Closed file

PACIFIC UNIVERSITY
SCIENCE AND TECHNOLOGY CAMP FOR GIRLS
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Final Report

It is my pleasure to report on the success of Pacific University's Science and Technology Camp for Girls held the summers of 1992 and 1993. The ultimate goal of this summer day camp is to increase the number of women in technical and scientific fields where they are seriously underrepresented.

To achieve this goal a multi-pronged approach was taken. One approach was to have them realize that women can and do have successful careers in science coming from a broad range of academic and social backgrounds and that as scientists they have many different lifestyles. To exemplify this: all the instructors in the camp were women; all our contact professionals were women on the science career field trips; and the student assistants were women. Another critical part of our approach was to demonstrate to them that they could "do science," that they both had the ability and were able to develop the skills necessary for scientists. The other aspect was to show them that girls and women interested in science were also interesting, talented people that they might wish to emulate. To show them that the style of scientific discovery was different from what is held by society at large much of the work was done in groups, the activities were almost exclusively "hands on" and there was no memorization of terms.

Some experimentation was done with the age group. This first year the camp was split equally between 7th and 8th grade girls (girls who had just finished those grades.) Because of the range in maturity and background experienced with the first year's girls, in the second year we included only 8th grade girls.

The structure and the curriculum was almost identical both years. During the four week camp a week was spent studying each of the following: biology, chemistry, physics, and mathematics/computer science. In all academic areas there was virtually no lecturing by faculty, instead, emphasizing student understanding and discovery through lab work. During a typical week two afternoons were spent on field trips to local scientific companies or research labs. The other days had labs all morning and afternoon with a long break mid-day for lunch and physical

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activity. Friday afternoons were reserved for picnics followed by swimming. Early in the camp there was a two day field trip to the coast for marine study, to collect samples, and to socialize. We felt time to socialize was important for the girls to become comfortable with the other girls and the instructors and assistants in the programs.

Our long term success cannot be determined for years to come but in the short term it is clear that the camp encouraged girls in science, changed their expectations of themselves and certain behaviors, increased their parent's knowledge and expectations, and had some impact on the intermediate/middle schools that we have had contact with. This was evidenced by our high attendance rates both years, the comments that local teachers have made, the number of inquiries that we have received, but most importantly the student evaluations and comments made by students and parents during and after the camps. Last winter during the reunion many parents told me that the camp had changed their daughter's behaviors. Since these girls are notable achievers, I was surprised by the changes that the parents attributed to our camp. The parents uniformly commented on increased confidence, unwillingness to be pigeon holed in interests and behaviors, and increased curiosity. This is encouraging as these are all characteristics necessary for women to succeed in science.

The two biggest changes in the camp between the first and second years were the introduction of student interns and a change in the physics and computer science/mathematics curriculum. The student interns were girls from the first year program who came for a week and assisted in the labs and in the recreational program. These girls were high achievers in their schools, had winning personalities, were excited about camp, and generated enthusiasm and interest in science and the camp. Strongly dispelling the myths of whether or not girls could be interested in science and still be interesting, successful students, they were an additional component of changing the campers view of how to and who succeeds in science.

In the first year the physics curriculum was well integrated into the marine science focus. Students determined the heavy metal content of black beach sand and compared it to the heavy metal content of white beach sand using neutron activation analysis. They also learned some basic nuclear physics and nuclear

safety. The problems with this wonderful integration were that: 1) there were strong indications that the reactor would be shut down before the second summer; 2) the ride to the reactor was an hour each way so on days spent at the reactor students averaged almost four hours in transport; and 3) the nuclear physics seemed too far from their knowledge base.

During the second year the physics portion used astronomy and physics-based astronomy to teach proportion, ratios, and basic solar system relationships. We were going connect this to the final two weeks of camp by using the telescopes and moon clocks we constructed in lab on our coast trip. The weather did not cooperate (quite unusual for Oregon in the summer).

During the first summer the goals of the math/computer science curriculum were to teach some basic mathematical skills necessary for science and basic computer science skills with computer applications. We discovered that the students' backgrounds in math varied too greatly to be able to teach the math skills in the way we had planned so we cut it short the first year and taught no math skills, as such, the second year. During the second year we emphasized commonalty among computer applications and got them skilled in spreadsheets; data bases, graphing, drawing, and word processing. The math skills were integrated into the physics/astronomy portion of the program. In that section our emphasis was on understanding proportion -- not only simple but also more complex. This understanding we feel is crucial for understanding science and is often lacking even in college students.

