

Recruitment and Advising of High School Students from “non-traditional” Groups

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ABSTRACT

The **Summer Experience in Science and Engineering for Youth (SESEY)** program was initiated in the summer of 1997 with the goal of promoting ethnic and economic diversity in the science and engineering fields through the recruitment of underrepresented minority high school students. Offered as a collaboration between Chemical Engineering and Biological Engineering at Oregon State University, the program has two primary focus groups:

1) traditionally underrepresented students (ethnic minorities and women) who have completed their freshman, sophomore or junior years in high school, and who have an interest in math and science, and 2) science, math, and physics teachers at High Schools which have a substantial population of the student focus groups.

The two groups (target of 20 students and 5 teachers) are brought to the Oregon State University campus for a one-week summer camp (all expenses paid) where they are paired with a faculty mentor in engineering for a one week mini-research project. There are also group learning activities (basic math and science instruction; computer training; field trips) and group social activities. For the students, the emphasis is on exposure to engineering and science as a viable and interesting career path. Career counseling is provided by faculty mentors, and the undergraduate and graduate students who work with the students throughout the week as research project advisors and friends. The culmination of the weeks' research projects is a poster presentation by the students at the “*da Vinci Days Festival of Science and Technology*” held each July in Corvallis.

The main goal for the science teachers during their one-week stay is the development of “engineering modules” -- plastics recycling; semiconductor processing; pulp and paper processing; high strength materials; etc., which they develop with their faculty mentor and bring back to their respective High Schools to present to the students in their science classes. This effectively serves as an outreach program for both science and engineering recruitment, and the SESEY program.

A SESEY Home Page was created by Jake Fitzpatrick, one of the SESEY participants, and can be viewed at the following **URL:** <http://www.che.orst.edu/SESEY/>

BACKGROUND

Oregon State University was established as a Land Grant University to serve the educational needs of the state of Oregon. OSU is the premier engineering institution in the state, and as such is given the mandate of providing a skilled work force in technologies important to the state's major industries. Over the past few years several electronics industry giants have announced major capital outlays, with accompanying increases in new employment, in the state of Oregon. The “*Silicon Forest*” is growing rapidly in Oregon and Oregon State University must respond to meet the challenge of providing a **diverse** work force to meet industrial needs.

SIGNIFICANCE of the SESEY PROGRAM

The goal of the SESEY program is to promote ethnic, economic, and cultural diversity in the science and engineering work force of the future by recruiting promising **underrepresented minorities** to these disciplines. In the state of Oregon and in the College of Engineering at OSU, this targeted group of underrepresented minorities includes ethnic minorities (African-American, Native American, Hispanic, and multi-racial) and women.

The 1995-96 enrollment statistics for the Oregon State University indicated that of the 11,280 undergraduate students enrolled, 44.2% are women and 7.5% are ethnic minority (excluding Asians/Pacific Islanders). In the College of Engineering, for a total enrollment of 2,190 undergraduate students these numbers **decrease to 12.8% women and 3.6% ethnic minority**. Thus, it is obvious that a serious effort must be made to first recruit a more diverse group of High School students, and secondly, to increase retention of those students in the COE. In Oregon, the primary ethno-centric areas are the Portland metropolitan area (African-American), rural eastern Oregon (Native American), and the Willamette Valley and southern Oregon (Hispanic). The program directors have worked with the well-established and OSU based SMILE and Saturday Academy High School programs to recruit from these ethnic groups, as well as women of all ethnicity.

SESEY PROGRAM DESCRIPTION

General Plan

The plan for the SESEY program was a one week summer science camp for underrepresented high school students and teachers, which began in Summer 1997. The two groups (24 students and 1 teachers in **Year 1**) were brought to the Oregon State University campus for a one-week summer camp (all expenses paid) where they were paired with a faculty mentor in engineering or science for a one-week mini-research project. There were **group learning activities** (basic math and science instruction; computer training; field trips) and **group social activities** (BBQ, softball, swimming, etc.). For the students, the emphasis was on **exposure to engineering and science as a viable and interesting career path**. Career counseling was provided by faculty mentors, and the OSU students who worked with the HS students throughout the week as research project advisors. The main goal for the **science teachers** during their one-week stay was the development of an **engineering module** (s) -- plastics recycling; semiconductor processing; pulp and paper processing; wastewater treatment; etc., which they would develop with their faculty mentor and bring back to their respective High Schools to present to the students in their science classes. This effectively serves as an outreach program for both science and engineering recruitment, and the SESEY program.

