Does A Computer Science Degree Matter Anymore?

SPECIAL FEATURE

Some argue that computer science is crucial to U.S. competitiveness, others say business skills are more relevant today

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The number of college students pursuing computer science degrees at U.S. universities rose in 2008 for the first time in six years, according to a recently released study. Academia and policymakers are hailing the news, but the question facing CIOs and others in charge of IT hiring is: How much do computer science degrees matter?

Do companies need employees with the deep technical skills developed through computer science and software engineering degrees, or are they better off hiring tech-smart business majors?

Not surprisingly, computer science educators, software companies and hardware manufacturers are adamant about the need for computer science majors to drive innovation at U.S. tech companies. The dearth of U.S. computer science graduates is forcing companies to look offshore for qualified people, they argue.

"Not having enough computer science majors has serious repercussions for our competitiveness," says professor Cary Laxer, head of computer science and software engineering at Rose-Hulman Institute of Technology. "There are a large number of Chinese students and Indian students who are very, very interested in doing this work. We're going to lose our competitive edge as a country if we don't turn out more software engineers."

But CIOs and IT staffing firms say the skills they need most are collaboration, problem solving and communications – all of which can be developed by any motivated college student. After all, today's tech-savvy Millennials have wireless and social media technologies integrated into their lifestyles and grasp how to exploit them far better than their 40-something bosses.

"Computer science degrees mattered a lot 20 or 15 years ago, when IT was a cost center. But the job of being in IT has completely changed. The huge IT budgets are not even under CIOs; they're under the lines of business," says David Foote, CEO of Foote Partners, which conducts a quarterly survey of IT skills and pay. "This has brought in a whole new group of IT skills that come out of mathematics, economics, business and marketing."

Computer Science enrollments are increasing

On March 17, The Computing Research Association issued its annual report on the number of college students pursuing computer science bachelor's degrees at U.S. universities. The numbers have shown a sharp decline throughout the decade.

In the fall of 2000, there were around 16,000 newly declared computer science majors. That figure dropped by half after the dot-com bust, bottoming out at 8,000 for the last two years. But in 2008, there was an 8.1% increase.

Having enough computer science and software engineering majors is critical for U.S. tech companies, which say they need to hire undergraduates with deep technical skills and practical programming experience.

"For our software engineering roles, we tend to look for people with a strong computer science background who have experience with programming," says Yvonne Agyei, director of Talent and Outreach Programs in Google's People Operations Department. "We need core programming skills, algorithm skills and quantitative analysis. We're looking for people who have majored in computer science or engineering or sometimes math or physics."

Agyei says Google hires computer-savvy business majors for other departments, but not software engineering.

"In addition to software engineering roles, we have roles within business, with-

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in legal, within finance where having a facility for technology and a passion for technology are important," Agyei says. "It helps if they have familiarity with our products. Having that knowledge is really important regardless of what aspect of the business you go into."

Even with this year's rise in computer science majors, U.S. tech companies say there are still not enough computer scientists and engineers to fill all of their open jobs. That's why tech companies and CIOs often hire computer-savvy business majors instead.

IBM pushes computer training to business majors

In 2004, IBM responded to the drop in computer science degrees by creating the IBM Academic Initiative, which provides free software, training and tools to college professors across disciplines rather than computer science departments. IBM is working with more than 9,000 college faculty worldwide and around 900,000 students.

"As companies have a greater and greater need for computers, communications and software, there's been a decline in students going into IT…. The consequence is the supply and demand are not in balance," says Kevin Faughnan, director of IBM's Academic Initiative.

IBM's goal with the Academic Initiative is to encourage college students to become more familiar with IT and how to apply it across industries. With this initiative, IBM is focusing on strengthening the technical underpinning of business majors rather than encouraging more computer science majors.

"The business students don't have the computer science skills – intro to data management or Web 2.0 – because it's not part of their major," Faughnan says. "We try to encourage faculty to be more interdisciplinary."

As part of its initiative, IBM has provided 100-plus universities with Innov8, a simulation game that teaches business process modeling

"It's incumbent on business schools to integrate technology into the curriculum," Faughnan says. "I think of technology not so much as computer science majors, but as a horizontal skill that can be applied across disciplines. For example, you can't do marketing these days without data mining."

CIOs say they are hiring more business majors with IT experience than computer science majors.

Henry Eckstein, senior vice president of strategy technology at York Insurance Services Group, says only 10% of the members of his 50-person IT shop have computer science or software engineering degrees. Most of those employees are from Russia.

Eckstein says that when he is making a hiring decision, he weighs experience first, IT certifications second and college degrees third.

