# Teaching IT: A Survey of Terminal Degrees, Hiring and Promotion for Information Technology Professors

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**Abstract**

Information Technology (IT) is a fairly new field, both in academia as well as in the "real world." Both its newness and its unique relationship with industry allow for a variant on the traditional academic terminal degree, which is typically a doctoral degree. Whereas traditional academic fields benefit greatly from the study and research resulting in a Ph.D. degree, the fast-paced field of IT needs to put a higher value on the actual work experience of the professors that are hired and retained with tenure. This is particularly important due to the ever-widening gap between the increasing number of new computer faculty positions and the decreasing number of new computer and technology Ph.Ds. I have conducted an online survey of IT professors to find out current policy standards regarding terminal degrees and work experience, as well as other information pertaining to hiring and promoting information technology professors.

**Keywords**: Information technology degree program, terminal degree, tenure, hiring and promotion of professors, professional work experience, academia.

## 1. SURVEY METHODOLOGY

The survey was put online in early July 2001, with a Web URL of **http://raven.ubalt.edu/staff/lankford**. The survey consisted of forty (40) questions, pertaining to the professor, the IT degree program, and tenure qualification information. The URL for the survey was emailed to several listservs (SIGCSE (ACM's Special Interest Group on Computer Science Education) and AITP-faculty (Association of Information Technology Professionals), among others) as well as to individual IT program professors and IS, CIS, and MIS programs that appeared to focus on IT-related courses. As of the time of publication, seventy-four (74) professors, chairs, and instructors representing sixty (60) colleges and universities completed the survey and their information has been used as the main data in this paper (see Figure 1).

The survey was written in ColdFusion with a Microsoft Access backend. The survey was put online on July 9, 2001. There were technical difficulties with the server, particularly ColdFusion, causing the survey to be unavailable for three days. It is possible that this downtime caused a lesser number of respondents, however a text version of the survey was available when the HTML survey was not. The short length of time to conduct the survey and the summer timeframe are additional considerations for the number of respondents. The survey was also amended within the second week of the survey, to capture the respondents' definition of IT in the Comments section.

## 2. SURVEY RESULTS

### A. Defining IT

One of the most interesting findings of the survey was the varying definitions of IT. This issue surfaced with the surprising variety of program names that appeared throughout the survey (see Figure 2). While I personally define IT to be a separate entity from Information Systems (IS), Management Information Systems (MIS), and Computer Science (CS), others find IT as the umbrella under which these other groups or divisions fall. Computer Science tends to be more of a science and math-based program, where IS and MIS are more business-based, and IT is more practical, hands-on, and technical. For example, Dr. James Blundell from the University of Missouri-Kansas City mentioned a car analogy showing the differences between IT, IS, and CS. In the analogy, the automotive engineer who designs the car and must know all the inner workings is a computer scientist. The driver or chauffeur of the car, who need not know how the car works, but only how to make it run efficiently, is CIS/MIS. The mechanic, in between the two, represents IT (Blundell 1999). The ITAA (Information Technology Association of America) defines IT as the "study, design, development, implementation, support or management of computer-

based information systems, particularly software applications and hardware" (Arnheim 1997). However, an ISWorld listserv poll found that a majority (43.6%) of the respondents perceived IS to be the umbrella category over IT, and felt that IS includes IT (Nickerson 2000). This debate, if IS includes IT or vice-versa, will not be answered in this paper but it does need to be mentioned as a bit of a quandary in academe.

In addition to the differing program names, the schools under which the programs fall are also varied. Twenty-two (22) of the programs fall under business schools. Eleven (11) include the word "Computer" or "Computing" in the title of the school. Nine (9) schools include the word "Technology" in the school name. Four (4) programs fall under Liberal Arts or Arts & Science schools, as well as four (4) whose schools had "Engineering" in the title. Three (3) schools had "Math" in their names. And lastly, two (2) respondents were from Professional Studies schools within their college or university.

**B. Program Characteristics**

Although the variety of program names was unexpected, I knew that there would be some programs that would concentrate on the same technical topics, and yet have a different degree title. The survey included a drop-down box consisting of possible program characteristics that the program focuses on. The list included:

Business - as electives,
Business - as requirements,
Computer Hardware/Architecture
Database,
Labs/Hands-on,
Basic Networking,
Advanced Networking (TCP/IP, routing, switching, etc.),
Operating Systems,
Programming, and
Web

These are characteristics that most IT programs will be focusing on, with the possible exception of required and elective business classes. Figure 3 lists the program characteristics and the number of respondents whose programs fit those characteristics. Of note is the thirteen (13) schools who focused on all characteristics with the exception of the business classes (optional). While these characteristics are typical focuses of IT programs, only six (6) are IT programs, the others are CIS (5) and computer science (2).

