# Everything I know I learned in Kindergarten: Examples of Synergisms between K-12 Outreach and Recruitment and Retention of Women and Minorities in Engineering

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**Abstract**

Most people by now have heard (and probably chuckled at) the statement, "All I really need to know I learned in Kindergarten". While this may not be factually or chronologically accurate, it certainly embodies the spirit of *K-12 Outreach* in that it acknowledges that early and continued exposure to science and engineering are keys to getting and keeping students interested in science and engineering career s. In the Spring of 2003 the Oregon State University College of Engineering was awarded a grant from the Flora and William Hewlett Foundation for the specific purpose of recruitment and retention of students into engineering, and in particular women and minorities. Approximately one-quarter of the funds allocated in that grant were targeted for K-12 outreach activities, acknowledging the importance of early exposure to both recruitment and retention of women and minorities in engineering.

The influx of funding from the Hewlett grant had a significant impact on both the expansion of existing high school outreach programs (Summer Experience in Science and Engineering for Youth (SESEY) and Saturday Academy Apprenticeships in Science and Engineering) and allowed for the development of several new programs targeted primarily at K-8 students. The emphasis in these programs is on the delivery of science and engineering content in a way that is attractive to young people, and on the development of modules for dissemination to K-8 science teachers . The new programs developed and discussed are: 1) E-Camp, a one week, non-residential engineering camp for middle school girls and boys that attracted 26 students (11 girls, 15 boys,); 2) LEGO- Robotics, a one week, non-residential camp for middle school boys (20 students), and a separate mixed gender camp (6 girls/5 boys); 3) Advocates for Women in Science, Engineering and Math (AWSEM), an after school club for middle school girls with women undergraduate and graduate student mentors; 4) Spirited Kids in Engineering and Science (SKIES), an 11 week non-residential summer camp for K-8 students (approx. 400 kids) that used a "holistic learning" approach, turning a "traditional" summer sports/crafts day camp into an experience that "exercises" both the body and mind of kids throughout the "lazy days of summer".

Another significant development in Summer 2003 was the creation by the OSU College of Engineering of a Women and Minorities in Engineering program. It is here that the synergisms of the K-12 outreach programs and the recruitment and retention of women and minorities into engineering is starting to be realized. The same types of programs used in middle school engineering camps can be used to introduce first year students to engineering in a way that makes it "attractive and fun" for women and minorities. Undergraduate women engineering students involved with the summer programs serve as mentors for the first year students and present workshops and brown bag lunches to informally discuss engineering as it applies to daily life. All of these programs and experiences will be presented in such a way that they can be adapted at other institutions.

**Introduction**

Some fifteen years ago Robert Fulghum published a book with the catchy title, *"All I Really Need to Know I Learned in Kindergrarten,"* which at the time caused much chuckling around the office water coolers and local coffee shops. The book raises some very interesting questions and observations about the influences of early childhood on adult attitudes. While this title may not be factually or chronologically accurate, it certainly could be the "mantra" of practitioners of *K-12 Outreach* , in that it recognizes that early and continued exposure to science and engineering concepts are keys to getting and keeping students interested in science and engineering career s. In essence, it brings the "challenge" of recruitment into engineering down to the kindergarten level, well under the "radar screen" of most University educators and programs. While it is acknowledged that the Universities cannot "be everything to everyone" when it comes to recruitment of students into engineering, we would like to demonstrate the many synergisms and great potential for leveraging of K-12 outreach (often referred to as "informal education") to the University missions of recruitment and retention of engineering students. In addition, that these synergisms could be particularly strong for the targeted group of young women and ethnic minorities.

A fundamental concept that must be realized in attempting outreach is that there are both similarities to be exploited and differences to be recognized in the delivery of science content across K-12. The admittedly simple ideas that we have utilized are reflected in the goals that we have in the development of new programs. For simplicity and correlation to formal education, grade levels are used as designators for the various age groups, but it important to remember that these are "informal education" activities conducted outside the traditional classroom environment.

