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In this issue:

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CIS Curriculum Development Post-dot-com

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Abstract

The information technology (IT) job market has gone, from a seller to a buyers market. From the late 1990's until early spring 2001 graduating IT students received numerous job offers with high salaries and bonuses. Today few job offers are made and salaries are now up to 10% less than two to three years ago. The dot-com implosion and economic downturn along with offshore outsourcing of IT jobs has led to this situation. Colleges and universities need to examine their IT curriculum to ensure that students are being properly prepared for current and future job trends.

Keywords: Curriculum Development, CIS Curriculum, MIS curriculum, Careers

1. INTRODUCTION

Developing IT (IS, CIS, and MIS) curriculum in the current economic environment has become very difficult. In the past many IT programs have focused on providing their graduates with entry-level development skills. This required a curriculum heavy on programming courses. It was not unusual to see degree programs that required two and sometimes three semesters of courses concentrating in programming. Most graduates went to work as junior programmers for organizations with a large development staff. Offshore outsourcing of programming tasks existed, but not at the current or predicted levels. Offshore sourcing went from 12% of IT budgets in 2000 to 28% of budget in 2003 (Keefe 2003) and 35 to 45% of full-time IT jobs will be offshore within a few years (Hoffman, Big 2003).

Except for creating flashy Web pages student interest in development jobs is also declining. Most of our current majors do not see themselves working on programming projects where transaction data is collected, verified, and then used to maintain data stored in a database. A greater amount of interest has been shown in database administration and networking administration. A survey of organizations that recruited our graduates and of our alumni was conducted during 2001-2002, academic-year. Most of the job titles were in system and/or network administration, technical support, and systems testing.

IT curriculum must change from preparing students to enter the job market as entry level programmers and programmer/analysts to preparation for jobs in business systems analysis (technology liaison for the business units), technical support analysis, system/network administration, IT integration of e-business systems with legacy systems, enterprise software, and new components (Web Services). The organization target may need to change from large development shops to independent contractor and consultant status or a jack-of-all-trades for small to medium sized businesses.

2. Current Employment Conditions

The dot-com burst and offshore outsourcing are two major factors impacting IT jobs. Offshore outsourcing will have the longest and

most significant impact on the IT profession. The dot-com burst and the subsequent downturn in the economy will end and jobs would normally return, except for the greater effort by organizations on outsourcing. First lets look at the dot-com burst and then at offshore outsourcing.

3. Dot-Com Burst and the Economic Downturn

Starting in early 2001 the job market for IT professionals begin a downward spiral. IT Companies were seeing a decline in the economy and they started to reduce recruiting and hiring of entry-level development staff. During the last two years the tech industry (hardware and software) lost about 500,000 jobs. This puts the total job numbers for the tech industry just a little above where it was prior to the dot-com mania (Bowman 2003).

Along with the reduction in hiring we also saw contraction in IT salaries. Compensation in the IT field during 2002 was mostly stagnant or in decline with a few bright spots. Salaries of 85 IT positions, "declined by an average of 2.8%" (Foote 2003). Exceptions to the salary decline were noted in security positions +5.5%, with Certified Information Systems Security Professional and Certified Information Systems Auditors certifications showing increases of 11% and 38% during 2002 (Foote 2003). Other skills that showed increases were "Voice over IP, Wireless Markup Language (WML), DB2, VoiceXML and SAP's Advanced Business Application Programming language" (Foote 2003). The highest paying skills were "Rapid application development/extreme programming, XML, SQL Server, WML and Oracle database" (Foote 2003).

Bureau of Labor Statistics for January 2003 show unemployment for computer scientists and systems analysts at 4.9%, computer programmers at 6.7%, database administrators at 3.4%, and network systems and data communications analysts at 7.4% (Quan 2003). Concurrent with these unemployment rates large organizations are continuing to lobby the government for maintaining the higher H-1Bs visas and L-1 visas where they can bring in cheaper IT employees (Quan 2003). The only advantage of H-1Bs and L-1 visas over offshore outsourcing that will be discussed next is that the jobs are in the U.S. and at least the employees will pay income and payroll taxes. If the work was offshore outsourced the employees would not pay U.S. taxes.

