

Definitions, Data, and Procedures

Nontraditional Definitions

Our study began with an effort to define a “traditional” and a “nontraditional” pathway into the IT workforce. We settled on a definition that refers to students’ choices¹ about when to start their education and decisions made to prolong the period of time it takes to earn their degree. We opted for this formulation to focus on students and not particular institutions, and, indeed, our analysis remains aggregated for the participating institutions. (No institutional affiliation is identified for any students, and only limited analysis is presented by institutional type.)

Our initial definition was based on two variables:

1. Beginning postsecondary education at or after age 21
2. Taking six or more years to complete a degree

As we began the process of administering our surveys and interviews, we found other concepts also of importance in determining nontraditional status, including distance learning, weekend learning, second degrees, and community college transfers.

With our study already two years underway, the U.S. Department of Education issued a special report in *The Condition of Education 2002* on nontraditional students. It found that nearly 73 percent of all undergraduates were “nontraditional” in some way.² Their definition of “nontraditional” included the following:

- Delayed enrollment of at least one year
- Part-time attendance
- Full-time employment
- Financial independence
- Having dependents
- Single parent
- No high school diploma/having a GED

We found that much of the data we had col-

lected could be used to add variables from the U.S. Department of Education study to our own definition of nontraditional student status. In particular, we had gathered data on the following:

- Delayed enrollment
- Part-time attendance
- Full-time employment
- Having dependents
- Taking six years or more to complete a degree

In contrast to the U.S. Department of Education study, however, we felt that a one-year delay in enrollment was not sufficient to designate someone as being nontraditional. So we retained our original three-year delay (or beginning at or after age 21). In our final analyses, then, nontraditional students have one or more of the five nontraditional characteristics outlined above.

Data Collection and Procedures

Before the onset of the data collection activities, all the researchers who would be participating in the data collection effort completed the online certification program that the National Institutes of Health operates for human participant protection.³ All participants in the interview protocols were notified of this certification.

Data collection involved both interviews and the execution of a survey instrument. The top 25 producers of IT/CS bachelor’s degrees in 1997 in the Maryland, Virginia, and Washington, DC, area were initially selected to participate in the study. Institutions were asked to participate based on the number of IT/CS bachelor’s degree graduates they produced in 1997. This year was chosen because it was the latest year for which data were available in 1999–2000 when we were designing the research plan for this project. Gallaudet University was

added to the list, since it was the world's only university in which all programs and services are specifically designed to accommodate deaf and hard-of-hearing students and was located in the geographic area under study. In addition, since the IT/CS boom of the late 1990s, other area colleges and universities have produced a significant number of IT/CS graduates and would have qualified for inclusion in this study.

Of these 26 institutions, five of the 1997 top producers as well as Gallaudet University declined to participate in our study. The 20 area colleges and universities that did participate included four major research universities, five HBCUs, and two liberal arts colleges that are retooling themselves to take advantage of the adult education market (see **Appendix Table B.1**).

Additionally, these 20 institutions were asked to allow our researchers not only to visit their campus and interview current students and faculty, but also to allow us to survey alumni from the year 2000 class of IT/CS graduates. Although interviews were conducted at 20 higher education institutions, only 16 area universities participated in the alumni survey.

Interviews were completed at 74 businesses, nonprofits, educational institutions, and government agencies in the Maryland, Virginia, and Washington, DC, area. The employees and managers were selected by calling area employers, describing the study, and asking if they would allow us to interview some of their staff. The sample is therefore not random, since those who were interested in the study objectives were more likely to participate. A total of 51 IT/CS managers were interviewed, including 23 human resources (HR) managers and 28 line managers. A total of 115 IT/CS employees were interviewed. Businesses were asked to participate based on a number of cross-sectional variables including size, sector, and geographical location. Employers recruited interviewees on their own (again a nonrandom sample), and all interviews were done on an individual basis. Employee surveys lasted about 30 minutes, while line and HR manager interviews were about 20 minutes in duration. All interviews were coded by hand and analyzed using SPSS software.

