US VS. CHINA: WOMEN FACULTY IN COMPUTER SCIENCE

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ABSTRACT

This paper reports the preliminary findings of a comparative study between China and the US on women faculty in computer science (CS), which shows that universities in China employ far more women in CS than their US counterparts. The author also speculates why Chinese women faculty in CS outnumber their American colleagues.

Keywords: Women Faculty in Computer Science, Comparative Study in Faculty, Women in China, Women in Higher Education

INTRODUCTION

Literature on women in CS is quite limited and mainly focuses on students in the US universities. Fisher and Margolis [8] report that female student enrollment in computer science at Carnegie Mellon University was 7% in 1995 but increased to 42% in 2000. They also note that women only made up 10% of the school's CS faculty, reflecting the national picture of this male dominated field. This is confirmed by Nelson's [18] ground breaking research, which reports that the percentage of tenured/tenure-track female faculty at the top 50 research schools' CS departments (chosen based on research expenditure in 2002) is 10.6% while female PhD earners in the field is 20.5%. Nelson attributes the low female faculty ratio to lack of recruiting effort. She advocates a re-examination of culture, attitudes, and policies universities have long followed in order to open wide the doors for women [18]. Galpin's [9] study on the participation of women in computing at the undergraduate level in more than 30 countries reveals that most countries fall in the 10-40% range with a few below 10% and a few above 40%. It is speculated that societal and cultural factors may affect women's participation. China is not included in the Galpin study. In fact, there is little literature on Chinese women, students or faculty in computing.

This investigation attempts to fill that void by drawing from Galpin's and Nelson's studies. Data from Chinese and US Midwestern schools are collected for comparison to see whether China's landscape of women faculty in CS is different from that of the US.

DATA

Chinese Data

Data were collected from 18 Chinese universities, 8 national key universities and 10 local universities. The national universities are governed by the Ministry of Education and generally considered more prestigious. They roughly correspond to the research schools in the US in terms of prestige, funding, and heavy emphasis on research. The local schools are governed by the provincial bureau of education and are similar to the regional schools in the US because of their primary focus on teaching.

There are four levels of faculty positions in the Chinese university system: professor,
associate professor, lecturer, and teaching assistant. Translated into the US system, professors and associate professors are the US equivalents; lecturers and teaching assistants are equivalent to assistant professors, gapped by seniority (usually three years). All ranks are permanent, similar to the notion of tenure.

Data from national key universities and local universities are in Tables 1-2, respectively, sequenced in descending order by the percentage of women faculty in CS. Table 3 summarizes Tables 1-2. The dash means data are unavailable / inapplicable. It needs to be pointed out that due to historical reasons, many Chinese faculty members, even at national key universities, do not hold graduate degrees. Data have been obtained from two main sources: University web sites and faculty profile files from their personnel departments.

Summary of Chinese Data

The overall percentage of women faculty in CS in China is 35.9%. The national key universities range from 20% to 59.4% with an average of 36.7%. The local universities range from 25.9% to 58.3% with 33.7% as the average, 2.2% lower than the national universities average.

Table 1. Women Faculty in China's National Universities

#	Name	Prof	Assoc	Assistant Prof		Total	PhD	Master	Src
				Lecturer	Assistant				
1	China University of Geosciences (CUG)	0/2= 0%	3/6= 50%	11/16= 68.8%	5/8= 62.5%	19/32= **59.4%**	-	-	[5]
2	Chang'an University (CAU)	0/0= -	7/11= 63.6%	6/8= 75%	2/7= 28.6%	15/26= **57.7%**	-	-	[1]
3	People's University of China (PUC)	3/8= 37.5%	11/19= 57.9%	17/31= 54.8%	0/0= -	31/58= **53.4%**	15/32= 46.9%	14/26= 53.8%	[25]
4	Northeast Forestry University (NFU)	2/2= 100%	6/16= 37.5%	0/0= -	0/0= -	8/18= **44.4%**	-	-	[19]
5	Shanghai University of Finance & Economics (SUFE)	2/3= 66.7%	8/19= 42.1%	1/3= 33.3%	0/0= -	11/25= **44%**	8/15= 53.3%	-	[31]
6	Wuhan University (WHU)	5/29= 17.2%	8/28= 28.6%	13/26= 50%	1/2= 50%	27/85= **31.8%**	5/22= 22.7%	13/29= 44.8%	[42]
7	Nankai University (NU)	11/66= 16.7%	11/45= 24.4%	5/10= 50%	2/3= 66.7%	29/124= **23.4%**	15/63= 23.8%	4/16= 25%	[21]
8	University of Science and Technology of China (USTC)	2/15= 13.3%	3/13= 23.1%	1/2= 50%	-	6/30= **20%**	1/10= 10%	4/13= 30.8%	[39]

