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In this issue:

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Gender and Technology Careers: The Gap Continues

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Abstract

A recent survey of 300+ undergraduates found few differences in how males and females use technology. Most students described themselves as experienced or very experienced with computers, and familiar with web browsing, e-mail, word processing, and multimedia tasks such as downloading and editing video. Male and female students spend roughly the same amount of time with computers doing roughly the same type of activities. However, in a survey of undergraduates in a general computing class, 73% of the females strongly indicated they would not consider a computing major, compared with 63% of the males ($p < .01$). So while men and women have similar skills and experiences with technology, women report much lower interests in technology as a career. This paper reports on the results of this survey and discusses its implications for IT education and the IT field.

Keywords: Gender, computing careers, computing skills, IT curriculum

1. INTRODUCTION

Students entering college in the Fall of 2006 have a different set of computing skills than students had five or six years ago. Today, most students are proficient at word processing, surfing and searching the Web, and downloading files. Many are comfortable using spreadsheet and presentation software. Some maintain their own Web sites. Unfortunately, this increased level of technical computer skills has been accompanied by a decrease in interest in technology related careers.

Since the "dot-com bust" in the early 2000s, there has been a steady decline in the number of students pursuing a career in computing. Only 1.4% of 2004 incoming undergraduates listed Computer Science as a probable major as opposed to 3.7% in 2000, a decline of more than 60%. More alarming is the rate of decline among women. In 2000, 1.4% of incoming women undergraduates listed Computer Science as a probable major as opposed to only 0.4% in 2004, a decline of more than 71%. At the same time, the relative gap between the percentage of men and women choosing a career in Computer Science has widened. In 2000, 4.6 times as many men as women were planning to choose a Computer Science career. In 2004, 6.8 times as many men as women were planning a Computer Science career. During the same time period, most other fields have seen an increase in the proportion of bachelors degrees awarded to women (Vegso, 2005).

Although these data are for Computer Science, other computing disciplines have seen similar declines. For example, in an informal survey of nine MIS programs, Steven Burd found that undergraduate enrollment dropped anywhere from 25% to 75% in the last five years (Burd, 2006).

Is there a relationship between the way in which first-year undergraduate men and women use technology and their choice of a technology career?

2. RECENT RESEARCH ON GENDER DIFFERENCES IN USE OF TECHNOLOGY

Recent research indicates both genders are active users of computing technology. However, there are differences in the way males and females use technology. Lenhart, Madden and Hitlin (2005) showed that teenagers use the internet to maintain complex networks of friends. Although males and females use the internet to the same extent, they differ in what they do online (p. 37). Malaney (2004) found similar patterns of use among college students. Wasserman and Richmond-Abbott (2005) found that although "access to the Web was independent of gender, women communicate on the Internet differently than men, are online less than men, and utilize different types of Websites than men (p.252)." Howard, Rainie and Jones (2001) concluded that women are more likely than men to use the Web to maintain social contacts. It should be noted, however, that not all studies find gender differences in computer use. For example, in a study of knowledge workers, Knight and Pearson (2005) found that neither age nor gender had a significant effect on computer usage.

3. DEVELOPMENT OF THE SURVEY INSTRUMENT

Pace University is a private institution with campuses in downtown New York City and suburban Westchester County. Students are required to take one computing class as part of their core requirements. Students are divided among four schools: business, arts and sciences, computing, and nursing.

The course CIS101, Introduction to Computing, is a core general education course. Most computing majors are waived from this class in order to begin courses in their chosen field of study. Therefore, the primary characteristic of this course is that it consists of mostly first year undergraduates who are either undecided or have selected non-computing fields, which could be as generic as "business."

This population was selected for study for several reasons. First, it is the largest course offered by the School of Computing, and is therefore a recruitment target for new computing majors and minors. Secondly, since it is required by nearly all students (including some computing majors), it is a good representation of the school's population.

CIS101 has undergone several curriculum changes over the past few years. One of the key drivers for these changes is a perception that students are entering college with more advanced computing skills than students in the past, along with a decreased interest in computing majors or minors.

Therefore, a goal for this survey was to determine the skill level of CIS101 students. Administering a standardized skill exam such as the International Computer Driving License (http://www.icdl.org) was impractical. As a result, the survey was designed to capture a number of interrelated perceptions and self-assessments. How much time do students spend using the computer? For which activities do they use the computer on a daily basis? How do students assess their knowledge of office applications, database, programming, and networking? What skills do students expect they will need in their careers? How do students plan to improve their computer knowledge and skills?

A literature review found a number of computer literacy and skill surveys (Davis, 1999; Villarreal, Smith, Akers and Haygood, 2002; Hoffman and Vance, 2005). These were adapted to the survey. A pilot version was tested with a student population of 50. Most of the students already had computer education in their K-12 schools. The survey contained questions on their perceptions of the effectiveness of that training.

