying and nerve-wracking.

Tuning in to the sounds of science, the producers create an audio journey that conveys how interesting and possible science is for women. Two versions of the series were prepared for state and national distribution in 5- and 15-minute segments. The Alaska Department of Education also distributed the series statewide, along with a written curriculum guide. In 1996 the Alaska Press Club awarded the series first place for Health and Science Reporting.

CODES: I, M, H	KCAW-FM RAVEN RADIO
KEN FATE, LISA BUSCH	
HRD 95-52947 (ONE-YEAR GRANT)	
PARTNER: ALASKA DEPARTMENT OF EDUCATION	PRODUCT: FIVE-PART RADIO SERIES
KEYWORDS: DISSEMINATION, RADIO, ALASKAN, BIOGRAPHIES, ROLE MODELS	

004
ACg
Out of the lab: an Alaskan camp for ninth grade girls

OUT OF THE LAB: AN ALASKAN CAMP FOR NINTH GRADE GIRLS

"IF THE PUBLIC COULD BE HELPED TO UNDERSTAND HOW SCIENTIFIC KNOWLEDGE IS GENERATED AND COULD UNDERSTAND THAT IT IS COMPREHENSIBLE AND NO MORE EXTRAORDINARY THAN ANY OTHER FIELD OF ENDEAVOR, THEY WOULD NOT EXPECT MORE OF SCIENTISTS THAN THEY ARE CAPABLE OF DELIVERING, NOR WOULD THEY FEAR SCIENTISTS AS MUCH AS THEY DO." —JONAS SALK

In conjunction with a public radio program, Sheldon Jackson College and Pacific High school will conduct a residential science camp for ninth grade girls, encouraging participation by girls from underserved populations, such as Alaskan native, low-income, and rural (bush) students. The camp will be held partly on the Sheldon Jackson College campus, in downtown Sitka, near the historic Sitka National Historic Park.

The camp will use Expeditionary Learning School (Outward Bound) techniques: guided questions and challenges posed to encourage students to explore science, with an emphasis on service learning. The girls will learn about scientific method, scientific assumptions, scientific communication, how science affects our culture, and how the media portray scientists. To improve teachers' scientific literacy, scientists will meet with science educators in a three-day pre-camp workshop to discuss how science is being taught and how science is really done.

This experimental project is the hands-on part of a national radio series on how science is really conducted. The six-hour series, to be produced by public radio station KCAW-FM in Sitka, will examine the sociological world of scientists, from how they get ideas to how Nobel Prize winners are selected—and how those selections affect science. Topics covered will include science and religion, evolution in the classroom, creativity and science, how culture may influence science, the Nobel Prize, science, and the media—and the Carl Sagan effect (why do scientists fear popularizing science and look down on scientists who reach out to laymen?).

Morning lectures will be followed by hands-on lab activities on campus, for the first two or three days. Later in the week, students will camp in an isolated area on Biorka Island (owned and operated by the FAA and a major military communication installation during World War II). In a camp setting, the girls will learn about the area's natural history while working on projects together. On a boat owned by a marine educator, they will explore the local marine environment—including how organisms adapt and evolve in an island environment.

CODES: H, I, U	Sheldon Jackson College
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HRD 00-86366 (one-year grant)	
Partners: Pacific High School, public radio station KCAW-FM, Public Radio International	
Keywords: demonstration, Alaskan, rural, underprivileged, exploration-based, service-learning, hands-on, radio, teacher training	

004
Ap
Appalachian girls' voices

APPALACHIAN GIRLS' VOICES

THE LITERATURE ON ADOLESCENT DEVELOPMENT—BASED LARGELY ON STUDIES OF ADVANTAGED, UPPER-CLASS, MAINLY CAUCASIAN GIRLS—DOCUMENTS GIRLS' LOSS OF VOICE IN ADOLESCENCE. THE RESEARCH IN THE VOICES PROJECT ASKED IF LOWER-CLASS APPALACHIAN GIRLS DON'T LOSE THEIR VOICE AND SENSE OF INDIVIDUALITY WELL BEFORE ADOLESCENCE.

Voices was a three-year research and development program designed to examine factors affecting rural and urban girls' participation in STEM subjects and to increase that participation. The Voices project worked with groups of ethnically diverse middle-school girls and their families, schools, and communities, drawing from urban and rural West Virginia middle schools in McDowell and Kanawha counties.

In the project's first year, Saturday workshops emphasized the math and science in traditionally feminine activities such as food preservation, holiday crafts, quilting, and folk medicine. *Hands-on activities showed the girls that science, math, and technology are not alien, abstract, and "masculine," but part of daily life*. The girls learned to use the Internet and were assigned *advocates* (parents or other adults who worked with them in math and science). The second year, the girls were assigned adult mentors from places such as Union Carbide. The third year, the girls and their mentors designed projects to involve the girls in STEM through community involvement with younger students and through a "virtual scientist" experience (reading a science fiction novel and thinking about women's lives), the idea being to help the girls see themselves as rocket scientists and CPAs, physicists and physicians—anything they want to be.

The project selected participants from all "tracks," including special needs classes, and by selecting a relatively high percentage of African American girls challenged certain assumptions. The research literature contains little indication that key staff might actively resist efforts to increase opportunities for students assumed to be incapable of rigorous academic work. The principal from one urban school chose not to refer any students from the school for testing, so the project worked with students a teacher recommended.

Voices explored *differences between the experience and culture of rural and urban girls, especially in terms of peer status, self-image, and attitudes toward authority. Girls in rural communities may have experience in hands-on learning and craft knowledge that are useful to the practice of science, often encounter less peer pressure against doing science, and may enjoy stronger community support than girls in urban schools*. Rural schools track students on the basis of ability; their assumptions about students' ability to learn are very different, and they provide support for low-track students. Moreover, rural teachers and coordinators live in the community where they work; urban teachers rarely venture into the housing projects where many of their students live. But *girls in rural schools may receive less encouragement to attend college or aspire to a career, may have fewer educational opportunities (advocates had to persuade two rural middle schools attended by project students to introduce or reinstate algebra and pre-algebra), may encounter fewer and less diverse role models, and may receive powerful social messages that limit their aspirations.*

The project expected to find resistance in rural communities to a program that challenges gender norms, but rural communities provided remarkably high levels of support for the program. Parental participation in the *workshops was especially high in rural areas*. The project learned the unexpected advantages of working in a poor rural school district: The enthusiasm and support these communities bring to a project may more than compensate for a lack of in-kind contributions from school districts. *Unfortunately, the Voices program awakened an interest in and enthusiasm for science and math that was not easily transferred to the girls' formal classwork. The program did not anticipate the severe disjunction between the hands-on approach to learning in Voices workshops and the worksheet- and text-based instruction common in the girls' classrooms*.

Parents, teachers, and principals (especially at the rural sites) reported positive changes in girls' attitudes, behavior, interest, self-esteem, and (less often) grades—*but the self-confidence and grades of special education students showed the most dramatic improvement*. Parents and teachers looked favorably on the program, an attitude that was sometimes misused: Parents and school personnel sometimes denied girls access to Voices activities as a form of punishment.

CODES: M, I	Appalachia Educational Laboratory
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www.ael.org/nsf/voices/index.htm	HRD 94-53110 (three-year grant) and HRD 98-15117 (one-year grant)
Partners: Eisenhower Regional Consortium for Mathematics and Science Education; Appalachian Rural Systemic Initiative (ARSI); Black Diamond Girl Scout Council; Educational Resources Information Clearinghouse/Center for Rural Education and Small Schools (ERIC/CRESS).	
Products: Documentary film, videotapes, Voices curriculum projects. Useful reading: The Project Book by Douglas Fleming.	
Keywords: demonstration, intervention, rural, urban, support system, research study, cultural barriers, Girl Scouts, Appalachians, workshops, mentoring, project-based, parental involvement, hands-on, self-confidence, achievement	

004

AW

Action-WISE in Zanesville, Ohio

ACTION-WISE IN ZANESVILLE, OHIO

WITHIN MUSKINGUM COUNTY, OHIO—WHICH IS PART OF THE FEDERALLY DESIGNATED APPALACHIAN REGION—THE ZANESVILLE CITY PUBLIC SCHOOL DISTRICT SERVES A COMMUNITY OF 27,000, MANY OF WHOM LIVE IN POVERTY, OFTEN IN ONE-PARENT HOUSEHOLDS. FEWER THAN A THIRD OF ZANESVILLE STUDENTS COME FROM COLLEGE-EDUCATED FAMILIES, AND FEWER THAN 45 PERCENT OF THEM PASS THEIR PROFICIENCY TESTS ON THE FIRST TRY. IN 1995 FIVE TEACHERS FROM GROVER CLEVELAND MIDDLE SCHOOL, CONCERNED THAT BRIGHT AND CAPABLE GIRLS WERE LOSING INTEREST IN MATH AND SCIENCE, BANDED TOGETHER IN A PILOT PROJECT TO IMPROVE GIRLS' ATTITUDES TOWARD SCIENCE. *AFTER 54 GIRLS (A THIRD OF THEM STUDENTS OF COLOR) HAD A CHANCE TO VISIT LOCAL WOMEN SCIENTISTS AT THEIR WORKSITES AND INTERACT WITH THEM AT MONTHLY SEMINARS, THE GIRLS STOPPED THINKING SCIENTISTS WERE ALL "GEEKY GUYS." THE OHIO DEPARTMENT OF EDUCATION NOMINATED THE PROJECT FOR A "BEST PRACTICES" AWARD.*

In a four-partner collaboration between the Zanesville schools, a two-year technical college (Muskingum Area Technical College, or MATC), a four-year private college (Muskingum College), and an international wildlife research and conservation center (The Wilds), this Action-WISE project expanded the number and grades of students involved in that project, strengthened the curriculum, and expanded the project calendar. Roughly 700 elementary students, 240 middle students, 100 high school students, and 56 educators (who took a graduate course in gender equity) benefited.

