

SEATTLE MESA SUMMER SCIENCE PROGRAM FOR MIDDLE SCHOOL GIRLS

Nancy Cook, Ph.D.

University of Washington
Seattle, Washington

Washington MESA (Mathematics, Engineering, Science Achievement)

Washington MESA's mission is to assist our state and nation in achieving an educated citizenry that is globally competitive and individually competent in mathematics, engineering, and science, with full participation of African Americans, Hispanics, Native Americans, and women. MESA accomplishes this through a partnership of higher education, school districts, business and industry, and community organizations. The partnership is dedicated to providing underserved students with an education process that increases their interest, effective participation, and contribution to mathematics, science, and engineering.

Washington MESA is funded by the State Legislature to provide academic support to middle and high school students across the state from populations that have been historically underrepresented in the sciences - African Americans, Hispanics, Native Americans, and women. Washington MESA is housed in the University of Washington's College of Engineering and coordinates programs in four Centers across the state: Seattle, sponsored by the University of Washington; Tacoma, sponsored by Pacific Lutheran University; Yakima Valley/Tri-Cities, sponsored by Washington State University; and Spokane, co-sponsored by Gonzaga University and Washington State University. In 1990-1991, the four MESA Centers served 2,200 students in 42 schools in nine districts across the state. Seattle MESA provides enriched mathematics and science classes plus support services to secondary school students, 85% of which are African American; Tacoma MESA provides these services to a population of which 60% are African American; Yakima Valley/Tri-Cities MESA provides such services to a population, 75%

of which are Hispanic; and Spokane MESA provides these services to a population of which 70% are Native American. MESA's academic support services for these students consist of an elective science class at the high school level, enriched mathematics classes at the middle school level, tutoring, college preparatory workshops, and summer science programs at both the middle and high school levels. This paper presents an overview of the Seattle MESA Summer Science Program for Middle School Girls.

Seattle MESA Summer Science Program for Middle School Girls

The Seattle MESA Summer Science Program for Middle School Girls, funded by a Department of Energy Pre-Freshman Engineering Program Grant, consists of a five-week summer session held on the University of Washington campus. A multi-cultural group of seventh and eighth grade girls from the greater Seattle area meet for four hours each morning, 8 a.m. until 12 noon, Monday through Friday, to acquire first hand knowledge of computers and how they are used in the sciences. In 1990, 33 students - 16 African American, 3 Asian, 3 Caucasian, 2 Hispanic, 5 Pacific Islander, and 4 Native American - participated in hands-on science labs in which the computer was used as the basic tool to collect and analyze data.

The Seattle MESA Summer Science Program for Middle School Girls' staff consists of two teachers and two teaching assistants, all female. The two staff teachers are middle school science teachers who are particularly interested in encouraging young women to enter the sciences. The teaching assistants are university students majoring in the sciences or in engineering. In addition, female university faculty and graduate students, or female scientists employed in industry, work with the students on at least one project a week. In consideration of the need to provide ethnically diverse role models to the girls, the ethnic composition of the staff reflects as closely as possible that of the girls.

Program Curriculum

The program has been supported by an Apple, Inc. EQUAL TIME Grant and a Department of Education Discretionary Fund for Mathematics and Science Education Grant. The Apple Grant put sixteen Apple IIGS workstations in the science laboratories, and the Department of Education Grant provided funds for the development of curriculum integrating computers into hands-on science activities. The computers are in the classroom at all times, and the

curriculum is dependent upon having access to them. The workstations are used for all data collection and analysis, as well as writing the lab reports. Having the workstations right in the labs allows the students to use the computer whenever necessary. Frustration is minimized; data can be collected, analyzed, and graphed in one session, rather than having to wait for access to the computer lab, as is the case in most school settings.

The curriculum for the program, designed in accordance with Project 2061 recommendations for teaching science, gives girls hands-on experience in each of the four general science disciplines: life sciences, physics, chemistry, and earth sciences. The curriculum consists of five one-week units, each focused on a different topic: *Computers in Science* (Computer Skills), *The Heart* (Life Sciences), *Bio-Mechanics* (Physics), *Water Quality Control* (Chemistry), and *The Environment* (Earth Sciences). The first unit, *Computers in Science*, introduces the girls to the Apple IIGS workstation, with special attention given to the use of spreadsheets for data collection and analysis. The study of each of the four science topics begins with a focus on the basic science and then moves to an investigation of the technological applications in that field. Each unit consists of science activities that involve: 1) hands-on laboratory experience; 2) interactive use of computers; 3) small group, collaborative work; 4) scientific reasoning; 5) keeping science journals; 6) writing lab reports; 7) campus field trips to science and engineering labs; 8) activities led by university or industrial scientists and engineers; and 9) field trips to industrial sites involved in projects that are related to the week's focus. For instance, the unit on the heart begins with a study of the heart, its components and their functions. The girls, working in teams, learn how to take their pulse and blood pressure. On the second day, they dissect sheep hearts and then learn how to replace valves and do by-pass surgery. To start the next day, the girls visit the University Cardiology ECHO Lab and have the opportunity to actually observe a human heart beating through the use of ultrasound. The remainder of the day is focused on physical fitness, and the girls use the *Cardiovascular Fitness Lab* (HRM) - a computer probe that measures heart rate - to investigate the effects of such variables as exercise or relaxation on the heart. Based on these observations, the girls, still working in teams, make a prediction relating to an activity that affects heart rate. They then design, execute, and analyze, an experiment to test their hypothesis, and make a report to the class on the entire procedure. The unit

ends with a tour through the Body Work Exhibit at the Pacific Science Center.

