Computer Science Faculty Diversity during the Past Decade

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A study examining data from 1993 through 2004 indicates that people of color and women are slowly assuming a larger percentage of faculty positions within the computer sciences.

The need to broaden the participation of people of color and women in the computer sciences is most transparent in the faculty ranks at institutions of higher education.[1,2] Compared to the relatively robust statistics on the representation for people of color and women entering and graduating from computer science degree programs,[3] data reflecting the hiring and employment patterns for individuals from underrepresented racial/ethnic groups and women within university computer science departments remains an indicator of the closed ranks of academic computer sciences.

Whether relying on data from the Taulbee Survey (www.cra.org/statistics), which includes computer science departments from only doctoral-degree granting institutions, or data from the National Science Foundation (NSF),[4] which draws from a much larger pool of computer science departments at educational institutions, the results are the same: People of color and women are underrepresented at all ranks of the professoriate and at all institution types—two-year, four-year, public, private, and Carnegie classifications.

The data we present was drawn from the National Study of Postsecondary Faculty (NSOPF)—the most comprehensive data available on faculty in the US—to provide another portrait of the racial/ethnic and gender work realities in higher education.[5,6] Our data was neither compared to nor contrasted with data from the NSF or the Taulbee Survey. Rather, it independently corroborates what these studies have reported.

To help fill the void in the research literature regarding the employment status for people of color and women as computer science faculty, this study addressed the following research questions:

- Did the employment representation for people of color and women as computer science faculty change between 1993 and 2004?
- Have these changes affected the representation of both groups by rank and principal work activity?
- Has this employment representation changed at the various types of higher education institutions?
- To what extent do these employment trends support or refute the need for intervention programs to broaden computer science faculty participation?

METHOD

The National Center for Educational Statistics (NCES) conducted the NSOPF surveys by collecting four waves of data for the following academic years: 1987-1988, 1992-1993, 1998-1999, and 2003-2004. Our study analyzed data from 1992-1993 and 2003-2004 to examine changes over time in computer science faculty positions. The NCES conducted the NSOPF surveys to address the need for national-level data on college faculty and instructors, those who directly affect the quality of teaching and learning at US postsecondary institutions.[5] The weighted responses represent the national estimates for 1993 (1,033,966) and 2004 (1,185,661).

Measures

The NSOPF datasets contained numerous variables measuring principal activities for faculty in a variety of roles. For example, faculty could select four main areas as their principal activities: teaching, research, administration, and other. Faculty that selected teaching as their principal activity tended to represent the traditional profile of a mix between teaching, research, service, and outreach. Likewise, faculty could select their rank as full professor, associate professor, assistant professor, or instructor and other.

Table 1. Percent change in distribution of full-time computer science faculty in higher education and average salary by race and ethnicity, 1993-2004.

		Percent change			
		Asian/ Pacific Islander	African American/ Black not Hispanic	Hispanic	White not Hispanic
Total		130	110	137	47
Gender					
	Male	144	68	103	45
	Female	209	110	867	47
Rank					
	Full professor	73	-51	104	63
	Associate professor	392	115	61	25
	Assistant professor	131	71	38	48
	Instructor and other	172	132	169	46
Principal activity					
	Teaching	147	110	115	45
	Research	153	410	276	33
	Administration	56	86	n/a	53
Institutional characteristics					
	Public	133	157	124	47
	Private	125	25	142	47
	Two-year	511	110	166	44
	Four-year	116	111	108	48
Carnegie classification					
	Research	97	149	-45	54
	Doctoral	235	276	61	38
	Comprehensive	106	229	192	44
	Liberal arts	22	20	n/a	61
Salary (average)		28	n/a	n/a	-.3

NOTE: Employment counts were based on the number of full-time computer science employees for each year: 17,361 in 1993 and 27,971 in 2004. Included in employment counts but not shown separately are American Indian faculty.
NOTE: The percent change value for salary has been computed using real dollars. Current dollars refers to the use of actual or real prices. Real dollars have been adjusted for inflation.
DATA SOURCE: Authors' calculations based on data from US Department of Education, National Center for Education Statistics, and 1993 and 2004 National Study of Postsecondary Faculty (NSOPF:93 and NSOPF:04).

These datasets also included important information about the institution at which the faculty member was employed, for example, institutional type and Carnegie classification. These measures were used to determine if the trends in computer science faculty representation in the academic workforce varied by institutional characteristics.

The sample of computer scientists used in our study included faculty from public/private and two-year/four-year institutions. Part-time faculty members were excluded, since we wanted to standardize our measure of computer scientists. The estimated means and populations were calculated taking into account the sampling weights and stratification schema in each of the NSOPF surveys.[5]

Procedures

To examine trends across this data, we calculated the percent change for ethnic/racial and gender groups at all institutions, as well as specific types of institutions. Because the data was cross-sectional in nature, we used a formula to calculate the change in percent from 1993 to 2004. Percent change analysis focuses on the differences in year-to-year comparisons; therefore, the results permit the tracking of key changes in employment statistics. Other empirical studies established the precedent for using percent change to measure change over time for employment status in higher education.[7]

COMPUTER SCIENCE FACULTY CHANGES

Employment opportunities within higher education for computer science faculty increased significantly during the past decade. Between 1993 (17,361) and 2004 (27,971), there was a 61 percent increase in available computer science faculty positions. Therefore, any group with a percent change of less than 61 percent did

Table 2. Percent change in distribution of full-time computer science faculty in higher education by gender, 1993-2004.