Program Details

1) Year #1 Program Dates

The week long program was held the third week of July, 1997. Participants arrived on Sunday evening and left the following Saturday afternoon. The actual dates were chosen such that the last days of the program (Friday and Saturday) corresponded with the **start** of the **"da Vinci Days Festival of Science, Technology, and Innovation"**, which is an annual event held in Corvallis and on the OSU campus. This coordination serves the dual purpose of allowing the students to explore the festival activities which promote science, as well as providing community exposure for the SESEY program.

2) Research Project

The students were assigned a faculty mentor (2 students per faculty) and a graduate or undergraduate student "colleague" to work on a mini-research project which could be brought to completion in one weeks time. At the end of the week, the students were required to make a poster and give a brief presentation to the entire group describing their project. The posters were then be put on display as part of the SESEY exhibit at the **da Vinci Days Festival**.

The High School teacher was assigned to a faculty mentor in an area in which he wanted to prepare a **curriculum module** for use in his high school classroom. The main goal for the High School teacher was to have a working module to return to his classroom with that promotes some aspect of engineering. He was encouraged to maintain contact with the faculty mentor upon return to the high school, given career counseling information which he could pass along to his students, and was made aware of various student groups (AIChE and TAPPI Student Chapters) that he could contact to conduct engineering outreach programs at their schools. It is envisioned that each high school teacher could become a focal point for engineering recruitment at their respective high schools, so maintaining a "lively" contact with the teachers will be a primary responsibility of the faculty mentors and program directors.

3) Group Learning Activities

In addition to the mini-research project that each student was responsible for completing, there were a number of group learning activities conducted during the week. The following is a partial list, which may be altered according to students needs and interests:

- **computer training:** internet (email and WWWeb browsing); word processing, database, and presentation software training. OSU student mentors will be primarily responsible for assuring the computer literacy of their high school student over the period of the week. The OSU Chemical Engineering Department has a new \$100,000 computer facility with a network of 25 pentium based computers, several MAC based models, printers, scanners, etc. with complete internet access.
- **basic math and chemistry skills:** the students will be evaluated and given instruction as necessary. Computer modules will be used to allow students to focus on individual deficiencies.
- **field trips:** OSU Hatfield Marine Science Center and Oregon Coast Aquarium (mid-week trip). There are also several industrial colleagues nearby which are possible 2-hr field trip plant visits: HP-Corvallis (Ink Jet Printer Division); NYPRO Plastics (custom injection molding); several Pulp and Paper mills.

4) Group Social Activities

Engineering is not all work -- in fact most of it is fun and games! Another primary component of this program is to promote diversity education, and social activities are a very important part of braking down communication barriers and promoting cultural interactions. A number of social activities have been considered and will be made available to the students and teachers. Activities will be arranged according to group interests.

- OSU Dixon Recreation Center: swimming, basketball, volleyball, weight room, etc.
- Memorail Union Game Room: pinball, bowling, pool, music.
- videos (evenings in the dorms -- student selected videos)
- computer room: email, WWWeb access, and a number of computer games (to help break-down any computer phobia the students may have)

SUMMARY -- 1997 SESEY Program

In the summer of 1997, twenty-four high school students took part in a one-week research experience at Oregon State University through the **Summer Experience in Science and Engineering for Youth (SESEY)** program. SESEY was funded through a grant from the Camille and Henry Dreyfus Special Grants Program and the OSU Summer Session and Pre-College Program Office. The SESEY program was created to attract girls and minorities traditionally underrepresented in engineering to OSU and careers in science and engineering. The summer 1997 SESEY group consisted of 19 girls and 5 boys from across the state of Oregon (of which there 8 ethnic minorities), ranging in class from 9th to 11th grade. In addition, one high school science teacher participated in the program.