Table 2. Women Faculty in China's Local Universities

#	Name	Prof	Assoc	Assistant Prof		Total	PhD	Master	Src
				Lecturer	Assistant				
1	Northeast Agricultural University (NAU)	1/2= 50%	2/4= 50%	6/8= 75%	5/10= 50%	14/24= **58.3%**	-	-	[17]
2	Zhejiang University of Forestry (ZUF)	0/1= 0%	1/4= 25%	6/19= 31.6%	21/44= 47.7%	28/68= **41.2%**	0/2= 0%	5/19= 26.3%	[48]
3	Shanghai University of Science & Technology (SUST)	0/8= 0%	5/13= 38.5%	11/17= 64.7%	0/1= 0%	16/39= **41%**	-	-	[32]
4	Hebei University of Technology (HBUT)	5/10= 50%	0/3= 0%	-	-	5/13= **38.5%**	-	-	[10]
5	Nanjing University of Science &Technology (NUST)	4/14= 28.6%	11/27= 40.7%	0/4= 0%	3/4= 75%	18/49= **36.7%**	3/16= 18.8%	8/24= 33.3%	[22]
6	Hangzhou University of Electronic Sciences (HUES)	2/17= 11.8%	37.5%	19/45= 42.2%	2/4= 50%	38/106= **35.8%**	2/18= 11.15	28/64= 43.8%	[12]
7	Zhejiang Normal University (ZNU)	0/7= 0%	4/21= 19%	10/21= 47.6%	17/42= 40.5%	31/89= **34.8%**	3/8= 37.%	7/23= 30.4%	[47]
8	Hefei University of Technology (HFUT)	0/20= 0%	19/56= 33.9%	17/57= 29.8%	20/59= 33.9%	56/192= **29.2%**	-		[11]
9	Wenzhou University (WZU)	0/1= 0%	2/12= 16.7%	9/24= 37.5%	4/18= 22.2%	15/55= **27.3%**	0/5= 0%	9/26= 34.6%	[45]
10	Shanghai University (SU)	0/15= 0%	5/23= 21.7%	13/39= 33.3%	3/4= 75%	21/81= **25.9%**	-	-	[29]

Table 3. Summary of Women Faculty in CS in China

Schools	Prof	Assoc	Assistant Prof		Total	PhD	Master
			Lecturer	Assistant			
National	25/125= **20%**	57/157= **36.3%**	54/96= **56.3%**	10/20= **50%**	146/398= **36.7%**	44/142= **31%**	35/84= **41.7%**
Local	12/95= **12.6%**	64/203= **31.5%**	91/234= **38.9%**	75/186= **40.3%**	242/718= **33.7%**	8/49= **16.3%**	57/156= **36.5%**
All	37/220= **16.8%**	121/360= **33.6%**	145/330= **44%**	85/206= **41.3%**	388/1082= **35.9%**	52/191= **27.2%**	92/240= **38.3%**

US Data

The US data on major universities in Kansas, Missouri and Nebraska are from university web sites and/or email communications with department chairs. They are categorized into research and regional universities, shown in Tables 4-5, respectively, sequenced by percentage in descending order. This information is summarized in Table 6.

Table 4. Women Faculty in CS in US Research Universities

#	State	Name	Prof	Assoc	Assist	Total	Src
1	MO	University of Missouri – Rolla (UMR)	0/6=0%	0/2=0%	3/7=42.9%	3/15=**20%**	[35]
2	MO	University of Missouri – Columbia (MU)	1/2=50%	1/9=11.1%	1/6=16.7%	3/17=**17.6%**	[16]
3	NE	University of Nebraska - Lincoln (UNL)	0/9=0%	1/7=14.3%	2/8=25%	3/24=**12.5%**	[37]
4	KS	University of Kansas (KU)	1/15=6.7%	1/12=8.3%	2/7=28.6%	4/34=**11.8%**	[14]
5	MO	University of Missouri – Kansas City (UMKC)	0/7=0%	1/8=12.5%	1/7=14.3%	2/22=**9.1%**	[34]
6	MO	Washington University in St. Louis (WashU)	1/6=16.7%	0/6=0%	1/13=7.7%	2/25=**8%**	[40]
7	KS	Kansas State University (KSU)	1/8=12.5%	0/7=0%	0/2=0%	1/17=**5.9%**	[13]

