CAMP-MESA Students Design for the Disabled

by Mark Richter

'My project made me realize that if I set my mind to helping others, I can do anything', was how one student described her engineering design experience at UC Santa Cruz as part of the CAMP-MESA Summer Fellowship Program. Engineering, Mathematics, and Physics students came together from Cabrillo College, Solano Community College, American River College, Modesto Junior College, and East Los Angeles Community College last August to participate in a two week intensive learning experience in engineering design for persons with disabilities. As a Cabrillo College student myself (AS 1994), I was exposed to the nurturing environment provided by MESA and recognized its effectiveness in creating a sense of family among its students. I found that same spirit while spending time on campus with my wife, Kyra, then a CAMP tutor at UCSC. Now, many years later, as a graduate student in mechanical engineering design at Stanford University, I was thrilled at the opportunity to instruct the engineering group and be once again be exposed to the CAMP-MESA experience.

The 'Designing for the Disabled' theme was chosen because the experience is very socially oriented. Developing assistive technology involves interacting with a person or group of people with special needs. It is often the case that even small improvements in the technology used by persons with disabilities can result in dramatic improvements in their ability to communicate and interact with the world around them. Being part of a team that creates such an improvement in technology is a very emotional and rewarding experience. Projects often infuse the students with an overwhelming desire to help others and as a result design, engineer and realize products to a level of excellence well beyond their previous abilities, much like the tales of a mother lifting a car to free her trapped baby.

The student projects were facilitated through a local occupational therapist, who had several project ideas for use at an elementary school for students with both learning and physical disabilities. Students were introduced to the basic flow of engineering design. We covered how to clarify client needs, brainstorm potential solutions, define design details, realize solutions, and evaluate design performance. Design documentation was stressed. Students were required to record details of their daily experiences such that they could easily synthesize their notes into a formalized report. Reports were to be a design road map, explaining to the project sponsor the spectrum of solutions explored and the decisions which led to their final design.

Teams of two were formed and they were introduced to the projects which included; the design of a utility head wand for a student with cerebral palsy, a universal computer keyboard support tray for both head wand and able-body users, as well as an integrated computer peripheral management system for students with learning disabilities who use both touch screen and story-board keyboard inputs. Initially, the learning atmosphere was somewhat stale and pointed towards just another academic exercise, until we made our site visit. We met the occupational therapist at the home of Francisco, our client with cerebral palsy, since he had most of his advanced communication equipment there. Greeted at the door by his mother, we made our into their home and into Francisco's bedroom. We all stood motionless in amazement as Francisco, in a sequence

of seemingly uncontrolled and ballistic movements, orchestrated a warm greeting and some humorous remarks through the use if his head wand and a communication keyboard. We remained captivated and engaged for almost an hour as we probed into how we might add additional functionality to his life through a new head wand design. The ride home was unusually quiet with only an occasional remark on how powerful the experience had been. We were still in shock.

Back in the classroom, our group momentum began to come alive and then swell as we came up with more and more ideas for design improvements. Before long, we had come up with so many incredible ideas, we couldn't wait to try them out. I introduced the students to some rapid prototyping methods using foam core, hot glue, and an eclectic collection of assorted hardware odds and ends. Students were soon busy as bees, building, sharing, and discussing the pros and cons of their functional design models. Once the teams had determined an optimal design solution, we began the detailed design phase. Materials and joining processes were chosen to replace those of their models. Next, we went shopping for materials at a local hardware store. Students, armed with pages of scribbled plans and tape measures, roamed the isles in search of the items on their lists. It wasn't long before teams were sitting in the isles, revising their plans to fit off-the-shelf material sizes and unexpected component shapes. The hardware store staff definitely earned their keep that day.

Students were provided with safety training in the use of power hand tools as well as some basic machining techniques. Then began the initially frustrating and later gratifying process of creating their functional design prototypes. Teams banded together to overcome roadblocks, learning how to make due with what they had. As patience and motivation wore thin, words of encouragement and support helped keep the projects moving forward. Once the designs began to take shape and actually function, student motivation accelerated and they raced toward their finish lines. One by one teams became satisfied with their products and began to develop their product evaluation protocols. Teams invited fellow students to put their products to the test, judging performance in areas such as ease of use, aesthetics, safety, and dependability. There was an overwhelming sense of accomplishment as the teams documented and reflected upon their experiences.

The experience climaxed as the students presented their work to the other research groups of the student body and staff of the fellowship program during its finale festivities. There was a clear sense of amazement and disbelief from the audience in the achievements of the student teams, reinforcing their confidence in the products. Unfortunately, due to time and scheduling constraints, the design teams did not experience first hand the joy of presenting their products to the clients. I represented them in delivering their products and was met with praise. Photos were taken of the products being implemented, successfully filling the specified needs, and sent to each of the students along with a summary report, detailing the positive response from their sponsor. The results of our design experience strongly supported the idea that engineering projects which directly help others who are in need, have the power to infuse students with motivation to far exceed their previous abilities. I would encourage students interested in an experience developing assistive technology to volunteer at a local rehabilitation hospital and educators interested to

contact an occupational therapist who can help provide projects to facilitate a similar program.