

A History of Society of Women Engineers (SWE) at Berkeley

By Jing Jin, '2023

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Early History of Women at UC Berkeley

In 1870, the UC Regents unanimously admitted women students based on the idea of “on equal terms, in all respects, with young men” The same year, the University of California opened its doors to women students, only two years after its founding, and UC Berkeley became one of

the first institutions of higher education in the nation to have such a policy” (Douglass, 44). In 1873, when the university relocated to the Berkeley campus, only 22 of 191 students were women, including undergraduates and graduates (Stadtman, 212-213). Rosa Scrivner, the first woman admitted to Berkeley, earned a degree in agriculture in 1874.

From 1870 to 2020, because of the small number of women enrolled in engineering, the glorious achievements of women undergraduate and graduate students over 150 years are sometimes overlooked in the history of Berkeley. In the 1970s, women engineering students recognized the importance of sharing encouragement, inspiration, and solidarity with like-minded peers in the traditionally male-dominated field. They believed that behind a powerful woman was a group of powerful women. They knew that they could accomplish much more as a group than as isolated individuals to make a difference in the engineering world. Chartered in 1974, the Society of Women Engineers, UC Berkeley section, has worked as an organization to support the growth and development of women engineering students at Berkeley for more than 45 years.

The Establishment of Society of Women Engineers

Before World War II

Elizabeth Bragg was the first woman who received a bachelor’s degree in engineering from an American university (Society of Women Engineers). She earned a B.S. degree in civil engineering from the University of California, Berkeley, in 1876. However, she never worked as a professional engineer after graduation. In 1894, Julia Morgan graduated from Berkeley with a degree in civil engineering and became the first woman architect licensed in California (Wilson et al., xv). Troy Eller English, the archivist at National SWE, observed, “It was rare for more than one woman a year to receive an engineering degree nationwide from 1876 until 1900” (Society of Women Engineers; Personal communication). In fact, by 1968, women were awarded only 0.2 percent of Ph.D. degrees in engineering in the nation and no more than one percent of the undergraduate engineering degrees until 1972 (Layne).

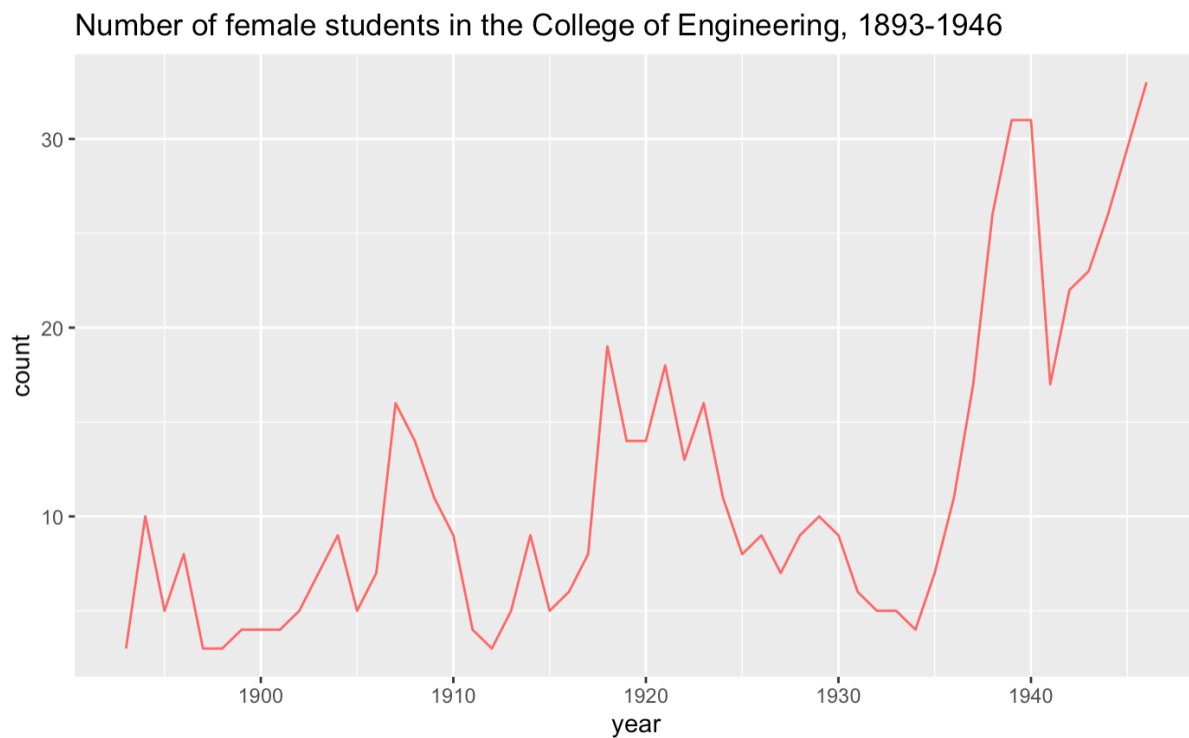
In the early 1900s, women who did not study engineering in college could also contribute to the engineering profession. Lillian Moller Gilbreth, instrumental in the founding of industrial

engineering, graduated from Berkeley with a degree in English in 1900 and earned a Ph.D. in Applied Psychology from Brown University in 1915. She was one of the first working women engineers with a Ph.D. and the first woman elected to the National Academy of Engineering (Society of Women Engineers). She was often referred to as the “first lady of engineering.” She strongly advocated abolishing age and gender barriers in employment (Landis). However, despite the accomplishments of a variety of women engineers, in the first half of the twentieth century, “Women in engineering were perceived as oddities, defying gender norms” (Society of Women Engineers).

Before and after World War II, 1935 - 1949

According to Laura Puaca, an Assistant Professor of History and Director of the Minor Program in Women’s and Gender Studies at Christopher Newport University, “World War II played a critical role in opening opportunities to women in engineering. Wartime demands for technically trained workers, coupled with the scarcity of male students and engineers, contributed to the increasing admission of women in colleges and the widespread recruitment of women in the industry.” During WWII, at U.S. institutions of higher education, the enrollment of women increased by seventy-five percent. Twenty-nine previously all-male engineering schools began to admit women (Puaca; Cardozier, 117). Women students started to enroll in engineering and science classes actively. In 1943, Harvard University permitted female students to attend classes for the first time (Dorn, 540). Smith College administrators recorded “a 33 percent rise in the number of women enrolled in mathematics courses, a 68 percent rise in chemistry, a 38 percent rise in physics, and a 70 percent rise in statistics” (Fine, 7). In 1940-1945, 181 women across the nation received engineering degrees from colleges, reaching an all-time high (Puaca; Turner, 122).

Between 1940 and 1946, the number of women at UC Berkeley who received degrees in mathematics doubled. According to the data collected by Dorn from the Registrar’s Office of the University of California, in 1945, the number of women enrolled in the engineering departments increased from two to thirty-eight (541).



Data source: Zachary Bleemer

In 1942, Morrrough P. O'Brien, the Chairman of the Mechanical Engineering Department, invited women who had completed one year of college work and three years of mathematics at high school to take qualifying examinations for a full-time engineering drawing course at Berkeley. According to O'Brien, "the program was the first of several 'courses for women' specifically designed to meet the nation's defense needs (Dorn, 541; "Women Will Take Exams in Engineering", 20)." Approximately 364 women received engineering training during the first year of the program ("Women Train as Drafters", 3). "Virtually every woman" who had accomplished the drawing course received a job offer from a Bay Area war production factory (Sibley, 10).