The week-long program included hands-on participation and completion of a supervised research project, workshops on oral and written presentations and computer skills (including email correspondence with OSU President Paul Risser!), and a variety of social activities including use of the Dixon Recreation Center and a trip to the Oregon Coast Aquarium for a "behind the scenes"

tour of the engineering facilities. Students were grouped in pairs and placed according to their interests in twelve (12) research projects. Each of the projects was headed by a faculty mentor and either a graduate or undergraduate student advocate. Six projects were in biological engineering and covered topics including drug formulation and delivery, down-stream processing in biotechnology, and the use of constructed wetlands for wastewater treatment. The balance of the projects were in chemical engineering and covered areas such as spin coating on silicon wafers for microelectronics applications, supercritical fluid extraction of oils from peanuts, superabsorbent polymers in diapers, saving Oregon's historic bridges from corrosion, gel beads for use in outer space (zero-gravity), and the formulation of the new ORBIT2 drink with gel beads.

Every effort was made to provide the students with a research experience involving concepts or techniques of commercial or social significance which would have some meaning to them. All twelve of the projects were completed, analyzed, and presented to the group of SESEY participants and mentors in a standard "meeting format". The final event of the week was a Saturday morning brunch and "poster session" with all the parents and friends. All of the posters were then placed on display in the COE's "Road of a Thousand Wonders" tent at the annual Corvallis da Vinci Days Celebration of Science and Technology. This inaugural offering of the SESEY program received excellent positive feedback from students, mentors, and especially parents of the participants, and we expect that the SESEY program will become an "annual summer event" on the OSU calendar. The 1998 SESEY program is slated for July 12 - 18. A SESEY Home Page was created by Jake Fitzpatrick, one of the SESEY participants, and can be viewed at the following URL: <http://www.che.orst.edu/SESEY/>

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BIOGRAPHICAL INFORMATION

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B.S. ChE University of Massachusetts (Amherst), M.S. ChE Northwestern University,
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Research interests in polymer materials characterization and processing, and undergraduate engineering education.

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B.S. Purdue University, Department of Agricultural Engineering

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Research interests are in the general area of biointerfacial phenomena, particularly as it relates to biomedical and bioprocess technology, and in issues relevant to engineering education reform (enhancing diversity and building community among students, teachers and industrial partners).

I. PRE-ARRIVAL QUESTIONNAIRE (to be returned one week prior to camp)

Name: _____ Date _____
Hometown _____ State H i g h S c h o o l _____
1) High School Activities, Clubs, etc.
2) Favorite activities, hobbies, interests
3) Previous summer camps (names, topics, dates)?
4) Computer and Software Experience [rating: 0 (none) - 5 (excellent)]
Macintosh P C W i n d o w s _____ O t h e r _____
Internet: email _____ WWWeb _____ Home Page (html)? _____
5) Have you ever visited the Oregon Coast Aquarium? Yes _____ NO _____
6) Do you have any "special requests" (visit soccer coach, specific engineering dept., etc.) ?

LAB PROJECT SELECTION -- Indicate TOP THREE choices by #1, #2, or #3.

- _____ Wired -- Saving Oregon's Historic Bridges from a "Rusty" Demise
- _____ Investigation into the effects of cell growth environment on cell function in culture
- _____ The design of constructed wetlands for treatment of wastes
- _____ Bioproduct recovery through the use of column chromatography
- _____ Supercritical Fluid Extraction -- decaffeinated coffee to biocides in telephone poles
- _____ Drug formulation and release mechanisms
- _____ The study of enzyme kinetics in our daily lives
- _____ Gels in our lives -- timed release drug delivery to the new ORBITZ gel bead drinks.

II. STUDENT ORIENTATION QUESTIONNAIRE (arrival meeting)

- 1) Do you have any "special requests" (visit person, department, facility, etc.) ?
- 2) Do you have any special dietary requirements (vegetarian, no cheese, meat, fish, etc.)?
- 3) What are your favorite PIZZA toppings?
- 4) What are your favorite beverages (be specific -- pepsi, diet coke, OJ, Snapple flavor, etc.)?

LAB PROJECT SELECTION -- Indicate TOP THREE choices by #1, #2, or #3.