Description of Survey Instruments

The research team developed interview protocol instruments for the students and faculty as well as for employees and HR and line managers to address research questions posed in this study. Two outside survey experts (Jessica Kohout, Director of Research, American Psychological Association, and Cynthia Deitch, Associate Professor, Women's Studies and Sociology, George Washington University) were engaged to review these instruments. The alumni survey instrument was also developed by the research team and reviewed by two outside survey experts (Joan Burrelli, Senior Analyst, SRS, National Science Foundation, and Roman Czujko, Director, Statistical Research, American Institute of Physics). The survey instruments are reproduced in Appendix A.

We asked many open-ended questions in the interview protocols for the students and faculty, for the employees and managers, and in the online survey instrument and thus had multiple answers. The analysis of this research notes when multiple answers are possible.

Reporting of Data

All data are reported and disaggregated when possible. However, when the "n" values dropped to five or less, to maintain statistical relevance and to avoid the risk of disclosing personal identifiers, the researchers have generally elected to aggregate the results.

Overview of Interview and Survey Participants

Students, faculty, and alumni

Our team of researchers interviewed 72 IT/CS faculty and 139 IT/CS undergraduate students at the 20 institutions. All students and faculty were self-selected or chosen by their departments to participate, so they do not represent a random sample. All interviews were conducted on campus, but on the interviewees' own time (i.e., not during class periods) and on an individual basis.

The respective institutions chose the students and faculty, although the research team asked that

they include students and faculty of both genders and of all racial/ethnic groups, especially underrepresented groups. We interviewed both nontraditional and traditional students to facilitate comparison across the groups, allowing us to isolate experiences and opinions specific to each group. Faculty interviews lasted 45–60 minutes. Student interviews were generally 25 minutes in length. Again, all interviews were coded by hand and analyzed using SPSS software.

The year 2000 alumni survey was sent to alumni of 16 area universities with an overall return rate in the range of 30–50 percent (many of the surveys were distributed by the academic institutions, and numerous mail surveys were returned unopened making it very difficult to identify an absolute return ratio). In total, 185 people either filled the survey out online or sent in a survey form. The survey instrument is included in Appendix A.

Employees and managers

A total of 115 employees with bachelor's degrees were interviewed, and we deliberately sought out women, underrepresented minorities, and those with nontraditional educational backgrounds (including men). All of the employees in our sample had received a bachelor's degree, although not all of them received formal training in information technology or computer science. For those who did not have an IT bachelor's degree, some had an associate's degree in an IT-related field that preceded their bachelor's degree, or IT/CS training that followed receipt of the bachelor's degree, while others only had on-the-job IT training.

The employer representatives were either relatively senior managers who had a role in hiring and workforce development (HR managers) or were immediate supervisors of IT employees (line managers). The HR managers included 23 executive managers, IT directors, IT senior staff, or HR personnel at 22 area organizations. We similarly conducted 28 line manager interviews, which involved discussions with IT directors and senior staff who supervised IT workers at 27 area organizations.

Demographics

The demographics of the student interviewees at the 20 area universities and colleges and the alumni who answered our survey from the 16 participating universities and colleges were remarkably similar. Given that we tried to intentionally oversample women, minorities, and nontraditional students in our interview sample, we came remarkably close to the actual population sample (see Appendix Table B.2).

Nontraditional students

Of the 138 students who responded, 33 percent (45) had one or more characteristics that qualified them as nontraditional, leaving 67 percent traditional students in our interviewee population. In our alumni survey, nearly 30 percent of respondents had one or more nontraditional characteristics when they were a student, similar to our interviewee demographics. The demographics of our employee interviewees were somewhat different from our other two student populations. Unlike our student interviewees and our alumni survey respondents, employees were asked if they were nontraditional students. Nearly 40 percent of our employee interviewees designated themselves as having been nontraditional students during the time they attended a university or college in pursuit of their IT/CS degree. We were also able to calculate whether employees had been nontraditional students using the criteria listed above. Using our measures, almost 50 percent of employee interviewees had been nontraditional. Men were much more likely than women to have been nontraditional students, with 80 percent of male interviewees having at least one nontraditional characteristic versus just 31 percent of females (see Appendix Tables B.3 and B.4).