Students benefited from monthly seminars and informal discussions with women in STEM-related careers, took field trips, and engaged in hands-on activities. In summer science camps, students learned math, biology, chemistry, physics, and geology in the course of solving environmental problems. Science, math, and computer labs at both colleges, regional field sites, and the diverse habitats at The Wilds gave students ample opportunity to explore. Undergraduate women served as lab assistants and mentors for the middle and high school girls. Few of the girls had been exposed to college, so most field trips were tied to a college visit.

Students enjoyed math activities and the Equate math game; conservation medicine and disease transmission activities; studies of the human skin; a tour of the Texas Longhorn Cattle Ranch and a discussion of food and food distribution; donning and doffing MATC's hazardous materials suits and self-contained breathing apparatus; tree identification and a nature scavenger hunt; testing water quality and seining for fish in local state parks; identifying plants, including medicinal plants; learning about animal behavior and doing field observations at the Wilds; learning about microbiology (culturing organisms and analyzing results) at Muskingum College; following a nature trail for the handicapped at Flint Ridge State Memorial; and doing electrical engineering lab activities at MATC.

K–12 teachers who served and supported the project benefited as if they were co-participants with the school-age girls. Having never scaled trees or studied astronomy themselves, for example, they said they grew with every experience they offered their students. Their enthusiasm for the project drew more teachers to it. Teachers valued working outside their grade levels, working with outside organizations, having access to sophisticated laboratories, and networking and exploring possibilities for further development. There was true collaboration among the partners. And sixth grade teachers were able to acquire science equipment they could not get with district funds.

CODES: E, M, H, I	Muskingum Area Technical College
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www.zanesville.k12.oh.us/grover/wise/index.html	HRD 97-14792 (three-year project)
Partners: Zanesville City School District, Muskingum College, and The Wilds (an international wildlife research and conservation center)	
Science links: www.zanesville.k12.oh.us/html/ScienceLink.html	
Keywords: education program, underprivileged, field trips, role models, teacher training, gender equity awareness, hands-on, career awareness, summer camp, mentoring	

004
HOs
Hands-on science in rural Virginia middle schools

HANDS-ON SCIENCE IN RURAL VIRGINIA MIDDLE SCHOOLS

GIRLS ARE OFTEN DISCOURAGED IN SUBTLE WAYS FROM PURSUING AN INTEREST IN SCIENCE. OVERCOMING SUCH BARRIERS WAS THE GOAL OF THIS PROJECT FOR MIDDLE SCHOOL GIRLS—AND THEIR MATH AND SCIENCE TEACHERS—IN RURAL AND ECONOMICALLY DEPRESSED COUNTIES OF FAR WESTERN VIRGINIA. FIFTEEN MIDDLE SCHOOL TEACHERS FROM SIX SOUTHWEST VIRGINIA COUNTIES SPENT A WEEK LEARNING ABOUT GENDER EQUITY AND PREPARING FOR HANDS-ON ACTIVITIES AT A GIRLS' SUMMER DAY CAMP. MEMBERS OF A TEACHERS' WORKING GROUP HAD MET BEFOREHAND BY PHONE, FAX, E-MAIL, AND ELECTRONIC CHAT ROOM TO REVIEW HANDS-ON SCIENCE MODULES.

The following week, those teachers helped 22 middle school girls engage in hands-on math and science activities. The camp gave the girls a chance to conduct simple experiments and to use math and physics to solve real-life problems. At companies in the Blacksburg area, including a biotechnology firm, they talked with female scientists. They were up to their knees in a creek, collecting and identifying creatures to assess the health of the stream.

Each afternoon the teachers discussed group dynamics, gender equity, and plans for the next day. Each day a different woman from the Virginia Tech faculty ate lunch with the girls and teachers, to help put a human face on becoming a scientist and to give teachers a chance to interact with role models they could invite to give talks or science demonstrations at their schools.

Part of the idea of SAGE-VA (the science and gender equity program of western Virginia) was to establish a collaborative network among middle school teachers, university professors, and community organizations interested in getting middle school girls to pursue STEM education and careers. It helped solidify collaboration between classroom teachers in isolated parts of Virginia and scientists and science educators at Virginia Tech.

Teachers got hands-on experience with teacher-tested approaches to "discovering" math and science as well as a chance to exchange ideas and experiences with teachers from other schools. "We can compare what we do and how we do it, and that can make our teaching more relevant," said one teacher. "And best of all, these are real activities. The kids are really going to love it."

CODES: M, I, PD	Virginia Polytechnic Institute and State University (Virginia Tech)
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www.chre.vt.edu/rebecca/sage-va/mission.html	HRD 97-10645 (one-year grant)
Partners: Giles, Montgomery, Roanoke, Washington, Wise, and Wythe counties; Virginia Space Grant Consortium	
Keywords: education program, engagement, hands-on, real-life applications, teacher training, rural, gender equity awareness, role models, support system	

004

Sc's

Science connections

SCIENCE CONNECTIONS

THE PLUS CENTER (PROMOTING LEARNING AMONG THE UNDERREPRESENTED IN SCIENCE) AT THE COLLEGE OF ST. SCHOLASTICA OFFERS WEEKLONG AND MONTHLONG SUMMER SCIENCE PROGRAMS FOR GIRLS THAT EMPHASIZE GENDER EQUITY AND REGULAR INTERACTION WITH FEMALE ROLE MODELS IN SCIENCE. *BUT THE ENTHUSIASM GIRLS DEVELOP DURING SHORT-TERM ENRICHMENT PROGRAMS IS RARELY SUSTAINED IN THEIR HOME AND SCHOOL ENVIRONMENTS. THIS IS ESPECIALLY TRUE IN RURAL COMMUNITIES, WHERE GIRLS HAVE LITTLE EXPOSURE TO FEMALE ROLE MODELS AND ARE UNLIKELY TO RECEIVE STRONG PARENTAL SUPPORT FOR SCIENTIFIC PURSUITS—AND WHERE TEACHERS ARE RARELY FAMILIAR WITH COOPERATIVE ACTIVITY-BASED LEARNING AND LACK EVEN THE RUDIMENTARY SUPPLIES AND EQUIPMENT NEEDED FOR HANDS-ON ACTIVITIES.* ONE PURPOSE OF THE PLUS PROGRAMS IS TO *OVERCOME TWO STEREOTYPES: THAT WOMEN CAN'T DO SCIENCE OR, IF THEY DO, THEY MUST BE NERDS.*

Students and parents had rated FAST Camp (a weeklong summer enrichment camp for sixth and seventh grade girls) highly, and the girls appeared to be highly motivated to continue math and science studies after camp. But despite strong encouragement, only eight of 122 FAST camp graduates actually participated in a follow-up summer enrichment experience when they reached eighth, ninth, or tenth grade. The single follow-up session the PLUS Center provided was not enough to counter the peer pressure and lack of support these students experienced after their initial summer experience was over.

To prevent these leaks from the science and math pipeline, St. Scholastica involved teachers, families, and scientists in Science Connections, a model program designed to give girls enrichment opportunities that would *sustain their interest in science during the impressionable middle school years*. The two-year program let sixth graders from the summer camp continue to be involved with a peer group and with role model scientists and activities until they entered the eighth grade (when the PLUS Center has programs geared to eighth grade students). Each year, 25 participants—sixth and seventh grade girls (from predominantly low- and middle-income rural or minority families) who had already participated in the weeklong science enrichment program—participated in a monthly series of Saturday Science workshops during the school year and a Summer Science Weekend.

Activities at the Saturday Science workshops featured, in turn, "MacGyver" problem-solving, a FAST Camp reunion, careers, kitchen science, computers, snow science, chemistry, and ecology. In the "kitchen science" workshop, students and parents made ice cream in ziplock bags, using milk, which launched a discussion of what the salt does and how recipes might freeze differently, depending on the ingredients (variables). In a milk chemistry experiment, they added food coloring and dish detergent to whole milk at room temperature, creating a reaction that surprised and baffled both students and parents. In the ensuing discussion of variables, they discussed what might happen if the experiment were repeated with skim milk or buttermilk—and were sent home with an assignment to repeat the experiment comparing different kinds of milk products at different temperatures.

At the end of each workshop, the girls received a science or math puzzle (from Marilyn Burns's books and the EQUALS book *Math for Girls*) to work on over the month; there was a drawing for a small prize from among those with correct responses. Families received two AAAS publications ("Science Books and Films" and "Sharing Science with Children") that suggest home activities. Teacher and parental involvement were emphasized as a vital link in the support network for each girl.

The Summer Science Weekend began with a chemistry magic show that included experiments with dry ice, helium, indicator solutions, and so on. Saturday morning problem-solving activities were followed by "What's My Line?" featuring eight female scientists who brought along one piece of equipment they use regularly. Saturday afternoon water activities included the "Lake Superior Game," in which a bucket of water representing Lake Superior gradually becomes polluted and depleted as the game progresses, with game cues such as this:

> I am a sixth grader…. I go fishing with my friend. When we clean our fish we dump the guts in the lake instead of wrapping them up and throwing them away. We think this is okay because they are biodegradable. [Add one unit of color.]

