

Technology and Women (Social & Behavioral Sciences Course Content): Taught by Engineering Technology Faculty

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According to Hollis MacLean, Director of Advocates for Women in Science, Engineering & Mathematics, 34% of high school girls do not take senior math on the advice of a teacher or counselor.¹ The United States Census Bureau (2000) and the National Science Board (2000) reported that while women constitute 51% of the United States population and 46% of the labor force,² of 1,397,100 engineers reported to be in the United States workforce, in the fall of 1999, the percentage of employed female engineers was 10.6.³ See figure 1. This decrease, although for only one year, may represent an alarming trend. Only 18% of B.S. in engineering degrees awarded nationwide in 1997 were awarded to women.⁴ Why? Sex-role socialization.

Table 1. Female engineers - Education and employment

Year	Earned Doctorate	Earned Masters	Earned Bachelors	Graduate Enrollment	Undergraduate Enrollment	Employed Engineers
1987	6.5	12.6	15.3	12.5	15.4	
1988	6.8	12.4	15.4	12.8	15.7	
1989	8.3	13.0	15.2	13.1	15.9	
1990	8.5	13.6	15.4	13.6	16.0	
1991	9.0	14.0	15.5	13.8	16.6	
1992	9.3	14.8	15.6	14.6	17.3	
1993	9.2	14.8	15.9	15.1	17.7	
1994	10.9	15.4	16.5	16.0	18.1	8.3
1995	11.6	16.2	17.3	16.9	18.5	8.4
1996	12.3	17.1	17.9	17.7	19.0	8.5
1997	12.3		18.0	18.5	19.4	9.6
1998					19.7	11.1
1999						10.6

Sex Role Socialization

Middle and upper class children have probably had computers in their households since they were born, believe the Internet has always been in existence, think cell phones are essential, and televisions have always had remote control and one hundred plus channels.⁵ Yet, according to Jacobs (1999), women choose different occupations from men because they are socialized to prefer different types of work.⁶ Sex-role socialization leads to occupational sex segregation: girls into nurturing roles and boys into building. Boys are encouraged to play with building blocks so they may become engineers. Girls are encouraged to play with baby dolls and learn to take care of others so they may become elementary school teachers and nurses.⁷ Phillips and

Wilson (2000) state that girls encounter a world of video games designed almost exclusively by young men for boys.⁸ Girls have been turned off by technology that promotes gory and violent computer games.⁹ As girls begin to fit into their societal given role as "not good" in subjects like math and science, their sense of worth and aspirations diminish.¹⁰ Surely at least a portion of the responsibility for sex-role socialization could be attributed to public school education.

Public School Education

Most girls are excited about math and science during early childhood.¹ Girls begin first grade with comparable skills and ambitions to boys. However, girls begin to lose interest around the age of twelve, and by the time girls finish high school, most have suffered a disproportionate loss of confidence in their academic, particularly science and mathematics, ability.¹⁰ The key window for creating interest in science and engineering is in the fifth through eighth grades.¹¹ However, girls avoid the sciences, math and technology because they do not receive enough support.¹² Traditional public school technology/engineering classes are predominantly male students taught by a male teacher. There is also a dearth of young women in secondary school computer science advanced placement classes. Their absence appears to, once again, stem from software applications, developed by young men, that seem more attuned to the interests of boys.¹³ The problem is, however, not K-12 alone. Colleges and universities may have to share the blame.

Colleges and Universities

From 1980 to 1990, according to the 1990 census, the number of women attorneys increased from 7,300 to 23,000.¹⁴ The Associated Press (2003) indicated that for the first time, women outnumbered men among those applying to U.S. medical schools.¹⁵ According to the Center for Women's Business Research (2004), the number of privately-held majority or 50% women-owned businesses grew by 11% between 1997 and 2002.¹⁶ However, despite these substantial increases in the number of women entering law, medicine, and business, previously dominated by men, there is still a scarcity of women in the field of engineering.¹⁷ Nearly one-third of women who are enrolled in technical university classes believe that professors of these classes do not treat women and men equally.¹⁸ If an initial interest to pursue technical careers is not present, young women entering institutions of higher learning will not choose to major in engineering or technology.¹⁹ Although many reasons exist for these low enrollment numbers of females in engineering and technology programs, several are still related to the limited pre-college exposure levels in math, science, and technology in public school, and the on-going guidance of female students, at all levels, into more traditionally female-populated disciplines.⁵ This funneling of students into "gender appropriate" fields throughout public education (K-university) perpetuates gender inequities in the work force.⁵