*Elementary level (grades K-5):* Goal is **exposure** to science content and vocabulary.
- example program – Spirited Kids in Engineering and Science (SKIES)

*Middle School level (grades 6-8):* Goals are continued **exposure** to science/engineering content and **reinforcement** of vocabulary and concepts.
-examples: E-Camp, Lego Camp

*High School level (grades 9-12):* Goals are **exposure** and **reinforcement** of science/engineering concepts, and **applicability** to daily life.
NOTE: The major challenge we have found with this age group is getting the AP chemistry, math, physics, and biology students (many of which are women) interested in engineering, which they consider to be a "shop based tech" life path.

*Community College or University (grades 12-14):* Goals are **reinforcement** of science and engineering concepts, **applicability** to daily life, and **career path.**

*Teachers (K-12):* Goals are **lifelong learning** (increased content knowledge and career information) and curriculum content development.

The synergism and leveraging opportunities occur when similar concepts can be used for delivery of content at each level, realizing the "grade appropriate" goals outlined above. A simple example that we have used is the AIChE Chemical Reaction Powered Car Competition (which is typically conducted by chemical engineering undergraduate students (http://students.aiche.org/events/chemecar.asp), which we have recently modified and used with a 1st grade class (http://engr.oregonstate.edu/momentum/k12/march04/index.html) as a science fair project. This same concept can be used in the informal education programs that will be discussed in the paper.

**Background – Women and Minorities in Engineering**
Over the last twenty years, women have made great progress in the biological sciences and have reached parity, or close to it, with men in medicine, veterinary medicine, and biological research. But Engineering remains a field dominated by men, and in fact, there has actually been a decrease in the percentage of women in this field over the last 15 years such that today just 8 % of professional engineers are female. *Table 1* shows the percentages of women earning their Bachelor's degrees in Engineering at Oregon State University as compared to the national rate. (Schrage, 2003)

**Table 1. Percentage of Women Earning Bachelor's Degrees in Engineering**

| | Oregon State University | National |
|---|---|---|
| **1966** | **0.5%** | **0.4%** |
| **1971** | **1.2%** | **0.8%** |
| **1976** | **2.8%** | **3.4%** |
| **1981** | **6.2%** | **11.1%** |
| **1986** | **15.3%** | **14.5%** |
| **1991** | **13.0%** | **15.5%** |
| **1996** | **10.6%** | **17.9%** |
| **2002** | **11.4%** | **18.0%** |

Over the past two decades, there have been many studies examining the paucity of women in engineering. Brainard and Huang (1999) have identified four major reasons for the lack of females in engineering:

- Lack of self confidence
- Lack of pre-college experience and knowledge in engineering
- Curricular focus and the climate in engineering
- Lack of females peers and role models

Although female students arrive at the University with higher grade point averages than men, they report lower levels of confidence in mathematics and science ability. Margolis and Fisher (2002) point out that in middle and high schools across America, the computer science curriculum reflects traditionally male interests and experience levels. The computer games on the market today appeal overwhelming to adolescent males and as a result, the classes and lunch time computer clubs are dominated by boys. Because of their high computer interest, Margolis and Fisher (2002) argue that parents are much more likely to purchase a home computer for their male child. Female students are less likely to have resources at home, or a peer computing community. This lack of access affects their confidence at using the equipment. Bottomley et al (1999) have conducted surveys with entering engineering students since 1995. They have found the freshmen female students begin college with less confidence in their ability to succeed in engineering than the freshmen males. Surprisingly, they find a consistent drop in the female students confidence levels in physics, even though they do not take a physics course during the freshman year. This drop in confidence levels continues throughout the college years. Comparable drops in confidence are not seen in the male students, indicating there is something different about the engineering experience for female and male students.

The gap in high school preparation in math and science between males and females is closing, but despite similar coursework, female students still lag significantly behind males in engineering. Margolis and Fisher (2002) speculate that the pre-college "tinkering" that is so common amongst male pre-engineering students leads to a greater comfort level in college courses. Many female students do not have this "tinkering" experience, and develop a drop in self confidence in laboratory classes. According to McIlwee and Robinson (1992), by not sharing the "culture of the tinkerer" the female students are placed at a disadvantage, and this further undermines their confidence in their engineering abilities.