**C. Problems with Hiring Faculty**

Even though IT is new as a major, not much older than a decade, IT degree programs have become very popular with students. At least part of the reason for the popularity is a public shortage of IT professionals. According to the U.S. Department of Commerce, the US will require more than two million new IT workers through 2008, more than three-quarters of whom will need at least a bachelor's degree (U.S. Department of Commerce 2000). Although the number has surely decreased somewhat due to the well-publicized slew of lay-offs, such as the 6,500 workers laid off in the greater Washington DC metro area alone over a five (5) month period in 2001 (Babco 2001), not to mention the layoffs that seem to occur just about everyday, there are still many openings for IT positions. There is also the promise of lucrative careers in the IT industry, heard and seen in advertisements in the newspaper, TV, and radio, announcing the high salaries to be had for people working in IT jobs. This increase in the number of potential and real students leads to the necessity of more and more qualified professors not only in IT majors, but in all computer-related majors.

Out of the seventy-four (74) survey responses, fifty-eight (58) or 78% reported problems hiring professors within their programs. The primary reason for difficulties in hiring professors was listed as a shortage of qualified candidates - with twenty-seven (27) of the respondents listing this as a problem. The shortage of candidates issue can be further broken down into subcategories: lack of appropriate technical skills, lack of professional work experience, lack of Ph.D. candidates or programs, and lack of teaching experience. This is a real problem that is occurring in both computer science and information systems. According to *The Supply and Demand of Information Systems Doctorates: Past, Present and Future*, "there has generally been a gradual decline in the number of new IS doctorates since 1993, while the number of tenure-track faculty positions has grown dramatically" and it does not appear that the problem will go away any time soon (Freeman 2000). The AACSB (American Association of Collegiate Schools of Business) found that that doctoral candidates from all disciplines of business schools have been declining from 1993 to 1998, specifically 43% for IS doctorates (Freeman 2000). The 1999-2000 Taulbee Survey identified the problem in the realm of computer science. According to the survey, "new undergraduate enrollments continue to reach historic highs" while the number of computer science Ph.D.'s awarded is at its lowest number in over ten years (Bryant 2001). Similarly, the computer science departments surveyed predict a 21% growth in hiring over the next two years (Bryant 2001).

The second biggest problem in hiring professors is salary limitations, with twenty-one (21) respondents listing the low salary as a problem in hiring faculty, specifically when compared to industry salaries. According to the 1999-2000 Taulbee Survey, the average salary of a tenured CS assistant

professor is $68,628 with a very close salary average of $68,915 for new Ph.D. tenure-track CS positions (Bryant 2001). In a recent Academe report on salaries within academia, it was determined that "professors are paid roughly 25 to 30 percent less than similarly educated professionals" (AAUP 2001). A specific look at the average salary of Computer and Information Scientists versus the average professor salary in the same report showed a 11.8% salary disadvantage.

Other problems in hiring consisted of: budget (which may deal with salary limitations), the location or size of the school, the rapid growth of the program, and the varying definitions of IT.

The combination of a majority of respondents suffering difficulties in hiring professors in their programs, along with the increasing number of students in these programs implies that something must be done to increase the number of qualified candidates that are available to teach. One way to handle this, which is being done by multiple schools in the survey, is to not require a doctoral degree, but to substitute professional work experience for the academic credential (see Figure 4). In using the combination of a Master's degree and professional work experience, the professor has a working knowledge of the "real world" that can easily be applied in the classroom. Having IT work experience can help both in communicating ideas to the students, as well as the ability to more readily incorporate practical and applied exercises in the classroom.

**D. Terminal Degree**

A terminal degree is the degree at which a faculty member is considered an expert in his or her field, and at which a tenure-track and tenure position is a possibility. While most of the responding colleges and universities did list a doctoral degree as the terminal degree, according to the survey, more IT programs have a Master's terminal degree than doctoral (see Figure 5).

While the data and comments from the IS, CIS, MIS, and CS programs are extremely useful, these older programs almost always listed a terminal degree as a doctoral degree. To get a more accurate view of just the information technology programs, I have looked at results both from the overall respondents, and then specifically from IT professors.