When can we expect the IT hiring situation to reverse? Challenger, Gray & Christmas Inc. (a Chicago-based outplacement firm) forecast that, "entry-level job seekers will face the most difficult job market in decades" (Rosencrance 2003). Companies are no longer willing to spend money on training and waiting for new hires to become proficient. They are looking to hire individuals with "prior IT experience" (Rosencrance 2003). This makes it extremely important for degree programs to include internships and cooperative education experiences so that IT graduates can be more productive in a shorter period of time.

The bleak outlook for improvement in the IT field has led many in the IT workforce to change their career opinion. Bureau of Labor Statistics show that about 10% of the unemployed IT workforce, more than 272,000, changed their view of the profession they belong to from October to December 2002. Interestingly the overwhelming majority of those who changed to a profession other than IT were 40 or younger (Chabrow 2003).

4. Offshore Outsourcing

Offshore outsourcing has existed for a long period of time, but has rapidly accelerated in the last few years. The reason for the significant increase is probably some combination of the high salaries that were paid for IT workers during the dot-com mania days along with the cost cutting that has taken place during the latest economic downturn. Whatever the cause or causes it is significant and it looks to increase into the future. The percentage of IT budgets for offshore outsourcing has gone from 12% in 2000 to 28% in 2003 (Keefe 2003). This increase in offshore outsourcing is taking place while the U.S. Bureau of Labor Statistics estimates 212,000 computer and mathematics professionals are unemployed (Keefe 2003) (Hoffman and Thibodeau 2003).

Help desk function jobs along with application development and programming are be-

ing added to the list of U.S. IT jobs that are being sent offshore in an effort to reduce IT costs (Hoffman and Thibodeau 2003). A recent prediction on the IT labor market shows that 35 to 45 percent of full-time IT jobs will be sent to Asia, Eastern Europe, and South America, where labor costs are 20 to 50 percent less (Hoffman, Big 2003). Programming skill is becoming a commodity. Programming in the U.S. is not any different than programming in India or elsewhere, so organizations are not willing to pay three to four times more for it (Hoffman, Panel 2002).

Proof that programming and other lower-level IT skills have become commodities is the concern of software companies and developers in India. The IT jobs that were offshore outsourced from the U.S. may soon be outsourced from India to Vietnam, China and the Philippines (Hayes, Frank 2003). Organizations will continue to move IT jobs they consider to be commodities from one "sweatshop" economy to another in their effort to reduce costs.

Therefore it becomes imperative for U.S. IT workers to find those job functions that are more difficult to offshore outsource. IT job functions that may be better choices are project management, security, and wireless networking (Hoffman, Big 2003). U.S. IT workers need to move closer to the business units and work on ERP and CRM efforts. The IT workers need to be more involved in planning, integrating, and implementing solutions that are being developed offshore (Hoffman, Panel 2002). IT workers need to become a business-technology liaison, planner-project manager, and integrators of e-business to legacy and ERP systems.

Displaced U.S. IT workers can at least gain some advantage of the increase in offshore outsourcing by becoming managers of the offshore outsourcing projects. A Gartner study reports that up to half of the outsourcing projects this year will not deliver the savings that was desired. Problems with outsourcing include communications, lack of planning, managing the outsourcing relationship, and lack of flexibility (Keizer 2003). Just like any IT project for outsourcing to be successful it needs top-level executive support, central management review, and continuous project management (Johnson 2003).

5. Curriculum Implications

With developers being hired by offshore companies to work in their native country IDC reports that North America will also lose it position as the top producer of software developers by 2005 (Roberts 2003). If the IT jobs are outside of the U.S. why would students from those countries come to the U.S. for preparation in the software industry? Faculty at U.S. colleges and universities can also be offshore outsourced. IT faculty in the U.S. must make IT curriculum relevant for the jobs that are available in the U.S.

One immediate problem that IT faculty must address is the pessimism that is permeating IT professionals. A recent survey by InformationWeek found that about 70% of IT professionals felt that an IT career path was not as promising as five years ago (Hayes, Mary 2003). Recruiting of future IT majors will become more difficult if those currently in the profession do not feel it is a promising career choice. Some of this pessimism is already being felt at colleges and universities. Reports indicate that enrollment in computer programs is down 20-30%, jobs are uncertain and big salaries with perks are gone (Kessler 2002).