The curricular focus and climate in the engineering college can be detrimental to many students (Seymour & Hewitt, 1997). Some researchers have found that the competitive structure, and "weed out" philosophy of engineering colleges is not attractive to female students. Women tend to choose majors that have a high degree of social interaction, and are perceived to be socially beneficial. The typically larger percentages of women in Chemical and Biological/Biomedical Engineering are testaments to this. Margolis and Fisher (2002) argue that the single-minded focus demanded in many engineering colleges is not attractive to many women who prefer a more balanced life, including hobbies, social interactions, and families.

The lack of female role models can lead to a feeling of isolation in the classroom. Tidball (1986) originated the idea of "critical mass." She found that institutions with greater numbers of women produced greater numbers of female PhD candidates. She identified structural changes that take place as the proportion of women in power increased.

Educating women to become engineers is critically important for the economy of the United States. Engineering is a creative profession which depends on collaboration between people to solve problems and create new products. When we lack diversity in those teams, we all suffer. The development of airbags is an example. Until they were in use in American cars, engineers did not anticipate that they could cause injuries and death to drivers under 90 lbs. Had women been on the design team, perhaps the body characteristics of females would have been considered.

What is it about the engineering profession that is unappealing to females? It has been hypothesized that female students are attracted to careers where they feel that they are helping people, or helping to improve society. They tend to go into careers where they will have human interaction. Engineering is perceived to be a solitary profession, with a life spent inside a cubical. The "reality" of the engineering workplace, highly interactive and people/group oriented in many cases, is very poorly understood by most pre-college students.

Recruiting female students to engineering involves educating the public about the work that engineers have done to improve the quality of life for all people. Students need to be taught about the advances in medical care that are only possible because of the work of biomedical engineers, or the safety devices that have been developed by industrial engineers. Enabling female students to work on engineering projects in collaborative teams will enable them to discover the way professional engineers work, and to experience the excitement of an engineering problem. We need to reach out to the elementary, middle, and high school teacher, and develop lessons and activities that do not perpetuate the stereotype of engineering, but delve into what the future of engineering can be. We need to involve professional women engineers as role models in the classroom, and use teaching techniques that no longer allow the male students to dominate in lab activities.

Unless we develop strategies to recruit and retain more female students into the colleges of engineering, we will all suffer. "We will suffer in opportunities lost, in products not developed, and in problems not considered." (William Wulf, 2003)

Oregon State University has developed programs to address the four identified issues affecting female retention and recruitment. They include mentoring, K12 outreach, social events to provide networking opportunities, and specialized classes exclusively for female students. This paper will focus on the synergisms between mentoring and K-12 outreach and how these activities have been promoted through recent activities funded through the Hewlett Foundation grant.

**K-12 Outreach Programs at Oregon State University**

In July, 2003, the College of Engineering at Oregon State University was one of several western Universities awarded a multiple year grant from the *Flora and William Hewlett Foundation* (referred to as the HF grant for simplicity) the recruitment and retention of engineering students, and in particular women and ethnic minorities. The majority of the funds awarded were for changes in the educational pedagogy of existing general engineering, math, and science courses taken by all college of engineering students in their first two years at OSU. However, approximately one-quarter of the funds allocated in the HF grant were targeted for K-12 outreach activities, acknowledging the importance of early exposure to both recruitment and retention of women and minorities in engineering.

There was already an active K-12 outreach community based at Oregon State University and loosely aligned as OSU Precollege Programs (PCP). The existing programs related to science and engineering are listed in *Table 2* and are briefly described in the Appendix.. While PCP has a modest annual budget for program development and maintenance, most of the listed programs have individual directors and are primarily self-funded through grants, program fees, and donations from companies and private individuals. The influx of funding from the Hewlett Foundation (HF) grant had a significant impact on both the expansion of existing OSU K-12 Outreach programs and allowed for the development of several new programs targeted primarily at K-8 students. These are listed in *Table 3*. An overview of the Hewlett Foundation Grant is given in *Table 4*.

