

Women in Computer Science - Why So Few? Who Make It Through?

Survey Amongst Women on the WICSE (Women In Computer Science and

Electrical Engineering) Listing at U.C.Berkeley ¹

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Introduction

Women constitute less than 17% of the graduate students in the EECS Department (see figure 1); the significant underrepresentation not only points to explicit and/or implicit barriers to women in academic science and computing, but also paints a gloomy picture of the future when there remains a shortage of women role models. Through this informal survey of the cultural and educational backgrounds of those that do enter graduate school, light is cast indirectly on the barriers, and some ways to leap across them.

The Survey Questions

- Your background - national, cultural, etc.
- Your standing in the sibling hierarchy i.e., were you the first-born, second-born etc.
- What kind of schools did you attend - public/private/single-gender/co-ed?
- What, if any, were the positive aspects that encouraged you to study maths and sciences, in your particular schooling background?

- What, if any, were the negative aspects that discouraged you in your particular schooling background?
- What was the ratio of male versus female teachers at your school(s), and did that effect you in any way?
- Was there any cultural aspect that motivated your choices?
- Did you feel presence/absence of gender-typed role models; did that effect you? Why not, or why, and how so?
- Who, if anyone, was most influential in your career choice?

The Response So Far

Of the 140+ women graduate students, professors, postdocs, re-entry students and alumni on the mailing list of the WICSE newsletter, 31 have responded so far.

National, Cultural Background

Breakdown of the 31 respondents is as follows:

- Thirteen respondents are Caucasian, American born women.
- Seven are of Chinese descent.
- Five are from South Asia (India, Pakistan, etc).
- Two are from Iran.
- One is from Croatia.
- One is from Belgium.
- One is of Caucasian American/Kenyan descent.
- One is of Caucasian American/Cuban descent.

Standing in the Sibling Hierarchy

Of the respondents, twenty three answered this question of the survey, that was added after an initial presentation of the results. Interestingly enough, 13 of the 23 women are first borns. Furthermore, 3 are first daughters, though

second borns. Four of the women are second daughters, second borns; two are the youngest of their families; finally, one is the seventh of eight children. Although it needs to be further investigated, the findings do add some weight to the old wives' tale that the first-borns are the over-achievers and risk-takers of the family! The preponderance of first-borns amongst these women scientists/engineers might just be anecdotal or might point to a link between the uncharted-territory-navigating skills developed by a first-born and the risk-taking involved in a scientific career.

Schooling - Public Vs Private,

Single-Gender Vs Coed

- An overwhelming majority (26 out of 31) attended primarily co-ed public schools K-12.
- Only six ever attended private schools; with two in basically co-ed institutions, and four primarily in all-girls schools.

Some Comments About the Schools

“In secondary school: Gender gaps come in. Since we are all girls high school, our headmistress didn’t care less to have any teachers train us in our inter school Math Competition, because they always expect the boys school to win it. However, our teachers always give us encouragement...Many teachers including our headmistress believe that boys are better than girls. So they stress more on learning skills like essay/poem writing and arts crafts.”

A doctoral student mentions, “I think that having gone to an all girls school (although not out of choice – it was after the Iranian revolution) was one of the best things that happened to me. Not only was it great fun, I learned to speak my mind, excel, and not be threatened by boys.”

Another grad student from Asia recounts, “In retrospect, the fact that I went to an all-girls’ school has made me be myself: curious, questioning, and refusing to play dumb/attractive/help-me games. Even the nuns appreciated my spunk, and couldn’t/didn’t smother it.”

Yet another scientist recalls, “I think that being in a girls school in middle school and early high school had a big impact on my desire to pursue a Ph.D. and probably also the field of study. In that environment, there is no subtle pressure for girls to be quiet, not ask so many questions, or play dumb.”

Five from coed public schools, mention as a positive aspect of their schooling, “a feeling of competitiveness” towards the males in their schools, and an accompanying thrill when they excelled over them.

“Nothing discouraged me, but the teachers could have been more encouraging; I did have encouraging teachers in the areas of English and social sciences, and one encouraging chemistry teacher.”

Some were told “by several teachers that women didn’t have “what it takes” to do mathematics.”

Of the twelve women who are mostly positive about their public school experience, all but four give credit to either a few outstanding teachers, and/or to the special programs like Accelerated Math Program, Women in

Engineering Program (at Cal Poly), the CRA sponsored Distributed Mentor Program with female professors as mentors, the Engineering Aptitude Test, enrichment activities for gifted children, and math and science fairs and competitions.

One woman appreciates the fact that co-ed public schooling helped her “look upon all people, male and female, as equals.”

