

# THE STATUS OF IT SKILLS IN BUSINESS DURING RECESSIONARY TIMES: IMPLICATIONS FOR EDUCATORS

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## Abstract

**Purpose:** The purpose of this study is to identify the demand for information technology (IT) skills in the business world in order to provide guidance to curriculum planners.

**Method:** Want ads in two online job banks were queried using various IT skills as key words. **Results:** Results show demand is strong for the following IT skills: SQL, JAVA, C++, UNIX, Linux, and HTML/DHTML. Demand was low for all desktop publishing skills except for Photoshop. Enterprise resource planning (ERP) skills are more often required of accounting and finance employees than IT employees. Educators should consider including database (SQL), programming languages (JAVA and C++), operating systems (UNIX and/or Linux) and web design skills (HTML) in their curriculums.

## Background

University business teacher educators prepare students to teach not just general business, accounting, and marketing courses but also computer courses. To require appropriate undergraduate course work for business teachers, business teacher educators must know what computer software and programming language skills to include in our undergraduate business education programs. The computer skills included in these programs should be based on the business demand for those skills in order to adequately prepare students who will teach at the high school and post-secondary levels.

Information technology (IT) continues to evolve at a rapid pace, encouraging the need for educational offerings that meet the changing needs of industry. Keeping up with the needs of business through curricular offerings in the information technology field has been an issue for decades not just in business education undergraduate programs but also in information systems programs, one that a model curriculum has attempted to address. In the IS 2009: Curriculum Guidelines for Undergraduate Degree Programs in Information Systems (Topi et al., 2009) report, recommendations were made to bridge the gap between industry needs and academic preparation. Those curriculum recommendations primarily focused on non-technical skills including the expansion of information systems across other fields such as health care and government as well as an emphasis on soft skills such as the importance of good problem solving as well as interpersonal and team skills.

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A model curriculum can provide useful information to IT curriculum planners; however, in order to bridge the gap between academic offerings and industry demand, further analysis of the national demand for specific IT skill sets is needed. Information technology educators at all levels need to be aware of the most-used information technologies so they can emphasize the skills that will best prepare students for the job market and de-emphasize the skills that are least used in businesses. The rapid evolution of information technology (IT) skills makes it imperative that educators at all levels align their course content with the information technology skills most in demand in the business marketplace.

### Related Literature

Even though the economy has experienced the worst recession in over 70 years, the U.S. government is quite optimistic about the occupational outlook for certain information systems careers with computer and information systems managers being listed as the third highest job category, with 50,000 job openings being available between 2008-2018 (Occupational employment, 2010). In testimony to the U.S. Congress (Katz, 2010), a Harvard University professor projected 175,000 jobs for computer software engineers in the U.S. between 2008-2018, 156,000 jobs for network and data communications analysts, 120,000 for computer software engineers, 108,000 jobs for computer systems analysts, and 79,000 for network and computer systems administrators, and 37,000 for graphic designers.

Technical skills needed by IT professionals change more rapidly than soft skills. Results of a study of 153 IT professionals from six organizations showed that, while soft skills are important, those professional IT workers believe that technical skills are a critical component of an information systems education, particularly database skills (including SQL), having two computer language skills, and web design proficiency (Downey, McMurtrey & Zeltmann, 2008).

Although some people may believe the need for programming skills is on the decline, a study of 240 business schools (Apigian & Gambill, 2010) showed that the most-required course in the information systems major was programming with 99% of the business schools requiring it, followed by a database course (97%), and a systems design course (85%). Other courses were required much less frequently such as project management required by 27% of schools and audit and security management at only 17% of the business schools.

The specific programming languages offered by schools have changed over the last decade. For example, COBOL was the language taught most often according to Porter and Gambill (2003). However, in a 2009 study (Apigian & Gambill, 2010) of IT majors at 240 business schools, JAVA was the most popular language (34%), followed by Visual BASIC (23%) and C++ (22%), with COBOL coming in fourth at 13%.

