

# **Camp Reach** An Engineering Outreach Program for Girls



# 2003 Annual Report

## Prepared by

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The goals of Camp Reach are to generate and sustain adolescent girls' interest in engineering and technology, their motivation toward education, and their self-confidence. We also seek to enhance the understanding of engineering among the parents of participants and among the middle school math and science teachers who are part of the program staff. This report details the activities of Camp Reach for January to December, 2003. It includes descriptions of the 2003 program, evaluation results, and the activities that were held in the past year for program alumnae from the years 1997-2003. A highlight of the year was receiving a prestigious Women in Engineering Program Award from the national organization WEPAN (Women in Engineering Programs and Advocates Network). This award provides recognition of Camp Reach as a premier, model program from a group of professionals who work in this field.

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Reach 2003 Campers and Staff

### Background

Camp Reach responds to a compelling national need for a larger technologically literate workforce. The program also reflects the mission of WPI and its pioneering approach toward technological education. In this section, we provide some context on these issues, as well as an overview of the program design and the rationale behind it.

#### Need for the Camp Reach Program

The most recently available statistics indicate that women comprise only 9.1% of engineers in the U.S. labor force, whereas they comprise more than half of our population.<sup>1</sup> In testimony to Congress in July 2002, Kristina Johnson, Dean of Duke University's School of Engineering, framed this problem quite directly:<sup>2</sup>

What was once a moral obligation to promote diversity by providing equal opportunity for interesting, high-paying careers for all citizens is now a national imperative. Simply put, unless we bring more women and minorities into science and engineering fields, we will not have the intellectual capital to address the major economic, environmental, health, and security issues facing our nation. Developing our underutilized human resources can be our competitive advantage.

A recent report<sup>3</sup> predicted the extent of this potential gap in our nation's intellectual capital—that by 2028, there will be 19 million more jobs than workers who are adequately prepared to fill them. In order for companies to maintain leadership in a global economy, more women and minorities must be prepared to assume positions as engineers and managers, and in general, to be technological decision-makers. A more diverse technological workforce could revitalize both the public and private sectors by providing new perspectives on old problems and by bringing a broader range of interpersonal skills and collaborative approaches to address those problems.

The optimal solution for a more diverse engineering workforce is to expand the "pipeline" of precollege and college students who are interested in and prepared for technological higher education. Yet the enrollment of women in undergraduate engineering programs has increased only marginally since the late 1980s—from 15.4% in 1987 to 19.4% in 1997. Moreover, no progress has been made in the last four years; in 2002, enrollment of women was still only 18.7% (representing a slight decrease from the previous year's enrollment of 19.3%).<sup>4</sup> A number of studies indicate that the critical time in the pipeline of women into technological careers is much earlier than college. Many girls lose interest in math and science in the middle school years.<sup>5</sup> Outreach programs are an important means of confronting this pipeline problem, and recently there have been calls for expanding and strengthening them.<sup>3</sup> WPI is well positioned to provide an outreach program to middle school girls, a program that draws upon the motivating effect of life on a college campus, use of state-of-the-art technological facilities, talented students and faculty to serve as mentors, and our unique programmatic emphasis on service to society.

<sup>&</sup>lt;sup>1</sup> National Science Foundation, Division of Science Resources Studies, 1997 SESTAT (Scientists and Engineers Statistical Data System), cited in *Women, Minorities, and Persons with Disabilities in Science and Engineering:* 2000 (NSF).

<sup>&</sup>lt;sup>2</sup> M. Mannix, "Facing the Problem," ASEE Prism, July 2002, pp.19-24.

<sup>&</sup>lt;sup>3</sup> A. P. Kellogg, *The Chronicle of Higher Education*, January 11, 2002.

<sup>&</sup>lt;sup>4</sup> Engineering Workforce Commission of the American Association of Engineering Societies, *Engineering & Technology Enrollments: 2002.* 

<sup>&</sup>lt;sup>5</sup> See, for example, P. Orenstein, School Girls, Young Women, Self-Esteem and the Confidence Gap (New York: Doubleday, 1994), p. 23; S. Brush, "Women in Science and Engineering," American Scientist 79, 404-419 (1991).

#### Camp Reach in the Context of the Mission of WPI

WPI is a pioneer in technological higher education, and is recognized as one of the leading outcomesoriented undergraduate programs preparing people for success in our technological world. Since its founding in 1865, WPI has broadened and perfected an influential curriculum that balances theory and practice. This innovative and unique combination of educational methods, learning environment, and a worldwide network of project centers is accredited by the New England Association of Schools and Colleges (NEASC). Its main campus is located in Worcester, Massachusetts. WPI supports the academic and research pursuits of over 2782 undergraduate students, 1003 graduate students, and 220 faculty pursuing opportunities to blend technological research and practice with societal needs.

WPI provides its students with a thorough conceptual foundation in science, engineering, management, the humanities and arts, and the social sciences. But this firm grounding is just the beginning; students learn to apply their knowledge by tackling real problems for real people, developing solutions that truly make a difference and that make the world a better place. This educational process is true to the founders' directive "to create, to discover, and to convey knowledge at the frontiers of academic inquiry for the betterment of society." WPI students understand that scientists and engineers do not work in a vacuum—that the decisions they make affect, and are affected by, the people and societies around them.

WPI's emphasis on developing "technological humanists" addresses recent calls for the liberalization of engineering education. Domenico Grasso, the director of the new engineering program at Smith College, recently commented on how engineering education has traditionally been perceived as training for narrow, vocational practice, lacking in social relevance.<sup>6</sup> Yet many college-bound students, *particularly women*, are seeking careers that offer a broader role in society. Grasso uses the example of how pre-med students tend to cite their desire to help people as their reason for choosing a career in medicine. Yet the most common response of engineering students when asked why they are pursuing engineering careers is that they "liked math and science."

A primary strategy of the Camp Reach program is to show girls how engineering can and should be a helping profession. This emphasis is in harmony with WPI's mission and also addresses the broader need for socially responsible engineers who are prepared to take leadership roles in shaping the appropriate use of technology to meet human needs.

In 1997, with funding from the National Science Foundation, WPI launched Camp Reach, a twoweek residential summer enrichment program in science and engineering that empowers girls, about to enter the seventh grade, to pursue math and science classes in order to gain access to rewarding and influential technological careers. Camp Reach is one critical component of a much larger effort at WPI to increase diversity in the engineering world. Now entering its eighth year, Camp Reach continues to meet its goals of helping middle school girls (30 annually) develop self-esteem and self-confidence in math and science, realize the importance of taking four years of both math and science in high school, and discover the excitement and rewards of technological fields and careers. Extensive program evaluation, follow-up activities continuing through high school, and commitment to continuous improvement of the program have made Camp Reach a star among WPI's highly successful K-12 outreach programs.

#### **Overview of Program Elements**

The program design of Camp Reach focuses on the premise that realizing the full representation of women among engineers requires us to communicate the nature of what engineers can do, how they can help our society, and the skills that are required. Thus, the objectives of the camp program are for girls to experience the following aspects of engineering:

• Engineering requires collaborative work in teams

<sup>&</sup>lt;sup>6</sup> D. Grasso, "Engineering a Liberal Education," ASEE Prism, November 2002, p. 76.