Both years attracted extremely talented teachers and students. There were more than twice the number of applications for the 24-25 places. This was despite the fact that we had very late notification of the program the first year and publicity difficulty the second year because of cutbacks in public school funding. Of the applicants over 90% had GPA's of over 3.8 (on a scale of 4.0 = A) and over 50% had 4.0's. Almost all applicants had taken the most difficult courses offered in their schools and were active in the *Talented And Gifted* program, if offered. As we got to know them we also discovered they were athletes, musicians, artists, and writers, as well. They were also used to being the "local" talent and found the increase in competition challenging, off balancing, and also reassuring that they were not unique.

Both years we choose the best two or three girls in each middle/intermediate school in the region. All accepted students came -- we were unable to accept any from our alternate list. Except for a rare conflict students arrived promptly and stayed all day. Both years we had one student drop out during the second week of camp who had not told us of their intent; we discovered their intent too late to replace them. All parents attended the opening and closing receptions, sometimes bringing grandparents and siblings along also.

Our teachers were also quite dedicated. The entire staff, faculty and student assistants, worked both summers with dedication and success. Our biology teacher was just named "Oregon Biology Teacher of the Year," and the two physics faculty were promoted (and one tenured) during this period.

Evaluation

Field Trips

Twice weekly there were field trips to area scientific and high-technology industries to meet women scientists in the workplace. Field trips included the following sites: Intel, Tektronix, Wacker Siltronic, Boise Cascade Research Labs, Washington Park Zoo, Portland Water Bureau, and the Oregon Health Sciences University DNA Lab.

During these visits, women scientists and engineers described their backgrounds, demonstrated what they did at work, allowed students to experience aspects of their job, and discussed the rewards and limitations of their careers. For example at Intel the girls used the testing lab to test new software, and then the women talked to them in small groups of 3-4 about their professional careers and lives. At Wacker Siltronic some of the girls wore "Bunny Suits," entered the clean room, and observed processing. On all of the field trips the girls were treated professionally and with great respect: this contributed to their science self-esteem. In addition, at all sites women described their personal lives in conjunction with their professional lives. The women professionals offered impressive diversity in their personal and educational backgrounds and their outside interests.

The only change between the first and second year was the replacement of the trip to the Portland Water Bureau Lab where they did water testing for the city's water supply by a trip to the Washington Park Zoo with an animal behaviorialist. The Portland Water Bureau lab facilities were just too small to successfully accommodate 30 people.

Curriculum

Our program exposed students to the three basic science fields: chemistry, physics, and biology, spending about a week in each field. In addition, we taught math in the sciences, especially physics, showing integral relation between science and math. We also developed computer skills - necessary for any science career.

In the second year we added daily puzzles. These were written on the board at the beginning of the morning and afternoon sessions and students worked on them as they waited for class to begin or if they finished early. It was very interesting to both students and faculty to see the different approaches used in solving the puzzles.

Chemistry Both years the Chemistry week was the most successful. The teacher of this section is a gifted middle school teacher and she had the right level of difficulty, excellent relations with her students, and the most interesting curriculum. The main research was an analysis of the ocean water obtained during our beach field trip. They also analyzed water from their own home and compared its chemical and physical properties to that of the beach water. This required making their own thermometer and learning analytical lab techniques. The highlight of the week was the testing of three unknown blue liquids. These were analyzed and an report written up supporting the student claims for what they had determined the liquids to be. They were stunned that the teacher did not tell them the "right" answer, but made them "live" with the anxiety of not knowing whether or not they were right. In addition there were optional lunch time labs where they made 'slime' and peanut brittle.

Biology The biology labs focused on a DNA analysis of the algae collected at the coast. This required developing an understanding of DNA and learning the lab techniques necessary for the preparation and analysis of the algae. The unusual

intense heat during the first summer and some equipment problems the second summer required some last minute adjustments to this portion of the curriculum; but the experience and skill of the biology instructor made this very successful.