However, after the war, women were discouraged from entering the industry because of the obligation to return to homemaking. The percentage of women on the assembly lines fell from 25% to 7.5% when the war ended (Society of Women Engineers). In 1994, 144,700 women worked in California's heavy industry, but only 37,000 remained by the end of 1945 (Chafe, 159).

Founding of National SWE (in 1950)

The postwar emphasis on domesticity aggravated the entrenched stereotype that women should stick to conventional pursuits instead of attempting to find a place in the male-dominated profession of engineering (Puaca). In response to the postwar backlash, between 1945 and 1949, several groups of women in New York, Philadelphia, Boston, and Washington, D.C. emerged independently. All of the groups happened to call themselves “Society of Women Engineers.” On May 27, 1950, 65 women engineers and engineering students met in New Jersey at the Green Engineering Camp of The Cooper Union. The first national gathering marked the inception of the Society of Women Engineers, an organized, united, and unique society for women engineers. Los Angeles SWE (Chartered February 7, 1953) was the first section to the west of the Mississippi River. The Society of Women Engineers expanded its influence from the east to the west and thus became a truly national organization (Society of Women Engineers).



SWE's Inaugural Meeting at the Green Engineering Camp of The Cooper Union back on May 27, 1950

Society of Women Engineers at Berkeley since 1974

“1974 was not a welcoming time for women engineering students at Berkeley,” reported by Charlotte Tyson. Tyson is in her “encore” career as a Certified Financial Planner. She was the second president of Berkeley SWE. She described her personal experience of isolation and bias against women as a student in engineering classes.

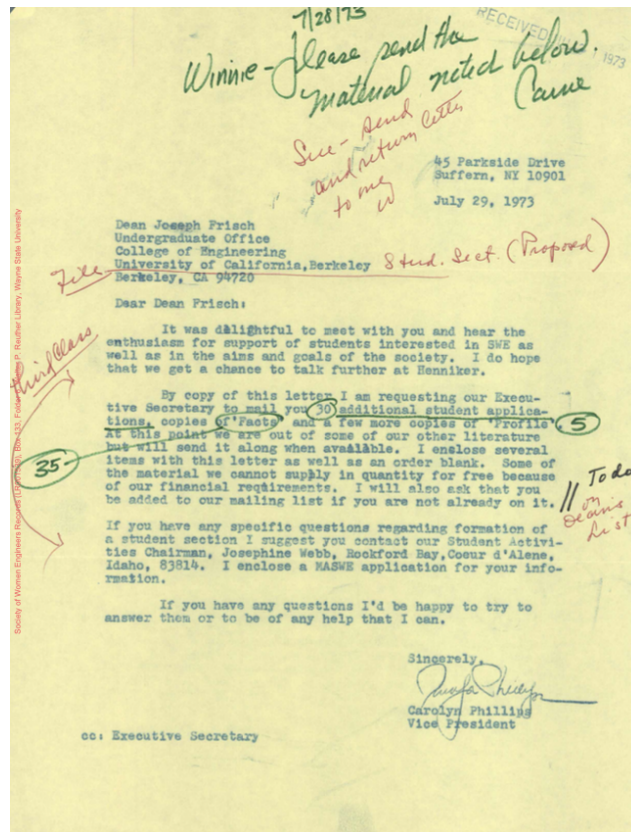
“In my first circuits class as a junior at Berkeley, after transferring from De Anza College in Cupertino, I chose to sit near the back of the deep, narrow classroom with individual desk seats. As the room filled with other students and the professor started teaching, I realized that I was sitting on an island in a sea of empty seats. The other seats in the classroom were filled with male students, but as the lone female, all seats adjacent to me in every direction were empty! I was unsure if it was due to my gender or because I was new, but it was unsettling to be avoided so completely. My gender awareness also led to a habit that I continued throughout my engineering program: I only listed my first initial and last name on homework and tests so that I would not be as easily labeled as ‘that dumb female’ by whoever graded the papers.”

In 1974, Tyson found herself usually the only female in her upper-division Electrical Engineering classes. In many classes, there were usually 70 men. Professor Constance W. Miller, Mechanical Engineering, was the only woman faculty member Tyson met at Berkeley. Miller later became the Berkeley SWE Faculty Advisor. Particularly in the EECS classes Tyson took (circuits, electromagnetics, microwave theory, and antennas), she never had a female faculty member teaching a class, nor did she remember any women teaching assistants. In fact, the first woman EE professor hired was Avidah Zakhori in 1988.

In that era, safety was a concern. Tyson related, “Berkeley had changed from a semester to a quarter system, and professors were challenged to fit all the material into ten weeks of classes, so midterm engineering exams were often scheduled for an extra session at night.” In the dark and hilly areas on the north side of campus, it could be unsafe for a lone woman walking late at night from campus to home. Therefore, Tyson and her roommates, who were other engineering and chemistry majors, developed a system. When one was taking an exam, the other two would accompany the one to the location of her exam and drop her off. Those two could walk home together and return later to pick the third up. As a group of three women, they felt warm and supportive in the dark night.

In 1974, a small group of women students in engineering determined to create a student section of the Society of Women Engineers at Berkeley chartered the Berkeley SWE Section. Early presidents of Berkeley SWE felt that they would have the power to lead the group to grow and accomplish its goals: providing support to retain women engineering students, help them graduate and find jobs, and encourage female high school students to choose engineering majors.

A room on the top floor of the Hearst Mining Building became the first office of SWE at Berkeley. Tyson said, "It was not an ideal location, and restrooms were hard to find since women had not been considered in the original design of the old buildings, but it was a start. It was often used by members as a quiet study room, and the file cabinet served as a repository for an archive of completed tests as a study tool for others" (Charlotte Tyson, EE '76, personal communication, January 2021).



Correspondence from Carolyn Phillips to Joseph Frisch, dean of College of Engineering to appreciate his support for Berkeley SWE

SOCIETY OF WOMEN ENGINEERS
PETITION FOR STUDENT SECTION CHARTER

AT
University of California at Berkeley
(College or University)
3/1/74
(Date of Petition)

We, the undersigned Student Members of the Society of Women Engineers, hereby petition the Executive Committee of the Society for a charter for a Student Section to be known as "University of Calif. at Berkeley" Student Section". We agree, if the charter is granted, to abide by the attached Student Section Bylaws and to conduct the business of this Student Section in accordance with the aims and purposes of the Society of Women Engineers.

Name (Legible signature)	SWE Serial Number	Degree Major	Date of Expected Graduation
<u>Grace J. Adams</u>	(1) S74101	EL ENG	8-75
<u>Rena Payette</u>	(2) S74150	Ind Eng	8-74
<u>Jane M. Haver</u>	(3) S74179	CE	12-75
<u>Carolyn C. Crowder</u>	S73597	ME (Bio)	6-75
<u>Paul E. Kendall</u>	S73491	M.E.	6-76
<u>Kathleen Aldridge</u>	S74067	CE	9-75
<u>Karen J. Johnson</u>	S73574	CE/MS	6-76
<u>Karen Ann Parker</u>	S74054	ME	6-77
<u>Joyce Holbrell</u>	S74070	CE	6-75
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NOTES: (1) Chairman-elect. (2) Vice Chairman-elect. (3) Secretary/Treasurer-elect.
Term of office to begin with granting of charter and to expire _____.

