CURRICULUM RECOMMENDATIONS FOR INFORMATION TECHNOLOGY RELATED DEGREES

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ABSTRACT

In order to determine the current products/technologies used in industry with regards to web and applications development, networking, operating systems, database, enterprise resource planning (ERP) systems and customer relationship management (CRM) systems, a survey of 350 IT managers/CIOs (Chief Information Officers) was conducted. The results of the survey are reported and analyzed. Based on the findings of the survey, curriculum recommendations for IT-related programs are made in the paper.

INTRODUCTION

Enrollments in Information Technology (IT)-related academic programs have declined significantly in recent years [6] [8] [9]. Several studies have investigated potential causes of the enrollment decline, attributing it most often to factors such as curriculum problems [1] [6] [7], issues that influence students to choose (or not choose) an IT-related major [12] [13], lack of availability of accurate information about the IT industry and related employment opportunities to high school students [4], and offshore outsourcing of IT jobs [10] [11].

The U.S. Department of Labor predicts that employment demand for IT-related professionals will grow much faster than the average for all occupations through the year 2016. For example, the Bureau of Labor Statistics projects that the number of jobs will increase 16% from 2006 to 2016 for the occupation entitled "computer and information systems managers", 37% for "computer scientists and database administrators", and 53% for "network systems and data communications analysts" [2] [3]. It is also estimated that the United States will have only half of the qualified graduates needed to meet the rapidly increasing demand for IT professionals through 2012 because of the declining number of student enrollments [5].

The purpose of this paper is to determine the current products/technologies used in industry with regards to web and applications development, networking, operating systems, database, enterprise resource planning (ERP) systems and customer relationship management (CRM) systems. The approach of this study is to conduct a survey of IT managers to identify the products/technologies their organizations currently use in order to determine their applicability to curriculum development in IT related programs. IT related degree programs that are more adept at meeting the needs of industry will be more likely to survive and will be better positioned to recruit students. Therefore, the authors will use the results of the survey to make curriculum recommendations to IT related programs.

METHODOLOGY

The primary purpose of this study is to identify what products/technologies are used in industry in order to determine their applicability to curriculum development in IT related programs. To this end, a survey was designed and administered to IT managers.

The items in the survey were created by examining current empirical studies. In addition, several demographic questions were added to the survey to gather information about the respondents and their respective organizations. The IT managers and CIOs (Chief Information Officers) that participated in the survey were identified through an email list from a respected online survey company.

A pilot study was conducted to test the questionnaire. The survey was administered to faculty, students and IT staff at the authors' university. Approximately thirty people participated in the pilot study. Feedback was gathered, leading to an improved version of the survey that was used in the data collection.

The survey was web-based and administered via email by a reputable online survey company. The survey was administered to 391 IT managers/CIOs. Of these, 350 responses were complete enough to use for analysis.

DATA ANALYSIS

Demographics of Respondents

Responses were received from IT managers in all but five states in the U.S. Twenty-eight percent (28%) of respondents were in organizations with annual gross revenue of over $1 billion and 30% were in organizations with over 10,000 employees. Sixteen percent (16%) of organizations had annual gross revenue under $50 million and 12% had fewer than 100 employees. Ninety-four percent (94%) of respondents stated that their organizations employed a full-time IT staff and 44% said that the number of IT employees exceeded 100.

The respondents represented a cross-section of industries. Table 1 provides an overview of the characteristics of the respondents and their organizations with regards to the industry to which they belong. The greatest concentration of respondents (19%) were in an organization in the IT industry.

Results

Demand for IT Workers, Sources for IT Workers and Outsourcing

Table 2 lists the areas of demand for IT workers cited by respondents within their organization and Table 3 lists the sources they use to acquire new IT staff. Respondents could select more than one response for areas of demand for IT workers and sources for finding IT workers. The most common areas of demand cited by respondents for full-time entry-level IT employees were IT help desk (70%), networking (56%) and programming (55%). The most common sources cited for finding entry-level IT workers were the web and internships. The average salary for an entry-level worker was about $43K based on respondents answers for the question related to salary.

Table 1: Characteristics of respondents and their organizations

Industry	% of Respondents
IT	19
Education	11
Health care related	10
Government/Military	8
Manufacturing	8
Financial	6
Other	6
Computer technology vendor	5
Consulting (not in IT)	4
Insurance	4
Retail	4
Telecommunications	3
Transportation	3
Non-Profit	2
Utilities	2
Other	10

Table 2: Areas of Demand for Entry-Level IT Workers

Area	% of Respondents
Clerical/Data Entry	29
Database Area	44
IT Help Desk	70
Networking	56
Programming	55
Systems Analysis & Design	48
Web Design & Development	46
Other	9

Table 3: Sources Used to Acquire Entry-Level IT Staff

Source	% of Respondents
Co-op	13%
Instructors' recommendations	6%
Internships	39%
IT department office	34%
Newspapers	37%
Relatives/friends	24%
School's career planning office	24%
Web	48%
Other	15%

Respondents were fairly optimistic about the job market next year – 28% of respondents said that the job market would be better next year while 49% said it would stay the same. 43% of respondents say that their organizations outsource IT operations. Of those that outsource, 54% outsource less than a quarter of the IT operations and only 3% outsource more than three-quarters of the IT operations.