A previous study compared the demand for information systems skills needed by employees in 2000 and 2004 (Groneman, 2005) by searching the [www.careerbuilder.com](http://www.careerbuilder.com) online want ad web site. That study showed JAVA and HTML

skills were listed most frequently in the programming/scripting category; SQL and Oracle were the most frequent database skills mentioned; and UNIX was the most-mentioned operating system skill. The biggest declines in information systems skills between 2000 and 2004 were as follows: Windows NT operating system, PERL, and Adobe Illustrator skills.

In addition to changes in technical skills required of information systems employees, in the last ten years IT educators have been dealing with a dramatic decline in the number of students majoring in information systems (Topi et al, 2009, Becker et al., 2006, McGann et al., 2007). One study indicated the decline was not isolated to a few universities; in fact, many departments across the U.S. experienced a decline in majors of 30% to 50% (Plice and Reinig, 2007). Possible reasons for such a decline may include news stories about the outsourcing of information technology jobs and the Internet bust in 2003, causing student interest in IT careers to wane. However, the outsourcing of jobs has mainly affected lower level IT jobs such as routine coding, testing of systems, and technical support— jobs that have moved to India and China (Wunker, 2007). As enrollments decline, educators search for new courses and skills to teach in order to attract more students and also to meet the demands of business.

The economic climate, job layoffs, and outsourcing of IT jobs in the last few years have affected the demand for IT employees. With many unemployed or under-employed IT workers, it will be even more crucial that IT educators prepare new graduates with the high tech skills required in the business world.

### **Purpose of the Study**

The primary purpose of this study is identify the information technology skills most-needed in the business world in order to provide guidance to educators so they can align their curriculums and course content with the IT skills most in demand in the business marketplace. Results of the study should also help business teacher educators evaluate and revise technology course content included in undergraduate or graduate business teacher preparation programs. Data gathered in this study should be used by educators as only one method to determine marketplace demands and curricular offerings.

Specifically, this study is designed to answer the following questions:

1. What programming and software skills are most in demand based on the skills needed to obtain employment in the information technology field in 2004 and 2011?
2. What are the changes in marketplace demand for computer programming and software from 2004 through 2011?
3. Within each of five categories of computer skills (programming/scripting languages, desktop publishing, database/enterprise resource planning, multimedia/design, and operating systems), what skills are most in demand in 2011?

4. Which employment fields have the highest demand for employees who have enterprise resource planning software skills?
5. What are the trends in information technology skills and the implications for curricular change/development?

### Methodology

Sound research should be based on the use of the most appropriate population, a large enough population, or a large enough sample of a population to draw valid conclusions. Frequently, surveys or interviews are utilized to gather data from employers about the skill sets needed by their employees; however, the cost and administration usually limits the size of the sample used for such a study. For this study, the want ads listed in two online job bank web sites were used as the population, allowing for access to national databases with IT job openings ranging from about 20,000 to over 70,000 jobs—far more data than one could obtain through a mail-out survey. This method of mining data from online want ads is not new; it has been utilized in two previous studies—one comparing web-related skills to other computer skills (Groneman, 2000) and the other identifying skills needed by IT professionals (Lui, Lui, and Lu, 2003).

For this study, the following two online job bank web sites were used to gather data: (1) in 2011, [www.dice.com](http://www.dice.com), listing 76,542 information technology job openings was used and (2) in 2004 and 2011, [www.careerbuilder.com](http://www.careerbuilder.com), listing over 20,000 job openings was used. Dice.com is a relatively new web site but considered one of the largest and best job sites for positions in the IT field (Web site reviews, 2011); it was not available in 2004. The other online want ad web site [www.careerbuilder.com](http://www.careerbuilder.com) lists job openings across a wide array of employment fields, not just information technology. For both job bank searches, the querying technique involved entering an IT skill as a key word/phrase, having the job bank search through the job qualification requirements in a given category such as IT in its database, and then providing a total number of ads that include that key word/phrase.