- ChE = Chemical Engineering BRE = Bioresource (Biological) Engineering
- _____ Wired -- Saving Oregon's Historic Bridges from a "Rusty" Demise
(Dr. Milo Koretsky, ChE)
 - _____ Investigation into the effects of cell growth environment on cell function in culture
(Dr. Frank Chaplen, BRE)
 - _____ The design of constructed wetlands for treatment of wastes
(Dr. Michelle Bothwell and Dr. Joe McGuire, BRE)
 - _____ Bioproduct recovery through the use of column chromatography
(Dr. Ajoy Velayudhan, BRE)
 - _____ Super-critical Fluid Extraction -- decaffeinated coffee to biocides in telephone poles
(Dr. Keith Levien, ChE)
 - _____ Drug formulation and release mechanisms
(Dr. Michelle Bothwell and Dr. Joe McGuire, BRE)
 - _____ The study of enzyme kinetics in our daily lives
(Dr. Michelle Bothwell and Dr. Joe McGuire, BRE)
 - _____ Superabsorbant Polymers -- How Disposable Baby Diapers have changed our lives.
(Dr. Skip Rochefort, ChE)
 - _____ Using computers to design aquaculture systems.
(Dr. John Bolte, BRE)
 - _____ Gels in our lives -- timed release drug delivery to the new ORBITZ gel bead drinks.
(Dr. Skip Rochefort, ChE)
 - _____ Design of Neutral Buoyancy Gels for Transport Studies in Space Applications.
(Dr. Goran Jovanovic, ChE)
 - - - Spin Coating of Fluids on Silicon Wafers -- the beginnings of Pentium microprocessors.
(Dr. Skip Rochefort, ChE)

III. SESEY 1997 STUDENT PROGRAM EVALUATION

Name (optional):

Research Project:

Mentor(s):

Please rate the following activities according to their value to you (most (5) to least (0)).

RESEARCH PROJECT

Lab Experience	5	4	3	2	1	0
Oral Presentation	5	4	3	2	1	0
Poster Presentation	5	4	3	2	1	0
Group work	5	4	3	2	1	0
Mentor and student advocates	5	4	3	2	1	0
Overall Research Project Experience	5	4	3	2	1	0

TECHNICAL WORKSHOPS

Careers in Engineering	5	4	3	2	1	0
Poster Presentation (Graphic Designer)	5	4	3	2	1	0

COMPUTER ACTIVITIES

email correspondence	5	4	3	2	1	0
WWWeb	5	4	3	2	1	0
Word, Powerpoint, EXCEL	5	4	3	2	1	0
Computer activities (overall)	5	4	3	2	1	0

SOCIAL ACTIVITIES

Oregon Coast Aquarium	5	4	3	2	1	0
Tide Pools and Beach BBQ	5	4	3	2	1	0
Dixon Rec. Center	5	4	3	2	1	0
Recreation Center Evening (bowling, pool, etc.)	5	4	3	2	1	0
Weatherford Dining Hall	5	4	3	2	1	0
Group Lunches	5	4	3	2	1	0
MusicScope Performances	5	4	3	2	1	0
da Vinci Days	5	4	3	2	1	0

“TOSS-UP” QUESTIONS

- 1) Did you find your project both interesting and accessible? In other words, did you have fun and understand what was going on?
- 2) Was the amount of time spent on actual “hands-on research” compared to that spent on computer work (e-mail, etc.), poster & oral presentation preps, meetings, etc. a good balance (i.e., was your project too long or too short)?
- 3) Did you have the appropriate resources (equipment, supplies, help, etc.) available so that you could work efficiently?
- 4) If you had to reorganize the basic daily schedule that was followed (group morning meeting, lab work, group lunch, lab work until 4 pm, free time, some evening activities, etc.), what would you change?
- 5) Briefly describe your relationships with your mentors. Were your mentors supportive, available, helpful, etc.?
- 6) Your evenings were mostly free. Was that a good thing, or should we try to incorporate more structured science and social activities?
- 7) Did SESEY help you to get a better idea of career opportunities in science and engineering? Would you now consider engineering as a career? Which field of study are you currently most interested in pursuing and was that influenced by SESEY?
- 8) After a week at OSU, what are your general impressions of the university? Would you consider OSU for your college career? Why or why not and was that influenced by SESEY.

COMMENTS: Please give an honest appraisal of the strong and weak points of the SESEY program (i.e., what worked well and what could we do better).