- The engineering design process can be used to find creative solutions to the problems of individuals, organizations, communities, and societies
- Engineering requires excellent written and oral communication between individuals and groups
- Engineers need knowledge in the areas of math and science

The program content is designed to meet these objectives, using multiple strategies that involve both activities and staffing. The central and unique feature of the camp experience is a design project in which teams of students solve a problem for an organization in the greater Worcester community, using teamwork and an engineering design process. The other major aspect of the program content is the Discovery Workshops, which emphasize hands-on learning and exploration rather than finding a "correct answer." Other program activities include field trips and speakers to enhance career awareness. The camp staff is selected in such a way as to expose girls to a broad spectrum of female role models, from female high school students to engineering faculty and practicing engineers. In this way, Camp Reach has an impact beyond the thirty girls who participate each year. The high school students and middle school math and science teachers on the program staff learn alongside the girls about engineering and why it is important for women to prepare for and enter this increasingly influential profession in our society. Several strategies are used to ensure the long-term effects of the camp experience, as well as to magnify the camp's sphere of influence, including follow-up activities that take place during the school year and outreach to parents.

## **Highlights and Innovations in 2003**

- Camp Reach was the recipient of a prestigious Women in Engineering Program Award from the Women in Engineering Programs and Advocates Network (WEPAN). Chrys Demetry and Stephanie Blaisdell accepted the award in honor of Denise Nicoletti at WEPAN's annual meeting in Chicago in June. This very competitive award recognizes programs that serve as models for other institutions. To be considered, programs must demonstrate improvements in the educational environment for women in engineering, and must have been established for five or more years and have assessment data, including pre/post data and long-term tracking to indicate how the program has made an impact. In addition to a plaque, the award carries a \$500 prize. Most importantly, however, the award carries the recognition of Camp Reach as a premier women in engineering program by a group of professionals who work in this field.
- Two additional program elements were offered for alumnae:
  - As an extension of the Winter Reunion in February, a "Mock Admissions Committee" activity was offered for high school sophomores and juniors and their parents.
  - In September, through the initiative of WPI students and alumnae in the Electrical and Computer Engineering Department and with support of the local chapter of IEEE, we were able to offer an academically-focused four-hour workshop for alumnae. Girls built RF-receivers on a breadboard using a circuit diagram, in an effort to hone in on a signal being transmitted by a lost dolphin.

More details about both of these activities are described in the *Alumnae Activities* section of this report.

• The first group of Reach participants from 1997 graduated from high school! A questionnaire was sent to the 28 alumnae for whom we had active/correct addresses, to find out about their post-secondary plans. All 14 of those who responded are attending four-year colleges. *Three indicated that they plan to major in an engineering field*. Four others are likely to major in math or science fields (biochemistry, mathematics, biology/pre-med, behavioral neuroscience), and two others have chosen professional paths related to science (physical therapy and pharmacy). Three Reach alumnae

from 1997 applied to WPI, and all three were admitted. One matriculated and is a member of the WPI Class of 2007.

- Enrollment of Reach alumnae in the Massachusetts Academy of Mathematics and Science continues at a steady pace. Two participants of Camp Reach '99 enrolled in the Fall of 2003, following two alumnae from Reach '98 and two alumnae from Reach '97 in the previous two years.
- Camp Reach Co-Directors Stephanie Blaisdell and Chrys Demetry submitted a proposal entitled "Effect of an Intervention Program on Girls' Entry into STEM Majors: A Controlled Study" to the National Science Foundation Program on Research on Gender in Science and Engineering. (STEM is a commonly-used acronym for science, technology, engineering and math.) A three-year research project was proposed, with the goal of making a significant contribution to what is known about the longitudinal effects of STEM outreach programs for girls. We recently learned that the proposal is not being funded by NSF, but we plan to initiate the research this summer using the Camp Reach Memorial Fund and perhaps resubmit the proposal next year with some initial results. More details about the study are described in the *Program Evaluation* section of this report.
- Each year we collect additional anecdotes about the lasting impact of Reach on participants. This year, the following three stood out:
  - Abby, an alumna of the 2001 program, wrote to us in May: "A few days ago, I got my high school courses, and I only wanted to get into Honors physics. I was so excited to hear that I got into it. I am sure this would not have happened if I had not gone to Reach. Reach has already made some great changes in my life."
  - Samantha, an alumna of the 1999 program, was admitted to the Massachusetts Academy of Mathematics and Science in May (a special public high school for 11<sup>th</sup> and 12<sup>th</sup> graders), but initially made the decision to stay at her home high school. After serving as a Teaching Assistant for Camp Reach in the summer, however, she changed her mind and enrolled at Mass Academy in the fall. She wrote: "This experience encouraged me to rethink my decision to attend Mass Academy, which has turned my life to a new academic journey."
  - Aimee, an alumna of the 1997 program and a Teaching Assistant in 2001 and 2002, wrote about Reach in one of her college application essays: "Mr. Setevdemio, my sixth grade science teacher, handed me the information packet that would change my life. It advertised a girls engineering camp called Camp REACH.... Little did I know how much this program would change my outlook on the world and compel me to develop self-confidence and integrity.... From Camp REACH I was able to learn real responsibility and a good work ethic. The camp motivated me to pursue knowledge not only within the confines of math and science, but in all subject areas. ..."

## Camp Reach 2003 Program

2003 was the first full year operating Camp Reach without Denise Nicoletti, who died in a car accident in July 2002. Denise was the driving force and passion behind the program since its inception in 1997. The amount of work involved in deciphering all that needed to be done to deliver the program was considerable. We were fortunate that WPI's administration provided Chrys Demetry with some release time in the spring of 2003 to focus on reviewing Denise's archive of documents and organizing the 2003 program.

The 2003 program was highly successful. In this section the program participants and the program content are summarized. Subsequently, evaluation results that indicate the quality of the experience will be presented.

#### **Description of Participants**

There are multiple participants and beneficiaries of the Camp Reach program. While the middle school campers are most directly affected, female high school and college students, along with middle school math and science teachers, are also influenced by the program.

#### **Camper Population**

Girls, living in Massachusetts, who will be entering the seventh grade in the fall following the Camp Reach program are eligible to apply. Advertising and promotion of the program is focused on central Massachusetts (Worcester County) since the program alumnae are encouraged to attend follow-up activities on campus through high school. Larger distances would likely preclude participation in follow-up activities and thus diminish the long-term effects of Camp Reach.

The main part of the application is an essay that asks girls to describe something that they have worked hard on, either in school or in their personal life. Prior achievement in math and science courses is *not* a criterion in the application or in the selection process. Teachers and principals are requested to distribute promotional material broadly, rather than pre-selecting girls they think have interest and aptitude. The rationale behind this approach is the strong belief that, at this age level, what is needed is to generate interest among a broad range of girls, rather than developing the pre-existing interest in those who are already high achievers.

In the 2003 year, 46 applications were received for 30 available spots in the program. This number of applications was a considerable drop-off from the previous three years; 68, 71, and 70 applications were received in 2000, 2001, and 2002, respectively. The difference was in the number of inquiries rather than in the "yield" of applications. For example, in 2002 we received 166 requests for information and applications, and 70 applications were received for a "yield" of 42%. In 2003, we received just 113 inquiries and 46 applications, corresponding to a similar "yield" of 41%. A decline in applications was also observed in most other WPI summer outreach programs, so the economic climate may have been a factor. In some sense it was easier not to have to disappoint as many girls whom we can't accommodate. Nonetheless, we will be monitoring the situation in an attempt to ensure that the program is advertised broadly, although we are somewhat at the mercy of sixth grade teachers and principals to distribute the brochures that we send.

After judging that the interest level and essay met minimum standards, thirty girls were selected <u>at</u> <u>random</u>, with a check to make sure that the ethnic diversity of the participants is representative of the aggregate for Worcester County.

