AIM | INSTITUTE

A 15-Year Look at Business Requirements for Educational Services in Information Technology

The AIM Institute's Comparison of Four Previous Studies

A research report compiled by
Robert E. Sweeney, Ph.D.
President and CEO Emeritus, AIM Institute

September 2009

AIM | INSTITUTE

TABLE OF CONTENTS

TABLES

AIM | INSTITUTE

BACKGROUND

AIM Institute commenced operations in April 1992. AIM was founded upon the principle that information technology was key to regional economic development. The founding partners who included business, academic and governmental leaders, believed that the community would be best served if the IT graduates from regional colleges and universities were well prepared for the IT needs of area employers. One of the greatest challenges, however, was the failure of the business community and other employers to speak with a "single voice" on issues related to information technology. Each had a different technical environment, different plans and strategies for future development, different expectations of employees, and different operating cultures. Meanwhile, the academic community frequently developed curriculum based upon the needs of employers that were on their advisory committees; the specific interests of individual faculty members; the specific emphasis developed by individual departments or colleges that offered IT courses; and topics that might lead to academic publication. In general, there was a mismatch between the needs and expectations of the employers and the educational community that developed courses and programs.

Meanwhile, a major transformation was taking place in the information processing world. Just a decade earlier, in 1981, IBM had introduced its PC. While other manufacturers had some very unique offerings and in some cases superior devices, networking and software applications, IBM's entrance validated the importance and role of desktop devices.

Over the following decade the demand to network the desktop device led to the creation of local- and wide-area networks and the creation of the client/server environments. For larger employers, these networks needed to be linked into mainframe-based data and applications. For both larger and smaller employers, the potential of server-based networks created opportunities for creative and efficient computer-based applications that were cost-prohibitive in the mainframe world.

By 1992, when AIM was created, there was a serious mismatch between the emerging demand for employees with different capabilities and knowledge versus the mainframe-oriented student graduating from most colleges and universities. To facilitate the dialogue between employers and the academic community, AIM Institute, working with an advisory committee of leaders from both communities, developed a survey that would document employer requirements for educational services in information technology. AIM wrote the study findings to effectively convey those needs to the academic community.

The initial study, *Greater Omaha Business Requirements for Educational Services in Information Technology* was completed in 1995. Generally, the document was viewed as being a fair representation of business requirements for IT employees and was well received by the academic community. A few years later both employers and academic faculties requested a follow-up study to map progress in meeting employers' needs. Throughout almost 15 years, that same study, with only minor changes in the questionnaire to track changes in technology, has been completed four different times.

The studies documented areas of greatest demand by the business community for IT educational services and noted areas where the academic community could strengthen its offerings. The studies also estimated the size of corporate educational budgets and information technology employment. The titles and results of these studies are listed below and are available at the AIM Institute, 1905 Harney Street, Suite 700, Omaha, NE 68102 and on the AIM website at: www.aiminstitute.org.

1. *Greater Omaha Business Requirements for Educational Services in Information Technology* (1995)
2. *A Vision for Information Technology and Engineering Education* (1995)
3. *Greater Omaha Business Requirements for Educational Services in Information Technology – Update for 1999*
4. *Progress and Change in Information Technology* (1999)

5. *Midwest Regional Business Requirements for Educational Services in Information Technology* (2002)
6. *Midwest Regional Business Requirement for Educational Services in Information Technology - A New Look* (2008)

The number of respondents varied from study to study. The 1995 study had 62 respondents. Respondents in each of the subsequent studies are as follows – 1999 = 43; 2002 = 124; and 2008 = 49. In the 1995 and 1999 studies, respondents were all from the Omaha Metropolitan area. The 2002 and 2008 studies included employers from across a four-state area including all of Nebraska, western Iowa, eastern South Dakota and North Dakota.

Also, in a very few cases, the respondents did not respond to a specific question. Hence, the numerical values that follow are based on the response of those that answered.

Finally, this period of time has seen dramatic changes in technology and the economic climate has been volatile (the dot.com bubble, the subsequent dot.com bust, the hiring bubble, the hiring bust, and the economic recession in late 2008 through 2009). But through it all, there has been steady growth in the demand for IT professionals by all types and location of employers. IT has moved from an operating department doing selected back office functions such as accounting and payroll, to the electronic platform on which all operational transactions are performed. In addition, for many enterprises, the strategic and tactical direction of the firm is charted using information gleaned from the systems operating on these highly integrated electronic platforms.