"If I look at a candidate, and I see that they have a computer science major, that is going to influence my decision if I'm looking for a newer, low-end candidate…. At least I'll know they have had good training and discipline," Eckstein says. "But it's not going to be a show-stopper for me if someone doesn't have a computer science degree. Particularly, if I'm looking for developers, I'm looking at what skill sets they have, how many years of experience and their knowledge of the subject matter." When CIOs are surveyed about the top skills they are looking for in entry- and mid-level employees, they cite few technical skills. Instead, their top concerns are ethics, critical thinking, collaboration, problem-solving and communication skills, according to the 2008 CIO survey compiled by the Society for Information Management. The technical skills that are in demand – programming, database and system analysis – are ranked 10 or lower on CIOs' priority list.

"You don't have to have a computer science degree to get an entry-level job in IT," says professor Jerry Luftman, executive director of the

Total enrollments per computer science department
increased 6.2% in 2008. For the first time in six years, the number of computer science majors increased.

SOURCE: COMPUTING RESEARCH ASSOCIATION

School of Technology Management at Stevens Institute of Technology. Luftman compiles SIM's annual CIO survey. "When CIOs are asked what skills they are looking for in entry-level and mid-level people, it's clear that…technical skills aren't that critical," he says.

Luftman says computer science majors and engineers make for "very, very good IT professionals" because of their critical thinking skills and logical analysis. But he says business and information systems majors can be valuable employees, too, because they balance technical skills with business, collaboration and communications skills.

"During this downturn, IT is being asked to work with its business partners to identify opportunities to leverage IT to improve processes and to improve productivity," Luftman says. "My advice to Generation X and Generation Y…is to make sure you have a good balance of technical and business skills."

Ideal candidates are well-rounded

Stephen Pickett, a past president of SIM and an auto industry CIO, says a lack of computer science majors is a problem for CIOs. That's why SIM's local chapters have been working with business schools to improve their technical offerings and with computer science schools to improve their business courses.

"We don't necessarily need a computer science graduate. A business graduate with a strong computer science curriculum can work out in a lot of cases," Pickett says. "In computer science schools, we try to add business curriculum so we can get a more well-rounded student coming out."

Pickett says MIS degrees are a good match of IT and business skills. It's not enough, he adds, to be a computer hobbyist.

"The things we need are project management experience and business process evaluation. You don't get those from knowing the applications on your desktop," Pickett adds. "College grads who can look at a business process and find out how to improve it – those people are going to be popular."

Striking the right balance between technical skills and business knowledge will be more critical given the global economic meltdown, Pickett says.

"In a downturn, it's even more important to get people who can solve business problems because the business problems are much more difficult to solve," Pickett says. "You have to solve the problem without significant business resources. You have to have technical knowledge, business knowledge and lots of imagination."

Foote says he would counsel a high school student to think carefully about where in the business they would like to work.

"The question is: Do you want to be a techie, propeller head guy and work in the bowels of an organization and work on…all the infrastructure jobs, or do you want to be out in front working on applications?" Foote says. "If you want to be more out in front, you might want to work

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■ PETER LEE, PROFESSOR, HEAD OF THE COMPUTER SCIENCE DEPARTMENT, CARNEGIE MELLON UNIVERSITY.

in HR or finance or whatever area of the business interests you most. You also want to look at the industry – casinos, insurance, whatever, and figure out what products and services you are interested in."

Foote recommends students majoring in math or business pursue a minor in computer science. "That gives you a much more forward-looking view of IT, and it gives you more options," he says.

Computer science departments adapt to new realities

Computer science educators claim the propeller-head image is an old-fashioned way of viewing their programs.

"There's a perception propagated by the media that being a computer science major means you work in the bowels of the organization, coding in front of a terminal 24 by 7, eating potato chips and drinking Mountain Dew," says professor Lenny Pitt, director of undergraduate programs in the Department of Computer Science at the University of Illinois at Urbana-Champaign. "This is far from the truth. Our graduates are working as a bridge between management and technical people. They are doing technical writing, software testing and usability."

In light of declining enrollments this decade, top computer science schools such as the University of Illinois have retooled their curriculums to embrace soft skills such as collaboration and communication. These departments are focused on graduating well-rounded students who can explain complex technical issues in laymen's terms.

"The decline in enrollments over the last six years has forced professors to think about what we are teaching computer science students and to make sure we are giving them the skills they need to be successful, like collaborative learning and working as part of a team," says Peter Harsha, director of government affairs with CRA.