Gender

Our total student interview population was split almost 50/50 by male to female. Of the nontraditional students, however, 36 percent were female and 64 percent were male. In the alumni survey, 60 percent of all students were male and 40 percent were female—the exact same percentages found for those who had been nontraditional students—again, remarkably similar to our student interviewee demographics (Charts 2.1 and 2.2 and Appendix Tables B.2 and B.3).

The demographics of our employee interviewees

were somewhat different from our other two student populations. Of the 115 employees interviewed, women were greatly oversampled—62 percent were female and 38 percent were male. Although there is a bias in our sample toward women, women and men were equally likely to have been nontraditional students (approximately 50 percent of each gender). However, if we look only at the nontraditional students, the percentages are nearly reversed, with 61 percent being male and 39 percent female (Charts 2.1 and 2.2 and Appendix Table B.4).

Race/ethnicity

In terms of ethnic makeup of our 45 nontraditional student interview set, 42 percent of nontraditional students who indicated a race were African American. This fact is less remarkable given that 25 percent (five) of our schools were HBCUs. What it might mean, however, is that HBCUs are educating a significant number of nontraditional students. Of the remaining nontraditional students, 27 percent were Caucasian, 15 percent were Asian, and the rest did not identify a race. This compares to the 138 students in our overall population of our interview sample, which was 28 percent African American, 12 percent Asian, 40 percent Caucasian, and 5 percent other races. Nearly 15 percent of our sample did not indicate a race or ethnicity (Charts 2.3 and 2.4 and Appendix Table B.2).

We had a much smaller population of African Americans in our alumni survey respondent pool.

Only 13 percent of the overall respondents were African American, 75 percent were Caucasian, and the rest were largely Asian. Of those who had been nontraditional students, however, 17 percent indicated their race/ethnicity as African American (around 41 percent of all African American respondents), 10 percent were Asian (approximately 33 percent of all Asian American respondents), and the rest were Caucasian (about 26 percent of all Caucasian American respondents). Of the total sample, 8 percent did not indicate race/ethnicity (Charts 2.3 and 2.4 and Appendix Table B.3).

Of the 115 employee interviews, the racial/ethnic makeup of the population was 57 percent Caucasian, 16 percent African American, 12 percent Asian, and 3 percent Hispanic or mixed-race. Of interviewees, 12 percent did not indicate their race/ethnicity. Caucasians clearly were more likely to have been nontraditional students—59 percent of all Caucasians were nontraditional students, which was 68 percent of all nontraditional student employees. African Americans in our employee interviewee sample were less likely to have been nontraditional students than in either our student interviewee pool or our alumni survey respondent pool—only 9 percent of nontraditional student employees were African American, which was 28 percent of all African American employee interviewees. The rest of the population of nontraditional student employees was Asian or did not respond to the race/ethnicity question (Charts 2.3 and 2.4 and Appendix Table B.4).

CHART 2.1 Gender Breakout of Survey and Interview Participants

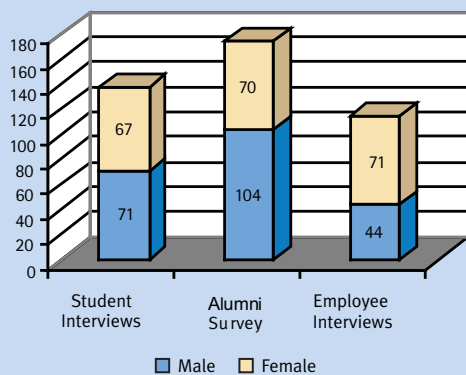
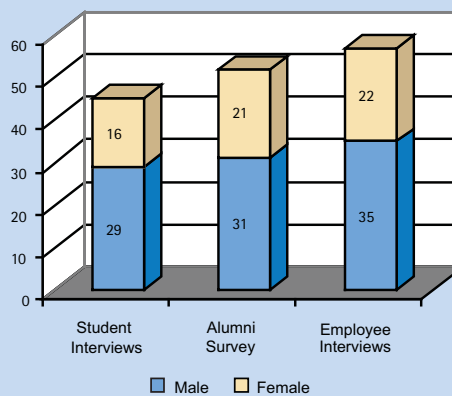