Petition for SWE section chartered at Berkeley on March 1, 1974

Carolyn Phillips
Beverly L. Turell
University of California
at Berkeley Student Section

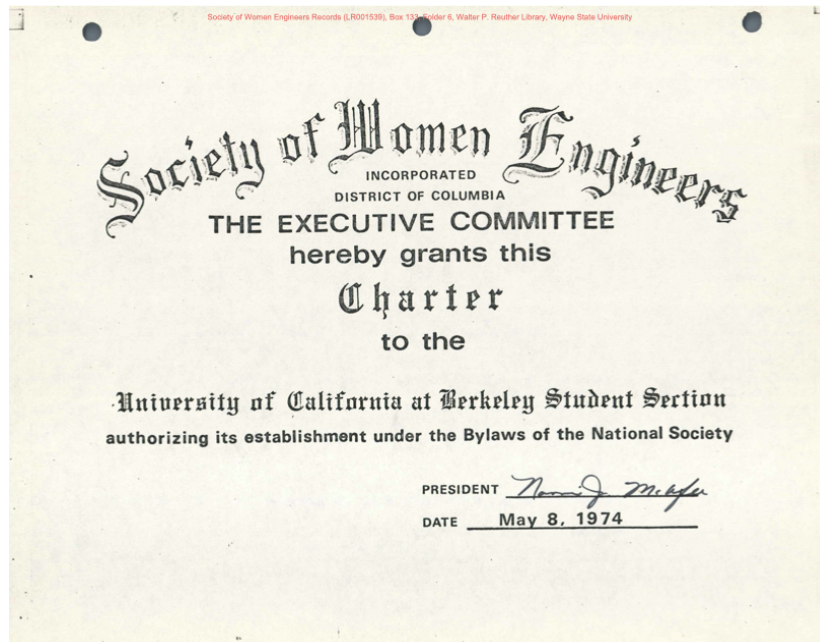
Chairman-elect: Grace J. Adams
1021 McKinley Avenue
Oakland, California 04610
415 - 893-4400

Vice
Chairman-Elect: Miss Rena F. Payette
2700 Le Conte Apt. 500
Berkeley, California 94709
415-
Phone: 848-8247

Secretary/Treasurer
elect: Linda Neff (application not received)
Linda Louise Neff S 74179
841 Solano #5 % Flavell
Albany, California

School Phone: 415-525-9684
Home Phone: 415-854-4121

Grace J. Adams became the first president of Berkeley SWE in 1974 before it chartered



Berkeley SWE certificate

According to the annual report 1976-1977, the first objective in the third year of Berkeley SWE was to make it noticeable on campus by actions, activities, and abilities. Officers of Berkeley SWE in 1976-1977 remarked, “We realized communications and publicity were the lifeblood of any campus organization. For SWE, we have had to invent better meeting bulletins to attract student attention. Using offset printing to make up over 100 large posters in brilliant colors, we have achieved instant recognition for the SWE logo.” Thus, from 1976 to 1977, by initiating its first outreach program, producing the first bound edition of a UCB resume book, and organizing various professional development activities for students on campus, passion for Berkeley SWE was at an all time high. The annual report 1976-1977 recorded, “Student members recognized that it was an honor to be an officer of the chapter. Volunteers were willing to serve as co-chairmen of key committees such as the outreach program and the resume book committee. The members in Berkeley SWE tripled from 23 members to 63 members (the number of 63 was understated as the officers were still processing some of the applications when compiling the annual report).”

Constance Lütolf-Carroll (Senior Lecturer of ESADE Business School and URL Lecturer of Ramon Llull University), the third president of Berkeley SWE, said, “In 1976-1977, we were known on campus as an organization which could ‘get things done.’ We were very active as a

club, and I had a wonderful team of officers helping me run it. We tried to involve as many people as possible and give each member a responsibility to fulfill. Serving as SWE officers were Pattie McNamee, who was my Vice-President and go-to person; Kon-Mei Wang, Secretary; Laura J. Lindberg, Treasurer; and Susan Sitnek, Engineer's Joint Council (EJC) Representative” (Constance Lütolf-Carroll, CE '77, personal communication, June 2021).



Photo: Keith Gockel

SWE members, Class of 1977, at their graduation

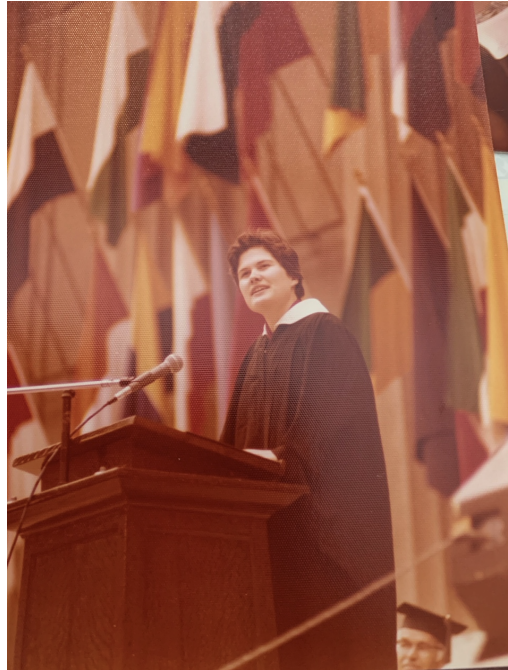


Photo: Keith Gockel

Constance Lütolf-Carroll gave the student graduation speech at Berkeley's Greek Theatre for the College of Engineering commencement in June 1977.



Women engineering students in the early 1970s at Berkeley, Patricia Delvac Daniels (left) and Gail Kendall (right) from MEET THESE ENGINEERS brochure by the College of Engineering

Outreach Pioneers

U.C. Berkeley SWE Pre-College Outreach Programs in the 1970s

According to Tyson, in 1975-76, Berkeley SWE outreach activities were limited. They provided incoming women engineering students with fliers about SWE activities in registration packets and set up a table to talk with visiting high school students during the College of Engineering open house. When visiting senior high schools, they found that only a few female students were in the advanced math classes. Interests in math and science developed as early as in junior high school (Maltese). Many academically prepared girls did not choose to study math or *engineering* because they did not know what a career in science or engineering would be like, and no one had ever encouraged them to study science and engineering when they were in junior high schools (Purzer, 403). Women in Berkeley SWE realized that it was critical for them to reach out to girls in junior high schools.

In 1976-77, Berkeley SWE carried out its most important project – the first outreach program geared towards 7th and 8th grade girls. Lütolf-Carroll said, “We knew that if we waited and talked to young women in high school, it would already be too late for them – by then the die would be cast. Girls who dropped out of math in 7th or 8th grade would struggle to catch up with the necessary quant skills to enter college and successfully study engineering. Targeting 7th and 8th grade girls was our aim. We wanted to help them understand engineering and encourage them to continue studying STEM subjects in college.” In 1977, teams of four Berkeley SWE students and practicing engineers visited five local junior high schools in Oakland and Berkeley, giving talks to over 300 girls to explain engineering and encourage them to keep taking math and science classes through senior high school. Because the teams consisted of students and engineers from Berkeley SWE, Berkeley Engineering Alumni Society, Golden Gate SWE, and the Bay Area Engineering Council, the school trips enabled the four organizations to unite forces together rather than wasting valuable human resources by duplicating programs. (Bix, 340; SWE student section, University of California at Berkeley; Berkeley SWE Annual Report 1976-1977).