Tables 1 and 2 show the geographic distribution and ethnic backgrounds, respectively, for participants of the past three years. Participants are focused in Worcester County, and their ethnic distribution can be compared to the Worcester County averages of 90.8% Caucasian, 2.0% African-American, 5.1% Hispanic, and 1.9% Asian.

Table 1: Geographic Distribution of Campers			
	2001	2002	2003
Worcester	7	10	13
Wachusett Regional School District	4	6	5
Shrewsbury	4	3	1
Fitchburg/Leominster	3	1	1
Other Worcester County towns	8	10	9
Outside Worcester County	2	0	1
Did not specify	2	0	0

Table 2: Ethnicity Profile of Campers for Past Three Years									
	20	2001 200		2001 2002		2001 2002		20	03
	Number	Percent	Number	Percent	Number	Percent			
African-American	2	7%	1	3%	1	3%			
Caucasian	19	63%	23	77%	22	73%			
Hispanic	2	7%	2	7%	2	7%			
Asian	3	10%	2	7%	-	-			
Other specified	-	-	1	3%	2	7%			
Did not specify	4	13%	1	3%	3	10%			

#### **Program Staff**

The staff for Camp Reach is composed of two Co-Directors, three Middle School Teachers, three Residential Advisors (RAs), one of whom is a specialized Health Supervisor, an After Hours Supervisor who supervises the RAs, eight high school student teaching assistants (TAs), and workshop leaders. The roles and responsibilities of each of these positions are described below.

**Directors:** As Director of Diversity and Women's Programs, Stephanie Blaisdell coordinates other programs for middle school and high school girls, including GEMS (<u>G</u>irls in <u>E</u>ngineering, <u>M</u>ath and <u>S</u>cience) and GEMS Jr. She is also responsible for diversity and women's programming for WPI students. Stephanie previously served as director of the Women in Applied Science and Engineering Program at Arizona State University. She holds a master's of counseling and Ph.D. in counseling psychology from Arizona State University. Stephanie and the staff of the Office of Diversity and Women's Programs coordinate advertising, applications processing, hiring and training of residential advisors, staff policy development, and state licensure.

Chrys Demetry is an Associate Professor in the WPI Mechanical Engineering Department. She was the co-principal investigator on the original grant from the National Science Foundation's Model Projects for Women and Girls, which was instrumental in initiating Camp Reach in 1997. Chrys received a B.S. in Mechanical Engineering from WPI in 1988 and a Ph.D. in Materials Science and Engineering from MIT in 1993. She has been on the faculty at WPI since 1993, involved with teaching and research in materials science and in engineering education. She is also a regular advisor at WPI's global project centers, co-directs the Bangkok Project Center, and co-directs the interdisciplinary program in Scientific, Professional, and Technical Communications. She coordinates the Reach academic program and the hiring of middle school teachers and teaching assistants. Stephanie and Chrys collaborate on alumnae programs, program evaluation, budget oversight, and assist in the fundraising that is led by Terry Adams, WPI's Director of Corporate Relations.

*Middle School Teachers:* The camp staff includes three middle school teachers from school districts in Worcester County. During the hours of each day allotted for the design project, they help the girls meet specific goals set for each day and facilitate the sharing of ideas. Teachers also participate in all of the discovery workshops. In some cases this participation is in large part observational, while other workshops need more active facilitation and co-teaching on the part of the teachers. What they do bring to the team is an all-important adult perspective and the experience of knowing how to work with girls of this age.

The involvement of middle school teachers is made more relevant by the Massachusetts Education Reform Act of 1993, which requires teaching of engineering and technology in the public schools. A continuing challenge, however, is that teachers are, in large part, unprepared to teach these subjects. Camp Reach provides the middle school teachers on staff with exposure to engineering fields as well as to the engineering design process. Different teachers participate each year, and they gain a much better

understanding of engineering that they then can pass on to all of their students and their colleagues. The teachers also come away with ideas for projects and teaching methods to use in their math and science curricula, and share with their colleagues, that will engage the interest of *hundreds* of middle school students.

A competitive application process is used, with interviews being a major part of the selection process. Selected teachers are given a \$2,000 stipend as well as professional development points (PDPs). The middle school teachers in 2003 were Kristden Cornaire (6<sup>th</sup> grade earth science, Grafton Middle School, two years experience); Julie Guerin (7<sup>th</sup> grade life science, St. Peter Marian Central Catholic Jr.-Sr. High School, two years experience), and Robin Scarrell (8<sup>th</sup> grade integrated math and science, Forest Grove Middle School, Worcester, seven years experience).

**Residential Staff:** Residential advisors (RAs) live in the residence hall with the girls, lead the evening activities, and coordinate a variety of personal issues for the campers. The three RAs for this year's program, all WPI undergraduates, were Erica Abrahamsen (senior Biology major), Kyna Hu (junior Computer Science and Theatre Technology double major), and Kerry Malone (senior Biomedical Engineering major). Kerry also served as the **Health Supervisor**, a position necessary to meet state regulations for camps. She helped to administer medications as directed by parents, performed first aid when necessary, and was on campus 24 hours a day. In 2003 we added an additional residential position, the **After Hours Supervisor**, held by Valerie Ambroise (senior Biochemistry major). This person supervises the RAs and had considerable responsibility in planning and implementing the evening program.

*Teaching Assistants:* Nine high school students are also part of the camp staff in the role of volunteer Teaching Assistants (TAs). Since they are closer in age to the campers than the rest of the staff, they serve as crucial role models, encouraging the girls to work hard during the camp and afterwards in school. Like the middle school teachers, they also learn about the engineering design process and college life while developing leadership and teamwork skills.

One exciting outcome of having this program in place for so many years is that the alumnae are now old enough to serve in these TA positions on the camp staff. The TAs were recruited largely from Camp Reach alumnae. We received a total of 29 inquiries for applications. Twenty-one of those were from Reach alumnae, which comprises 35% of the eligible alumnae (i.e., from the '98 and '99 programs). Eighteen followed through with the application process, thirteen of whom were Reach alumnae. We believe that the opportunity for alumnae to experience Camp Reach again at another level is a key element of our pipeline design.

**Discovery Workshop Leaders:** WPI faculty members, staff members, graduate and undergraduate students take the lead in planning, developing, and delivering the discovery workshops. Mechanical Engineering Professors Holly Ault and Allen Hoffman have led the "Mobility for the Disabled" workshop since the program's inception in 1997. Similarly, Professor Dan Gibson in the Biology Department continues to coordinate the Sandcastle Building workshop and many of the logistics for the weekend trip to Cape Cod. The Chemistry Department has been consistently supportive of the Forensics workshop. In 2003, Professor Fred Looft, Head of the Electrical and Computer Engineering (ECE) Department, developed and implemented an ECE workshop using purchased kits to build AM radios. The workshop was successful and sustainable, which is important since ECE workshops had been coordinated by Denise Nicoletti in the past.

#### **Program Content**

The program content can be divided into the design projects, discovery workshops, and other activities including field trips and recreation. The full 2003 program schedule can be found in Appendix A.

#### **Design Projects**

A design project for a real customer in the Worcester community is the major focus of the camp experience and is the primary means of introducing the nature of engineering as a collaborative problem solving process. The girls worked in groups of ten on projects during the two weeks of the program, along with one middle school teacher and three TAs. For each project, the team defined the problem and constraints, gathered information, defined design specifications, brainstormed alternative solutions and analyzed these against their specifications, and selected the best solution using a decision matrix. All team members are given specific roles (e.g., budget managers, project managers) so that everyone is a clear contributor. Each team prepares a written report for its customer, and gives both an interim presentation midway through the program and a final presentation to both families and project sponsors (typically an audience of more than 100!) during closing ceremonies. Following are descriptions of the 2003 projects.