The Information Technology Association of America (ITAA) conducted a study of employment for IT workers and reported a net gain for IT jobs of 147,000 for 3rd quarter 2002 and 97,000 for the 4th quarter of 2002 (Hayes, Mary 2003). While a net gain in IT jobs looks encouraging one thing to note is the decline from the 3rd to the 4th quarter. It was also reported that IT managers see a need for an increase in IT workers of 874,327 during the next year (Hayes, Mary 2003). With the current economic environment hiring of that many IT workers would appear to be too optimistic. Recognizing that the estimate was overly optimistic the ITAA recently downgraded their estimate to an increase of fewer than 500,000 IT jobs in 2003 (McCarthy 2003).

Therefore it is important to determine what skills are still in demand now and in the future. According to an ITAA/Dice updated IT workforce study, skills that are in high demand include C++, Oracle, SQL and Java (Hoffman, Demand 2002). Somewhat problematic is that C++ and Java are both pro-

gramming development skills. David Foote, president and chief research officer at Foote Partners LLC reports IT jobs in, "security, network management, enterprise infrastructure and architecture, database, SAP-related development, project management, and project-based work implementing customer-facing systems and processes" (Foote 2003). Hoffman and Thibodeau (2003) report that CIOs with Fortune 1,000 companies are looking for integration experts and people who can manage and coordinate development projects to put components together into a cohesive package.

So again it is important for the new IT worker to have a through understanding of the business and a broad technology background. Organizations want U.S. IT workers to be project managers and business/IT liaisons. They must be able to manage IT projects where requirements are obtained from business units, communicate those requirements to in-house IT functions and offshore outsourcers. They must then be able to direct the assembly of the components into an effective functioning system for the business.

Thibodeau and Hoffman (2003) and Rosencrance (2003) report that IT professionals with ERP knowledge (SAP and PeopleSoft) are in demand. Other skills in demand are security and some areas of Web development. When employers are asked what skills should be taught they respond with an understanding of Java, XML, and they need to get up to speed with .Net (Brandel 2003). A survey of hiring managers indicated that at the graduate level they would seek MBA students and at the undergraduate level over 40% would first hire students with business degrees (Rezendes 2002). The emphasis is on good business background along with computer technical skills, because employers want the prospective employee to "add value to a company's bottom line" (Radcliff 2001). DePompa Reimers (2002) indicates that IT professionals need to emphasize their business, management and communication skills as much as their programming and analytical skills.

Most companies are still developing corporate intranets, portals, connecting to legacy and ERP systems and other projects that add strategic value. The required skills are Web development (HTML, Java and .Net), XML, database, networking, security, disaster recovery, wireless LANs, and "soft" people skills such as the ability to communicate with end users. Another common demand is for project managers with technical, management, and critical-thinking abilities. (Radcliff 2001)

IDC reports that C, C++, Java and Visual Basic are the most common languages used in development (Roberts 2003). A recent report by Foote Partners LLC shows that bonuses are being paid for those with RAD, extreme programming, XML, SQL Server, Oracle database, security, CRM, and data warehousing skills (Hoffman, Report 2003). Hugos (2003) indicates that IT professionals need to understand six core techniques for building information systems and be a master at some of them. The six techniques are JAD, process decomposition and work flow definition, data modeling and volume analysis, prototyping, OO design and programming, and system testing, debugging and training.

Foote (2003) reports that IT professionals with certifications in security, project management, Linux, and networking are in demand. High demand skills for 2003 are "security, network management, enterprise infrastructure and architecture, database, SAP-related development, project management, and project-based work implementing customer-facing systems and processes" (Foote 2003).

Krill (2003) reports a demand for people skilled in component-based development for improving reuse and productivity and those having the ability to capture user requirements. Regan (2002) finds that back-end networking and programming have retained more of their gains during the dot-com run up than other high profile skills and skills in security are in high demand.

A Dice/ITAA report shows that IT people need to be aware that most IT hiring (10-to-1 ratio) is being done by non-technology not technology companies. Top skills listed were Java, SQL, C, C++, Oracle, and Microsoft Windows (Hoffman, Fears 2003).

In the past many organizations had different people administering their Windows and

UNIX/Linux systems. Now these systems and network administration functions are being combined (Sharon 2003). Students will have to be proficient in administering both Windows and UNIX/Linux systems.

In February of 2001, top IT jobs were Web developer (with legacy connection), database administrator (Oracle, Sybase, Informix and DB2), and security analyst (Bernstein 2001). These still appear to be in demand along with Linux/UNIX administration, b2b e-commerce developers with C++, Visual Basic, and Java programming skills, networking with knowledge of wireless technologies, PC technical support, somebody has to setup and maintain them.