For the school trips, members of Berkeley SWE prepared various hands-on demonstrations, including digital clocks, buzzers prepared from kits, how to make nylon from a beaker, and shedding of Von Karman vortices (Berkeley SWE Annual Report 1976-1977). These

demonstrations were essential in provoking questions and inciting the curiosity of young girls. The first trips turned out to be a success. SWE officers realized the necessity of the program and strived for expansion in the following years. Berkeley SWE also published a brochure for the outreach specifically designed for junior high school students, which would inform youths about engineering, encourage them to pursue math and science, and expose the opportunities and possibilities to them in engineering. Jean Colthurst, who would become the fourth president of Berkeley SWE, was responsible for preparing and designing the brochure. “She was sensitive to the kind of language that would appeal most effectively to 7th and 8th graders. We had junior high schoolers read sample texts to get their input before going to press. The brochures were handed out during the team visits” (Berkeley SWE Annual Report 1976-1977). One of the short brochures handed out to students was entitled “What do Jimmy Carter and Leonardo da Vinci Have in Common?” The answer to the title was “They were both engineers!” According to Lütolf-Carroll, “The brochure went on to ask more questions and provided answers designed to whet the appetite of the ambitious young.” In 1976-77, because of their efforts and insights for the outreach program, and its other activities, Berkeley SWE won the SWE National Best Student Section Award that year (Constance Lütolf-Carroll, CE '77, personal communication, June 2021).

U.C. Berkeley SWE Pre-College Outreach Programs in the 1980s

Deborah S. Franzblau, Class of 1980 (Associate Professor in the Mathematics Department at College of Staten Island), directed the outreach program in her role as vice president of Berkeley SWE. She reported, “We discovered that women engineering students could be excellent role models for girls in grades 7-12. A practicing engineer or scientist may be inspiring, but her achievements may seem unattainable to students who have not even started college. Junior high students, in particular, are more willing to take advice from those closer to their own age.”

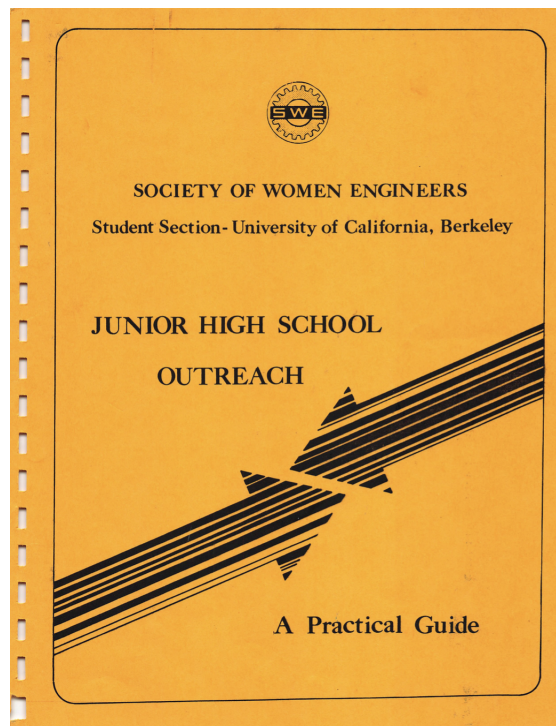
Continuing the successful outreach program in the 1970s and intending for expansion, by the spring of 1980, twelve teams of Berkeley SWE visited ten schools, reaching approximately 1000 students (Franzblau, 15).

“We hope to reach not only the ‘gifted,’ highly motivated students, but also the ‘average’ students, who are in more danger of avoiding math and science, thereby losing important

options. We chose the junior high level because, as one of our speakers emphasized, ‘Junior high is the place to talk to students - before they have made irrevocable choices.’ Also, most existing guidance programs reach only the high schools and junior colleges,” Fanzblau said.

SWE members believed that outreach programs would motivate women to enroll in advanced math and science electives. In 1980, based on prior outreach experience, Berkeley SWE created a handbook named *Berkeley Junior High School Outreach - A Practical Guide* to help other engineering student organizations to plan and execute successful outreach activities. In the same year, an article entitled “Have you considered outreach?” written by Deborah S. Franzblau was published in the U.S. Woman Engineer Journal.

In the article, Franzblau remarked, “visits to junior high schools could remarkably increase the students’ knowledge of engineering. 53% of students said that they knew very little about engineering before visits, and 40% of students never met an engineer. After the visits, 77% of students said they knew something or a lot about engineering” (Franzblau, 15).



Berkeley Junior High School Outreach - A Practical Guide

U.C. Berkeley SWE Pre-College Outreach Programs in the 1990s

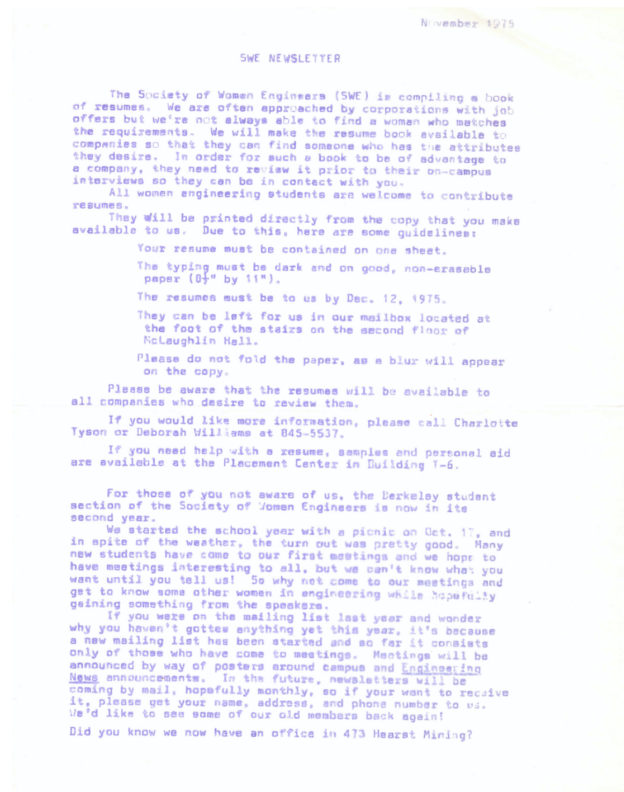
In the late 1990s, solar power was an emerging technology in its infancy. Around that time, Dr. Cynthia Tsao, Class of 1996 (Owner of Navilean LLC and Founder of Building AEC Learning, Inc.), was not only a member of Berkeley SWE but also of CalSol - Berkeley's recently started solar-powered vehicle racing team that competed against other universities. Leveraging that novelty of solar power, Tsao noted that Berkeley SWE organized an outreach program called Junior Solar Sprint which guided junior high school students in developing solar-powered vehicles and organized a race for them to compete at the Lawrence Hall of Science. In addition, by the late 1990s, Tsao clarified that Berkeley SWE managed outreach programs for both female and male pre-college students. Improving on the outreach projects of Berkeley SWE in the 1980s, they sent out mixed groups of female and male engineering students to local elementary and high schools. During their visits, Berkeley SWE students helped students develop interests in math and science and explore careers in engineering. Tsao remarked, "In particular, Berkeley SWE students helped high school students understand how engineers helped society in different ways compared to the more high-profile professions such as medicine and law" (Cynthia Tsao, CEE '96, personal communication, May 2021).

Professional Development to Empower Women

U.C. Berkeley SWE Professional Development Programs in the 1970s

Resume Booklets

In the 1970s, companies began actively seeking female candidates to hire. However, Tyson pointed out the challenge industrial recruiters faced in reaching students: "In the days before computers, people could only communicate by phone, mail, or by putting fliers up on bulletin boards, so there was no easy way to identify female candidates." Therefore, Berkeley SWE members decided to compile a resume book that they could offer for sale to the companies recruiting on campus. "We gathered about 25 resumes from our members and sold the booklets for \$25. In addition, a copy of the resume book with a cover letter including the president's contact information was placed in the campus recruitment center," Tyson said.