*American Red Cross of Central Massachusetts:* The Central Massachusetts Chapter of the American Red Cross is building a new facility in Worcester with more classroom space. They asked this team to recommend audio/visual equipment for six instructional classrooms in the new building. The Red Cross hoped to make better use of technology, and wanted multifunctional classrooms to be workable and comfortable for many years to come. They also needed the rooms to be flexible, so that any students and instructors could use them.

The group went to work finding out information about computers and other audio/visual technologies, consulting the Academic Technology staff at WPI, and interviewing instructors at the Red Cross. The team decided that computers, laptops, LCD projectors, projector screens, white boards, printers, and smart boards would be the most useful equipment.

The team also did extensive research to locate the best equipment for the Red Cross. They prepared a detailed purchasing list, with suppliers and price of each item, and came out under their allowed budget. In addition, they drew up a floor plan of a setup that could be used in one of the rooms. The team will see the results of their work when the new facility opens in late spring or early summer of 2004.

*Flagg St. Community Playground Initiative:* Community members around Flagg Street Elementary School in Worcester have organized to raise funds for a playground on the school grounds. Playground equipment and location had been chosen; it was up to the Camp Reach engineers to help them plan a field day to raise funds for the playground and to raise awareness about the initiative.

The team brainstormed and selected a variety of activities that would be fun and popular for children of a variety of ages but that wouldn't be too costly, to stay within the modest \$500 budget for the field day. They considered details such as what each activity and food item should cost and advertising strategies. They also developed a map and activity chart that would be helpful to organize and set up for the day's activities, and made phone calls and visits to local companies asking for food, drink, and prize donations.

The field day was held on Sunday, September 7<sup>th</sup> at Flagg Street School and was a great success. The turnout was superb, and \$3,950 was raised. Almost the entire Reach team returned to help staff the event, which turned out to be tremendously helpful. The festivities included:



Flagg St. team members practice face painting on each other before the crowd arrives.

face painting, a bean bag toss, races, moon bounce, raffles, food, a fire truck and fire fighters from Worcester, a visit from Scratch (the Worcester Ice Cat's Mascot), and picture frame making. The community group is nearing its overall fundraising goal of \$25,000, so the team will soon get to see the playground built. They will be invited to assist on construction day, which will be in the late spring or summer of 2004. The girls also prepared for their client a schedule that would allow all the grades to get an equal chance of using the new equipment during recess.

*Henry Lee Willis Family Care Program:* The Willis Family Care Program places troubled youth in specialized family foster care. Their staff asked this team to transform a small, multipurpose room in their current facility into an educational and functional study and computer lab for children, while maintaining a reasonable budget. The group started their project by researching computers, lighting, furniture, and other things that would be useful in the room. They tried to locate inexpensive, high quality, and safe products. The group had to remember to work within specifications given to them, such as making sure the room had "kid appeal," that it was handicapped-accessible, that it was safe, and had good lighting and storage.

One of the challenges the group faced was making the room appealing for children, but not distracting so they could focus on behaving and doing their work. They visited the site several times and prepared a detailed floor plan showing the location of storage, desks, and computers. They took detailed measurements to ensure they had enough space.

By the end of the Reach program the team was able to provide a thorough floor plan of ideas for computer and furniture location, rug and wall colors, and a list of supplies for the room. They were able to stay within a reasonable budget and provide for a fun, yet educational room for the Henry Lee Willis Family Care Program. The staff of the Willis Center are currently seeking donations of products and labor to complete the room's transformation. In December, they picked up three computers donated by WPI. A follow-up activity will be held in the winter or early spring, where girls can help during reconstruction of the room, and there will be a ribbon-cutting ceremony when the room is complete.

#### **Discovery Workshops**

The "Who Dunnit" Forensics workshop is a perennial favorite of campers and was designed by a group of WPI undergraduate students. Forensics is naturally engaging to middle school students and it also demonstrates the role of science and engineering in society. The crime scenario is that a fictitious jewelry thief has taken an emerald necklace, a student is found passed out and appears to have been poisoned, and the criminal has carelessly left key evidence at the scene. The campers discover "who dunnit" using modern forensic science techniques. Liquids are analyzed using gas chromatography, plastics with infrared spectroscopy, and pens and notes with ink analysis. The girls learn how to lift fingerprints from surfaces and conduct simulated DNA electrophoresis. More broadly, they learn the importance of observation and need to weigh the reliability of different evidence and measurement



syringe.

reliability of different evidence and measurement techniques. This was an opportunity to explore **the role of science and engineering in society**.

In the "Mobility for the Disabled" workshop, girls meet physically disabled teenagers and explore assistive devices that have been designed by engineers to make their lives easier. In 2003 Professors Ault and Hoffmann showed video of the advanced "I-Bot" wheelchair designed by Dean Kamen's company DEKA. Campers also learned about state and federal regulations that require engineers to design all



Campers measure the slope of a ramp on campus to see if it complies with ADA guidelines.

winner. Areas of engineering that were explored include **materials and civil engineering**. This workshop was a key part of the Cape Cod weekend trip, which also included a visit to the Woods Hole Oceanographic Institution, with its Endeavor House Exhibits, and an overnight stay in a church hall in Falmouth.

This year for a workshop in the area of **electrical engineering**, Prof. Fred Looft used his own funds to purchase AM "crystal radio" kits. Girls learned basics about signals, how radios work, and put the radio together. The end goal was to see if they could identify a song being transmitted by a CD player in the room, as well as hear local radio stations. Campers were able to take the radios home at the end of the program.



public buildings to be handicapped-accessible, and made measurements of WPI's campus to confirm that walkways, elevators, and building entrances comply with the standards of the Americans with Disabilities Act (ADA). Areas of engineering that were explored include **mechanical**, **rehabilitation**, **and architectural engineering**.

In the "Sandcastle Building" workshop campers learn how to build large, impressive castles by first understanding building dynamics and the material properties of sand. During this workshop, these topics were explained and experienced while the students made towers, crenellations, and other elaborate structures, each building one segment of a large fortress. The workshop leader, Prof. Dan Gibson, is a sandcastle competition



The Reach fortress comes together as each girl builds one segment.

The **automotive engineering** workshop began with a presentation by Provost John Carney, an expert in design of highway crash barriers. He presented models and a videotape to show how engineers improve highway safety. Three graduate students then led a hands-on exploration of various systems in automobiles: electrical, fluids, and tire/brakes. Girls learned how to check tire pressure, change a tire, check oil level, and find and replace blown fuses.

#### **Other Program Activities**

Educating parents about the program, engineering, and the necessary high school academic preparation for technological careers is a key outcome of Reach. This is achieved through

special parent seminars at the beginning of the camp, where they are told (separate from their daughters)

rules of the program and what they can do to help combat homesickness. At the end of the camp, teachers



explain what the girls' mathematics and science programs will be during the next two years, discuss math placement issues, and provide suggestions on what parents can do to support their daughters in their academic activities. Parents are also provided with information about the Massachusetts Academy of Mathematics and Science, a public high school located on the WPI campus. In addition, there is discussion of girls' career development and how families can be supportive of their interests in engineering, math, and science.

Our program schedule (available in Appendix A) shows all of the camp's activities. The "Ice Cream Sundae Building" activity is the girls' first introduction to the engineering design process by learning what specifications are. The first full day

starts with a "Computer Orientation," important because the girls come with a wide range of computer skills. "Optional Computer Time" was available each weekday morning, and was very popular as girls could send and receive e-mail.