Based on the feedback from the pilot survey, the authors developed the survey to contain the following sections:

- Demographic information
- Perception of K-12 computer education
- Self assessment of current skills
- Perception of skills needed for career
- Plans for future computer education and skill development

- Profile of computer use

4. RESULTS

The survey was administered to 330 students, 224 female and 106 male. These numbers are consistent with the general demographics of the university, which is about 60% female. The vast majority (81%) are between 18-21 years old. The student population is ethnically diverse. 4.8% selected American Indian or Alaska Native, 11.8% selected Asian, 11.8% African American, 10.9% Hispanic, 4.5% Mixed Race, 45.5% White, and the remaining as Other. They listed approximately 20 different majors, such as Accounting, Political Science, History, Business, English, as well as undecided.

Students reported they spend more than 4.5 hours a day online or using a computer. 83% have taken computer courses in high school or middle school. Of those who had previous computer courses, 32% described them as effective and 14% described them as very effective.

There were some significant differences between male and female students. For example, 41% of males spent more than 2 hours surfing the Web compared to 30% of females (Phi = .190, p = .035). 65% of female students reported they access social networking sites such as FaceBook or MySpace everyday compared to 47% of male students (Phi= .256, p < .0001). Male students reported more experience copying and downloading songs (Phi = .214, p = .004) and downloading digital videos (Phi = .321, p < .0001).

There were also many similarities. Male and female students reported equivalent experiences with instant messenger and using the computer in general. The majority of all students described themselves as able to use email, word processing and web browsing software. 35% reported experience maintaining and designing a website.

As Table 1 (see Appendix) demonstrates, the respondents were very confident in their computer skills. Only 15.7% reported their computer skills were inadequate. There were statistically significant differences between males and females. However, similar results were obtained if you add up the totals for "strongly agree" and "agree." 57.6% of males agreed or strongly agreed, compared to 63% of females.

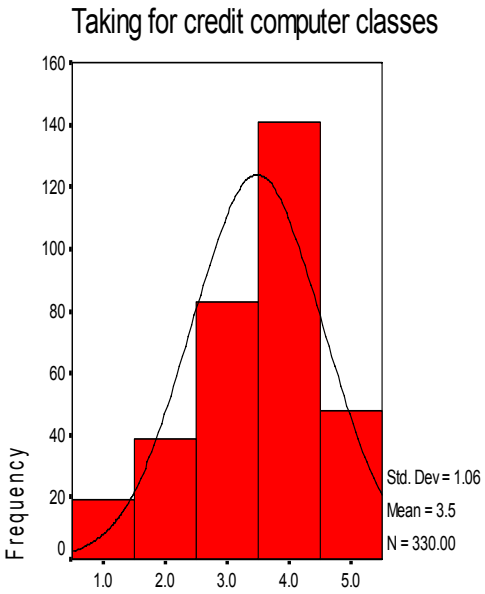

Figure 1; Distribution of intention to take for-credit classes

Although a majority of students reported their current computer skills are adequate for their career, 32% reported they will need to create a database using a standard database package and almost 55% expected they would need to use spreadsheet functions to evaluate standard business formulas. 54.2% also indicated they will need additional knowledge of computer hardware. It is not clear from the results whether students feel they already have mastered database and spreadsheet skills, or whether they think they have the skill to master these tasks without much effort.

The survey also asked how students plan to advance their skills. This is especially relevant to future curriculum development, because the university needs to understand the intentions of undergraduates to plan for future course offerings. The vast majority of students expected to learn through trial and error (69.1%), peer support (71.8%), and by reading documentation (85.1%). 37.9% plan to attend non-credit courses or workshops and 57.2% plan to take additional for-credit computing classes. Figure 1 demonstrates that there is a strong intention to take additional computing courses. The val-

ues along the X-axis go from one to five, or strongly disagree to strongly agree.

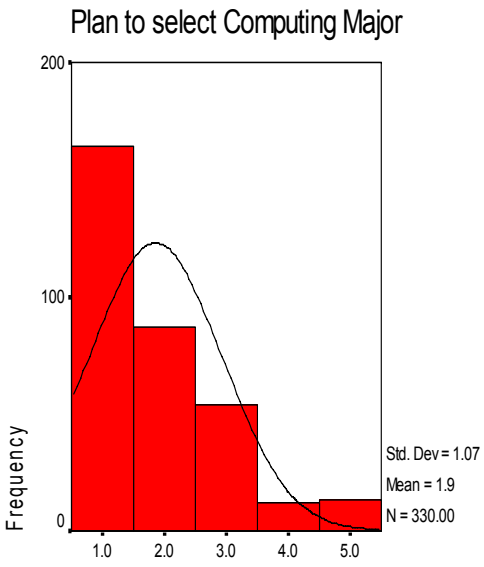

Figure 2: Plan to take computing major

5. GENDER DIFFERENCES IN COMPUTING DEGREES

Overall, the number planning to pursue either a computer MAJOR or MINOR was very limited (see Figure 2 and Figure 3). This was especially true among female students. 54.9% of female students strongly disagreed with the statement "I plan to select a computer based MAJOR" compared to 38.7% of males (Phi= .241, p = .001, see Table 2). Similar results applied to taking a computer based MINOR. 50.4% female strongly disagree compare to 31.1% of males (Phi= .261, p < .0001, Table 2, see Appendix). Overall the number of students who plan to select a computer based major is 7.5% and those who plan to select a computer based minor were 9.5%.