Offshore outsourcing should provide an implicit demand for quality assurance testing. You would hope that organizations would have someone in the U.S. test the outsourced code and the assembled components to ensure that requirements are being met.

In a buyer's market faculty must maintain close ties with industry and students need to meet with recruiters every chance they get. From the late 1990s through early 2001 IT majors received numerous job offers and could be very selective. Most of our students wanted to stay close to family and friends and would not consider job opportunities more than a short plane ride from home. Students are not attending on campus interviews ("they do not have jobs anyway"), and even when they do they do a poor job of researching the company prior to the interview ("why bother they won't make me a job offer"). When organizations start hiring again the recruiters will remember the students who were interested and knowledgeable and make them offers first. Those who did not put forth an appropriate effort in the recruiting process will be left in some secondary job outside of IT. Students who do not receive offers immediately need to stay connected to the profession by working in small organizations as a tech support resource or taking on a contracting or consulting job for smaller companies or non-profits to gain and maintain their skills.

6. Survey of CIS Alums and Hiring Organizations

Along with the review of the literature a survey was conducted of ten organizations who recently recruited our graduates. Both hiring personnel and our alumni were surveyed on desired IT skills for new hires. Top programming languages in order of priority were: Java, C++, C, C#, and Visual Basic. The priority ranking was interesting because the alumni who took part in the survey completed a curriculum that included Visual Basic and COBOL for programming languages.

Knowledge and skill areas that were ranked the highest were: operating systems, networking (Web and management), database and SQL, systems implementation and testing, and systems operation and maintenance. Very few of the alumni were working in what would be considered a pure developer type job. Most were doing system and/or network administration, technical support, and systems testing.

In the operating systems area UNIX/Linux knowledge was rated first with Windows coming in a close second. One common comment from most of the surveyed alums was that we needed to provide more UNIX/Linux in our curriculum. Currently all of our software development and applications are in a Windows environment. UNIX/Linux receives limited coverage as part of our networking course. For networking skills it was UNIX/Linux environment first with Windows again placing second.

Along with the technical skills the alumni and hiring personnel ranked interpersonal skills, communications, change management, and organizational behavior high or higher than the technical skills.

7. Proposed Curriculum

Based on the review of the literature and the survey information let's examine what jobs and skills are still in demand or predicted to be in demand. According to Foote (2003) skills that showed increases in salaries were in security (Certified Information Systems Auditor), database, SAP's ABAP, and internet technologies connected with voice, wireless, and Web services. Thibodeau and Hoffman (2003) and Rosencrance (2003) also see

skills in ERP systems and network security as important.

Hoffman (Report 2003) reports on bonuses paid to systems developers with skills in RAD and extreme programming methodologies. This means that our systems development courses must provide sufficient coverage of these along with structured and object-oriented methodologies.

Hoffman (Big 2003) sees the following job functions as better choices for IT workers: project management, security, wireless networking, planning, integrating, and implementation.

Networking courses must include coverage of both Windows and UNIX/Linux, since these are the major systems in the server marketplace. Most organizations will require their network administrators to have skills in both environments and not just one.

Since most IT programs are in a college or school of business we must make sure that our majors recognize the importance of developing fundamental business skills. Future IT majors will need a thorough understanding of business functions and processes to properly capture and specify requirements. Management, people-skills, both oral and written communication skills may become more important than strong technical skills.

It appears that skills in demand would be business-technology liaison, planner-project management, integrators of e-business to legacy, ERP, and CRM systems, networking skills in voice, wireless and security. System integrators must be proficient in assembling existing legacy, ERP, and components developed anywhere (Web services) into cohesive production systems. It would also be important to have skills in developing test cases based on requirements and to execute and evaluate those tests.

8. Job Titles in Demand

Following is a proposed list of job titles for the skills in greatest demand:

Business Systems Analyst
Database Specialist (analyst, developer, and architect)
E-commerce developer/integrator
ERP specialist
Project manager
Security specialist (background in both operating systems and networks)
Telecommunications/Network Specialist (analyst, developer, and architect)

9. Comparison of Skills Demanded and the Model Curriculum

One of the first things to note in the IS 2002 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems is a central focus to provide students with skills for "Technology-Enabled Business Development" (IS 2002, Gorgone et al., 2002, p. 13). Characteristics required of an IS professional include: broad business perspective, analytical and critical thinking skills, interpersonal communication and team skills, and the ability to develop systems to enhance organizational performance (IS 2002, Gorgone et al., 2002, p. v). A business orientation along with the ability to communicate business requirements and business solutions was mentioned very frequently in the literature and in our survey.