Berkeley SWE Newsletter in 1975 about resume book

Tyson then described a memorable experience with the resume book in 1976. "I had an early rejection that kicked my efforts into high gear to make sure I found a job that was a good fit. I interviewed with more than 25 companies on campus and went on 13 "plant trips" (company site interviews), but I had not been able to get on any of the IBM interview lists, regardless of location. One morning I got a call at the apartment (no cell phones then) from a recruiter from IBM in Boulder, Colorado. He said he was on campus and had extra time on his schedule - he wanted to buy a copy of the resume book so he could contact students to fill his slots. I said that I could drop one off soon, and by the way, I was on the waiting list for IBM, and could I interview with him when I came? He said yes, and it turned out to be a perfect match for my unusual expertise in fields and waves and electromagnetics. I accepted that job from my 13 offers and became an Electromagnetic Compatibility (EMC) engineer in Boulder." As a result, Tyson became the first female EMC engineer in IBM!

Tyson's SWE presidency resulted in an invitation to join the College of Engineering Student Relations Committee. In 1976, Tyson became the student speaker for the College of Engineering Commencement held in Berkeley's Greek Theater. The title of her talk was "Engineers' Responsibility for the Future" (Charlotte Tyson, EE '76, personal communication, January 2021).



Photo: Peg Skorpinski

Charlotte Tyson, the second president of SWE at Berkeley, 1976 student speaker for the College of Engineering commencement held in Berkeley's Greek Theater

In 1976-1977, according to Lütolf-Carroll, Berkeley SWE sponsored a wide variety of events and activities throughout the year, including the first SWE reception for incoming junior transfer students, resume workshops with the Career Placement Center, field trips and plant visits, panels, and informational meetings about the UC Berkeley Co-Op Work Program, and joint events such as the first Engineers-in-Training (EIT) Review Session on Economics with the ASCE. These popular activities helped Berkeley SWE become visible on campus.

Berkeley SWE also issued the first bound edition of the SWE Resume Book, which was made up of resumes from 54 students. Assisted by the Career Placement Office, Berkeley SWE held workshops to teach students how to write good resumes and best present their qualifications. According to the annual report 1976-1977, the first bound edition of the SWE

Resume Book was successful since most students received interview requests because of the book.

Additionally, members' connections with Berkeley SWE persisted even after graduating from Berkeley. As a former president of Berkeley SWE, Lütolf-Carroll reported that she was invited to various important Bay Area conferences during the first few years of her career at Exxon as a Refinery Engineer and during the time she was an MBA student at Stanford Graduate School of Business. At the conferences, she spoke to hundreds of young women and encouraged them to pursue careers in engineering, math, and science. In one of the Exxon Hesperian Magazines, Lütolf-Carroll reported the appeal of engineering to her, "I entered college with the intent of becoming a lawyer. To gain some insight into my chosen profession, I accepted a public administration internship. That experience altered my thinking. I became frustrated at the governmental bureaucracy's inability to cope with real problems. Through the law in the courtroom, I realized that you have an advocacy role, but your only tool is the power of persuasion. I was discovering that in other careers, e.g., engineering, you can put your ideas down on paper and actually implement those ideas. That appealed to me" (Exxon, 3; Constance Lütolf-Carroll, CE '77, personal communication, June 2021).



Society of Women Engineers
STUDENT SECTION AT THE UNIVERSITY OF CALIFORNIA, BERKELEY

March 28, 1980

EXXON COMPANY USA
3400 East Second Street
Benicia, CA 94510
Attn: Constance Carroll

Dear Connie:

Thank you so much for speaking to us at our Evening with Industry. You led such a fine discussion which made the evening so much more worthwhile.

My personal thanks to you for your friendliness which helped ease my nervousness that evening. Your continual support in our section's activities is always well appreciated.

I should tell you that I will be doing an Engineering Co-op this summer and fall. Hearing you speak again at the Options in Engineering Conference and attending the Co-op workshop prompt me into this decision. At first I was hesitant about the Co-op, since I have to take a quarter off. I am convinced now, that this is the best way (at least for me) to find out what is really out there in the "real world". Hope to see you again soon.

Best of luck,


Lai Ho Chan
Lai Ho Chan
Evening with Industry
Chairperson

A thank-you letter from Lai Ho Chan who decided to do a Co-op internship after listening to one of Lütolf-Carroll's talks

U.C. Berkeley SWE Professional Development Programs in the 1990s

1990s Student Member Conference

Because Berkeley SWE had been engaged with outreach programs geared toward pre-college school students for a long time, they realized that it was vital for them to address some needs of women engineering students on campus. Thus, in the fall of 1988, Berkeley SWE hosted its first Student Member Conference. The annual conference aimed to provide undergraduate students with information about career opportunities available to them and encourage female students to keep their determination in engineering, no matter in research or industry (Berkeley SWE Annual Report 1991-1992).



SOCIETY OF WOMEN ENGINEERS

**1991
STUDENT MEMBER CONFERENCE
AGENDA**

9:00 - 9:30	Registration: Garbarini Lounge, Second floor, Bechtel Engineering Center
9:30 - 10:00	Opening Meeting - Sibley Auditorium Kristina Nolan, Conference Coordinator Irene Hong, SWE UCB Student Section President Toni Torres, Director, Minority Engineering Program
10:00 - 11:00	Session 1 - The following panel discussions take place simultaneously *A Good Start: Resources at Cal - 210 McLaughlin Hall Michelle Bauzon, Career Planning and Placement Center Kurt Eto, Student Pugwash Debbie Lee, Engineering Joint Council Payman Haxsibi-Mohammadbadi, Engineering Co-op Student *Responsible Engineers: Careers for Our Future - Sibley Auditorium Dennis Frezzo, Development Engineer, Coherent Medical Diane Griffin, Program Manager, MEC Analytical Systems, Inc. Elyse Helshorn, P.E., Helshorn Environmental Engineering Jung Yoon, Hydrologist, Biosystems Analysis
11:00 - 12:00	Session 2 - The following panel discussions take place simultaneously *Life After the B.S.: Exploring Graduate Studies - 210 McLaughlin Hall Ann Kintzig, Energy and Resources Group Caroline Paxson, Computer Science Sigrida Reinis, Construction Management Tracy Thatcher, Environmental Engineering *Surviving in a Man's World: Strategies for Success - Sibley Auditorium Professor Mary K. Gaillard, Physics Jennifer Hymus, Senior Staff Engineer, Woodward-Clyde Consultants Dr. Carla Trujillo, Director of Women and Graduate Students of Color in Engineering Belinda Wheeler, Aeronautics and Astronautics, Stanford Junior University
12:00 - 1:30	Luncheon and Keynote Speech - 120ABC Bechtel Engineering Center Paula Humphreys, Research Leader of the Applied Plastics Group at the Dow Chemical Company, 'Making Plastics Recycling a Reality' Closing Remarks

First Student Member Conference Agenda

U.C. Berkeley SWE Professional Development Programs in the late 1990s

According to Dr. Tsao, in the late 1990s, Berkeley SWE was one of the most active and inclusive engineering clubs on campus. Endeavoring to empower all students, participants in Berkeley SWE professional development programs came from diverse backgrounds. James Hong, Class of 1995 (Angel Investor), remarked, "Berkeley SWE was the best and most active

organization in engineering at the time. I later shifted my focus onto Tau Beta Pi, intending to make it as good as Berkeley SWE somehow because it was not that active.” Evening with Industry (EWI) has been an iconic professional development program since 1978. By the late 1990s, Tsao noted that EWI was Berkeley SWE’s most popular professional development program attended by both company representatives and Berkeley engineering students. During EWI, Berkeley students experienced a full-course networking dinner with professionals. Preparation programs of EWI included resume review sessions, networking tips, and even formal dinner etiquette tips. Berkeley SWE also organized a Shadow an Engineer program that provided opportunities for students to visit with engineering professionals whose company offices were easily accessible by public transit. Students would learn about their hosts’ work and tour their office spaces during each visit. Some visits included tours of factories or job sites related to the work of the hosting engineers (Cynthia Tsao, CEE ’96, personal communication, May 2021).