There are surprises in the data collected. 29% of students who reported their current computer skills are *inadequate* indicated they *would not take* additional computer courses. There are also some "traditional" gender differences. 33% of males compared to 9.8% of females describe themselves as experienced with hardware, network management, and programming (Phi= .310, p < .0001). 69% of males compared to 48.7% of females expected to use basic spreadsheet functions in their career (Phi=.209, p =.006). 89.2% of females compared to 66.1% of males expected to use advance features of word processing software (Phi= .187, p = .021).

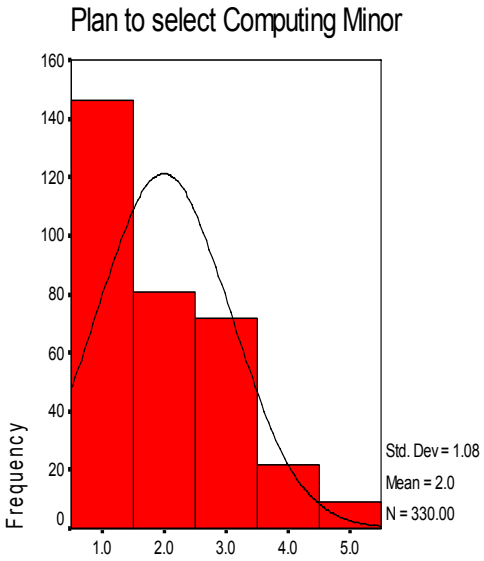

Figure 3: Plans to take a computing Minor

The survey does reveal some lingering cultural differences between male and female students. These do not affect the amount of time they spend with the computer or, in general, how they use the computer on a day to day basis. Cultural differences do unfortunately appear quite starkly with regard to female plans to pursue a computing major or minor. The response of the female students was quite emphatic: More than 50% selected the most extreme option: strongly disagree.

Female students are not averse to taking additional computing courses, however. 55.8% plan to take an additional for-credit computing course, compared to 60.4% of the male students.

6. CONCLUSION

The contribution of this paper is demonstrating that even though males and females have similar familiarity with and use of technology, female students are strongly biased against technology careers. The news is only a little better among male students. Both genders demonstrate a shocking degree of confidence in their own computer skills. This contradicts a study on the gen-

erally poor abilities of college graduates (Baer, Cook and Baldi, 2006).

Why are students not considering careers in computing? A recent U.S. Bureau of Labor Statistics study (College Board, (2006) shows that six of the ten occupations that will have the most new jobs over the next decade are in computing. However, students are not interested in pursuing computing careers! Do students feel that their current computer skills are adequate to carry them through their intended career? Do students think they "know it all" about computing and, therefore, are not interested in a computing career?

A follow up study underway is focused on understanding how taking a technology course affects plans to pursue IT related careers. With the severe drop in computing majors, a critical task is to identify what courses most relate to the needs and interests of the majority of students (57.2% in the survey) who indicate they would like to take additional for-credit courses.

What defines the technical skill set of the modern information worker? Do the university's students graduate with these skills? These are the questions that need to be addressed in developing curricula for the majority of students, who have a familiarity with technology, but have no plans to pursue computing majors or minors.

7. ACKNOWLEDGEMENTS

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APPENDIX

"I expect that my current computer skills will be adequate for my career."** (Phi=.207, p = .007)

	SD	D	Neither	A	SA
Female	1.30%	13.80%	21.90%	53.60%	9.40%
Male	5.70	11.30	25.50	38.70	18.90
Total	2.70	13.00	23.00	48.80	12.40

Table 1: Results of computer skills self assessment.

	** Very experienced with HW/SW/network				
	SD	**D**	**Neutral**	**A**	**SA**
% Female	17.9%	41.5%	30.8%	9.4%	.4%
% Male	11.3	28.3	27.4	25.5	7.5
	** Plan to select computing MAJOR				
	SD	**D**	**Neutral**	**A**	**SA**
% Female	54.9	27.7	12.9	2.7	1.8
% Male	38.7	23.6	23.6	5.7	8.5
	** Plan to take computing based MINOR				
	SD	**D**	**Neutral**	**A**	**SA**
% Female	50.4	26.3	17.0	4.0	2.2
% Male	31.1	20.8	32.1	12.3	3.8
	* Visiting a social networking site				
	Never	**1/Month**	**1/Week**	**2/Week**	**Daily**
% Female	14.9	2.3	8.1	9.5	65.3
% Male	13.2	12.3	9.4	17.9	47.2

** p < .01, * p < .05

Table 2: Comparison of male versus female responses.