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ABSTRACT

Operation SMART (Science, Math and Relevant Technology) is a project of the Girls Clubs of America, a national organization serving mostly low-income girls in local club centers. Girls clubs provide out-of-school programming that pays special attention to the needs of girls and helps them take charge of their futures. Operation SMART's hands-on science activities and visits to role models in science are accompanied by reflection about science, societal issues, and personal attitudes. This document describes the goals and programs of this operation including the background of the project, explanations of the activities of this group, and a discussion of the benefits to the girls who participate. This program stresses reflection and includes a set of evaluation materials. (Author/CW)

Do It, Think about It, Talk about It: Science Develops Girls' Leadership Skills

ABSTRACT

Dissecting a light bulb, testing the pH of pond water or designing cities of the future, girls see their power over materials and the influence they have on their peers through Operation SMART (Science, Math, And Relevant Technology). Operation SMART is a project of Girls Clubs of America, a national organization serving a quarter of a million, mostly low-income girls in local Club centers. Girls Clubs provide out of school programming that pays special attention to the needs of girls and helps them take charge of their futures.

SMART's hands-on science activities and visits to role models in science are accompanied by reflection about science, STS issues, and personal attitudes. As girls reflect upon their experiences, they influence one another to think more about science and STS issues. Operation SMART links Girls Clubs with science museums where the connection between science and leadership becomes clearer as girls share their excitement over static electricity, frozen shadows, and baby chicks hatching from their shells, and consider characteristics such as risk-taking and careful listening, that are common to science and leaders. Operation SMART's Research Tool Kit puts the power of project evaluation in girls' hands. Using activities that turn them into social scientists, the Tool Kit enables girls to discover how Operation SMART activities have affected their own and each others' attitudes towards, interest in, and knowledge about careers in math and science.

Throughout, girls are doing, thinking, and talking, using themselves and one another as resources for personal growth. The result, SMART hopes, will be girls who will be prepared to take a stand for responsible scientific and technological development -- young women who may or may not choose science or technological fields as their life's work, but who will have kept their options open and who will be clear enough about the role science and technology play in today's world to encourage their friends to join them in taking power over their own futures.

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> Jamaica leans over her bike, oil can in hand. Figuring out exactly where to lubricate, she reaches to get at the back gear. Later, she comments, "...it looked complicated, 'cause it was all greasy and ucky and dirty! At first, I didn't want to [do it]. But, dirt ain't that bad after all! It's kind of fun when you, like, fix the wheel, and you feel good about yourself -- because you know that you can fix it!"

Jamaica is one of thousands of girls all over the United States who is gaining the confidence to master technology through Operation SMART (Science, Math, And Relevant Technology). In Operation SMART at her local Girls Club, she does science and technology-related activities; she thinks about them; she talks about them to adults and other girls. Through this process, she grows to understand more about the role science and technology has to play in her life. The more she understands, the more she influences other girls. They see her, a confident, popular girl, involved in science and want to emulate her. They hear her excitement as she figures out the world around her, and are convinced that they want the same for themselves.

Operation SMART is a project of Girls Clubs of America, Inc. designed to make science, math, and technology part of girls' everyday experiences. Girls Clubs of America serves 250,000 girls and about 40,000 boys each year in 240 Club centers across the country; two-thirds are from families earning $15,000 or less per year and half are from racial or ethnic minority groups. Girls Clubs provide informal education and recreation to girls ages six to 18 in buildings that the Clubs own.

The first Girls Clubs began during the Industrial Revolution as safe places for the girls and young women who worked in the Northeastern mills and for mill workers' daughters. One hundred years later, through Operation SMART, we continue to respond to a changing, increasingly technological society.

SMART was established in 1985 in response to the underrepresentation of women in science, math, and technology. We focused initially on issues of access, providing girls with the chemistry set that only their brothers were given, the blocks that boys monopolized in their nursery schools, and the computers that they were too timid to fight for in school.

It quickly became apparent that access is not enough. Many characteristics of scientists are precisely those that are discouraged in girls from early on -- taking risks, getting messy, making mistakes and trying again. Questioning, exploration, and scientific inquiry, the mainstays of good Science Technology and Society (STS) curricula, then became the crucial elements in all activities at Girls Clubs. Inquiry fits into every part of the Girls Club: as girls work together to figure out how to shoot baskets most effectively in the gym, determine which are the most energy-efficient swimming strokes in the pool, or mix colors to obtain desired results in the art room.

If science is to become a tool to help girls take charge of their futures, we must find science-related activities that put the girls in a position of power. We sought activities that address the issues of today's technological society and that use scientific methods to pursue the questions of interest to girls. Girls tested the pH level of the local pond water. They planted community gardens. They designed cities of the future.

Reflection, thinking and talking about activities as they happen, was always a part of Operation SMART. With the addition of an adolescent component to Operation SMART, reflection took on new dimensions. The girls' penchant for discussing what they do and think supports work on early adolescents that advises reflection as an important element (Schine, 1981). With this in mind, a set of three criteria for equitable and excellent out-of-school science programming for early adolescents emerged:

1. Activities must be hands-on. Girls must have experiences with materials and tools.

2. Activities must entail invention. Girls must have opportunity to figure things out for themselves and to solve problems that are important to them.