**TABLE 2. Oregon State University K-12 Programs**

**K-8**

- Saturday Academy (Corvallis and Portland)
- SMILE - Science Math Investigative Learning Experiences (rural communities)
- Hydroville Project (SMILE associated program)
- Science Education PartnershipS (SEPS – Corvallis K-8)
- Adventures in Learning (2-week summer program for 5th-6th graders)
- Explorations (2-week summer program for 3rd –4th grades)
- KidSpirit (sports/arts summer camps – 11 weeks)

**HIGH SCHOOL**

- Saturday Academy ASE - Apprenticeships in Science and Engineering (statewide)
- SESEY - Summer Experience in Science and Engineering for Youth (nationwide)
- Science Connections (Portland)

**TABLE 3. OSU Precollege Programs created or expanded through Hewlett Foundation**

***Expanded***

- Saturday Academy ASE - Apprenticeships in Science and Engineering (high school))
- SESEY - Summer Experience in Science and Engineering for Youth (high school)
- Saturday Academy (middle school)

***Created (Summer and Fall 2003)***

- SKIES (Spirited Kids in Engineering and Science) – K-8 summer camp (11 weeks)
- E-Camp - middle school boys and girls engineering summer camp (1 week )
- Lego Robotics Camp - middle school boys and girls summer camp (1 week)
- AWSEM (Advocates for Women in Science, Engineering and Math) – middle school girls

**TABLE 4. Overview of the Hewlett Foundation Grant**
*An Integrated Learning Platform to Improve Engineering Recruitment and Retention*
PI: Dr. Toni Doolen, Industrial and Manufacturing Engineering
**Grant Specifics:**
- Hewlett Foundation Engineering Schools of the West Grant Initiative
- $1.1 M to OSU College of Engineering over three years (7/2003 – 6/2006)
  - $850K for faculty and student support; $250K for Outreach and Recruitment

*Goals*:
- Curriculum innovation to improve retention of engineering students
- Outreach activities aimed at recruiting women and minorities into engineering

The other significant activity that occurred in summer 2003 was the creation of the Women and Minorities Program in the College of Engineering and the appointment of Ellen Momsen as the first Director of that program. The mission statement for that program is both the *recruitment* and *retention* of women and minorities in engineering. Ms. Momsen has a background as a high school physics teacher and has worked with the OSU Physics Department to develop teacher training programs. The opportunity presented by the creation of this program is a coupling of the COE retention programs with the already strong recruitment activities on the OSU campus.

In particular, one of the most prevalent reasons for students, and in particular women and minorities, leaving engineering programs, is the lack of "connectivity" that these students feel towards the engineering field and their career aspirations through the often difficult and "dry" first two years of the program. The key synergism that has been exploited at OSU is the involvement of undergraduate students in the outreach activities as *teachers, mentors and advocates*. This "theme" of undergraduate students teaching and mentoring younger students, and often serving as role models for the younger students, is the cornerstone of all the outreach programs that have been developed through the Hewlett Foundation grant. In addition to being a great *recruiting* tool, it is an excellent *retention* tool. The mentoring students almost always feel a deeper connection to their chosen engineering discipline, and therefore are more willing to put up with some of the basic coursework because they can see applications to what they really would like to do with their careers. This may (and often does) include engineering major changes (to a different engineering field) but these are done early in the student's undergraduate career, and typically with good reason and counseling from knowledgeable sources. The mentoring students also form a "network of engineering friends" that is typically cross-disciplinary, which leads to summer mentors studying and socializing together during the academic year.