Physics During the first summer a comparison of the heavy metal content of black and white beach sand was done using neutron activation analysis. In addition, students prepared the samples, did a counting experiment with radioactive dimes, studied the intensity of the radiation of some common rocks and household items, and learned some radiation safety.

During the second summer they studied the structure of the solar system and made measurements of light intensity and distance using ratio techniques. In doing this they constructed a telescope, a moon clock and a photometer. This was based on Project STAR, a curriculum developed by Harvard-Smithsonian Center for Astrophysics. During the first summer we learned that the computer work could be much better done in groups of 12 instead of 24 students and was more successful if not done too intensely. So the second summer the first two weeks were taught in groups of 12 and the students alternated between computer science and physics/astronomy.

Computer Science/Mathematics The first day of the first summer made us realize that teaching mathematics to this group had to be done quite differently than we were prepared or it would not be successful. The range in student background was astounding and their animosity to anything that smacked of school was surprising. The first year we quickly modified our curriculum and the second year we made no attempt to teach mathematics directly. Our emphasis both years was on skills relevant to using computers as aids to understanding, calculation, creativity, and presentation of results. About the equivalent of one full week was spent teaching basic computer skills: graphing, spreadsheets, data bases, drawing programs, and word processing. Students designed camp T-shirts; there was a contest for the best design, with the winning selection printed as distributed as camp t-shirts. Their data base was on themselves and their interests and activities and served to help them know each other; all projects had several goals.

Oregon Coast Field Trip

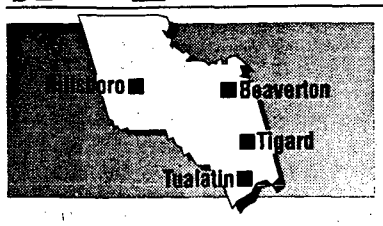
The two day trip to the Oregon Coast was the *coup d'etat*. Both years it was the highlight of the camp and the turning point in forming a cohesive group of students and teachers. Although too structured the first year, we structured it just right the second year. At the Hatfield Marine Science Center we took a bay trip in a sampling boat and collected the aquatic water, which we later analyzed, and also collected marine plant and animals samples, which we studied in their labs. We also toured both their museum and the new Oregon Coast Aquarium. But the highlight both years was the early morning tidepooling. Despite having to get up at 5:00 a.m., they all ended up to their knees in water *enthusiastically* searching for and handling samples in the very cold tidal waters. Three of the faculty were excellent teachers which helped generate the enthusiasm.

Equally important to the academics was the integration of the girls and the teachers into a cohesive whole. All the condominiums had 6 girls and two adults. This group size, making meals together and staying up late talking, formed close friendships. The girls were put in different groups for the different activities at the coast and this helped form an overall cohesive group. There was also time to play at the beach in which they all enthusiastically participated.

Camp Staff

Having a program staffed only with women scientists we have found has a powerfully positive effect on the girls. Our staff scientists have a variety of backgrounds, professional commitments, and lifestyles. The professional staff performed as a committed team; planning the curriculum together and guiding the focus of the camp to ensure a coherent experience for the student. All the faculty and assistants taught for both years and brought their experience from the first year to make an even better experience for the girls the second year. All were well liked by the girls and had good rapport with them.

During the second summer an important new component was added: the eight returning campers who served as interns. They assisted in labs and also brought enthusiasm and commitment to science. This is particularly effective



METRO WEST

Community news and features

Camp teaches girls they can do science

By MARTHA ALLEN
Correspondent, The Oregonian

FOREST GROVE — The girls and their teachers gathered at Pacific University are fighting society's stereotypes. Their weapons are computers, microscopes and other tools of science.

It's part of the university's Science and Technology Camp for Girls, a camp that provides more than science lessons for the 24 girls who attend the four-week session. The camp, in its second year, runs from June 27 to July 23.

According to teacher Mary H. Fehrs, the camp offers exposure to a variety of science careers and is intended to interest girls to take more advanced courses in high school and college.

"The idea is to encourage women to have careers in science and technology," said Fehrs, a physics professor at Pacific University. She said that the transition girls go through between junior high and high school is often a turning point where many give up taking science. "The idea of this camp is so girls will take classes in high school that will allow them, at college, to pursue a career in science."

The camp is funded by the U.S. Department of Energy. Pacific University provides the facilities, faculty and some financial support. Girls who have finished eighth grade are eligible to attend, and they must have recommendations from science or math teachers.