		1993		2004		Percent change	
		Male	Female	Male	Female	Male	Female
Total		79.9	20.1	69.4	30.6	39.9	145.3
Rank							
	Full professor	88.5	11.5	75.3	24.7	37.1	246.0
	Associate professor	93.0	7.0	69.8	30.3	20.9	597.4
	Assistant professor	75.1	24.9	72.6	27.5	55.7	77.9
	Instructor and other	69.2	30.8	63.9	36.2	48.8	89.4
Principal activity							
	Teaching	77.9	22.1	67.2	32.8	39.0	139.1
	Research	87.4	12.6	83.4	16.6	53.7	112.3
	Administration	84.9	15.1	71.6	28.4	35.9	203.0
Institutional characteristics							
	Public	78.3	21.7	67.2	32.9	38.3	144.3
	Private	85.7	14.3	78.4	21.6	47.4	143.4
	Two-year	70.3	29.7	54.3	45.7	24.4	147.9
	Four-year	84.4	15.7	77.7	22.3	48.3	128.8
Carnegie classification							
	Research	87.2	12.8	80.9	19.1	49.5	140.4
	Doctoral	79.3	20.7	72.0	28.0	46.3	117.9
	Comprehensive	86.6	13.4	79.8	20.2	48.5	142.9
	Liberal arts	70.2	29.9	67.9	32.1	55.8	73.0
Salary (average)		$48,588	$36,487	$65,784	$56,092	4.7	23.0
Additional income		$3,793	$2,129	$7,139	$3,080	57.5	13.9
Career patents (average)		0.1	0	1.2	0.3	1100.0	200.0
Career publications (average)		26.1	5.5	28.1	10.8	7.7	96.4

NOTE: Employment counts were based on the number of full-time computer science employees for each year: 27,971 in 2004 and 17,361 in 1993. Included in employment counts but not shown separately are American Indian faculty.
NOTE: While average salary and additional income are shown in current dollars, the percent change value for salary and additional income has been computed using real dollars. Current dollars refers to the use of actual or real prices. Real dollars have been adjusted for inflation.
DATA SOURCE: Authors' calculations based on data from US Department of Education, National Center for Education Statistics, and 1993 and 2004 National Study of Postsecondary Faculty (NSOPF:93 and NSOPF:04).

not keep pace with the growth in the academic job market. Interestingly, while white males remain the largest percentage of computer science faculty, for the most part their growth did not keep pace with the academic job market. Accordingly, the majority of the new positions were filled by people of color and women.

We can draw several key conclusions from this data regarding both race/ethnicity and gender. These results have implications for continued support both nationally—for example, the National Science Foundation—and locally—for example, high schools and universities—to encourage participation of underrepresented groups in the computer science profession.

Race/ethnicity

As Table 1 demonstrates, four key conclusions emerged regarding race/ethnicity.

First, whites continue to hold the largest portion of computer science faculty positions. However, the participation of people of color in computer science faculty positions is steadily increasing due to high growth patterns.

Second, among the groups of people of color, Asian/Pacific Islanders appear to be doing the best by all measures used for this study. However, African Americans/Blacks appear to be doing better with regard to employment at liberal arts institutions.

Third, two groups show through within group comparison, by gender, in which females constitute a larger portion than males: African Americans/Blacks and whites. That is, in both groups, females hold a larger portion of within-group positions by gender than their male counterparts.

Fourth, all groups of color realized significant employment increases between 1993 and 2004. Notably, Hispanics had the largest total increase by a group.

Gender

As Table 2 indicates, five key conclusions emerged regarding gender.

First, males continue to hold the largest portion of computer science faculty positions. However, female participation in computer science faculty positions is steadily increasing due to high growth patterns in hiring.

Second, considering the intersection between gender and race/ethnicity, Hispanic females realized the largest percentage increase in computer science faculty positions.

Third, there continues to be a serious gap (approximately $10,000) between average salary for males and females in computer science faculty positions. Likewise, males more than double the earnings in the category of additional income compared with female computer science faculty.

Fourth, there is a significant gap between males and females on two key merit-based performance indicators: career patents and career publications.

Last, females were for the most part located within lower-rank faculty positions compared to males.

Due to the nature of our data analysis, we only discuss the observed representation of computer science faculty positions by race/ethnicity and gender. In turn, we do not attempt to suggest causal relationships or present explanations for the observed data. A move to do so in this study would be a professional misstep due to the type of analyses performed.

Moving forward, our hope is that others will take up this call to join us in identifying and documenting the reasons the workforce has steadily become more diverse. Nevertheless, our results do show that whites and males constitute the largest groups in the profession. It is also worth noting that moderate to slow, but critically important, growth has occurred for people of color and women in these positions. Therefore, the current and future focus on broadening participation in computing to include these groups is not only the correct moral response by society, but also has proved keenly useful in filling new and open positions in the computer science academic workforce.

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