Thirty-seven (37) of the schools at which the respondents are employed require a doctoral degree for becoming tenure or tenure-track (nine (9) of which listed themselves as research universities). Of the specifically IT programs, five (5) schools require a doctoral degree. Eight (8) of the surveyed colleges have a Master's degree as the terminal degree, of which six (6) of these are IT programs. Respondents from four (4) schools, two (2) of which have IT programs, did not know the terminal degree, and six (6) schools have the terminal degree based on the professor (of which three (3) were specifically IT programs). This last option, "based on professor," means that there is no written rule for the school or the department, but rather the terminal degree or tenure-track qualifications are based on a case-by-case basis. Two (2) of the respondents mentioned that the professors at their colleges or universities do not use the tenure system. Overall, twenty-eight (28) of the respondents had become tenure or tenure-track with a Master's degree, eighteen (18) (64%) of which teach in IT programs.

Several reasons surfaced for using the Master's degree as a terminal degree. One is the lack of Ph.D.s, not only in the computing field, but even more specifically in IT. As listed above, there is a definite lack of new Ph.D.'s in both IS and CS disciplines. In 1998, there were an estimated 86 universities in North America with active IS doctoral programs (Freeman 2000). As of 1996, there were 154 Computer Science and Engineering departments in the U.S. that offer doctoral degrees (Denning 1996). However, I was able to locate only four (4) IT Ph.D. programs in the U.S. These programs were offered at: George Mason University (the first, offered in 1985), Rutgers and New Jersey Institute of Technology (NJIT), Florida Atlantic University, and Harvard University.

In addition to the lack of IT Ph.D. programs, one IT professor mentioned in the survey that the Master's degree is the terminal degree because the school follows the ABET accreditation guidelines for engineering technology programs. According to the Technology Accreditation Commission (TAC), responsible for accrediting engineering technology programs, faculty should have 3 years of industrial experience and "A master's degree in engineering or engineering technology, which is considered as the appropriate terminal degree" (ABET 2001). IT programs are not yet accredited, but it is likely that IT programs will fall under the TAC accreditation.

Finally, most professional IT positions do not require an advanced degree, such as a Ph.D, or even a Master's degree. According to a national survey of AITP (Association of Information Technology Professionals) of 620 randomly selected members, 41% had Bachelor's degrees, while 21% had Master's degrees (Davis 2001). Although the field is changing, it is still common for IT professionals to not even have an associates degree. This possible market of educating existing IT professionals may help out IT undergraduate programs, but it is hard to see how it will feed the flames of increasing the number of IT Ph.D. programs.

The data shows that in older academic programs, the terminal degree is typically the doctoral degree. However, in a majority of the IT schools surveyed, the Master's degree is the terminal degree, mostly coupled with professional IT work experience.

**E. Professional IT Work Experience**

Fourteen (14) schools require 1-5 years of professional IT experience to be hired as a faculty member. Of these schools that require professional IT work, five (5) require a Master's terminal degree, while four (4) require a doctoral terminal degree. Sixty (61) of the respondents or 84% found work experience or professional certifications to be important to teaching in the field. The primary reasons for the importance of professional work experience are (in order):

* to better prepare students for the "real world" and offer practical application of skills to students,
* to learn or master new technology and keep up-to-date with new skills,
* to understand that application of the technology differs from theory,
* to gain students respect and build credibility, and
* to meet the hiring requirement.

An impressive sixty-four (64) of the seventy-four (74) respondents or 86% had professional work experience, ranging from one (1) year to over twenty (20) years. The average amount of IT work experience among those who have worked in the field is eleven (11) years, which is probably a low estimate, due to the fact that the question listed only up to twenty (20) years of experience (20+ was listed in the survey, which translated to 20 in the database).

According to a journal article in Communications of the Association for Information Systems (CAIS): Only in rare cases, which are the exception, do people leave the IS industry and join the academic ranks. Too often, top IS practioners, who wish to bring their industrial experience to academia, have to start relatively low on the academic ladder in terms of status, power, and pay. The existing career-path model is rather rigid and does not encourage transition of practioners into the academic since practical achievements are usually not valued in academia (Heart 2001).

It is important to realize that those who have worked in industry and in the field have a lot to offer not just the students, but the faculty and college as a whole, and should not be ignored as a potential source of new faculty.

**F. Teaching Experience**

In addition to having a number of years of "real world" professional experience, the respondents have taught for many years, on average. As seen in Figure 6, the average number of years taught at the undergraduate level is fifteen (15), and the average number of years taught at the graduate level is ten (10). When looking at the specifics for teaching in an IT program, the average number of years spent teaching undergraduate students is twelve (12), and the average number of years teaching IT graduate level classes is nine (9).