**K-12 Programs Enhanced or Created through the Hewlett Foundation Grant**
The most significant and immediate impact of the Hewlett Foundation Grant at Oregon State University was in the enhancement of existing and development of new programs on the OSU

campus in the summer of 2003. Described in the following section are the various K-12 outreach programs that have been enhanced or created at OSU which utilize this synergy of recruitment of new students into engineering and retention of existing engineering students through involvement in these activities. It is important to note in each of these programs, the establishment of a "mentoring tree": faculty -- graduate students – undergraduates -- high school students (ASE students). The overwhelming benefit is to the K-12 students in these programs, who are being exposed to science and engineering early in their lives and in a summertime environment that puts the learning into a new light. That is, learning science and engineering is now FUN! Some of the programs, SKIES and SESEY in particular, have developed a "holistic learning" approach which combines intellectual activities with recreational activities throughout the daily routine. Sometimes kids can't even tell if the are playing or learning science!

1. **E-Camp -- Middle School Engineering Camp July 21 – 25, 2003**
   Middle school students spend a week on the OSU campus exploring the many careers available in the field of engineering. Hands-on classes and activities each day feature bioengineering, chemical, civil, environmental, electrical, industrial manufacturing and mechanical engineering. Students work in laboratories to design, construct, and test models. They are introduced to "wireless technology" through the use of Personal Digital Assistants for data acquisition and analysis.
   - coordinators: Ellen Ford (Saturday Academy) and Skip Rochefort (ChE Dept.)
   - one-week, non-residential camp on OSU Campus
   - **S'03: 26 middle school students registered (15 boys, 11 girls)**
   - lead instructors: Joelle Bennett (EnvE Grad ) and Shane Brown (CE Grad)
   - instructors: Skip, Jason Hower, Eric Mock (ChE); Levi Bennett (ECE); Joe McGuire (BioE); Toni Doolen grad student (IME Lab); Danny Orianyk (ME grad): Celeste Baine (Women in Engineering).

2. **SKIES (Spirited Kids in Engineering and Science) June 16 – Aug. 29, 2003**
   Science and engineering activities for grades K-5 where kids explore chemistry, physics, math, life sciences, ecology and engineering in a fun, interactive and learning environment.
   - Skip Rochefort, Ellen Ford, and Karen Swanger (KidSpirit Program Director)
   - K-8, all summer on OSU Campus in collaboration with KidSpirit Program
   - 10 one week sessions all FULL (20 kids/class) – see flyer
   - **S'03: K-2: 200 kids; 3-5: 100 kids; 6-8: 60 kids: Total approx. 360 kids**
   - lead teachers: Joelle Bennett (EnvE), Jason Hower (ChE), Alicia Lyman-Holt (GK-12 grad student), David Pulitzer (GK-12 grad student).
   - teaching assistants: Emily Egging (ChE); Sarah Freilich Katy Volmert, and Rachel McKenna (2002 HS grads and former ASE students), Alia Mulder (ASE 2003)

3. **Lego Robotics Camp for middle school girls and boys July 28 – 31, 2003**
   LEGO Robotics platform is used to introduce students to programming and design in engineering. Students have fun making things out of LEGO pieces and learn about the "smart" bricks including the Mindstroms RCX. They work with a partner to put together

touch sensors and use a computer to teach the robot to follow a line, play a favorite song and do a victory dance at the finish. They move on to solving robotic challenges with modifications to hardware and software, like saving Oregon's forests by helping to put out "fires." They also see how the RCX can be used as a "process controller" that automatically controls the temperature in a box, similar to a home thermostat, and how robots are starting to be used in surgery.

- coordinators: Ellen Ford, Kith Levien, Skip Rochefort
- organizer and lead instructor: Keith Levien (ChE Dept.)
- one-week, non-residential on OSU Campus (ChE Dept. LEGO Lab)
- **S'03: 2 sessions: middle school boys (20); middle school mixed (6 girls/5 boys)**

**4. Summer Experience in Science and Engineering for Youth (SESEY)**
**July 13 – 18th, 2003**

SESEY is primarily for high school girls and ethnic minorities traditionally underrepresented in science and engineering, and for science, math, or physics teachers who are interested in developing curricular materials to promote engineering activities in their classrooms.