The PLUS Center has developed a consortium of local educational institutions and community partners to expand and maintain a pipeline of youth and family programming for grades 4 through 12 (while improving teacher training) and to produce systemic reform in STEM education. Many PLUS programs serve primarily students of color and low-income youth, many from rural communities. Survey results indicate that 76 percent of Plus Center alums have graduated from high school, 63 percent of those graduates have gone on to postsecondary education, and of those who have declared a major, 68 percent have selected majors in math and science-related fields.

CODES: M, I	The College of St. Scholastica
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www.css.edu/PLUS	HRD-95-54497 (one-year grant)
The "Lake Superior Game," available from the University of Minnesota Sea Grant Extension Program, could probably be adapted to other bodies of water.	
Keywords: demonstration, support system, workshop, summer camp, hands-on, parental involvement, role models, rural, activity-based, cooperative learning, teacher training, underprivileged	

004
Mit
Master It: a program for rural middle-school girls

MASTER IT: A PROGRAM FOR RURAL MIDDLE SCHOOL GIRLS

MASTER IT (MATHEMATICS AND SCIENCE TO EXPLORE CAREERS INVESTIGATING TOGETHER) IS A PROJECT TARGETED AT RURAL KANSAS MIDDLE SCHOOL GIRLS WHO HAVE COMPLETED GRADES 7 AND 8. EACH YEAR 48 GIRLS (HALF FROM EACH GRADE) ARE SELECTED TO PARTICIPATE IN A ONE-WEEK SUMMER RESIDENTIAL PROGRAM FOLLOWED BY FOUR SATURDAY ACTIVITIES DURING THE SCHOOL YEAR. ACTIVITIES INCLUDE HANDS-ON INVESTIGATIONS OF MATHEMATICAL AND SCIENTIFIC CONCEPTS LED BY WOMEN PROFESSIONALS IN INDUSTRY OR ON THE UNIVERSITY FACULTY. THE PROJECT ALSO PROVIDES FOR CAREER DISCUSSIONS, FIELD TRIPS TO CORPORATE PARTNERS, AND ASSERTIVENESS AND SELF-ESTEEM TRAINING.

The point is to make rural girls aware of how math and science are applied in everyday life and in various workplaces, to acquaint them with female role models in nontraditional careers, to show them the importance of continuing to take advanced math and science classes in high school, and to set up a support network among peers and professionals. The girls maintain an ongoing dialogue with each other, the project staff, and women in industry through a group e-mail that is distributed to all participants. The project hopes that as the girls become more confident about their math and science knowledge, while networking with successful professional women, they will lean increasingly toward pursuing careers nontraditional to women, such as physics, engineering, and computer science.

Designed collaboratively by faculty at Emporia State University and by representatives from private and public Kansas institutions to keep young women in the math and science pipeline, Master It provides *a framework for developing programs for rural girls that other universities or community organizations can use in rural settings, where corporate partners might not be nearby.*

CODES: M, H, PD	EMPORIA STATE UNIVERSITY
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HRD99-08757 (ONE-YEAR GRANT)	
KEYWORDS: EDUCATION PROGRAM, HANDS-ON, SELF-CONFIDENCE, ROLE MODELS, CAREER AWARENESS, REAL-LIFE APPLICATIONS, SUPPORT SYSTEM, FIELD TRIPS, INDUSTRY PARTNERS, RURAL	

004
Tt
Training trainers in rural youth groups

TRAINING TRAINERS IN RURAL YOUTH GROUPS

GIRLS IN RURAL AREAS ARE AT A DISADVANTAGE IN ACQUIRING SCIENTIFIC LITERACY AND POSITIVE ATTITUDES TOWARD MATH AND SCIENCE; THEIR GEOGRAPHIC ISOLATION AND HARSH ECONOMIC REALITIES LIMIT THEIR EXPOSURE TO FEMALE ROLE MODELS IN STEM FIELDS AND TO THE KINDS OF HANDS-ON EXTRACURRICULAR SCIENCE ACTIVITIES THAT HELP YOUTHS BECOME COMFORTABLE WITH MATH AND SCIENCE. THIS "GET SET, GO!" PROJECT GAVE RURAL GIRLS IN IOWA GREATER EXPOSURE TO ROLE MODELS AND TO OUT-OF-SCHOOL LEARNING ACTIVITIES IN A COOPERATIVE, HANDS-ON FORMAT.

The project used a pass-through train-the-trainer model developed for Girl Scouts by the AAAS, adapting it to comply with national 4-H guidelines and incorporating a gender equity training component. The 4-H organization and program, one of the most gender-equitable delivery mechanisms for informal education, emphasizes experiential learning for rural youth aged 9 to 19. There are roughly 5.5 million 4-H members nationwide, 52 percent of whom are girls. By providing mixed-gender activities that expose both girls and boys to female role models in STEM, the project hoped to reduce STEM gender stereotypes.

The project trained trainers from adult youth group leaders and university students (all women), who in turn trained other volunteer Girl Scout and 4-H youth leaders: high school volunteers were trained to lead activities for (and train trainers from among) middle-school youth; and middle school girls were trained to lead hands-on sessions for groups of elementary school children.

CODE: I, PD, E, M, H, U	IOWA STATE UNIVERSITY (ISU)
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PARTNERS: ISU PROGRAM FOR WOMEN AND SCIENCE AND ENGINEERING; WESTERN TRIAD SCIENCE AND MATHEMATICS ALLIANCE (WTSAMA); ISU EXTENSION SCIENCE, ENGINEERING, AND TECHNOLOGY YOUTH INITIATIVE; MOINGONA GIRL SCOUT COUNCIL; SELZER-BODDY, INC.; ISU RESEARCH INSTITUTE FOR STUDIES IN EDUCATION (RISE)	
KEYWORDS: DEMONSTRATION, TRAINER TRAINING, GENDER EQUITY AWARENESS, RESOURCE CENTER, PARENTAL INVOLVEMENT, SUPPORT SYSTEM, EXPERIENTIAL LEARNING, GIRL SCOUTS, 4-H, RURAL, INDUSTRY PARTNERS, COMMUNITY COLLEGE, ROLE MODELS, HANDS-ON, CAREER AWARENESS, COOPERATIVE LEARNING	

004

Oh

Opening the horizon: science education in rural Ozarks middle schools

OPENING THE HORIZON: SCIENCE EDUCATION IN RURAL OZARKS MIDDLE SCHOOLS

SCIENCE IS NOT HIGHLY VALUED IN SOUTHWEST MISSOURI, WHERE EDUCATING WOMEN IN THE SCIENCES IS A LOW PRIORITY. AS A CULTURAL REGION, THE OZARKS TEND TO UNDERVALUE WOMEN'S CONTRIBUTION TO SOCIETY, AND THERE IS AN UNSPOKEN BUT OBVIOUS BIAS AGAINST WOMEN WORKING OUTSIDE THE HOME, ESPECIALLY IN WHAT ARE TYPICALLY PERCEIVED TO BE MALE OCCUPATIONS. *ENCOURAGING GIRLS IN THE OZARKS TO CONSIDER SCIENCE OR MATH AS CAREER OPTIONS CHALLENGES REGIONAL STEREOTYPES ABOUT WOMEN'S ROLE IN SOCIETY. THIS PROJECT AIMS TO INOCULATE MIDDLE SCHOOL GIRLS WITH THE SCIENCE BUG AND IMMUNIZE THEM AGAINST PEER PRESSURE THAT MIGHT DISSUADE THEM FROM PURSUING THEIR INTEREST IN SCIENCE. IT AIMS TO GIVE TEACHERS THE SUPPORT AND RESOURCES THEY NEED TO PRESENT SCIENCE AND MATH IN A WAY THAT WILL GET STUDENTS HOOKED FOR LIFE.*

Opening the Horizon (OTH) is a significant outreach effort to keep rural middle school girls in the region interested in math and science. *Combining hands-on science for students with distance learning and professional development for teachers*, this three-year project will engage up to 200 middle school girls and 30 science teachers from 26 Ozarks counties—as well as the girls' parents, school administrators, and local and regional communities—in an active, positive, and self-sustaining program to encourage scientific literacy, curiosity, and opportunity.

OTH was launched after an existing program, Expanding Your Horizons (EYH), had for six years successfully drawn 200 middle school students (mostly girls) from southwest Missouri to a one-day hands-on science experience. But whereas EYH targeted mainly girls from urban schools, OTH targets students in rural schools and their teachers, who may have neither the time nor the resources to teach science in such a way that students are likely to be drawn to careers in science.

Project components include kickoff and closing conferences each year at Southwest Missouri State University (SMSU) and Drury University (both in Springfield) for girls, their parents, and teachers; three Saturday workshops run simultaneously at five college sites closer to

the girls' homes; college student mentors for the girls; and distance learning course for middle school teachers. Women on the faculty at SMSU and Drury will run the program, with site directors at the other college sites.

Teachers will be recruited for a three-credit-hour graduate course (through SMSU, which will waive all tuition) on women in STEM. Among other things, they will work through exercises in the book *Women Life Scientists: Past, Present, and Future* (Matyas and Haley-Oliphant 1997) to see how female role models can be incorporated into classroom curricula. After researching women scientists, they will develop lessons for their classroom. Meeting at the site closest to them, they will take advantage of the distance education network already in place.

At a workshop featuring hands-on exhibits of curricular models and materials provided by about 25 vendors, teachers will have access to curricular materials, supplies, and equipment that many rural school districts cannot afford. They will be asked to inventory the basic science equipment and library resources in their schools, complete an equipment checklist, and indicate the equipment they need most urgently. In small groups they will discuss such topics as barriers for girls interested in science and how to tie workshop objectives to the Missouri state science standards. During the year they will remain in touch with other science teachers in the region and with faculty women in the sciences at participating colleges and universities.