There is no cost to the girls to attend. Transportation, lunch, snacks and even a trip to the coast are provided. Field trips include visits to high-tech firms in the area. All the teachers are women, as are the various scientists and engineers the girls visit at work.

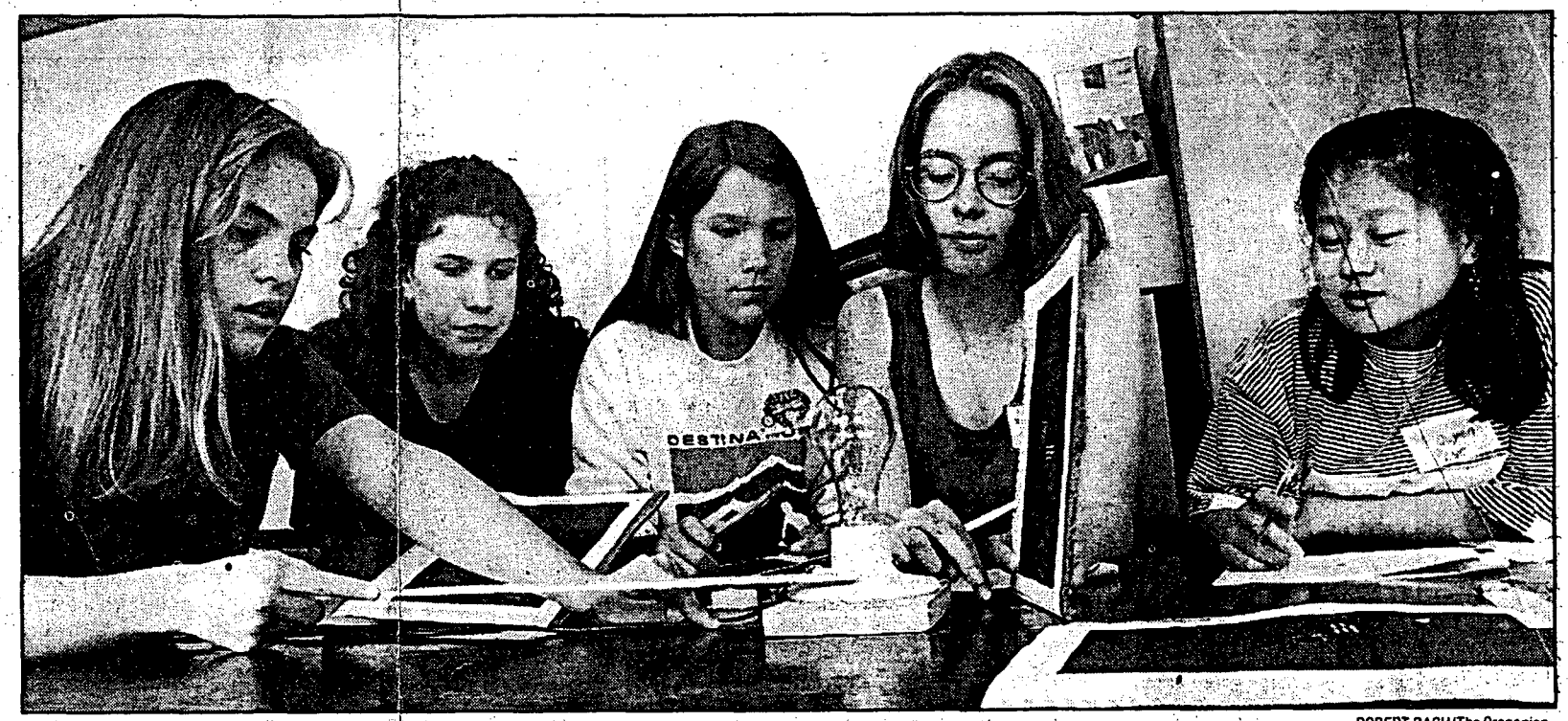
> *The idea is to encourage women to have careers in science and technology.*
>
> **Mary H. Fehrs,**

"We are really trying to fight society's stereotypes of women in science," Fehrs said. Those misconceptions include the idea that there are no women in science, as well as the idea that women who pursue careers in science must be prepared to give up having a spouse, children or the opportunity to work with others, Fehrs said.