CHART 2.2 Gender Breakout of Nontraditional Survey and Interview Participants



Simply by looking at the demographics of our interviewees and survey respondents, one finds that among the nontraditional student population at traditional institutions, a sizable proportion is Caucasian males. This has implications for any policies targeting nontraditional women and minorities.

Faculty demographics

We interviewed 72 faculty at 20 area colleges and universities. About one-third of our interviewees were women, and almost all were U.S. citizens or permanent residents. By race, 61 percent were Caucasian, 18 percent were African American, and the rest were largely Asian. Nearly 60 percent were either tenured or on the tenure track, whereas 33 percent were non-tenure track and 8 percent indicated that the tenure system was not used at their institution. Approximately 20 percent of our interviewees were either department heads or deans. Other demographic and administrative data on our interview population is included in **Appendix Table B.5**.

Employee demographics

The employees we interviewed were reasonably well distributed by age. A total of 29 percent were in their twenties at the time they were interviewed, 44 percent were in their thirties, 20 percent were in their forties, 5 percent were in their fifties, and the remaining 2 percent were 60 or older. In our sample, older employees were more likely to have been nontraditional students. This is not surprising, since IT is a relatively new field and older people are more likely to have received their initial education in a different field (see **Appendix Table B.6**).

Our employee interview group was also reasonably well distributed by years since receipt of their undergraduate degree. Approximately one-third had received their degree in the five years preceding the interview, another third within the preceding six to ten years, 12 percent in the past 11–15 years, another 13 percent in the past 16–20 years, and 6 percent more than 20 years ago (see **Appendix Table B.7**).

The employees in our sample had received a wide variety of IT/CS training, although as mentioned previously, not all had an IT or CS bachelor's degree. The large number of employees in our sample working in IT fields without IT degrees may well have been an accurate snapshot of IT pro-

CHART 2.3 Race/Ethnicity of Survey and Interview Participants

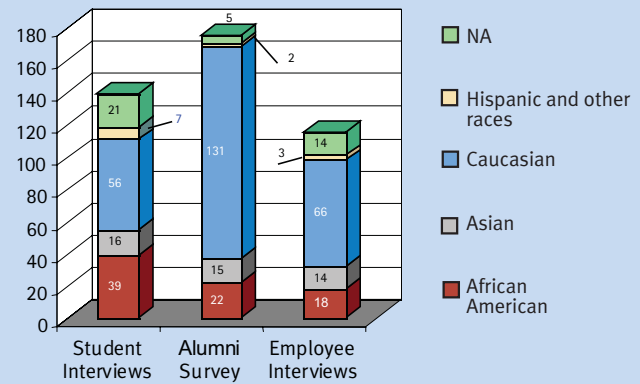
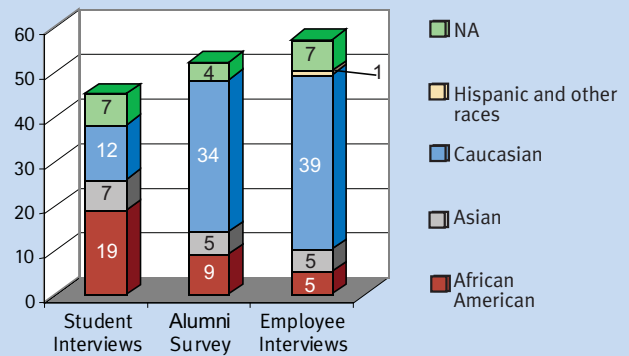


CHART 2.4 Race/Ethnicity of Survey and Interview Participants Who Were Non-traditional Students



professionals nationwide at the time the interviews were conducted. The IT employment market, however, has changed dramatically since then, and it may no longer be as feasible to work in IT without formal IT undergraduate training.