There was a half-day trip to Bose Corporation. This allowed the girls to see the engineering work environment, meet with female engineers who talked about what they do, and tour the research, testing, and manufacturing facilities.

Near the end of the program, lab tours were held to show the girls the wide variety of science and engineering activities going on at WPI. This included a discussion of **Biomedical and Tissue Engineering** and a tour of the Tissue Engineering lab, a **Robotics** demonstration where the girls got to "drive" one of WPI's FIRST robots through various obstacles, a demonstration of the Scanning Electron

Microscope in the Materials Science and Engineering lab, and a tour and demonstration of measurement equipment in the Fire Protection Engineering Laboratory. A popular new activity this year was Segway rides, which was part of the Alumnae Reunion held on the first Friday evening of the program.

Recreational activities were planned for each night. The program ended with final project presentations by the campers for their customers, families and friends, a closing ceremony with a presentation of certificates and a closing dinner. Bill Durgin, WPI's Associate Provost for Academic Affairs, gave a keynote address pointing out the many ways the girls' engineering efforts match industry standards for the qualities they desire in engineers.



Faye successfully navigates a Segway<sup>™</sup> Human Transporter.

#### **Alumnae Activities**

The Camp Reach alumnae community—former campers, staff, and project sponsors—is sustained and nurtured by extensive follow-up activities. After seven years of the program, we are now a community of approximately 210 young women and dozens of staff who share in common the two-week Camp Reach experience. We strive to be a supportive network for campers through the 12<sup>th</sup> grade, so that long-term effects can be realized. (We do not just say good-bye to them after the two-week program!) Following is a list of efforts made to keep in touch with and mentor program alumnae:

- Newsletters are published and mailed to all alumnae in January and June of each year. The newsletters include "class news"—accomplishments and activities of alumnae— updates on the most recent design projects, information about other K-12 program opportunities, links to interesting web sites, information about staff positions, and sometimes invitations to pilot test new workshops. Past newsletters can be viewed at <a href="https://www.wpi.edu/+reach/Newsletter/">www.wpi.edu/+reach/Newsletter/</a>
- A winter reunion was held for all alumnae in February 2003. Approximately thirty alumnae attended the traditional pool party, along with several staff members. We also held a "Mock Admissions Committee" activity for older alumnae and their parents, led by WPI's Director of Admissions, Kristin Tichenor. The group of ten were able to review real WPI applications (with names changed!) and decide whether the applicants should be accepted, rejected, or wait-listed. Both girls and their parents characterized the activity as fun and useful as they approached their college search and the application process. We plan to offer this activity once every two years in the future.
- A summer reunion was also held during the 2003 Camp Reach program. Alumnae combined with the current campers for a barbeque, Segway rides, and karaoke. Almost thirty alumnae attended.
- A special activity was offered in September where girls could build RF receivers to be able to detect the signal being transmitted by a lost dolphin. The response was tremendous; 24 alumnae participated, and there was a waiting list. (The number of participants had to be capped at 24 because of cost of components.) Also included were a pizza lunch and spring bulb planting around Denise Nicoletti's memorial area outside the Atwater Kent building. More information about this workshop can be found in our January 2004 newsletter, available on the Reach website at www.wpi.edu/+reach/Newsletter/.
- Birthday cards are sent to all Reach alumnae.
- In our newsletter we advertise and promote the Massachusetts Academy of Mathematics and Science (MassAcademy), which is a publicly funded high school for 11<sup>th</sup> and 12<sup>th</sup> graders located at WPI. In 2003 we did not arrange any special activities at the Academy for Reach alumnae. In 2004, however, we will be holding a special "Reach Shadow Day at the Academy" for 9<sup>th</sup> and 10<sup>th</sup> graders. Girls will be able to spend a day at the Academy, sitting in on classes with Reach alumnae who are currently Academy students.
- We follow up on opportunities to mentor alumnae remotely through e-mail. In 2003, Program Co-Director Chrys Demetry had e-mail conversations with alumnae from 1998 regarding college scholarship opportunities, differences between various engineering disciplines, and how to decide on college majors. Although these conversations initially started with an individual alumna, responses were also sent to other alumnae in that class if the topics seemed to be of general interest.
- As described earlier, seven of the nine Teaching Assistants for the 2003 program were Camp Reach alumnae from 1998 and 1999. Their feedback suggests that returning as a staff member significantly augments their initial experience as a camper. Several TAs mentioned that as a result of the program they felt more confident about pursuing engineering or a particular engineering discipline.
- Chrys Demetry wrote college recommendation letters for four TAs who were Reach alumnae.

### **Operating Budget**

Camp Reach expenses and income are presented in the tables below. Approximately \$42,000 needs to be raised each year to meet operating expenses. We strongly believe that it is important to keep the Camp Reach tuition affordable for girls from a wide range of socioeconomic backgrounds. Each year many parents tell us that the tuition is an incredible bargain compared to other summer programs, yet those with lesser means tell us that without the low tuition or without scholarships, they could not have afforded to send their daughter.

Budget			
EXPENSES	2003	2004 (Estimated)	
Food	\$14,539	\$15,266	
Lodging	\$6,541	\$6,868	
Director	\$6,000	\$6,000	
After Hour Coordinator	\$1,000	\$1,000	
Stipends for 3 middle school teachers	\$6,000	\$6,000	
Resident advisors	\$1,500	\$1,500	
Health coordinator	\$300	\$300	
Workshop leaders	\$1,400	\$1,400	
Closing ceremonies	\$179	\$200	
Cape Cod Weekend (lodging, food, transportation, tickets to Woods Hole Oceanographic Institute, etc)	\$6,842	\$7,000	
Transportation	\$1,656	\$1,800	
Printing	\$1,826	\$2,000	
Office supplies	\$1,219	\$1,300	
Workshop supplies	\$752	\$800	
Postage	\$1,506	\$1,500	
Recreation	\$312	\$500	
TOTAL EXPENSES	\$51,572	\$53,434	
WPI cost sharing (not included in expenses above): Summer salary for one.	oo diractor maati	ng rooms	

**WPI cost sharing** (not included in expenses above): Summer salary for one co-director, meeting rooms, laboratories, equipment, and utilities.

INCOME (with Funding Sources)	2003	2004
Tuition (\$400 paid by 22 campers; \$10 paid by 8 campers who qualified for scholarships)*	\$8,880	\$10,000
WPI Electrical and Computer Engineering Dept	\$349	
Donors:		
Intel	\$11,000	
Albert Rice Charitable Foundation	\$10,000	
Hamilton Sundstrand Space Systems International	\$6,818	\$3,182
TJX Foundation	\$5,000	
Intellution/Emerson Charitable Trust	\$2,500	
Mercury Computer Systems	\$2,000	
Raytheon	\$2,000	
Friends	\$1,650	\$400
WPI Society of Hispanic Engineers (SHPE)	\$800	
Alumni	\$325	\$250
UBS Financial Services	\$250	
3M	\$0	\$1,200
TOTAL INCOME	\$51,572	\$15,032
CURRENT SHORTFALL		\$38,402
*An additional three scholarships were awarded in 2003, made possible by	gifts specifically for	that purpose.

We could cut down on the necessity for annual fundraising by raising the tuition, and still easily enroll 30 campers each year, but then we would not be including those girls whom we most want to reach. Since WPI cannot justify spending our current college students' tuition dollars on K-12 outreach, this program can only continue with the financial support of corporations and foundations. Ironically, the longer Camp Reach exists the more difficult fundraising becomes, since many funders are looking for new and exciting programs rather than tried, true, proven programs.