A pilot test in 2004 that involved querying several different online job bank web sites ([monster.com](http://monster.com), [hotjobs.com](http://hotjobs.com), and [careerbuilder.com](http://careerbuilder.com)) showed that [www.careerbuilder.com](http://www.careerbuilder.com) listed the most information technology jobs of all the sites, and it calculated the number of jobs for each skill that was entered as a keyword in the search box—a crucial piece of data for the study. This web site was used in 2011 but only to determine the demand for enterprise resource planning skills needed by marketing, management, media/journalism, and administration/clerical employees; it was used because the [dice.com](http://dice.com) web site is limited to only IT want ads.

The IT skills used for the queries were based on lists provided in previous research studies (Groneman, 2005; Downey, McMurtrey & Zeltmann, 2008) as well as by thoroughly analyzing 30 different online job descriptions on the [dice.com](http://dice.com) web site in order to identify new IT skills. Because new programming

languages, protocols, and software were developed between 2004 and 2011, those new IT skills were added to the query list in 2011. Therefore, the findings will indicate “no data” (n.d.) was obtained in 2004 for some of the IT skills listed in the tables.

Findings are presented in terms of the number of information technology online want ads that mentioned each IT skill and the rank order of each computer skill in 2004 and 2011. Because the online job bank used in 2011 listed over 70,000 IT jobs and the job bank used in 2004 listed only about 20,000 jobs, in terms of comparison of data, the frequency of each IT skill may not be as important as the rank order although the frequency may indicate a difference in the overall U.S. economic between 2004 and 2011.

Besides overall frequency and rank of each IT skill, the skills were classified into categories based on a classification system that is similar to that used by Arnett, Liteschy, and Probhak (1998). The categories include programming/scripting languages, desktop publishing, database/enterprise resource planning, multimedia/design, and operating systems.

Finally, the data were analyzed and recommendations were made concerning information technology curricular offerings. The recommendations may be useful to university professors as well as community college and secondary school instructors. The educational level at which those skills should be taught is generally beyond the scope of this research study.

## Findings

Results of the queries of the online job banks for IT skills mentioned in the want ads will be presented in the order of the research questions stated previously. Table 1 presents a list of all the programming, protocol, and software skills queried, the frequency they were mentioned in the [www.careerbuilder.com](http://www.careerbuilder.com) online want ads in 2004 and in the [www.dice.com](http://www.dice.com) want ads in 2011 as well as their rank for both years. Some IT programs were not on the market or included in the 2004 data collected; the designation of n.d. is used to indicate no data was collected.

SQL, a database language, is clearly the IT skill most in demand by businesses based on the online want ads analyzed in both 2004 and 2011. The skill that is second highest in demand is JAVA, a programming language. C++, or a version of C++, went from a rank of 8 in 2004 to a rank of 3 in 2011. Two network operating systems, UNIX and Linux, were ranked 4<sup>th</sup> and 5<sup>th</sup> respectively in 2011. The web site creation skills of HTML/DHTML were also mentioned frequently in want ads, having a ranking of 5<sup>th</sup> in 2004 and 6<sup>th</sup> in 2011.

**Table 1**

*Frequency and Rank Order of 43 IT Skills Mentioned in Online IT Want Ads in 2004 and 2011*