Participating teachers will help recruit four students from sixth grade, two from seventh, and two from eighth. *Students who receive letters of acceptance will also get a bracelet of "UV beads," which appear white under indoor lighting but reflect visible colors under ultraviolet light. An activity sheet will suggest ways for them to experiment with the beads—for example, placing them under a piece of plastic wrap on which various types of sunscreen are smeared to test the sunscreen's effectiveness. This will give parents a chance to see the kinds of activities their daughters will experience in the OTH workshops—as well as science's relevance to their everyday life*.

Undergraduate math and science students will serve as facilitators for group activities and as mentors to a team of five to eight girls, maintaining close contact by phone and by e-mail throughout the year. The OTH experience will give student teachers and undergraduate education majors some student exposure to group facilitation of hands-on science activities.

The kickoff conference will provide a chance to get acquainted and a nurturing environment in which to experience the beauty, wonder, and excitement of science and math. Interdisciplinary hands-on activities at the conference and school-year workshops will emphasize the environment as a global system of interdependent parts. The subtheme the first year is pollution.

Students and teachers will work with thematic kits and other resources typically not funded in these rural areas and will engage in activities from the book *Whizbangers and Wonderments: Science Activities for Young People*. They will get basic instruction in report writing and in the use of computers and the library. During the school year, participants will keep in touch through distance learning workshops (for teachers), student–mentor e-mail, and postings on the project website.

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HRD 00-02129 (three-year grant)	
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004

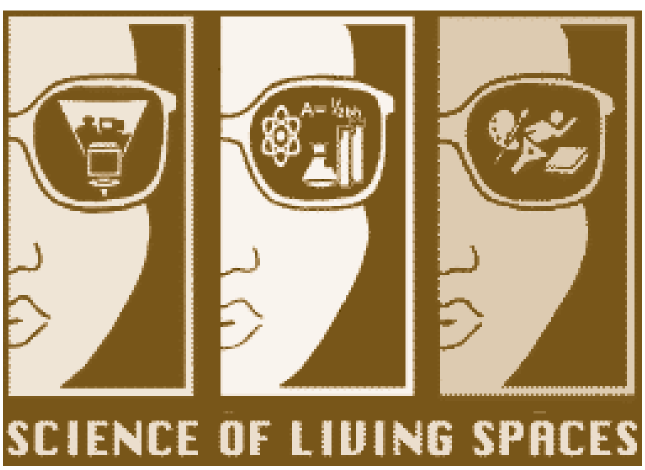
sls

The science of living spaces

THE SCIENCE OF LIVING SPACES

THE SCIENCE OF LIVING SPACES PROJECT GREW OUT OF CHRISTOPHER NEWPORT UNIVERSITY'S INTEREST IN BOTH K–12 SCIENCE EDUCATION AND WOMEN IN MATH AND SCIENCE. THE PROJECT'S CORE COMPONENT WAS AN INTENSIVE THREE-WEEK SUMMER SCIENCE CAMP IN WHICH 24 RURAL MIDDLE SCHOOL GIRLS, LIVING IN CNU'S DORM ROOMS DURING THE WEEK, WERE IMMERSED IN A TREMENDOUS VARIETY OF HANDS-ON SCIENCE AND MATH TOPICS. THERE WAS ALSO A YEAR-LONG FOLLOW-UP PROJECT, TEACHER INVOLVEMENT, UNDERGRADUATE MENTORS, AND TRAINING FOR ALL STAFF AND PARENTS INVOLVED WITH THE PROJECT.

The girls' days were packed with participatory sessions led by female scientists, including a veterinarian, a NASA chemist, two physicists from a Department of Energy accelerator research lab, and members of the Society of Women Engineers. For a session on greenhouse gases, for example, the girls measured methane and toured a greenhouse; for chemistry and food they created baking powder and ice cream; for dinosaurs and speed they measured leg length, stride length, and speed; for computers and ethics, they discussed medicine, privacy, artificial intelligence, and the future; for statistics and ethics, they learned about descriptive statistics and its misuses; for digital signals they learned about electronic circuits and logic testing.



In more intensive technology sessions, the girls made a working lamp, built a working Lego robot arm, and learned about the then-new World Wide Web. The summer schedule included science across the curriculum (in physical education, linguistics, and art), careers, ethics, and self-esteem building—and was rounded out with field trips to NASA Langley, CEBAF (now Jefferson Labs), the Virginia Living Museum (a plant and animal museum), Richmond Science and Math Center (role playing as scientists in a simulated control lab and as astronauts in simulated space), Busch Gardens (to examine the physics of amusement park rides), and Colonial Williamsburg (to examine women's early roles).

By all measures, the program succeeded: 94.5 percent of the parents reported greater awareness of the factors that influence their daughters' selection of careers in STEM, and 96 percent of the girls said they liked science more because of the project and were very to extremely interested in taking more science and math courses.

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PARTNERS: SCHOOL SYSTEMS IN ISLE OF WIGHT AND CHARLES CITY COUNTIES, VIRGINIA	
PUBLICATION: THE SCIENCE OF LIVING SPACES: WOMEN IN THE ENVIRONMENT OF THE 21ST CENTURY, AN EVALUATION AND GUIDE BOOK (ERIC DOCUMENT ED417929).	
KEYWORDS: DEMONSTRATION, RURAL, LIVING SPACES, FIELD TRIPS, HANDS-ON, PROBLEM-SOLVING SKILLS, TEACHER TRAINING, PARENTAL INVOLVEMENT, BARRIERS, SELF-CONFIDENCE, SUMMER PROGRAM	

004
Lab
Laboratory science camp for dissemination training

LABORATORY SCIENCE CAMP FOR DISSEMINATION TRAINING

FROM ITS BEGINNINGS A DECADE AGO AS A SIX-DAY SUMMER PROGRAM SERVING 60 ECONOMICALLY DISADVANTAGED GIRLS FROM RURAL MAINE, THE KIEVE SCIENCE CAMP FOR GIRLS HAS TRANSFORMED THE LIFELESS STUFF OF SCIENCE TEXTBOOKS INTO CHALLENGING ADVENTURE. THE PROGRAM HAS GROWN INTO A 10-WEEK SUMMER PROGRAM SERVING MORE THAN 250 GIRLS AND WOMEN A YEAR, FROM ALL OVER THE COUNTRY, IN BOTH THE RESIDENTIAL PROGRAM AND VARIOUS WILDERNESS SETTINGS.

When this information-dissemination project began, the camp provided fourth, fifth, and sixth grade girls from six resource-poor Maine communities with a residential experience in experiential science education and other activities requiring cooperation and risk taking. The camp hoped to have a ripple effect on science education in those six districts.

The camp's collaborative learning environment also provided professional development for teachers and a model for staff from other camps. By providing training, skills, materials, and professional development incentives, the science camp project also prepared parent–teacher "dissemination leadership teams" from rural Maine districts to be advocates and agents of change in local education—to help dispel the notion that science is a male pursuit.

In this project, 24 adults (parents, teachers, and leaders from other science camps) observed and participated in the camp and attended four seminars to prepare them to return to their communities as advocates for gender equity and experiential science education. *Observing underprivileged girls from upper elementary and middle school get a hands-on STEM experience in a supportive atmosphere—and engage in authentic relationships with adult role*

HANDS-ON, MINDS-ON CAMP ACTIVITIES

For many girls, the residential experience is a first time away from home—a challenge in itself—a chance to live, learn, and have fun with girls and women who are serious about science. At an age when peer pressure often deters girls from developing or acknowledging a serious interest in science, becoming part of such a community can be a turning point.

Camp activities emphasize group work, problem-solving, exploration, discovery, and healthy risk taking—in five core activities: the ropes course, engineering, rocketry, Lake Day, and the Otter Island adventure. For this project, pre- and post-assessments of relevant science concepts and skills measured what participants learned from the camp experience—and whether what they thought they could do was close to what they actually did. The results were generally very positive: The girls gained in skills, knowledge, and confidence.

In the *ropes course*, the girls learn that they can accomplish physical challenges that at first seemed beyond reach. *The ropes course becomes a metaphor for any learning that at first seems difficult, or even impossible. Girls and teachers learn that—given skills, techniques, tools, support, encouragement, time, and the chance to try, fail, and try again—they can succeed in the classroom, on the water, or crossing a high wire. They do more than they think they can do. They learn why goal setting is important, learn to cheer themselves on and to be good team members, and leave with higher aspirations*.

In *engineering*, the girls design and build a machine or a structure that incorporates motion using *gears,* a *pulley,* or a *belt drive*. They learn that there are no right answers, only good solutions. For girls and teachers who rarely use tools and materials to solve a problem, this is an entirely new kind of educational experience, but 98 percent of the girls learned to name and identify all three mechanical systems.

On *Lake Day*, girls and teachers learn about the water cycle process, why fresh water is limited, and how human actions affect the quantity and quality of the water in Damariscotta Lake. They learn how to identify a watershed area using a topographical map and explore the lake habitat, taking a hands-on approach to learn about the lake's plants and animals. Before the camp, few girls knew what a watershed was; after two weeks they could tell you.

In *rocketry*, girls and teachers who typically have little direct experience with physical science explore gravity, friction, and air pressure before building rockets. Their initial anxiety gives way to confidence in their ability to discover and understand—in this case, what forces allow flight to occur, how each part of a rocket is related to flight and aerodynamics, and what everyday items can serve as rocket components. They learned both the names of rocket parts and the principles underlying rocket flight.