THE SOCIETY OF WOMEN ENGINEERS AT BERKELEY THANKS THE FOLLOWING COMPANIES AND ENGINEERS FOR SPONSORING OUR EVENING WITH INDUSTRY			
BECHTEL CORPORATION P.O. Box 3965 San Francisco, Calif. 94119	Cindy Weber Cost Engineer/ Scheduling	NASA Mailstop 241-6 Moffitt Field, Calif. 94035	Margaret Aycinena Electrical Engineer
BELL LABORATORIES 600 Mountain Avenue Murray Hill, New Jersey 07974	Theresa Szczurek Operation Research	PACIFIC GAS & ELECTRIC CO. 245 Market Street San Francisco, Calif. 94106	Irene P. Russell Distribution Engineer
DOW CHEMICAL USA 2800 Mitchell Drive Walnut Creek, Calif. 94598	Jolain Anderson Chemical Engineer	PROCTER & GAMBLE PAPER PRODUCTS P.O. Box 4368 Modesto, Calif. 95352	Susan J. Chao Project Engineer/ Production Management
EXXON COMPANY USA 3400 E. 2nd Street Benicia, Calif. 94510	Simone Yuan Process Engineer	ROCKWELL INTERNATIONAL 3317 Lira Loma Anaheim, Calif. 92601	Judy Young System Performance Evaluation
HEWLETT PACKARD 11000 Wolfe Road Cupertino, Calif. 95014	Sue Powell Electrical Engineer/ Physics	STANDARD OIL CALIFORNIA 225 Bush Street San Francisco, Calif. 94104	Linda A. B. Backens Chemical Engineer
INTERNATIONAL BUSINESS MACHINES 1871 The Alameda San Jose, Calif. 95126	Gloria Montano Electrical Engineer	WOODWARD-CLYDE CONSULTANTS 600 Montgomery Street, 30th Floor San Francisco, Calif. 94111	Carol Ries Assistant Project Engineer
LOCKHEED MISSILES AND SPACE CO. P.O. Box 504 Sunnyvale, Calif. 94086	Clara M. Brock Electrical Engineer	XEROX 701 South Aviation Blvd. El Segundo, Calif. 90245	Sylvia Weatherford Digital/Electronic Engineer

Companies at Evening with Industry in 1980

Women Pioneers

Every year, Society of Women Engineers bestows its highest award, the **Achievement Award**, on a woman engineer who makes an exceptional contribution over a significant period of

time in engineering. Not all awardees are women who earned a degree in engineering from Berkeley. In this section, the significant contributions of selected Berkeley engineering alumnae are celebrated.



Laurel van der Wal

Laurel van der Wal was awarded the 1961 SWE Achievement Award for “contributions to bioengineering and bioastronautics; originating Project MIA study of physiological effects of space flight on mice in U.S. rockets; worked on escape and recovery systems and the design of human-crewed spacecraft.” She earned her B.S. in mechanical engineering with honors from the University of California, Berkeley, in 1949 (Society of Women Engineers, 37).

While attending UC Berkeley, she also worked as a photographic and fashion model. She directed MIA, the mouse-in-space project, which sent two white mice into space and was the first experiment with putting animals above an altitude of 100 miles in 1958. These flights returned valuable data on space flights and were the forerunners of America’s Human spaceflight (Sweeney). Because of her contribution to bioastronautics, she was named the Los Angeles Times’ “1960 Woman of the Year in Science.” She also became the first woman appointed to the Los Angeles Board of Airport Commissioners and the only woman airport commissioner in the United States in that year (Sweeney).



Jessie Cambra

Jessie G. Cambra was awarded the 1979 SWE Achievement Award for “outstanding contributions to the planning, design, and construction of major public works; managing Alameda County, California road department; designing and supervising first successful highway construction project in California; designed first computerized traffic signal at a major arterial intersection in California.” She earned her B.S. in civil engineering from the University of California, Berkeley, in 1937 (Society of Women Engineers, 39).

Cambra was the first woman to receive a civil engineering degree from UC Berkeley. She was the first woman to be licensed by examination in the state of California; first woman member of the American Public Works Association and its first woman director; first woman member of the County Engineers Association of California; and first woman president of the East Bay Engineers Club (Society of Women Engineers, 62).



Barbara Liskov

Barbara Liskov was awarded the 1996 SWE Achievement Award for “significant contributions to computer system design, especially development of data abstraction, aka ‘object-oriented or ‘modular programming’; researching Venus operating system; developing data abstraction concept and CLU programming language; researching Argus distributed programming language and operating system; inventing many practical distributed algorithms.” She earned her B.A. in mathematics from the University of California, Berkeley, in 1961 and her Ph.D. in computer science from Stanford University in 1968. She was one of the first women in the United States to receive a Ph.D. degree in computer science (Society of Women Engineers, 41).

Dr. Liskov is a member of the National Academy of Engineering and Sciences. She is also a fellow of the American Academy of Arts and Sciences and the Association for Computing Machinery (ACM). She was awarded the 2008 Turing Award from ACM for developing the Liskov substitution principle (“MIT’s Magnificent Seven: Women Faculty Members Cited as Top Scientists.”).



Frances H. Arnold

Frances H. Arnold, Ph.D., was awarded the 2017 SWE Achievement Award for “discovering and applying directed evolution; creating a paradigm shift in bioengineering; and for an inspiring career of accomplishments in research, mentoring, and tech transfer.” She earned her B.S. in mechanical and aerospace engineering from Princeton University in 1979 and her Ph.D. in chemical engineering from the University of California, Berkeley, in 1985 (Society of Women Engineers, 119).

Dr. Arnold is the Dick and Barbara Dickinson Professor of Chemical Engineering, Bioengineering, and Biochemistry at the California Institute of Technology. She holds 57 U.S. patents and has been elected to all three U.S. National Academies — Sciences, Medicine, and Engineering (Society of Women Engineers, 119).

In 2018, she was awarded the Nobel Prize in Chemistry for “pioneering the use of directed evolution to design new enzymes, with applications as broad as they are essential, from pharmaceuticals to renewable fuels (“The Nobel Prize: Women Who Changed Science: Frances H. Arnold.”).



Jacqueline Chen

Jacqueline Chen, Ph.D., was awarded the 2018 SWE Achievement Award for “pioneering research in computational combustion modeling; harnessing the power of computers to advance the discipline; and her service both to science and the scientific community.” She earned her B.S from the Ohio State University in 1981; her M.S. from the University of California, Berkeley, in 1982; and her Ph.D. from Stanford University in 1989, all in mechanical engineering.