- Skip Rochefort and Michelle Bothwell (co-directors) and Ellen Ford (coordinator)
- 9th-11th graders, one week residential camp on OSU campus
- **S'03: 28 HS students (19 girls, 9 boys) from 5 states (OR, CA, KS, TN, WA)**
- Research Mentors: Skip (7 ChE projects); Joe McGuire and Michelle Bothwell ( 5 BioE projects); Goran Jovanovic (1 ChE project)and Chris Pastorek (Chem. project).
- student mentors: 7 ASE HS students and 12 ChE/BioE undergrads and grads

**5. Apprenticeships in Science and Engineering (ASE) June 16 – Aug. 23, 2003**

Saturday Academy's Apprenticeships in Science and Engineering (ASE) Program offers high school freshmen through juniors a chance to work with an engineer or scientist for eight weeks in a summer research experience.

- Skip Rochefort (ChE Dept. coordinator) and Ellen Ford (ASE coordinator)
- Research mentors: Skip (4 students); Goran, Keith, Joe M. (1 student each)
- **S'03: seven (7) HS students spend 8 weeks in ChE Dept. Laboratories**

Jocelyn Frey, West Albany HS, senior
Samantha Lewis, Thurston HS, (Springfield , OR), senior
Amy Harvey, Philomath HS, senior
Brianna Anderson-Gregg, Philomath HS, senior
Alia Mulder, Philomath HS, junior
Julia Parks, Corvallis HS, junior
Stephanie Dost, Columbia River HS (Vancouver, WA), senior

**6. Host the Apprenticeships in Science and Engineering (ASE) Program Mid-Summer Conference (MSC) July 11-12, 2003**

- Ellen Ford, Skip Rochefort, and Molly Schmitz (Portland Saturday Academy)
- **S'03: 150 high school students on OSU campus for two days of workshops.**
- many COS, COF, COE, CoAg faculty involved in presentations.

**7. AWSEM After-School Clubs for Middle School Girls**

AWSEM's (Advocates for Women in Science, Engineering, and Mathematics)mission is to create and support a network of science and technology practitioners, educators, and parents and community organizations committed to enriching opportunities in science and mathematics for young women. Middle school girls participate in hands-on activities, visit laboratories and work sites, interact with students and professionals, and discover the many career opportunities in engineering. The girls began meeting with OSU student mentors twice a month in January, 2004.

• Ellen Ford (Saturday Academy)

• Graduate and Undergraduate Student Mentors:

- Heidi Schmidt (BioE) and Emily Egging (ChE): lead coordinators

- Joani Kroon (ChE grad), Danielle Leiske (ChE grad), Joelle Gordon (EnvE grad), Wendy Schmidt (EnvE undergrad), Erin Beatty (BioE undergrad)

## ASSESSMENT OF PROGRAMS AND OUTCOMES

At the end of every day, one has to pose the unavoidable questions of the *impact* of all these efforts on the recruitment and retention of students into engineering. Assessment is a necessary but often difficult component of any educational endeavor, particularly for those of us who are not expert in this area. We are working with experts in the SMET assessment area to develop tools for informal and formal short term and longitudinal assessment. Some assessments are rather straightforward, such as counting retention of students in the undergraduate engineering programs, and in particular, focusing on recruitment and retention of women and minorities. Assessment in "informal education" settings such as outreach are often difficult because the participant pool is diverse and transient. In the end, the results may not be realized for many years to come. For those of us in the field, the assessments we make each day are in the eyes and smiles of the students that are "playing" at the "science learning game". These are not quantitative, but we know that in a qualitative but very real way, we are making a difference, and that's what keeps us moving forward in these endeavors.

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## Biographical Information

**SKIP ROCHEFORT** has degrees in Chemical Engineering from the UMass (B.S.), Northwestern (M.S.) and UCSD (Ph.D.). He has held several industrial research positions (Dow Chemical, Kodak, AT&T Bell Labs), and since 1993 he has been on the faculty in the OSU Chemical Engineering Department. He is an OSU Honors College faculty and has been recognized for his teaching and advising activities by ASEE, AIChE, and the OSU College of Engineering. His research interests for the last 25 years have been in all areas of polymer engineering and science, engineering education and K-12 outreach. He was recently named Director of OSU Precollege Programs.