AIM | INSTITUTE

STUDY METHODOLOGY

Long-Term Trends in Academic Disciplines

Respondents in each of the four studies were asked to rank the following nine academic disciplines:

- Electronic Engineering
- Telecommunications
- Systems Integration
- Computer Engineering and Systems
- Systems Development and Business Integration
- Technology Management
- Technology Marketing
- E-commerce
- Networking (LAN/WAN/IP)

Many of these disciplines will appear in college catalogs across the nation. Some, however, reflect changing business needs that have not yet found their way into academic programs.

Ranking was based upon a 1 – 4 scale with 1=most important and 4=least important to your enterprise. All rankings were 'non zero' ranks — if a respondent failed to rank an item, that non-rank or zero was not included in the average rank.

Within each Academic Discipline, there are specific topics or Applied Areas. AIM also asked employers to rank each of the Applied Areas based upon a 1-4 scale. Each Applied Area relates more closely to the titles of individual courses students might take, within an Academic Discipline, as a part of their IT degree.

AIM | INSTITUTE

ACADEMIC DISCIPLINES

Electronic Engineering

In colleges and universities across the country, the intellectual roots for IT curriculums are frequently in three colleges:

- Engineering
- Business Administration
- Liberal Arts (often the Math Department)

In the Midwest, most programs have a strong business or liberal arts heritage. The survey respondents were asked to rank each technical discipline even though it may not be available in their community. *Electronic Engineering* is one of those disciplines that is not offered by all the area colleges and universities.

Telecommunications

The *Telecommunications* discipline included protocols, wireless, telephony, fiber optics and other communications technologies. Networking, discussed below, focuses on LAN, WAN, Internet Protocols, Integration, Server Security, etc.

Today, much of the Midwest business community has access to a functional and growing telecommunications infrastructure. That was less true when the earlier studies were completed. However, rural employers with global markets may still face challenges from a lack of adequate telecommunications and the associated intellectual infrastructure to capitalize on strong long-term market potential.

Systems Integration

The much-discussed convergence of IT disciplines such as computers, video, telecommunications, wireless, TV, performing arts, web, graphics & textual presentation, etc., is well documented. Building and supporting the networked platform used by most firms to conduct business requires significant *System Integration* skills. In addition, the integration of electronic devices into structures, machines, and processes is accelerating.

The integration of converging technologies takes place at the physical and application levels:

- The hardware platforms including the integration into physical structures and devices.
- Applications frequently transcend all levels of activity within and across the firm plus provide access to its suppliers and customers.

The survey's definition of Systems Integration captures the essence of the integration stated above. This activity consumes increasing amounts of corporate energy. These concepts are taught in various courses. However, increasing momentum towards interdisciplinary curriculums at post-secondary institutions would encourage greater Systems Integration focus.

Computer Engineering & Systems

Historically, many topics in the *Computer Engineering & Systems* discipline had a mainframe focus.

Systems Development and Business Integration

Applications that transcend all levels of business activity within a firm or industry are captured in the Academic Discipline of *Systems Development and Business Integration*. Historically, many of the area colleges and universities have had relatively strong courses and programs around systems and development topics. These programs are increasingly addressing broader issues associated with the changing platforms and business requirements and their impact on systems development.

Technology Management

One dimension of *Technology Management* is Project Management. As documented in each study, Project Management ranks near the top of the list of educational services desired by Midwest employers.

Technical Marketing

Few, if any, academic programs that focus on *Technical Marketing* exist in the area. The focus of a Technical Marketing discipline would include the technological knowledge and understanding of how to market technology-based products and services.

E-commerce

E-commerce has "exploded" onto the business and technology landscapes. E-commerce represents an entirely new discipline and skill set in IT. It also will affect public policy, the relevance of geography, law, marketing and numerous other business and policy issues.

Networking

Nearly every firm with multiple computers and an Internet strategy requires networking skills. *Networking* is one of the fastest growing IT disciplines for large and small firms alike. In the last decade a dramatic change has occurred in business and industry. The explosion of the World Wide Web and communication technologies is leading to a restructuring of the business enterprise and IT employment in Midwestern firms.

Table I shows the ranking of the Academic Disciplines from each of the four studies. The fifth column also shows the weighted average or composite score for all four studies. The number of survey participants was used as the weighting factor in computing the weighted composite rank. The table shows a high degree of consistency in the way employers ranked each discipline over each of the four studies. Networking (LAN/WAN/IP) was not listed as a Discipline in the 1995 study. Since that time, employers have ranked it as either the top or the second highest ranked Discipline in each subsequent study. In each Academic Discipline, the respondents were asked to rank different applied areas within the Discipline. In the case of Networking, each of its applied areas also ranked as top priority.