3. Activities must include a reflection component. Girls must have time to think and talk about what they do.

The reflection component serves several functions. Girls think about what they have done and work together for improved solutions to their problems. Such collaboration makes science more appealing to girls and more rigorous for everyone. Truly responsible science is the result of several people working together, checking one another. Reflection time also provides girls with the opportunity to delve into the ethical and moral issues that make science more inviting and interesting to them and that are essential if science and technology are to have a positive impact on the future. Lastly, reflection enables girls to look at their attitudes toward math and science and make connections among science activities at the Club, science lessons in school, science that could be a career track for them, and the scientific and technological literacy they will need as responsible adults.

To girls reflection means: DO IT. THINK ABOUT IT. TALK ABOUT IT. Girls do science at their Clubs, explore a museum, or take a trip to talk to a woman in a science-related or technological career. As they think about their experience, they come to know themselves better and increasingly regard themselves as young people who have real choices to make. As they talk to their peers about their experiences with science and technology, they become leaders. They become the most persuasive advocates that science and technology could have.

Three aspects of Operation SMART that promote leadership through science are:

1) Inventive, hands-on science including reflection and access to role models,

2) Peer leadership training at a science museum,

3) Girls as social scientists.

1) Inventive, hands-on science including reflection and access to role models. As girls connect wires to light a bulb, build machines with pulleys, and create clouds inside large glass bottles, they get their hands into the physical sciences. Knowing that women are significantly underrepresented in physics and engineering, SMART makes a conscious effort to offer girls experiences in these areas.

Besides experience, role models are the key to making connections between math or science and the real world (John-Steiner, 1987). A visit to General Electric's Research and Development Center made the difference for Danielle who discussed her math teacher with a female statistician there and later said:

> Well, I used to like math a lot, and I always wanted to do something with math. But then I got teachers that I didn't really like, so it kind of turned me off on math as a whole. But now, after talking to different people about it, they say it's still a good idea and just to separate it from the teacher. So I think maybe I can try and do that, and maybe I'd like it more again.

The statistician worked daily with mathematics, was attractive, and seemed to enjoy her job, so Danielle really listened to her.

2) Peer Leadership training at a science museum. Peer leadership was an elusive notion we had of girls influencing one another to pursue science. Working with the Museum of Science, we envisioned museum experiences helping girls develop their skills as leaders, as people who try new things, reach out and listen to others, and share with their peers what they know and feel.

In November 1987, 36 girls who had never met before explored the Museum of Science in Boston together. Their charge was to find out "What was awesome? What would you change? How will you explain what you saw to others?" Maps in hand, they went onto the museum floor, leading one another with, "Hey, look at this. Come on over here!"

Girls got excited about static electricity, frozen shadows, and baby chicks hatching from their shells. Critical of exhibits that did not have enough to do or that were in disrepair, enthusiastic about computer games, they took one another to share their discoveries.

Girls see the connection between science and leadership when they realize that power is inherent in science. Their favorite exhibits were ones that required strength or strategic thinking. Girls loved exhibits that challenged them to understand the underlying scientific principles.

Girls will return to the Museum of Science for more sessions to promote

the connection between science and leadership. Going behind the scenes to see science jobs at the museum and gathering materials and activities for their Clubs, they will pursue the idea of leadership through science.

3) Girls as social scientists. Instead of using traditional evaluation techniques for Operation SMART, Girls Clubs of America is developing a Research Tool Kit that puts the power of project evaluation in girls' hands. Using activities that turn them into social scientists, the Tool Kit enables girls to discover how science activities have affected their own and each other's attitudes, interest in, and knowledge about careers in science, math, and technology.

The tools are activities that girls do before regular science activities at their Clubs and that they do again afterwards, evaluating the changes in their own and each other's responses. For example, in one activity they examine ten photographs of girls involved in science or technology in ten different ways. They rate each photo, and then collate the group's data, revealing the range of reactions to each photograph and arriving at a composite picture of their group's attitudes about, interest in, and previous experience with ten aspects of science and technology. In later months, girls will repeat the photo-rating activity to find out whether experiences at the Club have affected their views.

Once again, girls are doing, thinking, and talking, using themselves and one another as resources for personal growth. Being among the project evaluators, they necessarily take a leadership role, thinking about what math, science, and technology can mean for them, their futures, and the futures of their peers.

Through all three aspects of the Operation SMART program, girls' individual involvement in science is broadened to affect the girls around them. They share their excitement and actively influence their friends to reconsider science and they quietly become role models displaying the power of science.

The result of Operation SMART at Girls Clubs all over the country is girls who will be prepared to take a stand for responsible scientific and technological development. No matter what careers they choose, they will not have cut off their options at an early age. Clear about the role science and technology play in today's world, these girls will be able to encourage their friends to join them in taking power over their own futures.

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