The average number of semester equivalent credits taught annually per professor is nineteen (19), which is over six (6) 3-credit classes taught per year. As seen in Figure 7, the average teaching, research, service ratio is 66% / 16% / 19% respectively. (Note: this ratio should add up to 100%, but actually adds up to 101%. Several respondents listed ratios that went over 100%, at least one was marked with a comment that more than 100% of his or her work time is devoted to academia.) As is evident from the numbers, the majority of the time and effort of the respondents is spent on teaching, and more time, on average is given to service than to research. With 25% of the universities responding to the survey as research universities, the teaching to research ratio appears to be high, but shows that these colleges and universities place a high importance on teaching.

**G. Professional Certifications**

There are debates regarding professional certifications in the professional field of IT, as well as in the academic world. Figure 8 lists certifications held by respondents of the survey. Included in the survey question regarding the importance of professional work experience was the importance of certification. Three (3) respondents wrote comments regarding certifications not being important at all for professors, while one mentioned, "Professional experience is very useful, but certification can substitute as a means of continuing the education process." Twenty-four (24) of the respondents have at least one certification. In a world where the technology changes quickly, and faculty needs to stay ahead of the pack, certifications can add credibility as well as the potential to keep up-to-date on technical skills, similar to, but not quite as important as work experience.

**3. GOING FORWARD**

With the number of existing and expected faculty openings in the field of IT, IS, and CS, along with the low, and even decreasing supply of new Ph.D.s to fill these openings, there are several solutions that can be gathered from this survey. The first solution is to follow the lead of those colleges and

universities that use a Master's degree, typically coupled with a number of years of professional work experience, as the terminal degree. This coupling of the Master's degree and IT work experience is already being done in several IT degree programs, and is listed as the terminal degree within a major engineering technology accreditation program. Given the practical nature of the program, professional work experience is not only a requirement for certain accreditation programs, but welcomed by faculty and students alike. The lack of existing IT Ph.D. programs also contributes to the argument in pushing for a Master's degree as a terminal degree in IT degree programs.

The second solution would be to allow IT professors to obtain a doctoral degree after being tenured or becoming tenure-track. Of the seventy-four (74) survey respondents, seventeen (17) either went on to get a doctoral degree after tenure (5) or knew others who went for a higher academic credential after they had been tenured (12). One example of implementing such a solution occurred at Dickinson College, where there was an opening for a computer science tenure-track position for ten years. Grant Braught was hired with a Master's degree, with the understanding that he would get a doctoral degree while on tenure track (Braught 1999; Braught 2001). This can be seen as a viable solution, particularly for potential faculty who have work experience and/or teaching experience.

## 4. CONCLUSION

The field of IT is new and growing quickly, both in and out of academia, even during economic downturns. To meet the demands of students, colleges and universities must be able to find, develop, and retain faculty in their technology degree programs. In similar technical fields, such as computer science, and information systems, there is already a lack of new doctoral students, not to mention an increasing number of faculty openings in those programs. The experience of professors currently teaching in the field needs to be given serious attention for schools to be able to attract and retain both students and faculty. This view was mirrored by an overwhelming majority of survey respondents remarking on the importance of working in the field.

Since most schools will not be able to compete with the salaries most IT professionals will earn in the workforce, schools need to be careful not to put up barriers to discourage talented professionals from becoming teachers. One such barricade is the lack of Ph.D. programs specifically in IT, for schools that require a doctoral degree as a terminal degree. In such cases, serious consideration needs to be given to using
the Master's degree as a terminal degree, particularly where the individual has professional work experience.

## 5. FIGURES

**Figure 1 – Overall results of survey**

| | |
|---|---|
| Total number of surveys filled out: (minus duplications and blanks) | 74 |
| Total number of colleges and universities participating in the survey: | 60 |
| Number of professors responding: | 62 |
| Number of tenure-track professors responding: | 49 |
| Number of tenured professors responding: | 34 |
| Number of chairs/directors responding: | 8 |
| Number of instructors responding: | 5 |
| Male respondents: | 55 (74%) |
| Number of research universities responding: | 15 |
| Average number of semester-equivalent credits taught per year: | 19 |
| Highest number of credits taught per year: | 30 (4 responses, 2 of which are community colleges) |
| Number of programs whose highest degree awarded is Bachelor's: | 32 |
| Number of programs whose highest degree awarded is Master's: | 22 |
| Number of programs whose highest degree awarded is post-graduate certificate: | 3 |
| Number of programs whose highest degree awarded is doctorate: | 4 |