The Work Force

The lack of females interested in technological careers is astonishing and frightening as technology dominates every facet of our lives.⁹ A July 2001 report released by the National Council for Research on Women finds that much of the progress that women have made in engineering and technology in the past two decades has stalled or eroded.¹⁸ The National Science Foundation's 2000 report found that, at all levels of employment, women are less likely than men to choose engineering and technology careers.²⁰

The under-representation of females in the areas of engineering and technology is recognized as a serious issue facing industry.²¹ A necessity for an increase in the number of women in engineering is prevalent. Early exposure to such fields through education is an effective way to motivate young women to pursue professions in engineering and technology.¹⁰

When young women are considering career choices, they sometimes have the false impression that women cannot advance in engineering and technology careers as successfully as men.⁸ Girls do not lack the capabilities to gain skills desired in technological careers nor are they fearful of technology, but choose not to pursue them because of a possible disinterest in a male-dominated culture. According to the American Association of University Women, girls believe that technology careers are directed at geeks and antisocial males.⁷ This belief might be changed with appropriate role models, both in education and industry.

Role Models

There is a lack of information presented at all levels of education about women who have been successful in scientific and engineering fields and how they succeeded. Phillips and Wilson (2000) state that one factor that contributes to the engineering and technology pipeline leaving young girls at every twist and turn is the lack of female role models.⁸ Wilson (2000) agrees that capable young women do not pursue careers in engineering and technology because of a lack of role models.²² Role models to whom female high school students can directly relate is important in influencing young women in careers.²³ The absence of women engineering faculty and mentors at universities, few women students in public school technology classes, and the lack of supportive networks create a "chilly climate".¹⁸ Girls surveyed by Taylor (2000) stated they were not told directly they were not competent to pursue careers in engineering and technology; it was the subtle messages they received such as few positive role models.¹² The author believes that rather than continuing to share blame, the first step, at least at the university level, may be to introduce a lecture on women and technology in an appropriate, existing course.

Technological Systems (An Existing Course)

Social and behavioral science courses are typically taught by faculty outside of engineering technology programs.²⁴ Technological Systems is a course developed at the University of North Texas that meets the social and behavioral sciences objectives as required by the Texas Higher Education Coordinating Board (THECB). See Figure 1. A faculty member of the Engineering Technology Department, before his retirement, wrote the original syllabus. The author, a current faculty member, adapted the syllabus to the THECB objectives and led the initiative to have the course approved, and listed, as an elective social and behavioral sciences course for all students at the University of North Texas. This request became reality and the new course was offered for the first time in the spring 2003 semester. The course was also approved as a required course for all engineering technology students.

Introduction	Definitions of Technology	Health Care	Time Line
	Technology is...		Today's Medicine
	Eastern & Western Logic		Medical Knowledge
	Technology Over Time		Practice of Medicine
	Cities		Ethics
	Technological Change		Where to From Here
	Technology Today		Leisure Time & Sports
	Society & Culture		Leisure Time
Agriculture & Ranching	Where to From Here	Leisure Time & Sports	Sports
	Urban Vs. Rural Living		Activities
	Agriculture		Sedentary Activities
	Ranching		Recreational Activities
Art	Food Processing	Military	Where to From Here
	History		Employment
	Definitions		Spending
	Artist as Technology		Economics
	Photography		Technology Transfer
Communication	Where to From Here	Music	War
	Information Society		Where to From Here
	From Where We Come		History
	The Work Force		Contemporary Music
	Freedom or Control		Where to From Here
	Today's Systems		Production
Non-Verbal Communication	Definitions		
Construction	Where to From Here	Religion	Economics
	Early Construction		Mass Production
	The Dome		Nanotechnology
	Residential Construction		Communication
	Commercial Construction		Transportation
Energy & Power	Where to From Here	Transportation	Construction
	The Good & The Bad		Is Coexistence Possible
	Sources of Energy		Vs. Technology
Environment	Nuclear Waste	Transportation	What Lies Ahead
	The Negative		Early Transportation
	The Positive		The U.S. has...
	Pollution		Cost
	Global Warming		Automobile
	Environmental Incidents		Trains
	Environmental Solutions		Water Transportation
Fashion	History	Women	Air Transportation
	Clothing		Space Transportation
	Accessories		Where to From Here
	Affect on Technology		Attitude
	Store Vs. the Internet		History or Herstory
Government	Where to From Here	Women	Rights & Equality
	Regulations		Women & ...
	Affected Technologies		
	Democracy		
	Where Government is Important		

