Faculty Turnover in CS Departments

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Abstract
The rapid growth of computer science in both academia and industry creates a special problem with faculty turnover. This paper examines data from a national study of computer science (CS) departments to describe the circumstances surrounding faculty turnover in computer science, identify the major factors related to faculty departure, and suggests approaches to addressing the situation.

1 Introduction
Faculty turnover afflicts all disciplines. The market for Ph.D.s outside academia has grown along with the dispersion of knowledge-based activity throughout the economy [2]. Non-academic positions are now particularly attractive because professors are paid roughly 25% to 30% less than similarly educated professionals [1]. Perhaps more than any other field, computer science (CS) offers a wealth of opportunities for those with the appropriate academic credentials. Accordingly, the potential for high turnover in computer science is greater than in most disciplines.

While some amount of faculty mobility is healthy for an institution, high rates of entrance and exit are not desirable. The departure of a faculty member can disrupt research and teaching programs and leave students without a familiar advisor [6]. High turnover leads to high administrative costs for recruitment, selection, training, and development [8]. Furthermore, remaining employees must often shoulder increased workloads without a rise in pay [8]. Turnover can also have a demoralizing effect on those who remain, as well as a negative effect on prospective employees. More concretely, high turnover is associated with low job satisfaction, poor productivity, and high stress among employees [12].

The costs and disruptions of faculty turnover can also lead to other undesirable outcomes that are less obvious than overworked and dispirited remaining faculty. For example, an examination of computer science departments in Virginia found that departments with higher rates of faculty turnover were likely to lose female undergraduate majors at disproportionately high rates [4]. Considering that females are greatly underrepresented in computer science, this finding provides additional motivation for addressing the issue of faculty departure.

The undesirable outcomes associated with turnover can be exacerbated when replacement faculty are difficult to find, and faculty are particularly hard to find in computer science. CS departments have been unable to find qualified faculty replacements at higher rates than any other discipline [7].

From 1995 through 2000, the following events combined to make any loss of CS faculty an especially serious event.
- Undergraduate CS programs graduated 48% more students [9] indicating the rising enrollments driving an increasing need for faculty
- CS Ph.D. production declined 9% [5] reducing the supply of potential faculty
- The number of CS faculty leaving their departments for reasons other than retirement or death rose 60% to 202 faculty (88% by 2001) [5] creating gaps in existing faculties
- Only 33% of 1999 CS PhDs accepted academic positions. This percentage was down from 38% going into academia in 1997 [11].

Comparing faculty turnover rates in CS with rates for other disciplines can put this situation in context. Furthermore, examining the conditions associated with turnover in CS and the conditions that lead faculty to contemplate leaving their positions might offer insight into how faculty turnover could be reduced. Not all faculty who think about leaving actually do, but intentions can indicate the potential of higher turnover or the alternative problem of dissatisfied faculty remaining in their departments. Examining both intentions and actual turnover gives us a fuller picture of the faculty retention problem.
2 Method

The data for this paper were collected as part of a three-year study that examined computer science programs and their undergraduate retention by gender. Two hundred ten study departments in the contiguous United States were selected based on their rank among the most prestigious computer science programs and/or their high number of recent computer science baccalaureate awards. As a group, the study departments produced approximately 60% of all Bachelor-level computer science graduates in 1996 [10].

Quantitative data was collected from chairpersons and faculty via web, mail, and telephone surveys in the Spring of 2002. The chairperson of every study department was surveyed about a variety of issues, including faculty turnover. Chairpersons were asked among other things to report the current numbers of adjunct faculty and full-time faculty who teach undergraduates, how many of the full-time faculty had permanently left their position for reasons other than retirement in each year from 1995 to 2000, and how many of all the faculty counted as having left were women. The resulting data provide annual turnover rates, gender information on those who left, and other information about departmental conditions.

In addition to chairpersons, a stratified random sample of up to 25 faculty was selected for each study department with women over-sampled. Faculty questions addressed many issues including thoughts of leaving the department. Surveyed faculty were asked, “To what extent were the following conditions concerns that you had about your department in the past 6 years?” Concerns listed were “lack of physical resources such as space or equipment; insufficient faculty; insufficient support staff; poor student quality; troubled gender climate; lack of support from the dean.” Additionally, faculty were asked, “Have you seriously considered leaving your position in this department during the past 6 years?” If this question was answered in the affirmative, faculty were asked to indicate the extent to which 11 specified factors motivated their thoughts of leaving. Additional questions about sex, age, rank, and tenure enabled analyses of subgroups.

The overall response rates were 73% for the chairpersons and 68% for the faculty members. Of the 209 participating departments (one sample department was dropped because of unusual conditions in the program during the study period), all offered 4-year undergraduate programs, 37 percent offered graduate programs, 75 percent were at public institutions, 58 percent offered more than one undergraduate computing program, and the median program size was 400 undergraduates. Of the 1716 faculty who participated, 33% were Full Professors, 29% were Associate Professors, 26% were Assistant Professors, and 10% were Instructors/Lecturers in continuing positions. Sixty-one percent of the faculty respondents were tenured, 82% were male, 95% were white, and 83% were United States citizens.