Carnegie Mellon University emphasizes teamwork and collaboration in its computer science program, which requires technical communications courses. Students also are required to take courses in the humanities and to pursue a minor in a non-computing field such as a foreign language.

"Twenty years ago, the kids we would get into our program would be very, very nerdy, and we added requirements into our program to force them to be broader," says professor Peter Lee, head of the Computer Science Department at Carnegie Mellon University. "Today, we have the opposite problem because people have the tendency to be dabblers. We want them to be deep and broad."

Carnegie Mellon's strategy seems to be working. Last year, 70% of Carnegie Mellon's computer science graduates went to work for industry, including IT vendors such as Microsoft and Google and IT users such as Bloomberg and Goldman Sachs. The other 30% went to graduate school.

"Where we see the demand and the high salaries are for the people with deep technical software skills," Lee says. "These students aren't just computer savvy and able to manage an IT operation. They actually understand software issues and can engineer software. Those are the people the recruiters want."

Lee predicts that computer science majors will remain in demand because industry is becoming more dependent on data-intensive computing and data mining.

"Companies face a broad range of issues from managing large amounts of data and being able to process it and extract knowledge from that data," Lee says. Companies such as Walmart and Google are looking for us "to produce graduates with the understanding and skill to cope with the new world of data-intensive computing."

Rose-Hulman also requires its computer science and software engineering students to take humanities courses including technical communications and to give frequent oral presentations. Laxer says Rose-Hulman has put more emphasis on humanities courses over the last four or five years, as enrollment in computer science and software engineering declined

around 15%.

"As I've talked to recruiters on campus, they tell me that they don't question the technical ability of our students. They know they are technically competent. It's the other issues – leadership of student organizations, communication skills – that come out during interviews," Laxer says.

Enrollment in Rose-Hulman's computer science and software engineering program is up this year, with 50 freshmen – the largest group in four years. "I'm hoping that it's a turnaround, but one year does not a trend make," Laxer says.

He argues that computer science majors have much to offer CIO shops as well as IT vendors.

"If you're a business major, you're learning how to use tools like word processing and spreadsheets but you're not writing those tools. Companies need people who can write IT tools or take existing tools and modify them, and those are the kinds of things computer science and software engineering majors can tackle," Laxer says.

Cutting-edge companies need computer science majors, according to professor Michael Heath, the interim head of the Department of Computer Science at the University of Illinois at Urbana-Champaign. Heath says enrollment in this program has risen 15% in each of the last two years.

"There's no substitute for the in-depth technical education that our computer science majors get," Heath says. "They learn problem solving. They learn technology. We emphasize a foundational kind of education that prepares them to change with technology."

In recent years, the University of Illinois has added industrial-sponsored senior projects, teamwork, communications and ethics courses to its computer science curriculum. But professors say that college recruiters are attracted by the technical skills that graduates have.

"I would agree that communications, interpersonal skills and those sorts of things are extremely crucial to career success. And you can develop those in any major," Heath says. "But tech companies aren't hiring English majors and history majors. They're hiring technically trained, problem-solving computer science majors. So you have to take some of that [demand for soft skills] with a grain of salt."

Recipe for success

Ultimately, CIOs need both strong technical skills and business-oriented workers who are computer savvy to run their IT shops. And regardless of major, they need employees who are well rounded.

"We are looking for the deep technical skills, but at the same time we value diversity – diversity of background, diversity of experience, people who speak different languages," Google's Agyei says. "We're looking for people who can communicate. A lot of our work is done in small teams, so we're looking for people who can work with others, who've done joint projects with others or participated in programming competitions that are team-based. The other thing we look for is people who have other passions, who aren't just programmers, who are interested in music or athletics or are engaged in their communities."

A Microsoft spokesperson agreed that the company is looking for a broad set of skills in its hires.

"The common threads that attract us to candidates are a passion for technology; desire to make an impact by innovating on cutting-edge technology; commitment to challenging and rewarding work; dedication to growing skills with an industry leader; ability to collaborate across teams to solve hard problems, and interest in working side-by-side with an amazing breadth of the best and the brightest in the industry," the spokesperson said in a statement.

Top 10 Tech Skills

Jobs are still available if you have expertise and certifications in these areas

Carolyn Duffy Marsan

Amid the worst job market in 25 years, IT is holding steady. Most CIOs are maintaining their current staffing levels, while a few are hiring specialists with particular IT skills. Here's our list a list of 10 tech skills that are still in demand:

1. BUSINESS PROCESS MODELING

Business process management, methodology and modeling is one of the few IT niches that saw pay gains in the fourth quarter of 2008, according to the quarterly IT salary survey compiled by Foote Partners. In particular, companies were willing to pay for workers with ITIL IT best practices and CobiT IT governance experience. Pay for these skills was up 10.3% from a year ago and 5.6% from the previous quarter, the Foote report says.