**ELLEN MOMSEN** has degrees from UC Davis (undergraduate) and Cal State Dominquez Hill (MS and teaching credential). She has been a mentor teacher in the Los Angeles Unified School District, and science department chair in Oregon schools. She has been active in K12 science education for over 20 years. She was named Oregons first Physics Teacher in Residence in 2002, and spent the academic year at Oregon State University assisting in implementing modifications in the undergraduate Physics courses, and in pre-service teacher education experiences. In the Fall of 2003 she was appointed as Director of the Women and Minority in Engineering program.

**ELLEN FORD** has a degree in Elementary Education (B.S.) from UO. Ford has taught in the public schools at the elementary school and middle school levels. She has been the director of Saturday Academy at OSU since 1990, providing math and science study opportunities for middle and high school students. She has also served on community boards and committees to coordinate with schools and the business community and is an active member of Precollege Programs at OSU.

**KEITH LEVIEN** has an engineering science degree from Iowa State University (BS) and degrees in chemical engineering from the University of Wisconsin, Madison (BS and PhD). Between chemical engineering degrees he worked for four years at the Warrensville Research Center of SOHIO (now BP). His research is in reaction engineering, process control, optimization and supercritical fluid technology. Levien has taught process dynamics, control and reaction engineering since coming to OSU in 1985. In 2001 he introduced the LEGO® RCX microprocessor into upper division process dynamics and control course laboratory experiences. He also incorporated the RCX, as part of the LEGO® Mindstorms™ set, in project-based design and programming activities in the first-year course "Chemical Engineering Computations". In addition, he has used this equipment in engineering outreach activities for middle school students. These efforts have been particularly successful in introducing girls to engineering design and computer programming based on this "user friendly and fun" platform.

**APPENDIX: SMET Related OSU Precollege Programs**

**Precollege Programs and Camps**

Dr. Skip Rochefort, Director, Precollege Programs
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**Saturday Academy**

Ellen Ford, Director and Nancy Wortman, Classes Program Director
oregonstate.edu/precollege/academy/
Saturday Academy is a nonprofit community-based program for 5th-12th graders, offering enriched educational opportunities, especially in science, math, and technology. Saturday Academy offers in-depth, motivating, real-world classes and workshops that supplement regular school curriculum. Classes are taught by experts in the community and held at the host business, college, or agency. Classes are small, hands-on, informal, and project-oriented.
Saturday Academy is open to all motivated students. Summer tuition is usually $20-$30 per class; assistance is available, and no student will be turned away due to financial need. Summer fliers will be available in May.

**Saturday Academy's ASE Program**

Saturday Academy's Apprenticeships in Science and Engineering (ASE) Program offers high school freshmen through juniors a chance to work with an engineer or scientist for eight weeks during the summer. Students also attend workshops, seminars, lectures, and leadership classes at the Mid-Summer Conference in July. At a symposium in August, students will present their work in a poster session and during oral presentations at Portland State University.

**Saturday Academy Summer Computer Workshop**

Saturday Academy will host computer workshops during the weeks of August 9 and August 16, 2004. The four workshops will provide opportunities to learn computer basics, Web page and Internet searches, multimedia presentations, and animation.

**Engineering Camp for Middle Schools Students**

Saturday Academy and the College of Engineering will host an engineering camp for middle school students during the week of July 19-23, 2004. Students will receive hands-on instruction in several engineering disciplines.

**Lego Robotics Workshops for Middle School Boys and Girls**

Saturday Academy and Keith Levien from the Department of Chemical
Engineering will host activities using the LEGO Robotics platform to introduce students to programming and design in engineering. Middle school boys 9 – 12 noon. Middle school girls 1 - 4pm. July 26-29, 2004.

