COLLABORATIONS FOR INFORMAL SCIENCE

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Introduction

The current comfort level and participation by women and girls in science, engineering and mathematics in our society is woefully low for a technology-based civilization. Scientific literacy has long been recognized as essential for individuals to function effectively in our current civilization. At the national level, a scientifically literate citizenry has been identified as essential for the purpose of maintaining a strong participatory democracy, strengthening the economy, and continuing to be a world leader in science and technology. The participation by women in technological fields has traditionally been low. As recently as 1993, women received only 31% of the bachelor’s degrees awarded in science and engineering while over 54% of all bachelor’s degrees were awarded to women. Women represent the largest under-utilized national resource of great potential in science and technology.

Early socialization regarding appropriate gender roles and lack of exposure and encouragement in math and science deter girls from developing an interest and confidence in these areas. In order to protect our national interests and democratic values, greater emphasis is needed to extend opportunities for science and technology education to all people regardless of factors like race, sex, language, or economic circumstance, for “... to neglect the science education of any (as has happened too often to girls and minority students) is to deprive them of a basic education, handicap them for life, and deprive the nation of talented workers and informed citizens—a loss the nation can ill afford.” Science educators agree that science instruction should include hands-on activities that allow students to participate in scientific investigations to enhance both students’ learning and their enjoyment of science. The hands-on approach to science exploration in a female friendly cooperative setting can be particularly beneficial to girls, who tend to have less skills, experience and enjoyment of science, and whose participation in science and mathematics may be limited by affective and motivational factors. A positive correlation exists between attitudes toward science and science proficiency. While students who enjoy science and see its relevance to society have higher science proficiency, a relatively small proportion of high school students surveyed for the National Assessment of Educational Progress (NAEP) study reported any involvement in out of school science and mathematics related activities. Males seemed to have an advantage in gaining exposure to a wider variety of equipment and apparatus than females. The NAEP report
recommended expansion of out-of-school learning opportunities, particularly for females and minorities, groups historically at risk in science education. The 1990 study found that the gender gap in students' attitudes toward science, engineering and mathematics (SEM) develops after fourth grade and widens between grades 8 and 12. Only 57% of the surveyed 12th grade female students reported liking science compared to 74% of the males. Intervention programs that use a cooperative, hands-on format have been found to be female friendly and, with the specter of failure missing, hold the promise of reversing some of these disturbing trends.

Research has also established that role models exert strong influence on girls' attitudes toward SEM and can positively impact their career choices and educational goals. One Iowa study found that ninth grade girls' attitudes toward science, math, and non-traditional careers significantly improved because of female role model intervention. This study also found that the attitude change of girls in mixed gender classrooms was as positive as that of girls in all girl groups and that boys' attitudes also improved, though not as much as girls.

A large proportion of Iowa's population resides in rural areas. Girls in rural areas are particularly disadvantaged in science, mathematics and technology due to less access to extracurricular science activities and role models. Rural students in Iowa are disadvantaged both as a result of geographic isolation and harsh economic realities.

**Project Partnership and Model**

The Program for Women in Science and Engineering (PWSE) of Iowa State University (ISU) has been working for ten years to promote participation of women and girls in science, engineering and mathematics from precollege to the professional level. To create a positive permanent change in the Iowa informal education infrastructure by increasing participation of women and girls in hands-on science activities, PWSE launched a collaborative initiative in 1995 entitled *Linking Girls and their Technological Futures Through Informal Science* with funding from the National Science Foundation. For maximum statewide impact, we forged partnerships in this effort with the Moingona Girl Scout Council, Boddy Media Group (formerly Selzer-Body, Inc., an audience research and video productions company with a commitment to equity and social justice), ISU Extension Service's Science, Engineering and Technology (E-SET) wing that works with 4-H, and the ISU Research Institute for Studies in Education (RISE).

The project model is a pass-through trainer training of volunteer science facilitators of community youth groups to engage their constituents in informal, hands-on science and mathematics related activities. The current trainers are college women from SEM disciplines, Girl Scout and 4-H leaders. The project delivers training in a stair-stepping format: college women and community youth leaders train peers and high school age girls as trainers and leaders; high school girls then train and lead middle school girls, who, in turn, engage youth down to the fourth and fifth grade levels in hands-on science. In addition to the fun aspects of hands-on SEM activities, the project emphasizes role modeling by women and girls engaged in or pursuing SEM careers, connections between SEM activities and career choices, gender equity issues and strategies, and near-peer and multi-age mentoring.
The project plans to make extensive use of the statewide fiber optic network for its dissemination; the network connects all 99 counties in Iowa through a network of over 250 sites. The links with community groups such as Girl Scouts and 4-H, with an excellent statewide infrastructure for reaching youth, are invaluable for widespread delivery of the informal science curricula.