#### **Program Evaluation**

Thorough evaluation of Camp Reach is conducted by administering pre-, mid-program, and postcamp questionnaires to camp participants. We also solicit staff and parental assessments of the girls' development and of the quality of the program. This information is used to determine whether the program is meeting its goals (summative evaluation) and to make in-program adjustments and improvements to the camp for the following year (formative evaluation). Long-term effects, of course, are of great interest, and this year we will be initiating research in that area that could have national relevance and impact.

#### Summative Evaluation of the 2003 Program

The purpose of summative evaluation is to determine the effects of the program on participants and to assess whether the program is meeting its stated goals of enhancing participants' interest in engineering and technology, their motivation toward education, and their self-confidence. Table 3 summarizes results in each of these three areas from pre- and post-questionnaires administered to the campers. *To a statistically significant degree, participants became more interested in engineering and technology, developed a better understanding of engineering, became more motivated about future math and science courses, and gained confidence and self-esteem about their skills and ability to be an engineer.* 

Since campers' self-assessments may not always be accurate, we also gathered feedback from each girl's parent(s) and Reach middle school teacher. The results in Table 4 provide reinforcement that the program enhanced interest in engineering, motivation toward education, and self-confidence, with degrees of improvement between "small" and "moderate" being reported, on average, in these areas.

We also sought feedback from the Teaching Assistants and Middle School Teachers to determine the extent to which the program was meeting its goals for staff development:

- All 10 staff members who returned the end-of-program questionnaire responded "Strongly Agree" to the statement "I learned a lot from being a Camp Reach staff member".
- Eight staff members responded Strongly Agree to the statement "As a result of Camp Reach 2003 I have a better understanding of engineering." The remaining two responded Agree to the same statement.
- Both of the Middle School Teachers who returned the end-of-program questionnaire responded "Strongly Agree" to the statements "I will be able to adapt design project or workshop activities or approaches in my own teaching" and "I have ideas from Camp Reach that I will be able to share with colleagues who can apply them in their teaching." One mentioned that her staff binder will be a great resource to introduce engineering and technology topics into her current curriculum.

Table 3: Effect of Camp Reach on Participants					
	M	Mean			
	Pre	Post	P		
Interest in and Knowledge of Engineering					
I find engineering and technology to be interesting.*	3.25	3.57	<mark>.004</mark>		
I have a good understanding of what engineering is.*	2.69	3.31	.002		
Motivation Toward Education					
I am looking forward to math and science courses in middle school and high school.*	3.04	3.37	<mark>.017</mark>		
I have given a lot of thought to my future career.*	2.71	2.71	1.00		
Confidence, Efficacy, and Self-Esteem	Confidence, Efficacy, and Self-Esteem				
I could be an engineer if I wanted to.*	3.11	3.46	.022		
Skills rating <sup>#</sup>	72.7	77.9	<mark>.000</mark>		
Self-esteem score <sup>†</sup>	33.5	36.9	<mark>.000</mark>		
$^{\text{The value } p}$ is the probability that the observed difference between the means is due to chance alone. In social science research, <i>p</i> values less than 0.05 (highlighted in vellow above) are generally viewed to be statistically					

\* Responses were given on a scale of Strongly disagree = 0; Disagree =1; Neutral = 2; Agree = 3; Strongly agree = 4.

significant.

<sup>#</sup> Participants rated their "comfort and confidence level" for 23 skills and abilities, on a 4-point scale from 1 = Poor; 2 = Fair; 3 = Good; 4= Excellent. The skills rating is the sum of these 23 responses, for a maximum possible score of 92.

<sup>†</sup> Participants were asked "How do you feel about yourself" for 11 paired descriptors such as "Smart—Not Smart", "Weak-Powerful", and "Indecisive-Decisive." Their responses were on a 5-point scale between those extremes, from the less desirable to the more desirable extreme: 0 = Very (less desirable, e.g. Not Smart); 1 = Only a bit; 2 =In between; 3 = Only a bit (more desirable, e.g. Smart); 4 = Very. Maximum possible score is 44.

Table 4: Middle School Teacher (Reach Staff) and Parent Assessments of Changes in Girls During   Program*				
Measure	Teacher Asse	essment (N=30)	Parent Assessment (N=25)	
- Actual C	Mean	Std. Dev.	Mean	Std. Dev.
Interest in engineering, science, and technology	3.57	0.73	3.96	1.20
Motivation toward education, learning, and achievement	3.73	0.83	3.58	1.02
Self-confidence	3.77	0.77	3.67	1.05
Ability to work with others	3.90	0.85	3.38	0.92

\* Both teachers and parents used the following scale: 1 = Decreased during program; 2 = No improvement; 3 =Small degree of improvement; 4= Moderate degree of improvement; 5= High degree of improvement.

#### Formative Evaluation of the 2003 Program

Campers, parents, and staff uniformly praised the overall quality of the 2003 Camp Reach program. Table 5 shows a history of participant satisfaction, and the 2003 program appears to be a fairly typical, well-received year.

Table 5: Campers' Ratings of the Overall Program Experience						
Program	% (	of Camper	rs Providi	ng Each F	Rating	Mean
Year	Very Poor	Poor	Fair	Good	Outstanding	Rating*
1999	0%	0%	13%	46%	42%	3.32
2000	0%	0%	3%	17%	80%	3.77
2001	0%	0%	3%	34%	62%	3.56
2002	0%	0%	0%	7%	93%	3.93
2003	0%	0%	3%	27%	70%	3.67

\*Calculated using Very Poor = 0; Poor = 1; Fair = 2; Good = 3; Outstanding = 4.

The following are examples of parent and staff feedback relevant to the general operation of the program:

- Of the 25 parents who responded to a questionnaire mailed in September, all 25 rated the program as either Very Good or Excellent, with 20 (80%) rating it Excellent.
- All 25 parents completing the questionnaire said that the value and quality of the program exceeded (20%) or far exceeded (80%) what they paid in tuition.
- All 10 of the Teaching Assistants (TAs) and Middle School Teachers completing evaluations responded Agree (20%) or Strongly Agree (80%) to the statement "The program ran smoothly and was well organized."

Our main focus for program improvement in 2004 will be to enhance some of the workshops and other academic activities. Table 6 shows participant ratings of enjoyment and learning in these activities; staff assessments of camper enjoyment and learning were similar. Although the average ratings for all activities were above the Neutral position, we feel we can make improvements in some of the lower-rated activities. Feedback from staff members indicated that many of these activities had too much listening/lecturing and too little hands-on experience for this age group. Based on these results we will be taking the following actions for the 2004 program:

- Substantially improve the Automotive Engineering workshop, or replace it altogether.
- Work with Biomedical Engineering students and faculty to develop a hands-on component for the Tissue Engineering/Biomedical activity, or come up with an alternative Biomedical Engineering activity.
- Determine from Materials Engineering students and faculty whether campers could operate some aspects of the Scanning Electron Microscope themselves. If that is not feasible, develop an alternative use for that time in the program.