3 Results

According to chairpersons’ reports, 18% of full-time faculty who taught undergraduates left their departments between 1995 and 2000, for an average of 3.3% per year. This departure rate is similar to the 4% average annual rate produced from calculations with Taulbee survey [5] data for PhD granting departments. It is also similar to the 3% annual faculty departure rate found for the average discipline through a 1998 – 2000 study of all 34 public 4-year universities in Texas [15]. Of the departed faculty, only 12.4% were female although women comprised 21.3% of the faculty in the surveyed departments. The approximated annual male turnover rate (4%) was twice the female rate (2%). This finding of female retention is particularly striking in light of repeated reports that women in academia have higher turnover than men [see for example 16; 3].

![Computer Science Faculty Turnover](image)

Faculty turnover was lowest in the CS departments with above average institutional support, departments with substantial commercial or private support, departments that were located in areas with high-tech industry, departments that emphasized research, departments where faculty had not seriously considered leaving, and in departments where faculty were not concerned about insufficient faculty or about poor student quality. Table 1 lists the average turnover rates for departments with these characteristics as compared with other departments.

Support the department received from the institution and from private or commercial sources was directly associated with low faculty turnover rates (r= -.17*2 and -.16* respectively). Departments supported by their institution at above or far above average compared with other

1 The female composition of the study departments is similar to the 22.3% figure for all doctoral computer scientists employed in universities and four-year colleges [9]. Our respondents were 18.4% female.

2 '* indicates that the correlation is statistically significant at least to the .05 level with a one-tailed test.
departments at the same institution had an average faculty turnover rate of 2.7%. Departments with average or below average institutional support had 3.9% average annual turnover. Likewise, when commercial or private support was non-existent or little, faculty turnover was high (4.2%). Some commercial or private support was associated with a 3.3% turnover rate, and substantial commercial or private support was associated with a low faculty turnover rate of 2.4%.

Proximity to areas of high-tech industry had a direct negative effect on faculty turnover \((r=-.15^*)\). Using the Software & Information Industry Association’s list of the top 25 metropolitan areas for software-related employment, we calculated that those CS departments located within a one hour drive of these 25 areas had a significantly lower rate of faculty turnover than departments located outside these areas, 2.5% compared with 3.7% respectively.

Departments that emphasize teaching had high turnover (4.6%) when compared with research (2.7%) or balanced (2.6%) departments. This relationship between teaching-orientation and faculty turnover \((r=.25^*)\) was reduced but still significant when controlling for the use of adjunct professors \((r=.20^*)\). In teaching departments where adjuncts comprised no more than 15% of the faculty, the average annual turnover rate for full-time faculty was 2.7%. However, when adjuncts comprised larger proportions of the faculty in teaching departments, full-time faculty turnover was high – 4.2% turnover for faculties employing 16% to 33% adjuncts, and 5.7% turnover for faculties employing more than 33% adjuncts. Use of adjuncts in departments that did not emphasize teaching had much less pronounced effects on turnover.

Greater percentages of departments’ faculty who considered leaving were associated with higher actual turnover rates \((r=.17^*)\). Over the six-year period on which this study reports, 41% of all faculty respondents seriously considered leaving their positions. This contemplation rate is lower than the nearly 50% of faculty from the average discipline who were willing to entertain other job offers, academic or otherwise in 1987 [14]. By this measure, CS is no worse than the average discipline.

Women were slightly less likely than men to consider leaving. Forty-two percent of men reported seriously considering leaving their position in their department during the past 6 years, compared with 36% of women. At departments where tenure was an option, women were less likely to consider leaving than were men with the same tenure status, but this difference between the sexes was greatest among those not on a tenure track. Likewise, women at every rank were less likely than their male peers to consider leaving, but the difference was greatest at the instructor/lecturer level.

Among those faculty reporting serious thoughts of leaving, the most commonly cited factors (rated either as strong or very strong motivations) were

- dissatisfaction with institutional support for their department (42.8%),
- dissatisfaction with departmental leadership (37.6%),
- seeking career change or advancement (35.7%), and
- money (30.6%).

In comparison, 41 percent of faculty in the average discipline reported in a recent national poll of all disciplines that they had considered a career change at some point in their career [13]. The most frequently cited factor was money (dissatisfaction with salary as well as available research funding), followed by personal or family issues, feeling burned-out and in a rut, and frustration with higher education itself.

The reasons men and women contemplated leaving were also very similar. The sexes differed most strongly in their motivation by money (35% male versus 30% female), desire for better students (28% male versus 20% female), and geographic location (20% male versus 14% female).
Only in the case of collegiality issues and workload (a write-in response to “other strong motivations”) were women more motivated than men to consider leaving (20% male versus 22% female for collegiality, and 0% male versus 5% female for workload.)