IT Skills	No. of Ads		No. of Ads	
	in 2004	Rank	in 2011	Rank
SQL	5,762	1	22,882	1
JAVA	5,737	2	15,979	2
C++/C#/Visual C++	1,613	8	14,298	3
UNIX	4,497	3	10,570	4
Linux	1,277	11	10,218	5
HTML/DHTML	2,662	5	10,092	6
Javascript	896	15	9,469	7
XML	2,108	6	9,243	8
J2EE (JAVA)	n.d.*		6,452	9
Microsoft Excel	n.d.		6,303	10
Microsoft Office	1,785	7	5,533	11
PERL	1,015	13	4,796	12
MS Visio	n.d.		3,796	13
IBM Websphere	n.d.		3,030	14
TCP/IP	n.d.		2,995	15
Peoplesoft	n.d.		2,679	16
Visual Studio	n.d.		2,404	18
Oracle WebLogic	n.d.		2,187	18
API	n.d.		2,239	19
Content Mgt.	n.d.		2,108	20
Oracle SOA Suite	n.d.		1,702	21
Windows 7	n.d.		1,565	22
Flash	286	18	1,527	23
Visual BASIC	1,991	9	1,495	24
Microsoft Exchange	688	16	1,490	25
Sybase	n.d.		1,323	26
Android	n.d.		1,152	27
Python	n.d.		1,051	28
Photoshop	376	17	1,029	29
COBOL	934	14	664	30
Lotus Notes	1,414	10	496	31

**Table 1** (continued)  
***Frequency and Rank Order of 43 IT Skills Mentioned in Online IT Want Ads in 2004 and 2011***

Windows Vista	n.d.		444	32
Dreamweaver	182	20	353	33
CGI	19	19	297	34
Adobe Illustrator	24	25	214	35
SED (scripting)	n.d.		95	36
PageMaker/Indesign	24	24	49	37
FrontPage	55	22	39	38
Quark/Quark Express	21	21	33	39
Macromedia Director	23	23	9	40
Shockwave	27	27	8	41
Windows NT	1,203	12	0	42
Windows 2000	3,215	4	0	43

Note: n.d. indicates no data was collected.

The skills related to older versions of Windows operating system, Windows NT and Windows 2000, were not mentioned in any want ads in 2011. Although Windows 2000 was ranked 4<sup>th</sup> in 2004, the newest version of Windows operating system, Windows7, had a midway rank of 20 out of 40 IT skills.

Multimedia/design programs such as Shockwave and Macromedia Director were mentioned in very few want ads in either 2004 or 2011; however, in 2011, two visual designer programs were mentioned more frequently: MS Visio (a graphical project management software) was mentioned in 3,796 want ads and Visual Studio was mentioned in 2,404 ads.

The frequency and rank of individual programming/scripting skills for 2004 and 2011 indicate that JAVA is ranked first and HTML is ranked second. in both years of the study. See Table 2. JavaScript, ranked third in 2011; several other web site creation skills are within the top ten ranking in 2011. COBOL programming, once the most popular programming language, went from a rank of 9 in 2004 to a rank of 17 in 2011.

**Table 2**

*Frequency and Rank of Skills in the Programming/Scripting Language Category in 2004 and 2011*

Skills	Frequency In 2004	Rank	Frequency In 2011	Rank
JAVA	5,737	1	15,979	1
HTML	3,180	2	10,092	2
JavaScript	896	10	9,469	3
.net	n.d.		9,274	4
XML	2,108	5	9,243	5
C#	n.d.		7,693	6
J2EE (JAVA)	n.d.		6,452	7
C++	3,174	7	5,846	8
ASP	2,780	3	5,347	9
Perl	1,015	8	4,796	10
Asp.net	522	11	4,345	11
Vb.net	352	12	1,653	12
Visual BASIC	1,991	6	1,495	13
Ruby/Ruby on Rails	n.d.		1,445	14
Python	n.d.		1,051	15
DHTML	195	15	1,042	16
Visual C++	287	13	759	17
COBOL	934	9	664	18
Vbscript	2,663	4	598	19
ColdFusion	112	16	332	20
3D	n.d.		331	21
CGI	235	14	297	22
SED scripting	n.d.		95	23

Note: n.d. indicates no data was collected.