Kevin Faughnan, director of IBM's Academic Initiative, says business process modeling is one of the key skills that business majors should be studying. "It's about how does our business work, what are the business processes and how do we analyze them," Faughnan says.

2. DATABASE

Database expertise is another area where pay is on the rise, up 2.9% in the last quarter, the Foote report says. Companies are looking for IT workers with experience in Microsoft SQL Server and the Oracle Developer Suite. They're also willing to pay for workers with database certifications such as the Oracle DBA Administrator Certified Master, the Teradata Certified Master, Certified Application Developer and Certified Design Architect, the Foote report says.

Similarly, a 2008 CIO survey conducted by the Society for Information Management listed database skills as among the top skills for entry-level employees. Experience with databases was one of only four technical skills listed by CIOs, who favored collaboration, problem solving and communication in hiring recent college graduates.

3. MESSAGING/COMMUNICATIONS

Messaging and communications is the only other skill set that experienced a pay increase in the fourth quarter of 2008, the Foote report says. Companies are particularly interested in hiring employees with experience in unified communications and messaging systems, which was among the highest paying IT skills in the Foote report. VoIP and IP telephony also ranked among the highest paying skills.

4. IT ARCHITECTURE

CIOs are paying less for IT certifications than they did three years ago, but there are a few exceptions to this rule. One of them is IT architecture, which has seen a 10% rise in the value of certifications during the past year, the Foote report says.

Foote says companies are looking to hire enterprise architects as well as system, network, application, data, information and security architects. Among the certifications rising in value are EMC Proven Professional Technology Architect, Security Certified Network Architects, Microsoft Certified Architects, SNIA Certified Architects and the Open Group's IT Certified Architect.

5. IT SECURITY

A slew of security certifications — including the CompTIA Security+, GIAC Security Essentials, Certified Ethical Hacker, GIAC Certified Incident Handler and Check Point Certified Security Administrator — have increased in value in the past three months, according to the Foote report.

"The value of security skills is going up, and jobs are pretty stable," Foote says, adding that many federal jobs are available for information security specialists with government security clearances

Demand for security specialists is likely to remain strong because few teens are entering the field. Professor Peter Lee, head of the Computer Science Department at Carnegie Mellon University, sees a shortage in students studying security-related topics.

6. PROJECT MANAGEMENT

The Project Management Professional certification remains in demand, the Foote report says. Even more important is experience managing complex IT projects and delivering results on time and on or under budget.

SIM's 2008 CIO survey listed project leadership as one of the top 10 skills needed for mid-level employees.

"Project management skills are going to be more important over the next few years," says Henry Eckstein, senior vice president of strategic technology at York Insurance Services Group. Eckstein oversees a 50-person IT shop. "We have set up a corporate project management office. We are working on changing the corporate culture to do more project management and more IT governance," he says.

7. DATA MINING

Jobs are plentiful for workers who understand data mining, as well as information on demand, content management and unstructured information management.

"The world revolves around data. Anything you can do to develop data analysis, data mining and information on demand skills is incredibly critical," IBM's Faughnan says.

"There's a broad range of issues involved with managing very large amounts of data and being able to process it and extract knowledge from that data," CMU's Lee says. "One of the things we are starting to see from leading-edge places like Google is the need for graduates with the understanding and skill to cope in the new world of data-intensive computing."

8. WEB DEVELOPMENT

Demand for employees with Web development certifications has plummeted in the past year, with the value for certifications in this area dropping 21.8% according to the Foote report. However, experts say there is still a need for developers who understand the latest Web trends, especially social media.

"You've got to learn to manipulate data on the Web, and that includes Web 2.0. Mash-ups are becoming commonplace," IBM's Faughnan says.

SIM's CIO survey listed programming and application development skills as key for entry-level employees, too. It was the highest ranked of the technical skills listed by CIOs.

9. IT OPTIMIZATION

IT experts predict a solid future for IT professionals with experience in IT optimization, including virtualization and cloud computing.

"Through software-as-a-service, through cloud computing, CIOs may be doing less IT in-house, but somebody is still going to be doing that. There will be a demand for more computer scientists in data centers," says Josh James, director of research and industry analysis for TechAmerica.

10. NETWORKING

Although pay for networking certifications is down over the last six months, many remain on the list of the IT certifications earning the highest pay premiums, according to the Foote report. These include certifications from Cisco, the Storage Networking Industry Association, EMC, Brocade and Avaya.