Rank and tenure status produced significant subgroup differences in thoughts of leaving. Associate Professors were most likely to have seriously considered leaving (47.8% had considered it), followed by Full Professors (39.2%), Assistant Professors (37.6%), and Instructor/Lecturers (33.3%). Similarly, tenured professors (44.4%) were more likely to consider leaving than those untenured but on the tenure track (35.2%) and those not on the tenure track at all (33.7%). When rank and tenure were both taken into account, tenured instructors, tenure track associate professors, and tenured full professors were most likely to have considered leaving their positions between 1995 and 2000.

Although many concerns were associated with consideration of leaving, and the percentage of a department’s faculty who had considered leaving was associated with actual turnover rates, none of the specific motivators were significantly associated with departments’ turnover. This result raises the possibility that the concerns of faculty who remained in the department were different from those faculty members who left.

There were also other faculty concerns that were not motivations for thoughts of leaving but were related with actual turnover. These were “insufficient faculty” (r=.20) and “poor student quality” (r=.20). Departments had higher turnover rates when high percentages of faculty rated these conditions as serious or very serious concerns. The former concern is very possibly an outcome of high turnover rather than a cause, but the latter concern could be a condition that prompts turnover.

4 Discussion

Despite career opportunities and financial incentives, CS faculty departures and serious considerations of leaving are no greater than in the average discipline. The reason for this similarity with other disciplines may be the strong appeal academia has for computer scientists.

The appeal of academia must be strong enough for computer scientists to sacrifice the financial benefits of an industry career. The salary gap between academia and industry is larger for those in the computer science field than it is for faculty in most other disciplines. The average computer science professor earned $63,000 in 1999, more than most faculty members, but less than average for engineering [11]. In contrast, the average doctoral computer scientist employed in industry earned $95,000, or 51% more than comparably educated professors. Considering this disparity in earnings, it seems surprising that the actual rate of turnover for computer science faculty is only 3.3% per year, but the gap might explain why money is among the top motivators for thoughts of leaving.

Proximity to computing industry can contribute to departments’ stability by making it possible for faculty to reduce the earnings gap and enhance their research. It provides opportunities to combine the attractive features of an academic career with supplemental income, opportunities to engage in research on real world problems, and other forms of support such as equipment.

When faculty are supported in their efforts to teach and conduct research, the likelihood of their leaving is reduced. This support can come from private/commercial sources (located nearby or not), or it can come from the college or university. In general, institutional resources, support, and funding have strong direct effects on faculty satisfaction and turnover intention [17].

Lack of monetary resources might be one reason why departments that emphasize teaching were particularly vulnerable to faculty turnover. These departments reported less exceptional institutional support than did research-oriented departments (45% versus 51% above average support) and their faculty were much less likely to have grant money (3% versus 14%). Teaching departments with few financial resources may hire adjunct faculty as a way of minimizing monetary commitments. The shortage of funds in these departments leads to their especially high full-time faculty departure rates, which makes it necessary to employ more adjunct faculty to take the place of those who had left. In other words, employing adjuncts might not lead to turnover; it could be caused by turnover, as we suspect is the case with concern regarding insufficient faculty in a department. Further investigation is needed to determine the causal direction and role these factors play.
Regardless of departments’ financial circumstances, they can take steps to minimize faculty turnover. “Support” can be more than monetary. Salary may not ensure faculty contentment. For example, higher compensation levels increase the retention of assistant and associate professors, but have no effect on retaining full professors [7]. In fact, six of the top seven reasons for faculty departure from the average discipline are intangible benefits such as research opportunities [7].

In place of, or in addition to monetary support, departments can take a number of steps to reduce faculty departure. They can enroll students who meet faculty members’ quality standards. They can reduce the faculty motivations to consider leaving that are within their control. For example, department leadership motivated some faculty to thin of leaving. Attention to the quality of leadership could minimize departures for this reason. And they can hire female faculty whenever possible, because women were shown to leave their positions less often than their male colleagues leave.

5 Summary

Computer science faculty are as committed to their profession and institutions as are faculty in other disciplines, perhaps more so given the exceptional opportunities available to them outside of academia. They think about leaving and actually leave their positions at about the same rates as faculty in other disciplines. This commitment to academia appears strongest among women, who stay in their positions at higher rates than men. However, the short supply of qualified CS faculty and the increasing demands put on faculty by skyrocketing undergraduate CS enrollments make even this typical rate of turnover a serious concern. Although several of the factors found to be associated with faculty turnover may be beyond the control of chairpersons and institutional administrators, other identified factors could be influenced to minimize departments’ loss of CS faculty.

References


This material is based upon work supported by the National Science Foundation under grant number EIA0089959. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.