HR manager demographics

To better understand how nontraditional education affects the hiring process, we conducted 23 one-on-one, open-ended interviews with relatively senior management staff (HR managers) at 22 area employers. These interviewees were selected based on having a role in the hiring of IT workers and, of course, having an interest in our study. It is not a

random sample. It is, however, a good complement to the interviews with employees discussed in the previous part of this chapter and the interviews with immediate IT supervisors (line managers), which are discussed in the next section. The participants in these “HR manager” interviews include very senior management personnel (vice presidents, CEOs) as well as IT directors, IT senior staff, and HR personnel. Our sample included more men than women, all of who were U.S. citizens. The vast majority were Caucasian. Over half of these HR managers were employed in science/technology. The roles these HR manager participants played in workforce development covered the full spectrum of hiring and recruiting responsibilities. The demographic characteristics are shown in **Appendix Tables B.8** and **B.9**.

Line manager demographics

There were 28 one-on-one interviews conducted with staff selected for their immediate supervisory responsibilities over IT workers (line managers) at 26 area employers. It is not a random sample, although the survey participants do represent a broad cross-section of area employers. This sample group contained slightly more women (57 percent) than men, and all were U.S. citizens. This group of participants was asked fewer questions (see **Appendix Table B.10**).

Educational Backgrounds

Interview and survey participants attend more than one institution

A significant population of both our student interviewees and our alumni student respondents had attended other institutions before the one they were either currently attending or the one from which they had graduated. Of the student interviewees, nearly 40 percent had attended another institution, but of the nontraditional students, over 73 percent had, compared to only 22 percent of traditional students (**Table 2.1**).

Among the 175 alumni survey respondents, 31 percent indicated that they had attended another institution before the one from which they received their IT/CS degree. Similar to the student interviewees, nearly 70 percent of alumni survey respon-

dents who were nontraditional students indicated that they had attended another institution, compared to only 15 percent of alumni who had been traditional students (**Table 2.1**).

For our 115-employee interview sample, more than nine out of ten (92 percent) had attended another institution before getting their IT/CS degree. For the employee interviewees who were nontraditional students, nearly all (96 percent) had attended another institution before getting their IT/CS degree. This is much higher than for the other two survey populations who were nontraditional students (**Table 2.1**).

Type of institution students attend before receipt of their IT/CS degree

Of the 53 student interviewees who indicated that they had attended another institution before receipt of the IT/CS degree, the largest percentage (43 percent) had attended a community college, followed by those attending a doctorate-granting institution. This ranking was true regardless of whether the students were traditional or nontraditional, although traditional students were more evenly distributed among a number of different institutions (**Table 2.2**). Among the alumni survey respondents, 31 percent (or 54) indicated that they had attended another institution before the one from which they received their IT/CS degree. Similar to the student interviewees, nearly 70 percent of alumni survey respondents who were nontraditional students

TABLE 2.1 “Have You Previously Attended Another Institution?”

	Yes	No
Student interviewees		
Nontraditional	73% (33)	27% (12)
Traditional	22% (20)	78% (72)
All students	39% (53)	61% (84)
Alumni survey respondents		
Nontraditional	69% (36)	31% (16)
Traditional	15% (18)	85% (105)
All students	31% (54)	69% (121)
Employee interviewees		
Nontraditional	96% (55)	4% (2)
Traditional	88% (51)	12% (7)
All students	92% (106)	8% (9)

indicated that they had attended another institution, compared to only 15 percent of alumni who had been traditional students. The majority of alumni who were nontraditional students and attended another institution had attended a community college—nearly 60 percent had, compared to 39 percent of alumni who were traditional students (Table 2.2).