Table 6: Participants' Ratings of Discovery Workshops and Other Program Activities*				
	Degree of	Enjoyment	Degree of	Learning
	Mean	Std. Dev.	Mean	Std. Dev.
Robotics Activity	3.80	0.41	3.53	0.57
Field Trip to Bose Corporation	3.63	0.56	3.63	0.49
Sandcastle Building Workshop	3.60	0.56	3.38	0.73
Rehabilitation Engineering / Mobility for the Disabled Workshop	3.37	0.72	3.53	0.57
Forensics / Who Dunnit Workshop	3.33	0.71	3.43	0.82
Fire Protection Engineering Lab Tour	3.20	0.55	3.33	0.71
Building an AM Radio (Electrical Engineering)	3.07	0.83	3.10	0.85
Tissue Engineering Presentation and Lab Tour	2.90	0.92	3.31	0.76
Scanning Electron Microscope (Materials Engineering)	2.63	0.96	2.87	0.86
Computer Orientation	2.63	0.96	2.40	1.10
Automotive Engineering Workshop	2.50	1.14	3.10	0.98
Visit to Woods Hole Exhibit Center	2.50	0.90	2.57	0.97
Guided Tour at Woods Hole	2.07	0.98	2.63	1.07

\* Participants rated their level of agreement with the statements "I enjoyed this workshop or activity" and "I learned a lot from this workshop or activity," on a scale from 0 = Strongly Disagree; 1 = Disagree; 2 = Neutral; 3 = Agree; 4 = Strongly Agree.

- Recommend eliminating the guided tour at Woods Hole Oceanographic Institution and instead visiting the Marine Fisheries Aquarium, as we did in previous years. While the tour is more engineering-oriented than the aquarium, it is simply too difficult to hold the girls' attention when all they are asked to do is listen.
- Decrease the length of the ECE/AM Radio workshop from 3 hours to 2 hours, and recommend less or no lecturing about concepts behind radio operation.
- Substantially reduce the time spent on the Computer Orientation, focusing primarily on making sure that the campers can access their e-mail accounts and send messages home. We will also modify the questionnaire that is sent to accepted campers to find out more specifically what their computer skills are. Rather than designing the orientation for the "lowest common denominator" of computer experience, we could do the minimum necessary to acquaint them with WPI systems and have TAs assist campers with less experience.

From January through April of 2004, a WPI Interactive Qualifying Project (IQP) team will be focusing on program development in several of the areas identified above.

Tables 7 and 8 summarize feedback from campers and staff about the design projects. Based on these results, we don't believe that any major adjustments will be needed for 2004. However, it is interesting to note that the campers' experience with the projects was substantially better at the end of the program than at the end of the first week. The difference may be due primarily to one team that had particularly challenging group dynamics issues, or it could be a natural consequence of realization in the first week that this camp does involve a lot of "work" and that reaching their goal seems a bit overwhelming. To address this, we can make an extra effort to emphasize how their work is helping their customer and providing positive reinforcement as they progress toward their overall goal. In addition, we can be even

more disciplined about constraining design project work to no more than half of each day, and trying to break down the work into tangible, feasible, short-term tasks.

Table 7: Participant Response to Design Projects*				
	Mean	Std. Dev.		
I am enjoying work on the design project (mid-program)	3.03	0.96		
I enjoyed working on the design project (end-of-program)	3.20	0.89		
I am learning a lot from the design project (mid-program)	2.93	0.91		
I learned a lot from the design project (end-of-program)	3.50	0.68		
I am contributing a lot to our team's project (mid-program)	3.43	0.63		
I contributed a lot to our team's project (end-of-program)	3.40	0.77		
We produced high quality results for our customer.	3.57	0.63		
The customer seemed happy with our work.	3.40	0.56		

\* Participants rated their level of agreement with each of these statements on a scale from 0 = Strongly Disagree; 1

= Disagree; 2 = Neutral; 3 = Agree; 4 = Strongly Agree.

Table 8: Staff Feedback about Design Projects*			
	Mean	Std. Dev.	
The project scope and topic seemed realistic and appropriate for this age group.	3.40	0.52	
The project provided an appropriate level of challenge for our team.	3.60	0.52	
I was comfortable with the level of guidance and support given by Chrys.	3.80	0.42	
I think our project team would have benefited from more guidance.	1.30	0.67	
It was easy to keep our campers focused and motivated on design project tasks.	2.40	0.47	
Each team member made a real contribution to the project.		0.84	
Roles for team members should have been more defined or structured.		0.63	
The team produced high quality results for the customer.	3.50	0.53	
The customer seemed happy with the results the team produced.	3.33	0.52	
The customer seemed knowledgeable about the project process.	2.67	1.0	
The design project was successful in teaching girls about problem solving using the engineering design cycle.	3.50	0.53	
Overall, the design project went well for our team.	3.60	0.52	

\* Staff rated their level of agreement with each of these statements on a scale from 0 = Strongly Disagree;

1 = Disagree; 2 = Neutral; 3 = Agree; 4 = Strongly Agree.

#### Recreation

The purpose of the recreational aspect of Camp Reach is two-fold: To build community among the participants, and to provide the girls with a much-needed break from the intensive academic focus of the camp. Recreational activities include ice-breakers during the first hours of the program and teambuilding activities to help the girls begin to rely on one another, to more stress-relieving activities such as swimming and crafts. The participants' ratings of these activities are found in Table 9. Based on these ratings, modifications will be made to the icebreakers and teambuilding activities for the 2004 program.

Table 9: Participant Ratings of Recreational Activities*			
	Mean	Std. Dev.	
Icebreakers	2.80	.714	
Teambuilding	2.97	.718	
Crafts Night	3.17	.834	
Swimming	3.80	.484	
Movie Night	3.20	.925	
Driving the Segway	3.77	.430	
Karaoke	3.67	.606	
Talent Show	3.70	.596	
Building a self-watering mini-garden	3.00	.587	
Making picture frames	3.00	.871	
Bowling	3.77	.430	
Ball games on the Quad	3.50	.731	

\* Participants rated their agreement with the statement "I enjoyed \_\_\_\_\_" for each of these activities on a scale from 0 = Strongly Disagree; 1 = Disagree; 2 = Neutral; 3 = Agree; 4 = Strongly Agree.

Related to recreation, participants evaluated food very highly (Mean = 3.53). They also rated their experiences living in the residence halls favorably (Mean = 3.47). We believe that having the girls live in the residence hall is a prime factor in their increase in self-esteem. The opportunity to live on their own, even for two weeks, teaches the campers self-reliance. The girls experience a good deal of homesickness throughout the program, but invariably when the program ends they don't want to leave.

#### New Initiative to Measure Long-Term Effects of Camp Reach

As described in previous annual reports, we have received much anecdotal evidence about positive long-term effects of Camp Reach from parents, teachers, and campers themselves, yet a more systematic investigation is desired. In December we submitted a pre-proposal to the National Science Foundation (NSF) to fund a three-year study that would be framed by the following research questions: 1) Does a single intervention in middle school have an effect on entrance into the college STEM pipeline? 2) To what extent, if any, are multiple interventions necessary to enhance entrance into the college STEM pipeline? 3) How does participation in an intervention program compare to other factors that influence choice of a college STEM major? The proposal was not funded by NSF, but we plan to go forward with the research this summer using the Camp Reach Memorial Fund (established at the request of Denise

Nicoletti's family). Using these initial results, we could be in a better position to reapply for funding from NSF or another agency.

This study is expected to overcome limitations and gaps in prior research. First, it will measure the most salient long-term outcome of an intervention program for middle-school girls: whether or not they ultimately choose a STEM college major. Previous evaluation of pipeline programs for girls has been limited to formative assessment or, at best, short-term summative assessment. Second, this study will use a true control group—girls who applied to Camp Reach but were not selected by the random lottery. To the best of our knowledge, no research on the effect of STEM intervention programs on girls has been conducted with a control group that takes pre-existing interest and self-selection into consideration. And lastly, we will be able to probe the influence of length of intervention. Camp Reach provides participants with opportunities for follow-up throughout middle school and high school. Currently there is little research comparing effectiveness of one-time programs, such as summer camps, versus longer-term experiences.