In the desktop publishing category of skills, Photoshop was the highest ranked skill in 2004 and 2011, as shown in Table 3. The desktop publishing software programs were mentioned infrequently in the dice.com job bank used in 2011 or in the careerbuilder.com website used in 2004.

**Table 3**

*Frequency and Rank of Skills in the Desktop Publishing/Graphic Design Category in 2004 and 2011*

Skills	Frequency in 2004	Rank	Frequency in 2011	Rank
Photoshop	376	1	1,029	1
MS Publisher	24	4	68	2
Pagemaker/Indesign	36	3	49	3
Quark/QuarkXpress	120	2	33	4

Both in 2004 and 2011, the two most frequently mentioned database or enterprise resource planning (ERP) skills were SQL and Oracle, as shown in Table 4. SAP came in a distant third in 2011; but all the database/ERP software programs, including Microsoft Access, were mentioned much more frequently than any of the desktop publishing skills listed in the previous table.

**Table 4**

***Frequency and Rank of Skills in the Database/Enterprise Resource Planning Category in 2004 and 2011***

Skills	Frequency in 2004	Rank	Frequency in 2011	Rank
SQL	5,762	1	22,882	1
Oracle	4,003	2	17,111	2
SAP	N.D.		7,954	3
CRM (customer relationship mgt.)	N.D.		2,813	4
Peoplesoft	N.D.		2,679	5
MS Access	1,227	3	2,417	6

Note: N.D. indicates no data was collected.

The top three multimedia/graphic design skills were MS Visio, Visual Studio, and Photoshop (see Table 5). Those three programs were mentioned in from 1,000 to almost 4,000 IT want ads in 2011 as compared to other programs in that Table, ones ranked 4-16, that were mentioned in only from 1 to 214 want ads.

**Table 5**

***Frequency and Rank of Skills in the Multimedia/Graphic Design Category in 2004 and 2011***

Skills	Frequency in 2004	Rank	Frequency in 2011	Rank
MS Visio	n.d.		3,796	1
Visual Studio	301	3	2,404	2
Photoshop	376	2	1,029	3
Adobe Illustrator	468	1	214	4
Fireworks	47	4	160	5
iPhoto	0	12	146	6
Adobe Studio	31	7	115	7
Adobe Premier	2	11	46	8
iTunes	0	13	27	9
3D Studio Max	5	9	16	10
Macromedia Studio	41	5	11	11
Shockwave	3	10	8	12

**Table 5** (continued)***Frequency and Rank of Skills in the Multimedia/Graphic Design Category in 2004 and 2011***

GoLive	6	8	6	13
Corel Draw	42	6	3	14
iLife	0	12	2	15
iMovie	0	11	1	16

Note: N.D. indicates no data was collected.

UNIX and Linux are clearly the operating system skills most in demand in 2004 as well as in 2011 with over 10,000 want ads mentioning each of those skills in 2011, as shown in Table 6. Those operating systems are often used for network operating systems and on servers rather than on desktop computers. The most current version of the Windows operating system, Windows7, was ranked third in 2011.

**Table 6*****Frequency and Rank of Skills in the Operating Systems Category in 2004***

Skills	Frequency In 2004	Rank	Frequency in 2011	Rank
UNIX	4,497	1	10,570	1
Linux	1,277	3	10,218	2
Windows 7	n.d.		1,565	3
Windows Vista	n.d.		445	4
Windows NT	1,203	4	0	5
Windows 2000	3,214	2	0	5

Note: n.d. indicates no data was collected.

Because enterprise resource planning (ERP) software is used by employees in many departments within a business and the [www.dice.com](http://www.dice.com) web site primarily lists jobs in information technology departments, the [www.careerbuilder.com](http://www.careerbuilder.com) web site was queried in 2011 to determine the frequency three ERP programs—SAP, Oracle, and PeopleSoft—are used. Results of those queries within five categories of jobs—accounting, finance, management, information technology and customer service—showed that all three ERP programs were mentioned most frequently in the accounting category, followed by the finance category. However, all five categories of jobs included some want ads mentioning one of the three ERP programs. SAP was mentioned most frequently followed by Oracle and PeopleSoft. The reason PeopleSoft and SAP were queried separately is because those programs were sold by two different companies until recently.