Figure 1. Topical Outline for Technological Systems Course

Technology and Women was added by the author as a lecture component of Technological Systems beginning the summer 2003 term. See Figure 2. Students in this course are made aware of the lack of information relating to the contributions of women to science and engineering. For example, how many students who use Hewlett-Packard equipment know the CEO is female. The contributions of forty-plus women (always adding more) to science and technology are reviewed - from Hypatia of Alexandria who invented the hydrometer to Jill Tarter who supervised the construction of 350 telescopes that listen for extraterrestrial intelligence. A review of rights and equality follows and recognizes inequality in the work place and the labor force. "Women and Non-Traditional Fields", or lack thereof, is next and points out that the first female did not receive a bachelors degree in engineering in the US until 100 years after the Revolution. Even then, a man had to read the first research paper completed by a woman engineer since women were not permitted to speak at a conference. "Women and Shopping Malls" and "Women and the Home" continue to emphasize male dominance in design of these structures.

Introduction	Work Separation	
	Women in Top Positions	
	Carleton Fiorina	
	Jill Tater	
History or Herstory	Hypatia of Alexandra	Patricia Billings
	Lady Augusta Ada Byron Lovelace	Hedy Lamar
	Catherine Green	Mildred Dresselhaus
	Martha J. Coston	Jacelyn Bell Burnell
	Nettie Stevens	Esther Conwell
	Mary Engle Pennington	Grace Murray Hopper
	Lise Meitner	Patsy Sherman
	Lilian Moller Gilbreth	Evelyn Berezin
	Emmy Noether	Elizabeth Gould
	Edith Clarke	Stephanie Kwolek
	Elizabeth Hazen	Ellen Ochoa
	Inge Lehmann	Darleane C. Hoffman
	Katherine Blodgette	Susan Solomon
	Mary Anderson	Mary-Claire King
	Beulah Henry	Sandra Faber
	Marjorie Joyner	Randice-Lisa Altschul
	Dorothy Crowfoot Hodgkin	Marcia McNutt
	Jane Wright	Jacqueline Barton
	Rosalind Elsie Franklin	Lene Hau
	Kathleen McNulty	Dorothy McClendon
Rights & Equality	Women's Rights	
	Equality in the Work Place	
	Labor Force	
	Non-Traditional Fields	
Women and...	Shopping Malls	
	The Home	

Figure 2. Outline for *Technology and Women*

The course has been taught three times: spring (34 students), summer (16 students) and fall (25 students) of 2003. The lecture on Technology and Women was added beginning summer 2003 so it has only been included twice. The current spring 2004 offering has 32 students. It should be interesting to track the impact of this course by determining if the number of non-majors who

register for the course increases over time, if the number of females increases and how many students change to engineering technology majors after having completed this course.

Summary

There is a lack of women in science, engineering and technology. One reason young girls do not pursue careers that utilize math and science is the lack of role models in the public school, industry and universities. Another reason is that textbooks, at all levels, do not give women their due recognition. There is an immediate need for change and it is the responsibility of all members of the engineering and technology profession to do their part, however small, in breaking the cycle. The lecture on *Technology and Women* in a social and behavioral science course, taught by an engineering technology instructor, is one such small step.

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