TIME	WEEK 1											
TIME	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY					
7.00	7/20/03	7/21/03	7/22/03	7/23/03	7/24/03	7/25/03	7/26/03					
7:30		Breakfast Morgan Dining Hall	Breakfast Morgan Dining Hall	Breakfast Morgan Dining Hall	Breaktast Morgan Dining Hall	Breakfast Morgan Dining Hall	Breakfast Morgan Dining Hall					
8:00			Optional Computer Time Atwater Kent 120d and Fuller Labs 222	Optional Computer Time Atwater Kent 120d and Fuller Labs 222	Optional Computer Time Atwater Kent 120d and Fuller Labs 222	Optional Computer Time Atwater Kent 120d and Fuller Labs 222	Pack for trip and relax in residence hall					
9:00		Introduction to Design Projects Atwater Kent 219	Forensics Workshop Congregate at end of brick walkway nearest to Goddard	Forensics Workshop Groups gather on brick walkway. Go to location of next	Automotive Engineering Workshop Intro: Atwater Kent	Rehabilitation Engineering Workshop (Mobility for the Disabled)	-					
10:00		Group 1: Computer Orientation Kaven Hall 202 Groups 2,3: Teamwork, Design a Birthday Party Atwater Kent 218	Hall. Divide into five groups and go up to Goddard Hall 311.	rotation station: Goddard Hall 311, 109a, or 110	219, then move to far end (shaded) of Library Parking Lot (rain location: WPI garage, 91 Prescott St.)	Higgins Lab 116	Bus leaves for Cape Cod In front of Alumni Gym Boxed Lunches Stop at Massasoit					
11:00		219					State Park					
12:00		Lunch Morgan Dining Hall	Lunch Morgan Dining Hall	Lunch Morgan Dining Hall	Lunch Morgan Dining Hall	Lunch Morgan Dining Hall						
1:00		Group 1: Teamwork, Design a Birthday Party Atwater Kent 219	Visits to customer sites Bus leaves from front of Alumni Gym	Forensics Workshop Goddard Hall 227	Design Projects Brainstorm alternatives Atwater Kent 218	Design Projects Evaluate alternatives using decision matrix Atwater Kent 218	Ocean Engineering: Visits to Woods Hole Oceanographic					
2:00	Registration In front of Daniels or in Wedge if rain	Groups 2,3: Computer Orientation Kaven Hall 202		Design Projects Gather information Atwater Kent 218, 219, 233	219, 233	219, 233	Institution (WHOI) Exhibit Center and Other WHOI Sites					
3:00	Welcoming Remarks Alden Hall	Break	Break	Break	Break	Break						
3:30	Campus Tours	All groups: Continue Birthday Party Design Brainstorm objectives for	Design Projects Develop problem statement and goal Atwater Kent 218, 219, 233	Design Projects Gather information and develop specifications Atwater Kent 218, 219, 233	Design Projects Atwater Kent 218, 219, 233	Design Projects Start preparing for Monday presentation Atwater Kent 218, 219, 233						
4:00	Orientation Parents: Alden Hall; Campers: On the Quad	Tuesday site visits Atwater Kent 218, 219, 233				Sandcastle Building Video Atwater Kent 219						
4:30	Parents depart											
5:00	Welcome BBQ Higgins House Courtyard	Dinner Morgan Dining Hall	Dinner Morgan Dining Hall	Dinner Morgan Dining Hall	Dinner Morgan Dining Hall	Barbecue with Alumnae Higgins House Courtyard (Rain location: Higgins House Great Hall)	Picnic Dinner (pizza)					
6:00	Ice Cream Sundae	Free Time	Free Time	Free Time	Free Time	Segway Demos and Karaoke	Overnight at First Congregational					
6:30	Building followed by Floor Meeting- get to know roommates and residential staff		Arts & Crafts/ Door Decorating / Picture Frames Odeum A	Swimming 6:30-8:30 pm	Movie Night Popcorn and drinks, Hagglund Room (6-9 pm) TA Night Out	Campus Center patio and stage area	Church Falmouth					
9:30	Lights Out	Lights Out	Lights Out	Lights Out	Lights Out	Lights Out	Lights Out					

## Appendix A: Schedule for Camp Reach 2003

WEEK 2											
TIME	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY					
	7/27/03	7/28/03	7/29/03	7/30/03	7/31/03	8/1/03					
7:30	Breakfast on our own at church	Breakfast Morgan Dining Hall	Breakfast Morgan Dining Hall	Breakfast Morgan Dining Hall	Breakfast Morgan Dining Hall	Breakfast Morgan Dining Hall					
8:00	Pack lunches	Optional Computer Time Atwater Kent 120d and Fuller Labs 222	Field Trip to Bose Bus leaves 8 am, in front of Alumni Gym	Optional Computer Time Atwater Kent 120d and Fuller Labs 222	Optional Computer Time Atwater Kent 120d and Fuller Labs 222	Optional Computer Time Atwater Kent 120d and Fuller Labs 222					
9:00	Sandcastle Building Workshop Old Silver Beach	GROUP PHOTO: AT THE FOUNTAIN Design Projects Finish preparing and practicing interim presentation Atwater Kent 218, 219, 233		Electrical Engineering Workshop: Building an AM Radio Atwater Kent 212A	Design Projects Finish written report, submit to Chrys Atwater Kent 218, 219, 233	Design Projects Fix any problems with final report Atwater Kent 218, 219, 233					
12:00	Lunch at beach	Lunch Morgan Dining Hall	Lunch Morgan Dining Hall	Lunch Morgan Dining Hall	Lunch Morgan Dining Hall	Lunch Morgan Dining Hall					
1:00	Bus leaves for home	Interim Presentations to Customers at Customer Sites. Bus leaves from front of Alumni Gym. (Flagg St. team will present in Campus Center, Morgan Boom.)	Design Projects Work toward completion of final recommendations	Design Projects How to write a report Atwater Kent 218, 219, 233	WPI Lab Tours and Demos (Rotation) Materials Engineering Washburn 245 Robotics Campus Center, Odeum C Biomedical Engineering Salisbury Labs 328	Design Projects Practice Oral Presentations Atwater Kent 218, 219, 233 – AK116 to practice in					
2:00		ochter, morgan room y		Design Projects Continue work on final design, report, and presentation		Parents Information Session Higgins Labs 116					
3:00		Break	Break	Break		Final Project Presentations Closing					
3:30		Design Projects Evaluate customer input and repeat problem solving cycle	Free Computer Time Atwater Kent 120d	Design Projects Atwater Kent 218, 219, 233		Ceremony Atwater Kent 116 (Newell Hall)					
4:00	Free time and phone calls home		FIRE PROTECTION ENGINEERING LAB TOUR Higgins Labs 026		Design Projects Atwater Kent 218, 219, 233						
5:00		Dinner Morgan Dining Hall	Dinner Morgan Dining Hall	Dinner Morgan Dining Hall	Dinner Morgan Dining Hall	Closing Dinner Campus Center Odeum					
6:00	Dinner Take-out food in residence hall	Free Time	Free Time	Free Time	Free Time						
6:30	Girls Night Facial masks, hair braiding, etc.	Mini-Gardens or Friendship Bracelets/ Hagglund Room/ Quad	Bowling (6:30-8:30 pm) TA Night Out	Swimming (6:30-8:30 pm)	Ball Games/ T-shirt Signing Quad	Departure					
9:30	Lights Out	Lights Out	Lights Out	Lights Out	Lights Out						