The model curriculum provides for coverage of fundamental business skills in the required business core courses of accounting, economics, finance, marketing, and management. Most business core courses also provide coverage of analytical and critical thinking, interpersonal, communication, and team skills. The IS curriculum should enhance those skills with additional coverage. Courses in programming and development need to provide the student with the connection between the technology and business processes that are being worked on.

The model curriculum provides colleges and universities with a conceptual framework to prepare students with a broad business perspective, analytical and critical thinking skills, interpersonal communication and team skills, and the ability to develop systems to enhance organizational performance. This conceptual framework provides curriculum development personnel with a clear statement of the requirements of the curriculum, while not requiring a specific physical implementation. Even though specific courses are listed faculty are able to modify the courses to better match their resources and needs, while still providing for

the same content coverage. This allows a university or college to implement a curriculum with different courses and tracks, while still meeting the conceptual or logical requirements.

The model curriculum provides for the following core courses in IS:

IS 2002.2 Electronic Business Strategy, Architecture and Design
IS 2002.3 Information Systems Theory and Practice
IS 2002.4 Information Technology Hardware and Software
IS 2002.5 Programming, Data, File and Object Structures
IS 2002.6 Networks and Telecommunication
IS 2002.7 Analysis and Logical Design
IS 2002.8 Physical Design and Implementation with a DBMS
IS 2002.9 Physical Design and Implementation in Emerging Environments
IS 2002.10 Project Management and Practice
(IS 2002, Gorgone et al., 2002, p. 18).

Comparing the core content to the required skills for IT professionals mentioned earlier we find the following. Integration of e-business to legacy, ERP, and CRM systems will receive content coverage in IS 2002.2 Electronic Business Strategy, Architecture and Design. IS 2002.3 Information Systems Theory and Practice can provide additional coverage of organizational, business, and information systems planning and strategy. Other content in IS 2002.3 would be systems theory, human-computer interaction, and an introduction to the development process.

IS 2002.4 Information Technology Hardware and Software would provide technology skills in the areas of matching hardware and software to business requirements. Besides hardware the content coverage will provide background in operating systems and an introduction to networking. The networking topics need to include coverage in voice, wireless, and security. Additional network coverage will be provided in IS 2002.6 Networks and Telecommunication.

IS 2002.5, 2002.7, 2002.8, 2002.9, and 2002.10 will provide the necessary skills in programming and database so that the student will be able to develop solutions integrating new development with legacy, ERP, and outsourced components. Currently this would require coverage of Web services implemented with Microsoft's .NET and J2EE. Part of these development courses should be coverage in project management and testing, verification, and validation of the developed system.

Based on this comparison IS faculty need to complement the editors of the IS 2002 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems for their great foresight. The model curriculum is recommending coverage of the skills that would still be in greatest demand given the current economic environment and offshore outsourcing trends. Besides the technical skills in programming, analysis and design, database, operating systems, and networking the student will also receive coverage of skills in communication, interpersonal skills, and team work.

10. Conclusions

Colleges and University computer programs must change their curriculum to match up with current and future jobs in IT. A great starting place is the IS 2002 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems. We must continually monitor the IT job market for changes in job skills that are being outsourced to countries outside of the U.S. and make sure that our curriculum is not targeted at those job categories.

Some organizations are not only trying to stop the offshore outsourcing trend, but are working on reversing it. Marcus Courtney, president and organizer of the Seattle-based Washington Alliance of Technology Workers thinks we should work to reverse the offshore outsourcing trend (Ferranti 2003). Maybe it is time to wake up our politicians. Continued offshore outsourcing of high paying jobs (in IT and manufacturing) will result in lower income and payroll tax revenues. Offshore workers do not pay these taxes and U.S. citizens who lost those high paying jobs will be paying taxes at a much lower rate in their replacement service jobs.

In the mean time offshore efforts continue and expand into other areas. Microsoft is

opening up a facility in India and GE is constructing a research center in India (Finley 2003). McCarthy (2003) reports on a couple of studies that show 22% of large IT organizations have already sent work offshore and within the next 15 years 3.3 million jobs in credit card processing and software development will be sent to India, Russia, and China.

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