**Table 7**

*No. of Want Ads Mentioning Enterprise Resource Planning Software in Various Occupational Fields*

Occupational Fields	SAP	Oracle	PeopleSoft
Accounting	1,503	1,211	590
Finance	1,124	866	392
Management	323	359	140
Information technology	220	285	122
Customer service	144	132	62
Totals	3,314	2,853	1,306

### Conclusions and Discussion

Overall, the findings show there is still strong business demand for information technology skills even during a poor economic climate. Specifically, SQL, JAVA, C++ (or a version of it), UNIX, Linux, and HTML/DHTML are the most sought-after skills nationwide in the IT field in 2011, based on searches of the [www.dice.com](http://www.dice.com) online and IT job bank.

At this point in time, information systems instructors should consider developing or revising IT curriculums to include the skills mentioned in 10,000 to over 20,000 online want ads. Those skills include the following: SQL, JAVA, C++ (or C# or Visual C++), UNIX, Linux, and HTML/DHTML. Such a curriculum would include database instruction (SQL), programming languages (JAVA and C++), operating systems (UNIX and/or Linux) and web design skills (HTML/DHTML). Business educators should evaluate their business education curriculums to determine whether their students are prepared to teach the most-used IT skill sets. Educators should be very cautious about teaching IT skills in the multimedia/graphic arts category, other than Visio, Visual Studio, and Photoshop because the demand for employees across the country is so low.

In the short term, meeting the immediate demands of business for specific IT skills is important; however, in the long term, emphasizing general categories of IT instruction such as principles of database creation and web design may be the wiser course to take. Some IT skills may be most appropriately taught in technical schools and community colleges rather than at the university level; however, identification of a minimum educational level related to each IT skill set was beyond the scope of this study.

The job outlook does not look promising in the desktop publishing field with the possible exception of the need for employees with Photoshop skills. However, Photoshop is not only used for desktop publishing but also for web site creation. Primarily, medium to large businesses are the ones that post job openings on the online job banks so it is possible that small businesses still have a need for employees with desktop publishing skills. Further research of local businesses is needed to determine if that is true.

Programming languages are not dead—the need to teach programming languages is as strong as ever. However, the languages taught should include JAVA and C++ rather than COBOL. This corroborates results of an earlier analysis, an analysis of 163 programming jobs listed on the monster.com and hotjobs.com web sites, showing that COBOL was only mentioned in seven job listings (Koong, Liu and Liu, 2002).

To prepare students to create web sites, instruction in HTML, DHTML, JavaScript, and XML are recommended rather than having students create web sites with Dreamweaver, based on the low number of want ads mentioning Dreamweaver. Secondary and post-secondary business teachers should consider using HTML/DHTML rather than Dreamweaver in their web design courses.

Clearly, numerous businesses need employees who have UNIX and/or Linux operating system skills; technical schools and universities should be preparing students for those employment opportunities.

Accounting and finance employees are more likely than IT employees or other business employees to need enterprise resource planning skills. As compared to the number of job openings for other IT skills, the demand is relatively low. Including ERP course work nationwide in accounting and finance is probably not warranted at this point in time; however, that skill could provide the extra edge new college graduates may need to obtain employment. Accounting and finance professors should watch the demand for ERP skills closely over the next few years as it may change.

A major conclusion of this study is that the business demand for highly skilled information technology employees appears to be strong even in poor economic times, with six IT skills being mentioned in over 10,000 jobs.

Further analysis of individual IT want ads is recommended in order to identify the minimum degree, diploma, or certification required of job applicants. This would provide guidance to IT educators in terms of the most appropriate educational levels to offer various IT courses.

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