Many of these girls had never been on a boat or a coastal island and had never hiked, carried equipment, or taken a detailed look at the world at their feet. On an overnight *camping trip,* 30 girls explored *the marine environment of Otter Island* and learned about how various types of marine organisms adapt to island life.

models who encouraged them to take risks and undertake challenges—was far more persuasive than reading about theories of change. Gender equity training has a greater impact on teachers and parents when course work is integrated with observations of equitable teaching and learning. Seeing a successful science camp in action is a pivotal experience for those trying to replicate the experience.

Actively involving parents and school board members in the dissemination of support for hands-on science and gender equity helped broaden support for science education locally and helped create a shared sense of vision and purpose. The science camp was to be a catalyst for reshaping the local school district's elementary science program. The connection forged between teachers and girls, the project hoped, would help keep the girls from losing the confidence they'd gained in camp. A mentoring project was developed to support camp alumnae as they moved to middle or high school, where social and peer values often inhibit their participation in math and science.

The camp activities are replicable. Engineering and rocket-building activities require only inexpensive, easily available materials. Many group-building and trust activities are not site-dependent and can easily be replicated elsewhere. Doctors, foresters, farmers, oceanographers, and midwives (to use examples from Kieve) can visit any camp or classroom, bringing along the tools of their trade and answering questions, just as they did at Kieve. Two new science camps for underprivileged Maine children—Tanglewood (4-H) and Camp Susan Curtis (community-based, tuition-free)—opened their doors modeled on Kieve. Twenty-five Maine women who work in science, math, or technology were trained and have mentored 50 camp alumnae. Other camps, many out of state, have shown an interest in a similar program.

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Products: Girls and Women Seizing Science Together: A Kieve Science Camp for Girls Training Manual and Guide, a 10-minute video.	
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Science for all: opening the door for rural women

SCIENCE FOR ALL: OPENING THE DOOR FOR RURAL WOMEN

MONTANA STATE UNIVERSITY (BOZEMAN) DEVELOPED THIS PROJECT TO INCREASE THE NUMBER OF RURAL AND NATIVE AMERICAN HIGH SCHOOL GIRLS WHO PURSUE OR BECOME MORE INVOLVED WITH SCIENCE OR ENGINEERING. THE PROJECT PROVIDED INTENSIVE EDUCATIONAL EXPERIENCES FOR TEACHERS AND FACULTY AND SUPPORTIVE ACTIVITIES FOR STUDENTS AT MSU AND IN BOZEMAN, ESPECIALLY AT RURAL AND RESERVATION MIDDLE AND HIGH SCHOOLS. TRAINING AND DEVELOPMENT OPPORTUNITIES INCLUDED A SUMMER SHORT COURSE, A FACULTY INSTITUTE, A FRESHMAN SEMINAR, SCHOLARSHIPS AND FELLOWSHIPS, MINI-GRANTS TO IMPLEMENT IDEAS GENERATED IN THE SHORT COURSE AND FACULTY INSTITUTE, AND ONLINE COUNSELING AND MENTORING FOR TEACHERS, COUNSELORS, AND TRIBAL FACULTY.

Summer short course. Each year the project staff presented a weeklong summer course on "female friendly" science teaching. From 1997 through 1999, 53 teachers, 31 counselors, and 17 administrators from reservations and other Montana rural schools studied why women are underrepresented in science and what they could do to help reverse that trend. They also interacted with national experts on science and gender issues and spent time learning about computers.

Faculty institute. In conjunction with the short course, 51 faculty members from MSU-Bozeman and 21 from three tribal colleges attended a three-day faculty institute on gender, science, and engineering. Several joint sessions allowed middle and high school teachers and counselors to interact with the college faculty. Moving the institute from MSU to one of the tribal colleges opened fresh dialogues between faculty at the MSU and tribal college campuses.

Follow-up surveys suggested that *participants in the short course and faculty institute changed their mentoring and teaching strategies, becoming more sensitive to strategies to help women and minorities succeed. Using female and minority role models was found to be especially effective, but participants were also receptive to changes in assessment, content, lab activities, approaches to problem solving, small group work, and other classroom discussions*.

Freshman seminar. *Two cross-disciplinary seminars on science, technology, and society for students entering MSU-Bozeman provided "survival training" for women and minorities going into the sciences, showed women's place in the science majors, and provided nonmajors with better tools for understanding science and engineering*. Aided by students awarded fellowships for their research assistance, a faculty team designed the seminar to show that science is interesting, socially valuable, relevant to women's lives, and an enterprise to which women and minorities can and do contribute.

Mini-grant program. Participants in the short course and faculty institute were awarded 48 mini-grants ($5,000) to develop, test, and implement activities to get more female participation in math and science in their departments or schools. Grants were awarded to support one or more of seven goals:

- To balance gender/cultural content in the curriculum
- To improve communication styles
- To promote collaborative learning styles
- To recognize the value of diversity for scientific progress and problem solving
- To present scientific instruction in a real-world context
- To assess student learning in a way that encompasses students' individual experience
- To provide support for girls, young women, and minority students in science, math, and engineering

Final reports on the mini-grants were full of success stories, and two of the projects had a noticeable impact on teaching strategies in science and engineering courses at MSU-Bozeman. First, physics faculty used external experts to assess gender equity in collaborative small-group learning activities in a large lecture class. *They found that the group's gender composition significantly affected women's, but not men's, participation. Women's participation was best in single-sex or gender-balanced groups*.

Second, a chemical engineering professor and an education professor investigated how new instructional methods affected an introductory chemical engineering course. Their finding that *changes in teaching strategies made the class a more positive experience for students, especially young women*, was shared with other engineering faculty. A mini-grant also helped create the first lab-based chemistry course at a tribal college.

Many of the mini-grant activities were designed to reach beyond the isolation of the rural and reservation classroom to the community, to research facilities, and to local women professionals. Such projects helped educate the community and get them involved in support for women's participation in STEM careers. For example, 600 trees were planted to help reestablish vegetation and reduce erosion in the Teton River watershed (with support for a follow-up count). Many projects resulted in more positive attitudes toward computers and computer research and more parents wanting their children to attend college.

Changes in teaching made MSU women studying science or engineering more confident and involved in their course work and more enthusiastic about pursuing STEM careers. Women involved as scholars, mentors, and fellows were particularly affected by the project. The availability of the mini-grants led to many activities outside the classroom in rural and reservation middle and high schools and had a direct impact on course content and teaching approaches. It is too soon to tell how big a difference the project will have in the long run on young women's expectations, their preparations for college-level science and engineering, and their retention rates once on campus.

MIDDLE SCHOOL GIRLS WIN AWARD, APPEAR ON 'OPRAH'

On February 11, 2002, a team of Native American middle school girls from the Crow Agency appeared on the Oprah Winfrey show. Concerned about the severe housing shortage on their reservation, Montana-Lucretia Birdinground, Kimberly Duputee, Omney Sees the Ground, Brenett Stewart, and their coach, science teacher Jack Joyce, had found a way to build low-cost houses out of straw and stucco concrete. They had tested the straw with thermometers, blowtorches, and hoses to determine its energy efficiency and its resistance to fire and water. For their efforts, they won the Bayer/NSF Award's Columbus Foundation Community Grant. With community volunteers, the team planned to build a straw-bale community center on the Crow Reservation.

The girls did their science project as part of their science class, but for two years they had been enthusiastic participants in the NSF mini-grant-funded science club for girls at Pretty Eagle School—a rural K–8 school with only 140 students, all of whom are bused to the school, some as far as 55 miles. The science club brought in monthly speakers (Native American and female role models), and the girls made two campus visits to MSU-Bozeman, four hours from their school, to observe labs and interact with women under-graduates and science and engineering faculty. At a club-hosted technology evening to which the girls could bring their mother, grandmother, or aunt, the women surfed the Web—the first time many of them had touched a computer.

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PARTNERS: BLACKFEET COMMUNITY COLLEGE, DULL KNIFE MEMORIAL COLLEGE, LITTLE BIG HORN COLLEGE	
KEYWORDS: DEMONSTRATION, SUMMER PROGRAM, TEACHER TRAINING, GENDER EQUITY AWARENESS, ELECTRONIC MENTORING, SCHOLARSHIPS, RURAL, NATIVE AMERICAN, SELF-CONFIDENCE, FELLOWSHIPS, MENTORING, MINI-GRANTS, OPRAH WINFREY, INDUSTRY PARTNERS	

004
IE
Internet explorers

INTERNET EXPLORERS

DO YOU KNOW WHY THE *TITANIC* SUNK? IF YOU'RE NOT SURE, CHECK THE ANSWER ON ONE OF THE STUDENT-CREATED PAGES OF THE INTERNET EXPLORATIONS WEBSITE. UNDER THE INTERNET EXPLORERS PROJECT, HIGH SCHOOL GIRLS WHO HAD COMPLETED THEIR JUNIOR YEAR SPENT EIGHT SUMMER WEEKS ON THE IOWA STATE UNIVERSITY CAMPUS RESEARCHING PROGRAMMING METHODS AND DEVELOPING HANDS-ON MATH, SCIENCE, AND ENGINEERING ACTIVITIES FOR MIDDLE SCHOOL GIRLS. DIRECTED BY FIVE WOMEN IN GRADUATE SCHOOL, 20 HIGH SCHOOL GIRLS FROM RURAL AND MINORITY BACKGROUNDS COMPLETED A SOPHISTICATED COMPUTER PROJECT ADDRESSING THE NEED TO INTEREST RURAL GIRLS IN MATH AND SCIENCE BY ENGAGING THEM IN INFORMAL MATH AND SCIENCE ACTIVITIES IN A SELF-PACED, NONCOMPETITIVE ENVIRONMENT.