Dr. Chen is a distinguished member of the technical staff at Sandia National Laboratories and a fellow of The Combustion Institute. She has 153 publications in peer-reviewed journals and serves as an editor for three major scientific journals. She has been elected to the U.S. National Academy of Engineering for “contributions to the computational simulation of turbulent reacting flows with complex chemistry” since 2018 (“Sandia Researcher Jacqueline Chen Elected to National Academy of Engineering.”; Society of Women Engineers, 119).

Celebrate the History of SWE at Berkeley

Margaret Pritchard, a life member of SWE, who was nominated a Fellow in 1987, said in the 2009 National SWE Conference, “The history of SWE is a story of women developing their

capabilities through education and experience, and moving forward in a male-dominated profession that did not necessarily welcome them. It is a story of determination, leadership, and women offering mutual support and camaraderie. Especially in the early days of the Society, it is also the story of courageous women swimming against the current of the times, refusing to abandon their dreams or deny their potential” (Pritchard, 52).

Since 1974, Berkeley SWE has been committed to supporting the growth and development of not only women engineering students at Berkeley but also pre-college girls for more than 45 years. Pioneers in outreach, Berkeley SWE was one of the first SWE sections to reach out to junior high school students starting in 1976-77. In 1980, it created a practical guide to help other engineering student organizations to plan and execute successful outreach activities for junior high school students. SWE++ is a recently established outreach program piloted under Berkeley SWE and adopted by many other SWE sections over the nation. The program aims to “encourage the development of a female computer science community” by teaching middle school students the foundations of Python and inspiring them to pursue computer science as a profession.

Berkeley SWE also provided women engineering students with unique opportunities to meet people, honing their professional skills and leadership. From the earliest resume booklet in 1976 to its long-lasting Evening with Industry, which enabled women engineering students to approach company representatives at their booths and introduce themselves, Berkeley SWE always persisted in its determination to promote the development of intelligent and passionate women engineers.

Charlotte Tyson (in her “encore” career as a CFP® LPL Financial Advisor), the second president of Berkeley SWE from 1975-1976, is still connected with her SWE secretary/treasurer Deborah (Williams) Miller. She said, “one of the most important SWE lessons was that relationships with other women engineering students could last a lifetime” (Charlotte Tyson, EE '76, personal communication, January 2021).

Constance Lütolf-Carroll (Senior Lecturer of ESADE Business School and URL Lecturer of Ramon Llull University) was the third president of SWE from 1976-1977. She remarked, “a unique aspect of SWE compared to other engineering clubs, e.g., the American Society of Civil Engineering (ASCE) or the Chi Epsilon Fraternity, was that SWE was open to all women and men engineers or scientists, regardless of major (Civil, Mechanical, Material Science, Chemical

Engineering, Physics, EECS or Computer Science, etc.) or degree (BS, MS, or Ph.D.). It was an open and transversal club where you could meet up and socialize with people studying a wide variety of subjects. Therefore, I think Berkeley SWE had a broad appeal as a club, as it opened doors and introduced participants to many different career paths. Berkeley SWE membership crossed the usual department and college silos” (Constance Lütolf-Carroll, CE '77, personal communication, June 2021).

Monica Tanza (Sustainability Project Manager at BART), the president of SWE 2007-2009, reported that at a time when only 10 percent of Mechanical Engineering students were women when she was at Berkeley, the SWE community made her undergraduate years feel supportive and memorable. Being one of the only two women students in her class no longer made her feel isolated, but it motivated her to become the role model to encourage incoming women engineering students (Monica Tanza, ME '09, personal communication, January 2021).

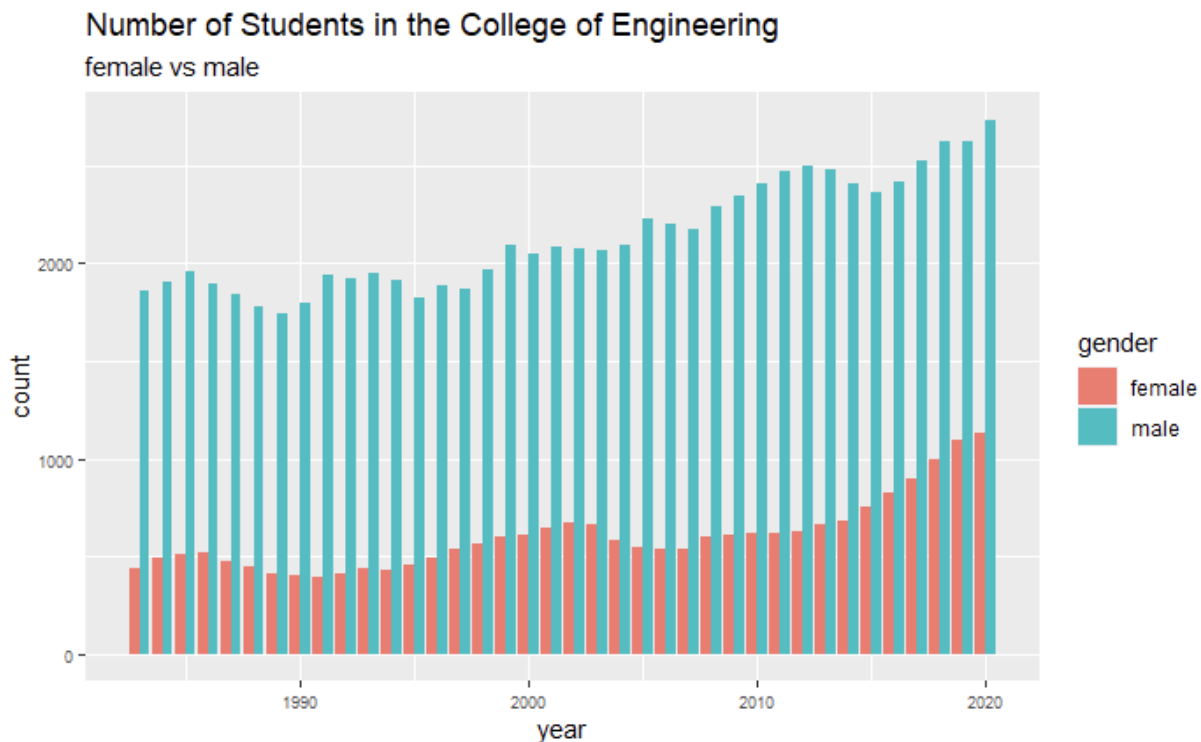
Cassi Janakos (Chief Operating Officer at Healthy Horizons), the Recipient of UC Berkeley SWE Gold Member and Membership Award in 2010 and *40 under 40 Silicon Valley Business Journal* in 2016, mentioned that organizations like SWE were critical since they showed young women what was possible in their careers, and were a wonderful resource for career growth. She got her first job at Lockheed Martin, partly due to meeting a recruiter at an SWE event. Through SWE, she was able to hold over 35 leadership positions. She then started her first company to offer comprehensive corporate lactation programs, aiming to make a positive impact in the lives of new mothers and parents. In only five years, the company has grown to serve customers in over 100 cities. Customers range from Silicon Valley startups to the Fortune 100, including PG&E, Ford Motor Company, and many others. For young women in engineering, she suggested, “Don’t let anyone deter you and be persistent to achieve your dreams. Engineering is an amazing field that will open so many opportunities and allow you to go on many adventures as a student and professional” (Cassi Janakos, ME '11, personal communication, December 2020).