The scientist from Eastern Europe rejoiced in the fact that “there were as many girls as boys. Such company did not even make me think that science is not for me.” She is amongst the only four women who could not name even a single aspect of their schooling that discouraged them from maths and sciences!

Everyone else had some negative aspect to relate. The gamut was all the way from lack of social acceptability, “un-coolness,” to a Physics teacher laughing outright when a woman mentioned that she wanted to take the course from her, and a guidance counsellor who actively discouraged another woman from entering the sciences. This lack of social acceptability hits some women harder.

“ Throughout my junior high and high school years, life was hell. I was completely ostracized/teased/picked on because I was smart and, God forbid, I didn’t particularly attempt to hide it. I had other interests besides chasing boys.”

“Smart girls were encouraged to get a teaching certificate if there was any academic encouragement at all (usually there was none).”

One says, “We had to fight to get the same education that they were getting.” She also mentions “American anti-intellectualism” as a stigmatizing factor and recalls that “boys were just encouraged more by whatever influence, be it parents, teachers, peers, or our culture, to stick it out in science and math. Watching many boys who I didn’t think were as smart as I do these things gave me a perverse motivation to stick with these untraditional areas to prove that girls were in fact as smart as boys.”

Another remembers, “My teachers were mostly very poor, and nobody in my classes was getting a good education or getting much attention for anything other than misbehaving. One teacher that sticks out in my mind

is Mr. Walsh, my 6th grade teacher. He was an alcoholic with a big, red, spongy nose. Kids used to throw spit wads at him and climb out the window whenever he turned around.”

Gender and Attitude of Teachers, and Their Effects on Women

Until college years, and especially until commencing graduate studies, most women did not feel too discouraged in their scientific ambitions by the steadily decreasing number of women teachers, elementary school onwards, but did report a valid sensitivity to gender-bias displayed by both male and female teachers.

One mentions a female teacher who “practically dismissed most of my questions in class, and only treated the boys’ inquiries seriously.”

“It is pretty intimidating to study in a field so devoid of role mod-

els/mentors. One begins to wonder if one's detractors are correct."

One woman mentions that some of her "best math/science teachers were female."

Another doctoral student remembers how "most of my science and math teachers in high school were women, and I liked it very much. I felt close to them as my role model. I could never relate to a man as a role model."

One scientist says that it was not until college that she "became very aware of the lack of women teaching math and science, and it depressed me. In fact, I didn't realize that I could be an engineer until I happened to meet a female engineering student. That opened my eyes."

Yet another woman graduate student says, "Another thing that bothered me but didn't affect me until college was the steadily declining ratio of females in math classes. In high school, it became clear that girls were dropping out of honors math classes with much higher grades than the boys who were dropping out, until virtually the only girls left were those who were A students.

But there were still enough of us that I didn't feel like an uncomfortably visible representative of my sex until I chose computer science as a major in college."

Talking about the lack of women role models, a doctoral student from Iran says, "right here in the U.S., it did effect me very much, and still does! before then, I was not aware of many details of life, but now I am..."

"Actually I had a lot more role models in India," states another woman.

Yet another summarizes this as, "It would be impossible not to feel the presence of gender-typed role models; I think the primary effect would be a sense of having to prove myself repeatedly. In college my female friends in computer science expressed this as feeling that we have a chip on our shoulders, that at times we feel the burden of having to show that women can do well in the sciences too. With so few women in higher education for these fields, it is impossible not to feel representative. This is not to say that all of my research and work is motivated by the need to prove anything about the capabilities of women; rather, it is more an undercurrent that is worrisome in the abstract, and may contribute to general insecurity."

One scientist describes the irritations of working in a male-dominated field as “having people assume you’re stupid until proven otherwise. As are constant questions like “but what are you going to do with it?” (degrees), questions they would never ask a man because they would assume a fascinating career. And being asked for directions and coffee by visiting honchos, who assume you must be a secretary if you don’t have a dick. And the constant competition and resistance to new ideas, and so on and so forth. Never being given the benefit of the doubt..having to think twice before using your first name on a paper instead of gender neutral initials for fear of rejection.”

Strongest Influences in the Scientific Lives of Women

- Out of the 31 respondents, 6 could not and/or did not name any such influence.
- Ten exclusively credited parents and siblings who either all were scientists with Ph.D’s, or had not had the privilege of higher education at all, but had all instilled in their daughters/sisters a love of math and

science.

- Eight women credited both parents and teachers for guiding them into the sciences.
- Five women gave that honor to grade school teachers, or some professors at college with whom they had done research.
- One awards the laurels to the “Women in Engineering” program at Cal-Poly, for most deeply influencing her career choice.
- One mentions the Re-Entry Program at the UC Berkeley Computer Science Department, as being the most important factor motivating her in a scientific career.

