

WONDER TO EXPLORATION: A COLLABORATIVE EFFORT BETWEEN A WISE PROGRAM AND THE GIRL SCOUTS TO INTRODUCE GIRLS TO ENGINEERING

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The Arizona Cactus-Pine Girl Scout Council has been attempting to involve science and engineering activities in individual troop sessions. The stumbling block was not a lack of interest on the girls' part, but a lack of knowledge on the troop leaders' part. The Girl Scout Council approached the Arizona State University WISE Program for assistance. In a collaborative effort, an experimental program was developed to incorporate science and engineering activities into the local Girl Scout Day Camp. The program, "Wonder to Exploration," was facilitated by WISE and Arizona State University female engineering graduate and undergraduate students.

The ASU student facilitators were trained both by the Girl Scout camp director as well as by the WISE Program. The Girl Scout camp director required that the engineering students be trained on issues such as child abuse, personality differences, children's health and safety, emergency procedures, and crisis management. The WISE Program training included how to encourage young women to excel in math and science, how to be a good role model, and how to run the various labs with enthusiasm and confidence.

The camps were designed for three age groups: 2nd-3rd grade, 4th-6th grade, and 7th-8th grade. For each group an age-appropriate, hands-on introduction to science and engineering was researched by WISE and ASU engineering students. During the week sessions, we met with each age group for 45 minutes daily for three weeks. Each day the girls were performing a science or engineering activity and learning about women in these fields.

"Science Wonders", the camp targeting 2nd-3rd graders, focused on elementary engineering and science concepts. The "Magical Egg Experiment", taught the girls that a vacuum can be created by extracting of oxygen. In another lab, the campers learned that air has weight by placing two identical balloons on a balance, puncturing one of the balloons, and observing the shift in weight. The well known, although not well understood,



fact that the sky is blue and the sunset is red, was easily illustrated using water, which represents the atmosphere; milk, which represents the particles in the atmosphere; a flashlight, which represents the sun; and a dark room, which represents space. The simple concept that heat causes expansion was demonstrated through the "Bottle Fountain." A bottle containing cold water and air was submerged in a bowl of hot water. When the air was warmed, it expanded and pushed the water out a straw on top of the bottle. Finally, the girls were introduced to the states of matter when they made a thixotropic substance we called "goo." The substance was made of cornstarch and water. To encourage continued interest in science, we provided the girls with a mini book of science and engineering activities to do at home.

The 4th-6th graders participated in "Fly Me to the Stars." In the first project, campers were given background information and limited supplies and were instructed to make a scale model of a planet. An understanding of the distances between the planets in the solar system was achieved when they used string to show the scaled length of their planet from the sun relative to the other planets. They reinforced their knowledge of the planets by sharing what they had learned with the rest of the camp. Stories were created using star constellations to form characters and events, similar to Hercules battling Serpens. During another experiment we discussed what makes an airplane fly. The concepts of lift and drag were introduced, and, using these ideas, the campers competed in a reengineering contest. Given specific criteria, they were challenged to redesign a paper helicopter. In the final lab, the 4th-6th graders worked with the older girls to make a space bubble out of plastic and a fan.

The experiments for the oldest group of girls, 7th-8th graders, were drawn from the theme "Space Exploration." They got a taste of environmental engineering during the global warming lab. Campers used plastic two liter bottles and a thermometer to study the greenhouse effect. The girls made balsa wood planes and perfected their flight by tweaking the control surfaces. Physics, astronomy, and chemistry principles were clearly illustrated during "Comet in a Bag." Several ingredients were placed in a freezer bag and, after a few minutes, a simulated comet was formed. Rusty nail shavings (iron) interacted with charcoal pieces (carbon), sand (debris), water, and dry ice (solid icy core of comet). In another demonstration, a police helicopter was flown into the camp giving the girls the opportunity to see applied aerodynamic principles. Teamwork was emphasized when the girls worked together to make a space bubble. Once the space bubble was made, a planetarium was used in simulating an actual flight in space.

For each activity, we focused on a woman who had made a contribution to that particular field. The major information for this part of the activities was taken from *The Scientist Within You*¹.



As the camps went on, we quickly realized that we had underestimated the knowledge base and previous exposure to basic scientific principles of the girls. The level of difficulty was increased by one of two methods: expanding the background information or using the labs designed for the higher age groups. An unforeseeable obstacle occurred when some of the girls attended the camp multiple times. We did not alter our programming to compensate for this. However, we allowed the girls who had done the experiments previously to explain the underlying concepts to the new campers. A motivational factor for the girls was that the labs filled badge requirements. Overall, the feedback and evaluation indicated positive response. The girls stated that they enjoyed the "Comet in a Bag" and the "Space Bubble" the most.

The Girl Scouts have been educating girls and women for many years, operating on the principle that girls grow, learn and have fun by making decisions, doing and discovering for themselves. A collaboration with them was an opportunity for the WISE Program to reach out to younger girls. The activities were designed to stimulate curiosity and to teach science and engineering through interactive and participatory learning. A planned extension of this project is to incorporate these sorts of activities in the Girl Scout's residential camps and the individual troop meetings.

Working with the Girl Scouts is a unique opportunity for WISE programs because they have an established national organization that supports girls ages 5-17. We suggest other WISE organizations interested in pursuing this sort of program completing all monetary arrangements, program expectations and time commitments (in writing) with the outside organization prior to initiation of the activities.

REFERENCE

1. Thompson, Mary and Warren, Rebecca Lowe. *The Scientist Within You: Experiments and Biographies of Distinguished Women in Science* Vol.1. Eugene, Oregon: ACI Publishing, 1995.