**Adventures in Learning**
Judy Michael and Sarah Tuttle, Co-Directors
oregonstate.edu/precollege/ail/
Adventures in Learning combines stimulating academic and social opportunities in a fun-filled ten-day experience that exposes participants to exciting and sophisticated areas of interest not usually found during the regular school year. The program is designed for gifted, talented and creative learners who complete grades 5-7 during the 2003-04 school year and are interested in fast-paced, challenging opportunities.

**Expeditions**
Carol Brown, Coordinator
oregonstate.edu/precollege/expeditions/
Expeditions is a two-week, half-day educational experience for gifted, talented, and creative youths who completed grade 3 or 4 during the 2002-03 school year. Courses are taught by experts in a variety of topics of interest to TAG students.

**Summer Experience in Science and Engineering for Youth (SESEY)**
Skip Rochefort and Michelle Bothwell, co-directors
Skip@engr.orst.edu
http;//che.oregonstate.edu/SESEY/

SESEY is primarily for high school girls and ethnic minorities traditionally underrepresented in science and engineering, and for science, math, or physics teachers who are interested in developing curricular materials to promote engineering activities in their classrooms.
Students come to the OSU campus for a one-week residential summer camp and are paired with a faculty mentor in engineering for a mini-research project in areas such as microscale technologies, plastics recycling, drug formulation and delivery, bioprocessing, microelectronics, and environmental engineering. There are also group learning activities (computer instruction, communication skills, field trips) and social activities. Students are exposed to science and engineering as viable and interesting career paths. Career counseling is provided by faculty mentors and OSU graduate and undergraduate students who work with the students throughout the week as research project advisors and friends. Students live in OSU housing, so they receive a complete college experience.
The main goal for science teachers during the week is the development of engineering modules, which they create with a faculty mentor and take back to their high schools to present in science classes.
Fee: $100 for the week (includes room and board, field trips, materials, and instruction) due after acceptance into the program. Students are responsible for getting to and from OSU. Scholarships are available so no student will be excluded because of financial constraints.

**STARS 2004: Study Techniques, Academics, and Research Skills**
For SMILE high school graduates and a limited number of other ethnic minority students entering OSU. STARS is an eight-week summer academic program for SMILE high school

graduates and a limited number of ethnic minority students who plan to enter the OSU College of Science the following fall term. The purpose of STARS is to help these students make a successful transition to OSU. STARS students live on campus and take regular college classes during the summer.

**OSU KidSpirit Summer Day Camp**
Grades: K-8th
Eleven One-Week Sessions June 14-August 27
Coordinators: Karen Swanger/Katie Ekstam
kidspirit@oregonstate.edu
http://kidspirit.oregonstate.edu/

KidSpirit, sponsored by the College of Health and Human Sciences, is an innovative youth summer day camp program Monday-Friday for children grades K-8. Children may attend morning, afternoon, or all day. Programs are based on grade level. All activities are coeducational.

Junior Beavers, grades K-2, have an established daily program with variations in class offerings from session to session, including skill development and supplementation in recreational sports such as basketball, gymnastics, swim lessons, T-ball, and arts. Dam Builders, grades 3-8. Offerings include archery, art, basketball, bowling, ceramics, gymnastics, rock climbing, soccer, swim lessons, and much more. Group leaders will help in classes and escort the children to activity areas. Head instructors plan, organize and lead activities.The camp staff emphasizes skill development, group cooperation and socialization, safety, and fun.

**SKIES- Spirited Kids In Engineering and Science**
Coordinators: Skip Rochefort, Karen Swanger and Ellen Ford
Classes run in conjunction with the OSU KidSpirit Summer Day Camp program.
Science and engineering activities for grades K-5 where kids will explore chemistry, physics, math, life sciences, ecology and engineering in a fun, interactive and learning environment. Science activities will be mixed with physical activities throughout the AM or PM session. SKIES is offered as a collaboration by Chemical Engineering, Saturday Academy, and KidSpirit funded through a grant from the **Hewlett Foundation** to the OSU College of Engineering.