Web and Applications Development

Seventy-one percent (71%) of respondent's organizations host their own web sites entirely, 13% host their own web sites partially, while 10% outsource their web sites entirely. 47% of respondent's organizations conduct e-commerce on their web sites.

Thirty-eight percent (38%) of respondents build applications in-house. The remaining respondents buy off-the-shelf applications, then customize or buy customized applications. Table 4 lists the programming languages used by organizations that build software applications. Respondents could choose more than one programming language in response to this question.

Table 4: Programming Languages

Programming Language	% of Respondents
C	19
C#	26
C++	48
COBOL	27
J#	8
Java	66
Visual Basic	55
Other	25

Networking and Operating Systems

Ninety percent (90%) of respondent's organizations had their own network administration staff while the remainder outsourced network administration. Table 5 lists the network operating systems in use in the respondent's organizations. Respondents could choose more than one network operating system. Table 6 lists the operating systems in use in the respondent's organizations. Again, respondents could choose more than one operating system. 81% of respondent's organizations handle network security in-house, 4% outsource it and the remaining respondent's claim their organizations do a combination of both.

Table 5: Network Operating Systems

Network Operating System	% of Respondents
Linux	41
Novell NetWare	20
Sun Solaris	29
Unix	46
Windows NT	27
Windows 2000	38
Windows XP	58
Windows Server 2003	57
Other	5

Table 6: Operating Systems

Operating System	% of Respondents
Linux	19
Mac OS X	20
Windows	94
UNIX	23
Other	1

Database, ERP and CRM

Table 7 lists the database management systems (DBMS) in use in the respondent's organizations. Respondents could choose more than one DBMS. 37% of respondent's organizations use an enterprise resource planning (ERP) system while 14% plan to use one in the future. Of the 37% that use one, Table 8 lists the ERP that is in use. Respondents could choose more than one ERP. The departments that primarily use the ERP system are accounting, finance and human resources. 40% of respondent's organizations use a customer relationship management (CRM) system while 16% plan to use one in the future. Of the 40% that use one, Table 9 lists the CRM that is in use. Respondents could choose more than one CRM. The departments that primarily use the CRM system are customer support, sales, marketing and human resources.

Table 7: Database Management Systems

DBMS	% of Respondents
Access	43
DB/2	24
MySQL	24
Oracle	58
SQL Server	66
Sybase	14
Other	7

Table 8: Enterprise Resource Planning Systems

ERP	% of Respondents
Baan	3
Oracle	45
PeopleSoft / J.D. Edwards	42
SAP	31
Other	12

Table 9: Customer Relationship Management Systems

CRM	% of Respondents
ACT	4
Oracle	23
PeopleSoft	18
SAP	13
Siebel	9
Other	19

CURRICULUM RECOMMENDATIONS

With regard to job placement, the findings indicate that IT help desk positions are the most likely jobs for entry-level workers, according to Table 2. This suggests that educators may need to manage student expectations about the nature of entry-level positions (and the associated salaries). As part of this process, IT educators should also help students understand the important role that entry-level positions play in further developing the personal, interpersonal, technical and organizational/managerial skills that lead to career growth.

The next two most likely entry-level jobs are in the area of networking and programming (see Table 2). This suggests that IT related programs need to have options that allow students to prepare for careers in these areas such as specializations, emphasis areas or tracks. In addition, students need to be advised that these are areas of opportunity upon graduation. Java (66%) and Visual Basic (55%) appear to be the two most frequently cited programming languages by respondents whose organizations do in-house development (see Table 4). Therefore, if an option to specialize in a programming language exists, the languages should include Java or Visual Basic. Windows XP, Windows Server 2003 and Unix are the most frequently cited network operating systems in use, according to Table 5. These should be among the network operating systems taught in a curriculum with a network specialization.

Respondents use the web (48%) and internships (39%) to find new IT employees (see Table 3). Educators need to advise students that internships are a valuable way to find a permanent job. Internships provide the student with an opportunity to interview the company and the company with a way to interview the prospective employee without committing to a permanent position. IT-related programs might consider internships as an optional or required part of the curriculum.

SQL Server (66%) is the most frequently cited DBMS in use at respondents organizations followed by Oracle (58%), as illustrated by Table 7. However, Oracle is the most frequently cited ERP system (45%) and CRM system (23%), according to Table 8. Therefore, either using SQL Server or Oracle in a data management course in an IT curriculum is acceptable.

Based on the findings of this study:
1. Students can expect to find entry-level jobs in the areas of help-desk, networking or programming
2. Internships play an important role in securing entry-level IT jobs
3. The technologies that are in use in the organizations surveyed are Java, Visual Basic, Windows XP, Windows Server 2003, Unix, SQL Server and Oracle.

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