After grant funding ended, the program continued providing summer internships for high school seniors. Every summer, interns design web pages on dozens of science-related topics—from spiders and rainbows to tsunamis and jet engines—to interest girls of middle school age in science and engineering. Web pages of interest to students and teachers alike answer such questions as why things glow in the dark, what lupus is, how airplanes fly, how boats float, how a camera works, how plastics are made, what microwaves are, how caves form, how shampoo gets to the store, how eggs are formed, how we predict weather, how the dinosaurs died, and why the great ship *Titanic* went under. If there's not enough to keep you fascinated on this website, check out its links to other science websites.

CODE: H, M, I	Iowa State University
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004
Jsun
Jump for the sun

JUMP FOR THE SUN

"A MAMA ALWAYS EXHORTS HER CHILDREN, AT EVERY OPPORTUNITY, TO JUMP FOR THE SUN.

THEY MAY NEVER REACH THE SUN, BUT AT LEAST THAT WAY THEY GET THEIR FEET OFF THE GROUND." — ZORA NEALE HURSTON

The comprehensive Jump for the Sun project was a collaboration between a university, a large public school district, and a museum in a heavily rural area that was suddenly becoming a major tourist attraction. *One part of the project changed the way Coastal Carolina University (CCU) taught science to early childhood and elementary education students—which is important because teachers' attitudes about math and science profoundly affect how they teach and whether their students become interested in math and science. Another part of the project, targeted at middle school girls and teachers, demonstrated that middle school girls engaged in inquiry-based science can get very excited about it.*

Changes for undergraduates. The project changed the way CCU teaches biology and physics survey courses to preservice teachers. Physics 102, for example, is an introductory physical science course required of all CCU elementary science majors. Traditionally taught in a standard lecture-laboratory format, this course romped quickly through the physical sciences (physics, chemistry, geology, and astronomy) to prepare students to teach these subjects in grade school. Most students came to the course fearful of physics and science in general and left knowing only a series of loosely connected facts, despite ample research documenting the inadequacy of such an approach for teacher training. New standards emphasize that students learn both content and process skills.

The project redesigned Physics 102 and Biology 211, introducing hands-on, inquiry-based teaching techniques—with minimal lecturing and maximum group work and small group discussions—so student teachers would be better prepared to teach to the new science standards and to improve student attitudes toward science. Separate lectures and laboratories were replaced by block scheduling, with the class meeting three times a week for two hours. During this two-hour block, students worked in groups on curricular materials (*Powerful Ideas in Physical Science* and *Physics by Inquiry*) designed by physics education researchers and adapted for use at CCU. These materials led students to explore concepts (through experimentation, theory building, analysis, and conclusion drawing) and to master process skills (such as graphing, math, and equation building), emphasizing the computer as a learning tool.

Meanwhile, the course instructor learned about using interactive techniques, establishing a learning community in the classroom, and acknowledging *women's ways of knowing: viewing the teacher as midwife rather than banker (drawing knowledge out rather than depositing it*).

Students' initially responded negatively, feeling there was too little lecture and review time and no feeling of closure on the subject; because the learning was self-directed, students weren't sure they were learning what they were supposed to learn. The second time the course was offered, *class goals were posted at the beginning of each session, students were asked to come to a consensus about their ideas before starting a unit, and, as a class, they later summarized their findings. Student attitudes toward the class improved dramatically*.

Education majors did just as well on the post-course content exam in biology as a control group of 111 students, which was encouraging since Bios 211 (the experimental course) covered less content because of the techniques used: active learning, inquiry, and discussion. Students said the biggest benefit of group work was that if someone didn't understand how the teacher explained a subject, someone in the group would be able to explain it—so they had a chance to teach one another. Group work allowed quiet students to participate and helped material "stick" better than it did with lectures—although it also allowed the group to get off-task.

The students—who were largely unaware of differences in male and female pay or biases in books, movies, and the classroom—were overwhelmingly positive about gender equity assignments such as analyzing a textbook, looking at toys geared to girls/boys, and observing other teachers in the classroom.

Changes at the middle school. Some of the CCU education majors observed Jump for the Sun at the local middle school, where a problem-solving approach to learning made girls more mature, confident, and positive about math and science. Field trips and hands-on experiences were integrated with the content, providing opportunities to talk not only about content but also about issues of everyday life. In a unit on pollution, for example, the girls interviewed the faculty to see who drove cars to school and who carpooled, with whom. They made pragmatic recommendations about who could carpool, recognizing that teachers who didn't have the same schedules couldn't carpool. In another lesson, a trip to the cemetery led them to discover that yellow fever had killed many children during a certain period in the 1800s, when even cemeteries in North Carolina were segregated by race. This led to a discussion about race as a social construct, not a scientific concept—all from visiting a cemetery and being touched by the babies buried there.

An inquiry-based life science room was built in the Children's Museum of South Carolina and outfitted with microscopes, posters, hands-on specimens, tables, and live creatures. NSF funds were used to train and pay 15 middle school children to work at the museum on Saturdays, helping younger children and parents fully use the resources and equipment. Grant funds were used to run a science club for the participants who worked at the museum, who learned about such things as hurricanes, volcanoes, and extracting DNA from an onion using everyday kitchen utensils. These middle school students learned about science and math, encountered female role models, and had opportunities to connect, build community, construct their own learning, and help protect the environment.

Parents attending special workshops on raising daughters read *Raising Daughters* by Jean and Don Illium and *The Heart of Parenting* by John Gottman and learned to become better listeners—less reactive and confrontational with their daughters, more understanding, and more likely to ask questions in ways that spark discussion instead of yes/no responses.

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Partners: Children's Museum of South Carolina, Horry County Schools	
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004

Sum

Summer camp for rural high school girls

SUMMER CAMP FOR RURAL HIGH SCHOOL GIRLS

THE NORTHWEST CENTER FOR RESEARCH ON WOMEN (UNIVERSITY OF WASHINGTON) PUT TOGETHER THIS COMPREHENSIVE PROGRAM TO ENCOURAGE RURAL HIGH SCHOOL GIRLS' MATH AND SCIENCE ACHIEVEMENT. THE GIRLS ATTENDED A TWO-WEEK RESIDENTIAL SUMMER CAMP; THE TEACHERS, A ONE-WEEK SUMMER INSTITUTE; AND COUNSELORS AND PRINCIPALS, A THREE-DAY WORKSHOP FOR COUNSELORS. EACH SCHOOL-BASED GROUP PARTICIPATED IN ACTIVITIES DURING THE SCHOOL YEAR, INCLUDING A LONG-TERM RESEARCH PROJECT AND AN INTERNET SCIENCE CLUB. THE PROJECT SERVED 73 GIRLS FROM 16 RURAL WASHINGTON HIGH SCHOOLS, 35 HIGH SCHOOL MATH AND SCIENCE TEACHERS, AND 19 COUNSELORS AND PRINCIPALS.

Summer camp on ecosystems. At camp, the girls learned about aquatic (lake and river) and terrestrial (forest, wetland, and grassland) ecosystems and became more knowledgeable about their local watershed. They conducted hands-on experiments in science laboratories and in the field, led by female scientists, researchers, and high school teachers. They engaged in trust-building and challenge exercises, including a knot-tying activity to practice how to give and receive feedback within a mentoring relationship.

They were matched with graduate scientists in a field in which they showed interest and were in touch with their scientist mentors throughout the year, as they worked on long-term research projects with their school team. Their long-term research projects were on topics such as deer behavior, the health of lakes and rivers, rain, runoff, tree growth, and whaling rights. (Their research notes are posted on the project website.) Working on the project taught them about forming plans, doing fieldwork, and putting information together and presenting it to others. Students on the deer project, for example, took pictures, videotaped, and interviewed hunters, conservationists, and residents about deer behavior, gathering material for their presentations as they worked. A cyberspace science club ("Soaring") helped them develop communication and science research skills. They also got pre-college counseling and a workshop on writing résumés.

Summer institute for teachers. Teachers participated in a weeklong summer institute taught by university faculty in biology, chemistry, and physics. Master teachers designed model lessons that integrated physics, chemistry, and biology through the question "What is necessary for life?" The open-ended, experiential lessons emphasized the scientific process and modeled various methods of measuring and recording data. Teachers could take home write-ups of the lessons and had time to adapt a lesson or unit of their own. They also got six hours of Internet training, fall and spring follow-up meetings, and at least one site visit.

The workshop for counselors and principals gave participants a concrete, realistic framework for understanding how careers are chosen and how girls might be helped to succeed in STEM fields. Counselors learned about group process so they could facilitate a support group for girls in the project.

Two curricula are available from the program: an inquiry-based curriculum in aquatic and terrestrial ecosystems from the girls camp and a curriculum the university faculty created for the teachers, integrating chemistry, biology, and physics.

CODES: H, I, PD	The Northwest Center for Research on Women, University of Washington	
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http://depts.washington.edu/rural/RURAL or contact (nwcrow@u.washington.edu) or rural@u.washington.edu		HRD 94-50053 (three-year grant)
Partners: Zymogenetics, Norcliffe Foujndation, Haas Foundation. Science at home (activities involving photograms, natural fragrances) and Science in the lab (master teachers' lesson plans on radishes, temperature, and brine shrimp) are available online at http://depts.washington.edu/rural/RURAL/resources/resources.html		
Keywords: demonstration, rural, summer program, teacher training, hands-on, mentoring, role models, science club, career awareness, inquiry-based		

004

Pass

College studies for women on public assistance

COLLEGE STUDIES FOR WOMEN ON PUBLIC ASSISTANCE

"WOMEN'S VENTURES" HELPED WOMEN ON PUBLIC ASSISTANCE PURSUE CAREERS IN SCIENCE AND TECHNOLOGY. A COLLABORATION BETWEEN TWO- AND FOUR-YEAR COLLEGES AND UNIVERSITIES IN THE CINCINNATI AREA AND THE MAIN ORGANIZATIONS OFFERING WORKFORCE DEVELOPMENT PROGRAMS FOR WOMEN ON PUBLIC ASSISTANCE, *THIS DEMONSTRATION PROJECT SET OUT TO PROVE THAT THIS SEGMENT OF THE POPULATION—HISTORICALLY VIEWED AS UNABLE TO COMPETE IN MAINSTREAM SOCIETY—COULD COMPETE AND BE INTEGRATED INTO STEM CAREERS*. ITS GOAL WAS TO RECRUIT, PREPARE, AND ENROLL 50 MINORITY/LOW-INCOME WOMEN INTO A TWO- OR FOUR-YEAR COLLEGE PROGRAM.