Table 5. Women Faculty in CS in US Regional Universities

#	State	Name	Prof	Assoc	Assist	Total	Src
1	MO	Park University (PU)	0/0=-	1/1=100%	2/4=50%	3/5=**60%**	[24]
2	MO	Northwest Missouri State University (NMSU)	0/4=0%	1/2=50%	1/2=50%	2/8=**25%**	[20]
3	MO	Missouri State University (MSU)	0/1=0%	1/5=20%	1/2=50%	2/8=**25%**	[15]
4	NE	University of Nebraska in Kearney (UNK)	0/0=-	1/1=100%	0/3=0%	1/4=**25%**	[36]
5	KS	Washburn University (WU)	0/3=0%	1/5=20%	1/1=100%	2/9=**22.2%**	[44]
6	MO	Southeast Missouri State University (SEMSU)	0/1=0%	0/2=0%	1/2=50%	1/5=**20%**	[27]
7	KS	Pittsburg State University (PSU)	1/3=33.3%	0/1=0%	0/1=0%	1/5=**20%**	[23]
8	NE	University of Nebraska in Omaha (UNO)	0/7=0%	0/0=-	2/7=28.6%	2/14=**14.3%**	[38]
9	MO	Truman State University (TSU)	1/4=25%	0/2=0%	0/1=0%	1/7=**14.3%**	[33]
10	MO	Southwest Baptist University (SBU)	0/1=0%	0/2=0%	0/0=-	0/3=**0%**	[26]
11	KS	Fort Hays State University (FHSU)	0/2=0%	0/0=-	0/2=0%	0/4=**0%**	[7]
12	KS	Emporia State University (ESU)	0/0=-	0/2=0%	0/0=-	0/2=**0%**	[6]
13	KS	Wichita State University (WSU)	0/1=0%	0/2=0%	0/2=0%	0/5=**0%**	[43]
14	MO	Southern Missouri State University (SMSU)	0/2=0%	0/4=0%	0/1=0%	0/7=**0%**	[28]
15	MO	Central Missouri State University (CMSU)	0/3=0%	0/1=0%	0/1=0%	0/5=**0%**	[3]
16	NE	Creighton University (CU)	0/2=0%	0/3=0%	0/0=-	0/5=**0%**	[4]

Table 6. Summary of US Universities

Schools	Prof	Assoc	Assist	Total
Research	4/53=**7.5%**	4/51=**7.8%**	10/50=**20%**	18/154=**11.7%**
Regional	2/34=**5.9%**	5/33=**15.2%**	8/29=**27.6%**	15/96=**15.6%**
All Schools	6/87=**6.9%**	9/84=**10.7%**	18/79=**22.8%**	33/250=**13.2%**

Summary of US Data

The overall percentage of women faculty in CS in the tri-state area is 13.2%. The research universities range from 5.9% to 20% with an average of 11.7%. The local universities range from 0% to 60% with an average of 15.6%, 3.9% higher than the research schools average.

COMPARISON AND DISCUSSION

The percentage of women faculty in Chinese universities is 22.7% percent higher than that of the compared US schools, 25% higher in the research school category and 18.1% higher in the local school category. In China, key universities have a slightly higher percentage (36.7%) than local universities (33.7%). In the US tri-state area, the research schools percentage (11.7%) mirrors the top 50 research schools reported in Nelson's study (10.6%). The regional schools' average of 15.6% is 3.9% higher than research schools at 11.7%. In both countries, women tend to be in the lower rank. 59.3% of the Chinese and 54.5% of the American women faculty hold the rank of assistant professor, as summarized in Table 7.

Table 7. Summary of Universities in Both Countries

Category	China	US	Difference
Research Schools	146/398=**36.7%**	18/154=**11.7%**	**25%**
Local Schools	242/718=**33.7%**	15/96=**15.6%**	**18.1%**
All Schools	388/1082=**35.9%**	33/250=**13.2%**	**22.7%**
% of Women Faculty as Assistant Professor	230/388=**59.3%**	18/33=**54.5%**	**4.8%**

Table 7 also shows Chinese schools have over four times more CS faculty than the US schools, 1,082 in 18 schools versus 250 in the 23 US schools. The average is about 60 per school in China and under 11 in the three US states. One obvious contributing factor is the program size. For example, Zhejiang Normal University, a local school with 20,000 students, reports 2,030 undergraduate majors, 10% of the school total, in the school of computer science. Another reason is that Chinese universities do not use graduate teaching assistants and use few adjuncts. Another observation is that the US faculty are more academically qualified. In the research schools all tenured/tenure track faculty have a PhD in the area they teach. In regional schools, all full time faculty have at least a master's degree in the area, if not a PhD. In China, even the research universities have a substantial number of faculty without graduate degrees. Historically academicians in China were trained to focus on practice rather than on theory. Advanced degree offering is a relatively new phenomenon.

