

1996 CSU SWE AND BEATTIE ELEMENTARY GIRLS IN MATH AND SCIENCE CLUB SLED DESIGN CONTEST

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INTRODUCTION

The Colorado State University (CSU) Society of Women Engineers (SWE) student section held a snow sled design contest for the Beattie Elementary Girls in Math and Science Club during February and March of 1996. The purpose of the Club, which meets two afternoons per month, is to spur the girls' interests in math and science careers, including engineering. The teachers formed the Girls in Math and Science Club after a similar club for both boys and girls had dwindling female participation as the school year progressed.

The club's activities include speakers discussing their technical careers, and field trips. This year, in addition to giving the girls a tour of the CSU Engineering Research Center, Dr. James and the SWE students created the Sled Design Contest which introduces the girls to engineering, shows them how fun and important engineering can be, and encourages interaction between the elementary school-age girls, the college-level engineering women students and women engineers from industry.

PARTICIPANTS

Dr. Susan P. James, Assistant Professor in the Department of Mechanical Engineering at CSU and SWE Faculty Advisor, teamed the CSU SWE students up with Kathie Hagen and Nancee Codd, who teach 4th, 5th and 6th graders at Beattie Elementary School in Fort Collins, CO and run the Girls in Math and Science Club. Beattie is one of 26 elementary schools in Fort Collins' Poudre R-1 school district. Thirteen 4th, 5th and 6th grade girls from the Beattie Club girls participated in the event along with their teachers. Approximately 10 SWE students helped build and design the sleds, and run the contest, while others helped with fund raising, supply purchases, etc.. There were also 5 volunteers from industry (Woodward Governor, Hewlett Packard) who helped in sled building and contest judging.

SPONSORS AND BUDGET

The sled contest sponsors donated \$1,100 in cash which was used to purchase tools, sled building materials and hardware, event banners, T-shirts and prizes. In addition, the sponsors donated sled building materials, T-shirt logo design and printing, two prizes (calculators), and most importantly several hours of their employees' time. The women engineers from industry helped the girls design and build their sleds and then helped SWE judge the final contest. The sponsors were Woodward Governor, Hewlett-Packard, CSU Civil Engineering, Hach and Fiberlok.

OUTCOME

Participant Quotes

"I thought it was really cool. We got to use power tools, and there were no boys around."
-- Adrienne Morgan, age 12.

"It was a lot of fun. I got to meet a lot of people and made a lot of friends. I'm going to be an engineer when I grow up." -- Mai Abdulrahman, age 11.

"I liked that we designed our sled. We got to design and model them ourselves. It was really fun." -- Ana Delgado, age 11.

"... the girls have realized that there was a lot they didn't know that was math- and science-related. There was a lot of enthusiasm." -- Nancee Codd, Beattie teacher.

Design/Building Sessions

There was a total of four sled design and building sessions, each 1.5 hours long, held after school at Beattie Elementary on Tuesdays and Thursdays. We began by discussing with the girls some of the engineering principles involved with sled building (friction, aero(snow)dynamics, strength, stiffness). We also explained the various contest categories (see below) to the girls and encouraged them to design sleds which could meet some or all of the categories.

The girls were divided into five teams and each team built one sled. All the adults helped all the teams come up with a design and then construct the sled. A wide variety of supplies were made available to the girls, including wood, plastic sheets, inflatable rafts, foam, wax, old skis, rope, oars, PVC pipe, and plastic containers. They were also allowed to make requests for additional supplies.

It was during the actual design and building that the girls learned the most about engineering. For example, one girl requested a steering wheel for her sled. When asked why she explained that she wanted to be able to steer and thus need a steering wheel. The adults helping her design got her to start thinking about steering mechanisms and sent her home to climb under her parents' car to investigate how the steering wheel on the car worked. In the end she went with a simpler steering mechanism. Many of the girls learned about strength and stiffness and joining methods.

Both the adults and the kids learned about group dynamics with the help of the Beattie teachers. We wanted everyone to learn, have fun and work together. Designing by a group is not easy and we did have to settle occasional small disputes within teams. There was some jealousy from the boys who peered in the windows at their female counterparts hammering and drilling away at their sleds.

Contest

The biggest obstacle to the contest was the lack of snow in Fort Collins during February and March. The contest had originally been planned for the Saturday after the sleds were built but had to be postponed almost three weeks due to a lack of snow. The contest was finally held on Monday, March 25 after school at the Pine Ridge Natural Area in Fort Collins. There was enough snow for sledding but it was very cold!



There was a grand prize for the team whose sled won the most overall points, plus prizes for each team that won the most points in each of the following four categories:

- 1) Best Engineered (as presented by each team to the judges): most original, most elegant, most durable, simplest, least expensive, most user-friendly (easy to get up the hill, stores in small space, comfortable to ride);
- 2) Fastest: fastest time down the alpine course;
- 3) Most Maneuverable: best steering through the slalom course;
- 4) Safest: shortest breaking distance on alpine course (pilot must stay in sled).

The grand prizes were a scientific calculator for each team member. The other category prizes were book store gift certificates, movie theater passes and ice skating and swimming pool passes. Everyone won a prize and each team got a certificate. All the girls, teachers, SWE and industry participants received contest T-shirts.

It is difficult to gage whether the girls or the adults had more fun! It was a positive (albeit cold) experience for all. Several of the sleds broke during the contest and had to be fixed on the spot (duct tape!). Although the designs were far from perfect, some of the sleds were quite fast and some could stop on a dime. Steering through the slalom course proved to be the most challenging event with no one successfully clearing all the pylons. The girls presented their sled designs at the end of the contest to the judges and discussed which design aspects worked well and which did not. It was at this point that girls learned by consensus from all the adult engineers present that failure and redesign were a part of engineering.

LESSONS FOR THE FUTURE

Participants

Next year we hope to involve more girls from the Poudre R-1 schools. We will have a better budget and more experience on how to run things so involving more girls should be relatively easy. We will encourage the girls who participated this year to be advisors to next years' teams.

Sponsors and Budget

The costs for running the sled contest will be lower (per sled) next year because we now have all the tools needed and event banners made. Raising the sponsor money should be even easier next year since we can demonstrate how successful the event and because Dr. James has NSF funding for next year which can be used to match industrial contributions.

Design/Building Sessions

Next year we will allow more time for instruction, design and building of the sleds. We will also have them try out their designs before the contest so they can redesign if necessary. We now have a better idea of what types of materials and designs work better than others. In an effort to be more efficient we will not buy any building supplies ahead of time but will go shopping with lists specified by the various teams. In fact, we may even try to get the parents to help with the shopping and reimburse them for costs.

Contest

We will hold the contest next year up in the mountains where there is always snow (i.e., CSU Pingree Park campus).