To prepare the women for college, the program offered special classes to strengthen their math, science, and reading skills and to help them develop good study habits, time management skills, and personal support systems. (They especially wanted help with math.) Employers provided co-op work experiences and insights into the types of careers available to the women and the training necessary for them. Professional women provided mentoring on multicultural and gender issues. Case managers provided counseling, follow-up, and help with career plans, childcare, and support services. Participating schools provided on-campus contact people to help with admissions, registration, and class scheduling.

The project was 70 percent successful in meeting its objectives. Of the 50 women it recruited—80 percent black and 17 percent white—7 out of 10 were receiving some form of public assistance. Median income was $420 a month, often from Aid to Families with Dependent Children.

Of the 42 women who enrolled in a college program, 72 percent enrolled in science, 24 percent in engineering, and 2 percent in math. *At project evaluation, 48 percent of the participants had grade point averages between 2.5 and 3.5—and 31 of the 42 women who had enrolled were still in college. Financial concerns were the main reason for not completing course work*.

CODE: U	Cincinnati Institute for Career Alternatives
Betty J. Warren	
HRD 94-53725 (one-year grant)	
Partner: Consortium for Adult Education,	
Products: OMI College of Applied Science, University of Cincinnati College of Evening and Continuing Education, College of Mount St. Joseph, Cincinnati State Technical and Community College, Xavier University	
Keywords: demonstration, community college, recruitment, underprivileged, welfare, science skills, support system, work experience, career awareness	

004

RE-e

Re-entering the workforce

RE-ENTERING THE WORKFORCE

LITTLE ATTENTION HAS BEEN PAID TO ENCOURAGING WOMEN WHO HAVE DROPPED OUT OF THE WORKFORCE—FOR CHILDCARE AND OTHER REASONS—TO RE-ENTER ALONG CAREER PATHS IN SCIENCE AND TECHNOLOGY. IN OCTOBER 1994 THE WOMEN IN SCIENCE SECTION OF THE NEW YORK ACADEMY OF SCIENCES HELD A ONE-DAY WORKSHOP ON THE SUBJECT. THE PARTICIPANTS DISCUSSED SURVIVAL TACTICS, TIME MANAGEMENT, TARGETING YOUR CAREER SEARCH, AND FINANCING COLLEGE EDUCATION, WITH MANY PERSONAL STORIES ABOUT "HOW I DID IT."

Women who re-enter, retrain, and change fields several times during their career learn that re-entry is a process of self-development, self-growth, education, and re-education. It helps to see re-entry as a stepwise process, a series of tasks that can be managed, not a formidable group of problems. Cognitive psychologist and re-entry specialist Pamela E. Kramer advised participants that women *who feel traumatized by getting back into the classroom in science and technology need to factor into the equation what research tells us: Men tend to overestimate their abilities and women tend to underestimate theirs. Acting as self-confident as you would like to feel will stand you in good stead and most women will very shortly discover that they are academically stronger than many of the men in their classes. Know that women tend to be more easily discouraged by an average grade (a C, for example) than men are*, re-entering women were told. If you get a D on that first exam, don't quit—you may learn that a particular teacher gives an average grade of D on that first exam.

The women learned that if they had majored originally in history and now wanted to be electronic engineers, they might have to redo a good deal of their undergraduate degree, but for most fields it was unnecessary to redo a whole degree—and they should not do so if they didn't have to.

They were advised to go back to school as consumers, asking the schools what support systems they offered: Childcare? Special networking? Counseling? Job counseling and job placement? Peer support groups? It was particularly *critical to find a group to study with*, and not to sit struggling alone with calculus or differential equations on the kitchen table late at night. If a school didn't offer study or support groups, they should form their own. They should find a mentor, and find friends. They should not let what might seem a chilly classroom climate—especially for women and minority students, especially in engineering and the physical sciences—deter them. Dig deeper, use their social skills, and they *could* negotiate this environment. They should also consider attending institutions that offer work internships through cooperative education programs, so they could earn money and get job-related experiences while attending college.

CODES: U, PD	New York Academy of Sciences
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www.nyas.org	HRD 93-53679 (one-year grant)
Partners: AWIS, Metrowomen Chemists	
Keywords: dissemination, workshop, career awareness, self-confidence, re-entry, support system, peer groups, study groups, mentoring, internships	

004

gold

Project GOLD: girls with disabilities online

PROJECT GOLD: GIRLS WITH DISABILITIES ONLINE

GIRLS WITH DISABILITIES ENCOUNTER MORE NEGATIVE ATTITUDES FROM THEIR PEERS THAN DO BOYS WITH DISABILITIES AND TEND TO BE VICTIMIZED BY OVERT AND SUBTLE FORMS OF "EDUCATION TOWARD PASSIVITY." BARRIERS OF GENDER AND DISABILITY BLOCK THEM FROM PURSUING STUDY AND CAREERS IN STEM IF THEY ASSUME THEIR OWN PASSIVITY AND INCOMPETENCE AND POSTPONE IMPORTANT ACADEMIC DECISIONS. STUDENTS WITH DISABILITIES CAN PERFORM WELL IN A RIGOROUS SCIENCE CURRICULUM IF SIMPLE MODIFICATIONS ARE MADE AND IF THEY HAVE LEARNED TO BE AUTONOMOUS AND ADVOCATES FOR THEMSELVES.

The University of Minnesota General College, the Minnesota State Department of Education, the Minneapolis Public Schools, the St. Paul Public Schools, and the Parents Advocacy Coalition for Equal Rights collaborated on this experimental project to *identify key age-appropriate skills, processes, and activities through which to remove barriers to girls with disabilities (grades K–8) participating in STEM classes, activities, and careers*. Removing those barriers requires building their self-confidence, providing experiences to strengthen their understanding of concepts, and developing appropriate curriculum and individualized education plans.

The project targeted girls in elementary and junior high school, when girls must make so many decisions—including whether to take advanced math—that enable them (or not) to pursue rigorous secondary and postsecondary courses of study. It stressed computer-based technologies that support the development of self-determination (including assertiveness, creativity, self-advocacy, and the ability to make decisions), so that even severely disabled girls could undertake demanding courses of study leading to career options in STEM, making them more autonomous in their education, social lives, and decision-making.

The project emphasized

- Aggressive training in state-of-the-art and emerging adaptive computer technologies (15 student–adult pairs were helped to attend the annual Closing the Gap Conference)
- Peer training and interaction with mentors and role models
- Immersion in opportunities to interact through telecommunications with mentors, school personnel, and other girls with disabilities
- Training for school-based personnel to accommodate students with disabilities early on in STEM courses and co-curricular activities
- Aggressive dissemination of more positive images of the futures of girls with disabilities

Workshops helped build the 30 participants' self-confidence and improve their understanding of concepts. A component was added to encourage parents to help the girls become self-advocates. A two-day summer camp was added to allow the girls to spend a day at the Minnesota Zoo, speaking behind the scenes with women naturalists, including a physically disabled zoo intern. The second day, a geometry scavenger hunt doubled as a tour of the University of Minnesota campus, with the girls photographing art and architecture that used various forms of geometry.

The project was unable to overcome one important problem: Most of the girls did not own computers or adaptive equipment and had only limited access to such equipment in the schools. Without home computers they were often unable to communicate with the other girls or with mentors in the ways the project expected them to.

Project GOLD opened the girls' eyes to options they hadn't realized were available to them. One parent reported that her daughter, who had always expected to live with her parents for life, was now talking about living outside of home after high school. Teachers reported that *the project changed the transition from school to work for many girls, broadening the range of vocational opportunities they were considering. The adults and undergraduates who worked on the project spoke differently now—both about students and to students. They did not assume that a person is not disabled because there are no visible signs of disability*. They consider multiple approaches in their teaching. Most of the girls involved in the project had been told not to pursue math or science because of their disabilities, but the project found that *many of the girls, given appropriate accommodations and environment, could become competitive with students who did not share their disabilities*.

HOW CHALLENGED SCIENTISTS SUCCEED

In *The Challenged Scientists: Disabilities and the Triumph of Excellence* (1991), R.A. Weisgerber identified certain common patterns found in many children with disabilities who later become scientists. These children tend to have been

- Encouraged by a parent or teacher to pursue science, engineering, or mathematics
- Exposed to key mathematical and scientific ideas in an exciting hands-on context
- Mentored by a practitioner
- Helped by special programming (e.g., clubs or summer programs) that addressed their needs in a positive way; allowed to take risks in learning skills
- Knowledgeable about their real limits, without imagining barriers that didn't exist
- Around key adults who looked beyond stereotypes of passive incompetence
- Introduced to computers and given needed equipment
- Given support for persistence.