Cultural Factors that Influence Women in Pursuit of Scientific Careers

“It’s in Chinese culture that we must be good at Math (that’s the concept passed on to us by the teachers, in one form or other)”

“...sciences and maths are highly respectable fields to go into in the Asian

culture.”

“Chinese culture valued sciences and maths, and also my parents think that only sciences and maths majors can find a job.”

“My public high school was in a Jewish neighborhood, which made it very competitive.”

“Seems like lots of Chinese people are in engineering and science fields, although I sort of view myself as ”born that way”, it’s probably true that Chinese culture gives high regards to these disciplines.”

“The education system in Taiwan really forces us to learn things when we were young ... a lot by rote memorization, but that’s alright for addition and multiplication stuff, which I later learn how to really apply to problems.”

Another woman of Chinese descent says that she “didn’t ever want to test the water of “failure” – that sort of fear always prompted me to do my work, do my best, and bring home the perfect report card or awards or whatever

else. I think this fear is part of my cultural background – education is of utmost importance.”

“The American South, where I grew up, is very conservative and religious and that culture’s idea of a good role for women is restricted to Good Wife and Mother.”

“Contrary to common belief, in my high-school class (in Croatia, at high school level a person decides which way their studies go) there were as many girls as boys. Such company did not make even think that science is not for me.”

“Whenever the Quran mentions knowledge, I’ve always discerned that there is an equal emphasis on both men and women to seek it. The Prophet Muhammad (PBUH) advises muslims to travel to the furthest part of Earth in search of knowledge. The base of my South Asian culture also venerates intellect and learning.”

One doctoral student mentions “respect for intellectual achievement in the Jewish culture.”

“Chinese parents are well known for their advocacy of careers of a distinctly practical nature. A lot of 1st-generation Chinese-Americans seem to end up in medical school or engineering of some kind, and I was definitely encouraged, at least implicitly, to pursue math and science.”

“My culture probably had the biggest influence on my decision. Although I was always encouraged to choose my own path, I was constantly surrounded by family role models who were doctors, scientists, and engineers... I think I would have been happy in any number of fields; after choosing one, I’ve found the niche that is most fulfilling while pursuing a career which is approved by family and friends here and in India.”

All but four of the Caucasian American women reported no particular aspect in their culture that motivated their choices. Of the four, one grieved over the conservative nature of the culture of the south, and its restrictions on women. The second mentions that “the American culture is not particularly encouraging toward women in scientific careers, but I think it is getting better over the years.” The other two are more positive; one woman speaks

of the influence of a “feeling that women no less than men should have an education and career that could provide for a family on one salary, which I characterize as cultural because of growing up in a time when the divorce rate skyrocketed and I watched divorced mothers having to do just that.” The other woman realizes that “it was a man’s world, and because of that I didn’t want to immerse myself in any topic that was dominated by women. I must have figured, on some level, that if I could excell in a man’s field I’d survive and be beyond reproach.”

Conclusions

Despite the stereotype of the engineer/scientist who speaks in monologues, the responses I received were moving, articulate, detailed autobiographies, as the verbatim excerpts amply demonstrate.

As far as the schools are concerned, the importance of all-girls’ schools, of mentorships, more role-models, more gender-neutral teaching in the sciences and mathematics; and that of special programs for girls, cannot be over-emphasized. As long as the explicit and implicit messages that women

just don't have what it takes to do good in mathematics, continue to perpetuate in our schools, claiming that women and men emerging from the same high schools are coming from the same turf, is extremely questionable if not absolute nonsense.

An unusually high degree of optimism, a refusal to be discouraged, and an ability to gain strength from any existing strong educational value of their culture, are some elements of personality that come out again and again amongst these women. Coming from China, where some grandmothers and great-grandmothers still limp around on bound feet, feet that were bound so women couldn't run, feet that were bound because their "precarious" balance was found attractive by men, with minds that were unschooled because learning was only for males, the women of Chinese descent still quoted again and again the reverence in their culture for learning.

The muslim woman quotes the Quran as a spur for learning, looking beyond the fact that Afghanistan, recently, prohibited all women from Universities, based on its archaic interpretation of Islam. The women from India derive strength from their culture's approval of maths and science, similarly

looking beyond the bride-burning and female-fetus-aborting issues of India.

For all women who have made it to the graduate level, leaping over the hurdles thrown against them time and over again, sheer persistence and courage turn out to be vital weapons for survival - weapons not necessarily needed by the men in the department. Turning adversity into advantage, and refusing to be discouraged when told, "You'll never succeed there; you know you only got in because you're a girl." Metamorphosing such derogatory remarks as spurs to excellence, seems to be the hallmark of these women.