**Figure 2 – Program Names From Survey**

| Program Name | Number of Respondents |
|---|---|
| Applied Information Technology | 1 |
| Applied Science (Associate degree) | 1 |
| Business Computer Information Systems | 1 |
| Business Information Systems | 1 |
| Computer and Information Sciences | 1 |
| Computer Applications (Associate degree) | 1 |

| | |
|---|---|
| Computer Information Systems | 10 |
| Computer Science | 7 |
| Computer Science – Management Information Systems | 1 |
| Computer Systems Technology | 1 |
| Computing and Information Systems | 1 |
| Industrial Technology | 1 |
| Informatics | 1 |
| Information Engineering Technology | 1 |
| Information Sciences and Technology | 1 |
| Information Systems (IS) | 5 |
| Information Systems Management | 2 |
| Information Systems, Computer Science | 1 |
| Information Technology (IT) | 16 |
| Instructional Technology Distance Education | 1 |
| Internet Technology | 1 |
| Management Information Systems (MIS) | 5 |
| Office Information Systems | 1 |
| Professional Studies in Computing | 1 |
| Technology | 1 |
| Telecommunications Management | 1 |

**Figure 3 – Program Characteristics**

| | |
|---|---|
| Business – as electives | 20 |
| Business – as requirements | 32 |
| Computer Hardware/Architecture | 39 |
| Database | 55 |
| Labs/Hands-on | 49 |
| Networking (Basic) | 48 |
| Networking (Advanced) | 29 |
| Operating Systems | 29 |
| Programming | 52 |
| Web | 46 |
| Surveyed colleges and universities that had all characteristics (except for Business which was optional) | 12 (6 of which are IT programs) |

**Figure 4 – Educational Background of Respondents:**

**Degrees Earned by Respondents:**

| | |
|---|---|
| Number of respondents with highest degree is Master's of Science (**MS**): | 19 |
| Number of respondents with highest degree is Master's of Arts (**MA**): | 5 |
| Number of respondents with highest degree is **post-graduate certificate**: | 1 |
| Number of respondents with highest degree is doctorate or **Ph.D**.: | 46 |

**Degree Programs Earned by Respondents:**

| **Degree Program Name** | **Number of respondents** |
|---|---|
| Business | 5 |
| Chemistry | 1 |
| Communication | 1 |
| Computer Science (including Computer Technology) | 22 |
| Education related (Computer Education, Business Education, etc.) | 9 |
| Engineering related | 3 |
| English | 1 |
| Finance | 1 |
| HPER | 1 |
| Information and Computer Science | 1 |
| Information Science | 1 |
| Information Systems | 6 |
| Mathematics | 4 |
| Media Studies | 1 |
| MIS | 12 |
| Physics | 2 |
| Software Development and Management | 2 |

**Figure 5 – Terminal Degrees**

| **Respondents** | **Overall** | **Schools with IT programs** |
|---|---|---|
| **Master's Terminal Degree** | 8 | 6 |
| **Doctoral Terminal Degree** | 38 | 5 |
| **Unknown Terminal Degree** | 4 | 2 |
| **Terminal Degree Depends on Professor** | 6 | 3 |

**Figure 6 – Teaching Experience**

| | **Average** | **Minimum** | **Maximum** |
|---|---|---|---|
| Years of teach | 15 | 1 | 45 |

| | | | |
|---|---|---|---|
| ing undergraduate (in general) | | | |
| Years of teaching graduate (in general) | 10 | 0 | 41 |
| Years of teaching undergraduate (specifically IT) | 12 | 0 | 30 |
| Years of teaching graduate (specifically IT) | 9 | 0 | 31 |

**Figure 7 – Teaching / Research / Service Percentage Breakdowns** (# of respondents in parentheses)

| | Average | Minimum | Maximum |
|---|---|---|---|
| Teaching | 66% | 0% (1) | 100% (1) |
| Research | 16% | 0% (13) | 50% (2) |
| Service | 19% | 0% (4 ) | 85% (1) |

**Figure 8 – Professional Certifications**

| Certification Name | Number of respondents with certification |
|---|---|
| A+ | 2 |
| CCNA | 2 |
| CCP | 4 |
| CDP | 7 |
| CNA | 3 |
| CSP | 4 |
| Insurance related certifications (FLMI, ChFC, CLU, CPCU) | 1 |
| ISP (Canadian) | 1 |
| MCP | 5 |
| MCSE | 1 |
| MCT | 3 |
| Network+ | 1 |
| PeopleSoft Programmer Analyst | 1 |

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