There are no textbooks or lectures for the girls. Instead, they are given projects to work on in small groups. On Tuesday, six girls were gathered around a 200-watt light bulb. Using a hole cut in cardboard and a sheet of graph paper, they were estimating distance by brightness. In another room, students were using computers to organize data bases.

"It's harder than normal science at school," said Anne Swart, a Meadow Park Intermediate School student from Beaverton.

"But this is more fun," said Sarah Bowen, also a Meadow Park student. "Here, you get to build things and really do things."



ROBERT BACH/The Oregonian

ROBERT BACH/The Oregonian

Graphs, charts, data bases and other science applications are among the skills taught on computers during a four-week science camp for girls at Pacific University in Forest Grove. Top: How far away is the sun? Using a 200-watt light bulb, campers study the effect of distance on brightness. Student intern Adrienne Leverette (left) of Whitford Intermediate School assists campers (from left) Janet Abramson, Whitford; Dale Booth, Highland Park Intermediate School; Sarah Swanson, Whitford; and Quyen Luc, of Five Oaks Intermediate School. Right: Student intern Sung Bang, 15 (standing), of Sunset High School helps camper Kimberly Schulze, also 15, of Brown Junior High School with an assignment.

because they are seen as "mature" peers. In turn, the interns' interest in science was strongly reinforced when they were leaders and teachers in the program. Many of them gave up other very exciting possibilities to participate as interns.

Parent Nights

The evening before the first day of camp and the evening of the last day of camp we held parents nights. The first night was an orientation to the camp and included logistical as well as curricular and personnel information. There was also a brief lecture on the effects -- positive and negative -- that parents can have on their daughters' scientific careers. The last night was a presentation of the work done by the girls. Their work was displayed around the room; there was a slide show of their activities; and then the high point -- their skits. In groups of 6 they presented skits on each academic area of the camp: these were original, informative, extremely clever, and funny.

Other Aspects

The camp logistics worked very well also. The length of the day, the number of types of field trips, the noon time activities, and the length of the session were all appropriate. A surprising success was riding public transportation to and from camp. Many of the girls had never ridden a public bus and it seemed like a great adventure to them.

Reunion

We have held reunions for the students from the first and second years. These evenings were very successful. We had make-your-own-sundaes, an outside speaker, and time to catch up with each others news. The high point for the girls was the awarding of $1,000 scholarships from Pacific to all the girls. They were clearly very honored and impressed by their achievement. All girls and their families will be invited back each year until they complete high school.

Publicity

There were articles in the local papers and TV coverage of the camp both summers. During the second summer there was a longer article in the *Oregonian* which is enclosed. There were four TV news spots on the camp: one the first summer and three the second summer. These TV spots generated very good publicity about the camp and we have received many inquiries about the camp as a result of them. All coverage noted that the project was funded by the U.S. Department of Energy.

Budget

Below is a comparison of the two-year budget proposed in the grant application compared to the final budget, based on Federal Form EIA-459C -- Federal Assistance Budget Information Form. A detailed budget is also enclosed.

Object Class Categories	Proposed	Actual
a. Personnel	$21,180	$19,783
b. Fringe Benefits	$ 0	$ 1,412
c. Travel	$ 1,200	$ 1,815
d. Equipment	$ 0	$ 0
e. Supplies	$ 2,484	$ 1,754
f. Contractual	$ 0	$ 0
g. Construction	$ 0	$ 0
h. Other	$15,066	$ 9,666
i. Total Direct Charges	$39,930	$34,430

Final Comments

Our success cannot be proven for many years and I don't think it can be measured just by the percentage of these girls who become scientists or engineers. I think this camp also effects the community in which it is a part. Friends of these girls, their sisters, and their teachers are also effected by this program. Even if none of these girls become scientists or engineers I think it has effected their self

perception and their ambitions in a very positive way. Their comments and their parents comments reflect this: "Learned lots," "Experience not available in school," "My daughter changed into a more assured, assertive person," "My daughter is willing to be more daring and experimental with what she tries to do," and my favorite, "Also, all the women I met showed me that if I'm determined I can do anything I want to do."

Respectfully submitted May 20, 1994
Mary H. Fehrs, Ph.D.
Program Director

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