For the employee interview sample, it is possible to classify the institutions from which they obtained their IT/CS degrees. Of those employees who had indicated that they were nontraditional students, most had attended master’s colleges and universities—over 42 percent, compared to just 14 percent of traditional student employees. Slightly more than 40 percent of nontraditional student employees had attended a doctoral research university, compared to 62 percent of traditional student employees. Traditionally, educated employees were more likely than their nontraditional peers to have attended a doctoral/research university, a baccalaureate college, or an HBCU (Table 2.3).

Employee interviewees were also asked if they had a degree from an institution other than the one from which they received their IT/CS degree. An astounding 37 percent (43) of the total 115 respondents indicated that they have a second degree from another institution. Of the employee interviewees who were nontraditional students (30), 53 percent had another degree compared to the 13 or 22 percent of traditional students. Moreover, second degrees for most employee interviewees, both traditional and nontraditional students, were in fields outside of IT/CS, as shown in Table 2.4.

These data suggest that IT/CS majors in general and nontraditional IT/CS students in particular are likely to attend multiple institutions, choose IT/CS simultaneous with or after exploring other fields, and enthusiastically embrace lifelong learning.

Although anecdotal data suggest that, nationally, women and minorities are more likely to be nontraditional students, this was not necessarily true among our survey and interview participants. Our research finds that among the nontraditional student population at traditional institutions, a sizable proportion is Caucasian males. This finding has implications for any policies targeting nontraditional women and minorities (see Appendix Tables B.2–B.4)

TABLE 2.2 Type of Institution Attended Before Receipt of IT/CS Degree

Student interviewees	Nontraditional	Traditional	All Students
Community college	46% (15)	40% (8)	43% (23)
PhD-granting	18% (6)	20% (4)	19% (10)
Foreign institution	12% (4)	15% (3)	13% (7)
HBCU	18% (6)	5% (1)	13% (7)
Liberal arts college	6% (2)	10% (2)	8% (4)
Women’s college	0	10% (2)	4% (2)
Alumni respondents			
Community college	59% (19)	39% (7)	52% (26)
Doctoral research	16% (5)	44% (8)	26% (13)
Master’s colleges/universities	6% (2)	11% (2)	8% (4)
Baccalaureate colleges	9% (3)	6% (1)	8% (4)
International institutions	6% (2)	0%	4% (2)
HBCU	3% (1)	0	2% (1)

TABLE 2.3 Type of Institution from Which Employees Obtained Their IT/CS Degree

Type of Institution	Nontraditional	Traditional	All Students
Doctoral/research universities	40% (232)	62% (36)	51% (59)
Master’s colleges/universities	42% (24)	14% (8)	28% (32)
Baccalaureate colleges	2% (1)	9% (5)	5% (6)
HBCU	2% (1)	9% (5)	5% (6)
International institutions	4% (2)	5% (3)	4% (5)
Associates colleges	7% (4)	2% (1)	4% (5)
Specialized institutions	4% (2)	0%	2% (2)

TABLE 2.4 Field of Degree for Those IT/CS Employees Who Had a Second Degree

Field of Degree	Nontraditional	Traditional	All Students
Non-IT	68% (19)	46% (6)	61% (25)
Computer information systems	18% (5)	23% (3)	20% (8)
Computer science/computerengineering	7% (2)	15% (2)	10% (4)
Other IT	7% (2)	15% (2)	10% (4)

References

1. We recognize that choices are not made without constraints and within a particular societal context. Our emphasis on choice, therefore, does not imply a denial of the importance of context and constraints, but an examination of the choices students make within those contexts and constraints that constitute a pathway into a career. See The Institute for Higher Education Policy, *The Policy of Choice: Expanding Student Options in Higher Education*, August 2002, for more information about the construction of a choice framework within the context of individual perspectives and a public policy perspective (page 5).
2. U.S. Department of Education. 2002. *The Condition of Education 2002*. Washington, DC: U.S. Department of Education.
3. Further information on the online human subjects certification is available at <http://cme.nci.nih.gov>.