Amy Zhang (Staff Software Engineer at Google), the president of SWE from 2013-2014, remarked that SWE was like a family where she could find belonging, support, and friendship. She was a member of SWE from her freshman year to her graduation, and her officer corps was one of the best groups of people she ever met. It was where she cultivated her leadership skills, where she found a doorway to her current career, and where she was given the opportunity to

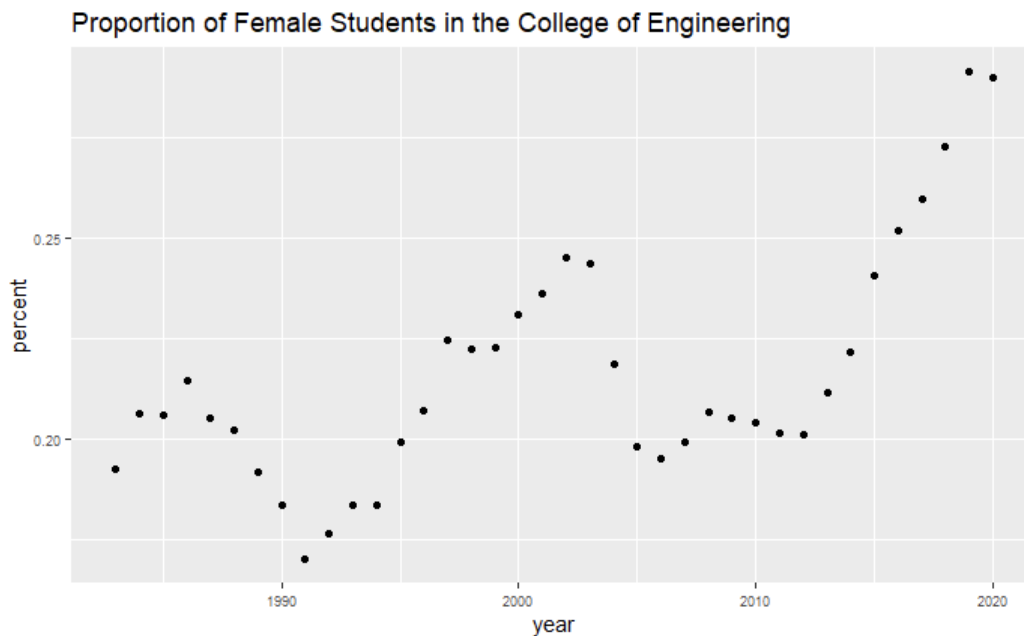
make a difference. She learned valuable skills, such as communication, organization, delegation, teamwork, and was able to apply them in her current job today as a manager at Google. She also learned what it meant to create a positive culture and a psychologically safe environment, build trust, and trust in others (Amy Zhang, EECS '14, personal communication, January 2021).

Zoe Husted (Software Engineer at Google), the most recent president of SWE from 2020-2021, said that Berkeley SWE provided her the valuable opportunity to meet with other women in similar situations, which boosted their confidence when they found that they always had something in common to share. The group of women prevented her from feeling isolated. “SWE welcomed the participation of students from any majors, any gender, no matter if you studied engineering or not, no matter if you were male or female. If you wanted to join SWE or participate in SWE events, you could always drop by.” She felt proud to find that SWE enabled women engineering students to thrive on campus (Zoe Husted, EECS '21, personal communication, December 2020).

Conclusion: Is SWE still relevant?



Data source: Dat Le, College of Engineering



Data source: Dat Le, College of Engineering

Professor Constance Lütolf-Carroll, the third president of SWE from 1976-1977, remarked, “Being a part of UC Berkeley SWE made me realize how few women were studying engineering and how few went on to practice the profession in the mid-to-late 1970s. I know that I had no women as a professor in any of my civil engineering classes during the two years at the College of Engineering. Therefore, SWE had a strong role to play as an advocate for helping women enter engineering or any STEM disciplines and supporting them during their studies. We advocated for women to become practicing engineering professionals. We also saw the need to increase the number of women in academia as tenured track professors, lecturers, or teaching assistants. We also hoped to see more women rise to senior management roles in university administration.”

Compared with women engineering students in the 1970s, since 2010, women report feeling less bias when seeking employment in the industry. However, women are still a small group comprising only 20 percent to 30 percent of students in the College of Engineering. With few women faculty members, Berkeley SWE continues to provide women engineering students with a platform to find other passionate women who share a similar experience, receive suggestions from alumnae, and cultivate their leadership skills. More importantly, Berkeley SWE is the place where the friendship between engineering women flourishes. Prof. Constance

Lütolf-Carroll excitedly told me, “Because of SWE, Pattie McNamee and I became life-long friends!”

“It was great to have this amazingly supportive group of women, and it was the one student group that I stuck with through all my four years at Berkeley. I got my Google internship after a fellow SWE member, Sara LaVigna (the president of SWE from 2011-2012), told me about the program, and I don’t think I would have ended up where I am today if I hadn’t listened to her advice and applied,” Amy Zhang, the president of SWE from 2013-2014 said.

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I investigated the official website of the National Society of Women Engineers and the magazines of the Society of Women Engineers from 2009 to 2020 to find information about women engineering students related to SWE since 1974. I consulted with Troy Eller English, Society of Women Engineers Archivist at Walter P. Reuther Library in Detroit. With her help, I obtained the 1980 outreach guide created by women engineering students at Berkeley and two other documents about Berkeley SWE in the 1970s and 1990s and was able to identify the first two presidents of Berkeley SWE. I was glad to connect with Charlotte Tyson (EE '76), the second president of Berkeley SWE, who provided me with significant resources about Berkeley SWE in the 1970s. URAP sponsor Dr. Sheila M. Humphreys connected me with Prof. Constance Lütolf-Carroll (CE '77), the third president of Berkeley SWE, and Dr. Cynthia Tsao (CEE '96), a former president of Berkeley SWE. Prof Lütolf-Carroll (CE '77) provided me with valuable resources related to Berkeley SWE in the late 1970s. Dr. Tsao helped me compile the outreach and professional activities of Berkeley SWE in the 1990s. I owe a debt of gratitude to Zoe Husted (EECS '21), the president of SWE in 2020-2021, who shared contact information of former SWE presidents in the 2000s and 2010s and recent activities of Berkeley SWE during the last 15 years with me.

Acknowledgments

I want to express my great appreciation to my URAP mentor Dr. Sheila M. Humphreys, for her advice and insightful editorial suggestions throughout the whole progress of the paper. I owe Charlotte Tyson, Constance Lütolf-Carroll, and Cynthia Tsao a huge debt of thanks for their critical contributions to the early history of Berkeley SWE in the 1970s and 1990s. I want to express my indebtedness to all the women I interviewed for their essential contributions to the project.

Appendix

Interview Questions with SWE alumnae

1. The mission of the Berkeley SWE section is to strive to support the next generation of women engineers. How did SWE affect you as a woman undergraduate engineering student at Berkeley?
2. Did you have any women faculty teaching you when you were at Berkeley?
3. Did you believe women teaching faculty help to enhance the confidence of women engineering students?
4. Berkeley SWE has a long history of activities for professional development. Could you provide some examples of professional activities when you were at SWE?
5. Did these activities empower you as a woman engineer?
6. From your perspective, how did these activities encourage women to remain in engineering?
7. Berkeley SWE has always been the pioneer in outreach activities. Could you provide some examples of outreach activities when you were at SWE?
8. Would you like to share a few examples of your weekly / monthly activities?
9. Did you think Berkeley SWE relevant to undergraduate women engineering students?
10. Did you have any memorable experience as the president of the Berkeley SWE or anything else you would like to share with me?

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