WHY CHINA HAS MORE

Data on women academic issues in China are spotty and hard to obtain. Most of the information in this project is from descriptive texts, media, and university web sites. Therefore, the discussion of why China has a substantially higher percentage of women faculty in CS is rather speculative and will require more work in future research. But at this point of time and given the evidence available, the author thinks there are four main contributing factors:

First, social transformations set the stage for women's involvement in sciences in general. Nearly a century of Chinese revolutions and western influences helped women discover themselves and set a favorable family and social environment for their contributions. For dynasties, women in China were mostly illiterate—conforming to the feudal doctrine of "A woman has virtue when she has no talents (not educated)." Women were confined to domestic roles and responsibilities. They were labeled as the male's "accessories." Around the turn of the last century through 1949, China went through five decades of continuous dramatic social changes: western influence through missionaries, territorial disputes with its neighbors and foreign powers, fall of the last emperor, and the republic and communist revolutions.

Although early revolutionary vanguards like Zou Rong (1885-1925) and Qiu Jing (1875-1907) tried to sow the seed of gender equality, it was during the republic revolution (1911) and the May 4th Movement of 1919, the new cultural movement, that the gender issue was brought to the forefront of social reforms. Dr. Sun Yet-san (1866-1925) put forward the Three People's Principles (nationalism, democracy, and livelihood) and advocated equal education rights for women. In the early years of the Republic, elementary schools became co-ed. After

1919, secondary schools became co-ed and universities lifted the ban on female students. Foot-binding was abandoned and outlawed. The First Nationalist Party Congress announced in January 1924 the principle of gender equality in law, economy, education, and social status. Dr. Sun [30] commented, "Gender equality is an unalterable principle."

Madame Sun (Song Qingling, 1893-1981) and Madame Chiang (Song Meiling, 1897-2003), both US educated, were very active on the political center stage. They used their husbands' influence to advocate and advanced the cause of women's rights and social status. More and more women were encouraged to step outside their homes and even to join the workforce.

After the communist took over in 1949, eager to win the heart of the people in order to legitimize their rule, Mao's government launched a series of drastic social, political, and economic movements. Among them was to "emancipate the women." Under the propaganda of "Women can hold up half of the sky. Women comrades can accomplish what their male comrades can," equal education, equal pay, and equal social status for both men and women were mandated through legislation and administrative measures. Women were encouraged to gain financial independence by having jobs in all areas in the society even in the once male-dominated fields such as science, medicine, politics, military, and even construction. Whether intended or unintended, progress was obvious and women started entering the workforce with vengeance.

Second, financial independence and traditional family values help create a friendly domestic environment. Once women were encouraged to work outside their homes, they made immediate financial contributions to the family. In order for the wives to be able to continue the contribution, husbands willingly step in to share household responsibilities. Parents also jump in to help, especially when the next generation arrives. It is very common that they retire early or even move in to help out. Daycare and after school care are very accessible and affordable. Boarding school style daycare is common place. Many families are able to hire full-time nannies because of increased income and relatively low labor costs. All of these make it possible to keep women in the labor force. According to a government report [46], 72.33% of all women 16 years and older are employed, and women make up 44% of the total work force.

Third, government policies and social agendas, some of which are highly controversial, aid in creating a conducive environment for women to seek employment. For example, the Marriage Law stipulates that the minimum marriage age is 20 for women (and 22 for males). This almost wiped out the phenomenon of teenage brides and mothers, who would have been unable to work outside the home due to family and childbearing responsibilities. The most profound of all, perhaps, is the one-child-per-couple policy, which cuts women's childbearing duties to the "bare minimum" and prolong their longevity in the work place.

Fourth, education is highly valued by all, including women. Many view education crucial in the competition with men. A job in education is perceived to be prestigious, and light (in terms of physical demand) with fringe benefits such as stable weekends and long summer/winter breaks, therefore more suitable for women. A career in sciences is considered even more reputable. "You can handle the world with ease if you master math, physics and chemistry." Girls are strongly urged to get a college education. In 2004, the total percentages of college, master's level and PhD level female students were 45.7%, 44.2% and 31.4%, respectively [46]. The percentage of full time female instructors in colleges is 42.5%, and at Beijing University, one of the top universities in China, one third of the faculty are female [46]. According to a survey [2] conducted by the Chinese Women's Daily, women spend 22.09% of the expenses on educational products, second only to clothing at 24.24% percent. In the same study, 16.71% of the women surveyed choose IT and/or engineering as their top career choice, third highest after office management (21.13%) and law (19.3%). According to a 2005 study [41] by the Shanghai Women's Association, by the end of 2004, females made up 54.6% of all technically skilled workers. In high tech, they made up 35.3% of the labor force, a 4.5% increase over the previous year.

FUTURE WORK

This paper reports the preliminary findings of a comparative study between China and the US on women faculty in CS. It is only the first step in the ongoing investigation in this relatively little researched area. More data and analysis is needed for subsequent research.

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