The students use the computer in different ways in each unit. During the first week, in *Computers and Science*, the students become familiar with general applications, such as word processing and spreadsheets. The girls are introduced to keeping a science journal, and they learn how to use spreadsheets for data collection and analysis. In the *Heart* unit, the students utilize probes to collect on-line data on heart rate, and the data is then downloaded into LabQuest, a spreadsheet that allows them to analyze and graph it. In *Bio-Mechanics*, the girls build machines and run them using the LEGO Logo software. In *Water Quality Control*, the students use probes to determine the pH level of various solutions, including water samples brought from home, and in *The Environment*, they use simulations to better understand renewable and non-renewable energy resources. In addition, the girls use the wordprocessor, as well as spreadsheets and graphing packages, to prepare lab reports on at least two of the science activities for that week.

One facet of the program that has become pivotal to the day's activities is the *Daily Bulletin*. The computer is used to communicate on a daily basis with the students regarding the work they have just completed as well as to introduce the work for the next day. During the last half-hour of each day, the girls enter their questions and comments onto the master disk. After the class is dismissed, the staff responds to all questions and concerns, which are taken into account when planning for the next day's work, and the instructions and worksheets are then entered onto the master disk. The student's first job of each day is to read the *Daily Bulletin*. They review the comments regarding the prior day's work and then download the instructions and the worksheets for the day. The computer has become the hub of the program in a way we had not expected.

Program Benefits

One goal of the Seattle MESA Summer Science Program for Middle School Girls is to provide girls interested in science the opportunity to meet and work with other girls who have the same interests. The girls in the MESA program come from many schools within the greater Seattle area. Program planning includes frequent regrouping of the students as well as special activities designed to facilitate their getting to know each other. Much of the first day of the program involves "getting acquainted" activities, and the Friday

of the first week is devoted to *Project Initiative*, a series of outdoor group problem solving activities designed to facilitate cooperative effort and group cohesiveness. The planning throughout the program is designed to facilitate the growth of relationships among the girls, thereby maximizing the potential of sustaining their interest in science despite peer pressure to do otherwise.

The benefits from conducting the Seattle MESA Summer Science Program for Middle School Girls on the University of Washington campus are many. One of the most important benefits is to familiarize the girls with the campus. Exposing them to the university environment on a daily basis for five weeks can lead to major changes in their thinking about the future. The university becomes a familiar place with which they can identify. In addition to visits to academic labs, such as going through the fisheries salmon labs with graduate students in fisheries, the students are taken on many short campus tours just to see what campus life is all about. They are particularly interested in the dorms and the many libraries. The girls are also given daily chits to use in the Student Union Building cafeteria on break time, and this time spent in the cafeteria among college students facilitates the development of the girls thinking that they really can and should go to college.

Another goal of the Seattle MESA Summer Science Program for Middle School Girls is to instill and nourish an interest in the sciences. The classes are held in the freshmen biology labs and the freshman physics labs. In many cases the girls use the same equipment in their morning labs as the college students use in their afternoon labs. The girls are quite aware of this, and much impressed, and this in turn, facilitates their gaining self-confidence in their scientific capabilities.

There are certain attitudes and behaviors over which middle school girls have control that facilitate success, and recognition is given to the girls who exhibit such attitudes and behaviors. Awards are given for *Leadership*, *Good Partnering*, *Curiosity*, *Hard Work*, *Perseverance*, *Computer Knowledge*, and *Software Expertise*. In addition, the girls themselves, give an award to each student in recognition of her outstanding trait.

Program Evaluation and Impact

Results of voluntary, anonymous evaluation indicate that students feel the program is worthwhile. Each girl is asked to fill

out a Likert-type rating on each unit, and then to list those activities she liked best as well as those activities she thinks are in need of improvement. The units always receive overall ratings of above average in interest. No one activity has stood out as the overriding favorite in any unit; rather, the girls report liking a variety of activities in all the units: "I really liked it when we had to make our own machines" and "I liked everything about the water week."

Parents, guardians, relatives, and the teachers who recommended them for the program, are invited to join the girls and program staff for the Award Luncheon on the last day of class. Parents and younger siblings of many of the girls, in addition to many classroom teachers, come to see their daughter, their sister, or a memorable student, receive a certificate of completion, and to join us for pizza and pop. This contact with the parents and younger siblings is quite important in the development and reinforcement of the thinking that a career in the sciences can and should be an attainable goal for their daughter.

The program has not been in existence long enough to know the impact on girls choosing a career in the sciences or engineering, however, the responses suggest that the program is meeting its goal to foster an interest in the sciences: "It was a great program with lots to do! Thanks," or "My Mom wants to know how I can get in next summer," or "I hope to come back next year. It was a great program."

Bibliography

Project 2061: Science for All Americans. American Association For The Advancement of Science, Washington, DC, 1989.

Math/Science Education Action Conference Report. U.S. Department of Energy, Washington, DC, 1990.

Everybody Counts: A Report to the Nation on the Future of Mathematics Education. National Academy Press, Washington, DC, 1989.

Curriculum and Evaluation Standards for Mathematics, National Council of Teachers of Mathematics, Reston, VA, 1989.