**Project Development and Current Status**

The first training was conducted based on a curriculum developed by the American Association for the Advancement of Science (AAAS) to serve Girl Scouts in Minnesota, North Dakota and South Dakota. It was a two day training on a set of hands-on science activities developed and delivered by AAAS consultants. Subsequently, based on the response to the training by the project partnership and focus group findings, we decided to make significant changes in the activity curricula as well as the training format to make it fit the guidelines of activities for 4-H and Girl Scouts and to customize it for our target groups.

Nine focus groups were conducted in Year 1 with the project target audience throughout the state in order to:
1) assess overall attitudes and awareness levels about math and science among youth,
2) examine the potential for linking this project to existing organizations,
3) evaluate respondent interest in participating in the project and response to proposed activities, and
4) examine the role/need for gender equity awareness/training.

The results from the analysis of the focus group information are being incorporated into project design and delivery. Based on feedback from the focus group with participants of the first training, the sessions have been modified to fit a four hour core format with the option available to expand on specific components of the training based on need. The training sessions include three main components: Gender Equity, Presentation Skills, and Hands-on Activity training.

The revised science curriculum, *Funtivities*, includes two youth activity manuals, Volume I for grade levels 4 and 5 and Volume II for grade levels 6 - 8. There is an accompanying helper’s manual for both levels, to assist leaders (middle school and high school girls, college students and adult volunteers) in delivering the curriculum. A Trainer Training Manual is also in preparation.

The 4-H experiential learning model is serving as a guide in the modification of activities and preparation of the training and activity manuals. The proposal to submit the curricula for possible dissemination by national 4-H has prompted this choice.

There have been a total of nine training sessions held through February 1997, with 141 individuals participating. The trainings were conducted at various locations throughout Iowa. The trainers comprise adult Girl Scout and 4-H leaders, as well as undergraduate college students, high school students from PWSE's Summer Intern group, and high school and middle school age Girl Scouts.

The first trainer group, which included 11 undergraduate women majoring in science and engineering, provided support in piloting the modified curriculum in various informal
settings over the last year. The seven sets of pilot sessions were in a variety of settings, for example, Girl Scout troop meetings, after school science clubs, day camps for at-risk youth, overnight youth camps, and career exploration conferences. A total of 561 youth participated in the pilot activities.

A motivational video tape has been produced to promote the Funtivities training and activities with potential trainers at the middle school and high school levels. The 4-5 grade activity manual and accompanying helper manual are ready and will be submitted to the National 4-H jury for inclusion in their national curriculum by summer, 1997.

A Gender Equity training video and accompanying discussion guide have been developed for use by trainers. The video format involves short vignettes of training/activity sessions showing examples of inequities that can occur in these situations, sometimes in a subtle manner. The discussion guide suggests possible ways of addressing these inequities.

Current and Future Plans

We are currently in the second year of our project. The 6-8 grade level activities are in the pilot stage and in the process of being finalized. The helper manual accompanying these activities is under preparation.

In March 1997, 15 4-H counties in Iowa will have their specialists trained on the project and will pilot the activities with youth through the summer of 1997. Trainings are being scheduled by the Moingona Girl Scout Council, both live and via the fiber optic network. PWSE summer interns will once again have training opportunities during their summer on the ISU campus.

There is ongoing data collection from all participants relating to the training, interest level in continued participation, as well as any attitudinal changes among youth participants relating to math and science.

Community interest in the project is very strong and we are already working with Girl Scout troops outside the Moingona Council area. The scope of Girl Scout Partnerships seems to be growing. Our last training was at the University of Iowa in Iowa City at the invitation of their Women in Science and Engineering Program. There have been overtures from some community colleges in the state to have the training made available to their students. Local School-to-Work teams are expressing interest in linking up with the project. Before and after school programs are approaching us to use the activities with their youth. We anticipate that the project will continue and grow beyond the planned three-year funding period.

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