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Partners: The University of Minnesota General College, the Minnesota State Department of Education, the Minneapolis Public Schools, the St. Paul Public Schools, and the Parents Advocacy Coalition for Equal Rights. The University of Minnesota's Computer Accommodations Program, a partnership of Academic & Distributed Computing Services and Disability Services, helps university students, staff, and faculty with disabilities access computers and information by using adaptive technology.	
Keywords: demonstration, disabled, self-confidence, barriers, computer skills, mentoring, role models, staff training, peer groups, co-curricular, workshops, summer camp	

004

Mc

Math camp for deaf high school girls

MATH CAMP FOR DEAF HIGH SCHOOL GIRLS

GIRLS WHO ARE DEAF RARELY PURSUE CAREERS IN STEM BECAUSE THEY ARE NOT ENCOURAGED TO DO SO. TYPICALLY THEY ARE NOT EVEN ENCOURAGED TO TAKE MATH AND SCIENCE COURSES IN HIGH SCHOOL BUT ARE URGED TO TAKE VOCATIONAL EDUCATION INSTEAD. THIS PROJECT WILL FOR THE FIRST TIME INTEGRATE DEAF HIGH SCHOOL GIRLS INTO A SUCCESSFUL, WELL-ESTABLISHED SUMMER MATH PROGRAM AT A UNIVERSITY. SUMMER MATH PROGRAMS OFFERED TO HIGH SCHOOL GIRLS AT U.S. COLLEGES HAVE PREVIOUSLY BEEN CLOSED TO DEAF STUDENTS.

The National Technical Institute for the Deaf—a college of the Rochester Institute of Technology—will train Mt. Holyoke's faculty and staff in strategies for deaf education to, and will provide support services (including sign-language interpreters) for, the deaf students. In Mt. Holyoke's successful four-week Summermath program, students take three 90-minute classes a day in basic math and computer (SuperLogo) concepts and skills. They work in pairs and small groups, applying math concepts to practical problems. The teacher serves as facilitator and guide, rather than as lecturer and expert.

The project aims to improve the deaf students' confidence and problem-solving abilities and better prepare them for postsecondary programs in STEM. The eight initial students are expected to become role models for other deaf high school girls. The project should also change adult perspectives on career opportunities for young deaf women.

CODES: H, I, U	Rochester Institute of Technology (National Technical Institute for the Deaf)
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Partner: Mt. Holyoke College	Keywords: demonstration, hearing-impaired, deaf, summer program, self-confidence, problem-solving skills, role models

004
FOR
FORWARD
(and deaf access)

FORWARD (AND DEAF ACCESS)

ADVANCED DEGREES ARE OFTEN THE KEY TO PROFESSIONAL SUCCESS AND CAREER FLEXIBILITY, BUT FEW COLLEGE GRADUATES ARE AWARE OF THE DOORS SUCH DEGREES OPEN OR ARE PREPARED FOR THE CHALLENGES OF GRADUATE SCHOOL. *RELATIVELY FEW WOMEN—AND EVEN FEWER DEAF AND HARD-OF-HEARING WOMEN—GO ON TO GRADUATE SCHOOL IN STEM DISCIPLINES*. FOR STUDENTS FROM GALLAUDET UNIVERSITY (THE ONLY LIBERAL ARTS UNIVERSITY FOR DEAF AND HEARING-IMPAIRED STUDENTS) AND THE NATIONAL INSTITUTE FOR THE DEAF, THE CHALLENGES OF GOING ON TO GRADUATE SCHOOL ARE CONSIDERABLE.

To begin with, *for someone whose primary language is signing, the Graduate Record Exam is a test written in a non-native language*. Asked why they were not applying for graduate school, Gallaudet students expressed three main concerns: finding a graduate school with a sizeable community of deaf students (so they wouldn't be socially isolated), fear of being rejected by the graduate school, and fear of not being good (or prepared) enough for research and work in a hearing environment, especially when there is little access to sign-language interpreters to help with day-to-day lab routines. The rapid development of computer and communication technologies could enable more equitable access to STEM fields, but these technologies are not yet fully integrated with modes of communications currently used by students with hearing problems.

A collaboration between several institutions, FORWARD aimed to improve instruction, increase enrollments, promote teamwork through computer networks, and bridge the gap between undergraduate and advanced degrees in STEM fields. *It was targeted especially to deaf and hard-of-hearing women (and their teachers and counselors), women at women's colleges or traditionally black universities, and nontraditional students (those returning to school after several years). The various components could be viewed as steps leading to a STEM career*.

FORWARD graduate-planning workshop. Targeted to male and female juniors and seniors considering graduate school, this spring workshop drew 32 students the second year, more than double the attendance the first year. Half the students learned about it through e-mail. The simple, intense 24-hour training helped students re-evaluate their personal and career objectives. Highlight of the Friday evening program was a presentation on learning styles. Participants were given a workshop binder containing information they don't normally have as undergraduates, on choosing and applying to a graduate program, getting financial support, gaining workplace and research experience, writing résumés and proposals, and mentoring, plus URLs of useful websites and material about deaf role models and women in STEM fields. The workshop made the daunting task of applying for graduate school seem more approachable, unveiling the mysteries of the process and helping them see their options. It helped to hear about people's personal experiences in grad school.

Forward research competition. This summer research opportunity challenged nine first-year woman graduate students early in their graduate career with developing, implementing, and documenting a research activity. It was easier to attract industrial support if they called the research internships "apprenticeships," which industry felt more comfortable with.

Forward seminar. This yearlong, project-centered, multi-institutional, interdisciplinary science and engineering seminar ("A Walk on the Moon") gave participants direct experience solving interdisciplinary problems, collaborating electronically in workgroups, implementing and evaluating strategies in the research environment, and building confidence in their ability to manage a successful career in STEM. Electronic networks linked students, faculty, and mentors on issue-focused collaborative projects. Research methods were blended with technical project activities so students could experience doing STEM as it is actually practiced, actively conferring with distant team members. Participants were engaged in reporting on both broad and narrow issues, both professional and personal concerns, and both technical and human details of implementation.

Planning for the seminar took place at the Oshkosh Curriculum Institute. *One of the best project outcomes was the collaboration and network developed among the principal investigators at various institutions. Mirroring today's multidisciplinary, team-centered workplace, the seminar used open-ended case studies to engage student teams in seeing new solutions and applying technical knowledge to create new products—in emulating the work needed for preproduct development*. The textbooks used were *Consider a Spherical Cow* by John Harte and *Environmental Problem Solving* by Isobel Heathcote. The case-study-leading-to-a-proposal format led students through the steps needed for creating technical proposals, a key ingredient in technical communication and professional development. Students were to analyze the case study, determine the problem in need of a solution, evaluate the community response, write a proposal, determine the proposal's technical viability, model, determine the human resources needed, develop teamwork strategies, conduct an assessment, and write a report.

DEAF ACCESS

Several initiatives were developed to provide support services for interpreters and deaf students and to make STEM activities more accessible to deaf students. Every five years Gallaudet Research Institute surveys institutions of higher learning to evaluate how accessible they are to deaf students and students with other disabilities. Steps were taken to simplify access to information about STEM academic departments, financial aid services, and offices and programs for students with disabilities. The project also developed brochures highlighting the personal, academic, and professional stories of deaf people successful in various STEM fields.

Technical interpreting. Access to classroom instruction most often happens through a sign-language interpreter, and STEM classes are challenging for even the best-trained interpreters. They are exhausting for the student trying to follow both what the teacher is demonstrating and what the interpreter is trying to sign. Inadequate interpreting services in advanced STEM classrooms severely limit deaf students' access to advanced learning. To disseminate a common sign language vocabulary between interpreter and deaf students, the idea was to develop Web pages summarizing strategies for technical interpreting, providing an overview of engineering specialties, explaining important vocabulary, and providing short videos with signs for common advanced technical terms. Technical interpreting workshops would help interpreters improve their technical signing skills and techniques.

Videoconferencing relay service. With relay services for personal videoconferencing, sign-language interpreters could be available anywhere. This part of the project was to use videoconferencing stations to facilitate interactions between researchers and deaf students. Readily available low-cost systems such as CU-SeeMe could be used to convey technical advice or to conduct job interviews with foreign applicants. It is important to develop more "deaf friendly" software tools for collaboration—more visual software, with more signing content—and to investigate ways to capture faster/real-time signing speeds with video.

FORWARD mentoring network. Considerable time was spent developing a network of scientists and alumni with disabilities to mentor participating students, and mentoring was one aspect of the project the students appreciated most. The workshop helped them evaluate who their current mentors are (they learned they should already have about 15 mentors), explore what areas of support were lacking in their lives, and understand how to interact with a mentor. By highlighting the importance of interactive video teleconferencing, videos, and online communications generally, the project opened up new possibilities for linking professors, students, and mentors across time and space.

CODE: U	George Washington University
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HRD 97-14729 (three-year grant)	
Partners: Gallaudet University (H. David Snyder, Charlene Sorensen, Department of Chemistry and Physics), Smith University (Ileana Streinu, Computer Science), National Technical Institute for the Deaf (Harry Lang), Hood College (Elizabeth Chang, Mathematics), Hampton University (Jale Akyurtlu, Chemical Engineering), MentorNet (Carol B. Muller), Duke University (Martha Absher), and Tuskorara Intermediate Unit (Carol O'Conner)	
Useful links: www.student.seas.gwu.edu/~forward www.agnesscott.edu/lriddle/women/alpha.htm	
Keywords: education program, teacher training, mentoring, research experience, deaf, hearing-impaired, African-American, scholarships, workshop, industry partners, internships, apprenticeships, seminars, collaborative network, videoconference, brochures, role models, self-confidence	