This very consistent ranking of academic disciplines suggests that the major disciplines within IT have maintained a similar level of importance over time by all employers no matter their location (urban or rural) or size. Certainly, the web world has brought major new requirements as reflected in the networking discipline and, to some extent, in the e-commerce and telecommunications disciplines. Key development and management issues remain essential to all employers.

Table I

ACADEMIC DISCIPLINES
By Study and Weighted Composite Average

	Study Averages				Weighted Composite Average
Academic Discipline	**1995 n=62**	**1999 n=43**	**2002 n=124**	**2008 n=49**	**1995-2008 n=278**
Electronic Engineering	3.07	2.39	2.59	3.22	2.78
Telecommunications	1.93	1.36	1.72	2.30	1.81
Systems Integration	1.72	1.13	1.39	1.81	1.50
Computer Engineering & Systems	2.05	1.72	1.93	2.17	1.97
Systems Development & Business Integration	1.59	1.05	1.74	1.83	1.62
Technology Management	1.88	1.19	1.83	1.85	1.75
Technical Marketing	2.72	2.06	2.98	3.13	2.81
E-Commerce	n/a	1.25	1.95	2.26	1.88
Networking (LAN/WAN/IP)	n/a	1.11	1.24	1.61	1.30

Rank 1 = Most Important 4 = Least Important

AIM | INSTITUTE

ACADEMIC ACHIEVEMENT

Academic achievement is one of the criteria employers frequently consider when hiring an Information Technology professional. In each of the studies, respondents were asked to document the number of IT employees by educational status. In addition, the respondents were asked to estimate the desired educational status of their IT employees in five years. In each study, the employers projected increased numbers of baccalaureate- and graduate-degreed employees in five years. Table II shows that employers have done what they said they would do and have steadily increased the academic achievement of their IT employees.

These data suggest firms expect employees to make a logical progression in academic achievement while on the job. It also suggests these employers will be seeking more new employees with baccalaureate or advanced degrees.

The data also implies the need for good articulation agreements between two- and four-year institutions to facilitate these career development requirements. It also argues for good web-based distance educational opportunities for employees whose work is not near a college campus.

Employees with sub-baccalaureate degrees make a large potential market for additional academic courses / degree programs. Numerically, these employees are highly concentrated in larger firms that frequently have college-tuition reimbursement programs.

Table II

ACADEMIC STATUS OF IT EMPLOYEES
By Study and Weighted Composite Average

	Study Averages				Weighted Composite Average
Academic Status	**1995 n=62**	**1999 n=43**	**2002 n=124**	**2008 n=49**	**1995-2008 n=278**
Percent Sub Baccalaureate	57.9%	41.3%	40.1%	39.3%	44.11%
Percent Baccalaureate	34.7%	47.6%	50.2%	45.4%	45.49%
Percent Graduate	7.4%	11.0%	9.7%	15.3%	10.38%

APPLIED AREAS

In every study of Business Requirements for Educational Services in Information Technology since 1995, employers have ranked 48 different *Applied Areas*. Applied Areas relate more closely to the titles of individual courses a student might take within an Academic Discipline as a part of their IT degree. These Applied Areas include both technical IT courses as well as typical IT management studies. Respondents were asked to rank specific Applied Areas within each Academic Discipline. The Appendix shows ranking for all 48 Applied Areas for each of the studies as well as a composite weighted-average score.

Table III shows the 23 Applied Areas that ranked most important based upon the composite weighted-average score. While scores varied somewhat from study to study, the highest ranked Applied Area remained amazingly consistent from study to study. The data in Table III also shows that management issues such as Project Management; Security; Quality Assurance; and Continuity, Interruption and Recovery are as essential to successful ongoing operations as are many of the very technical issues. In fact, Continuity, Interruption and Recovery ranked as most important with a weighted-average composite score of 1.34. No matter how exquisite or simple an application is, it is meaningless if there is not continuity and rapid recovery when failure happens.

Table III also shows that every Applied Discipline within the Networking (LAN/WAN/IP) Academic Discipline were among the most important topics for employers. Ten of the 23 top-scoring Applied Areas are in Networking/E-commerce/Telecommunications areas, documenting the relevance of these disciplines in the *wired* world of today's Midwest firms.

AIM | INSTITUTE

Table III

APPLIED AREAS
By Study and Weighted Composite Average

			Study Averages							
			1995 n=62		1999 n=43		2002 n=124		2008 n=49	1995-2008 n=278
Electronic Engineering	**3.07**		**2.39**		**2.59**		**3.22**		**2.78**	
Telecommunications		**1.93**		**1.36**		**1.72**		**2.30**		**1.81**
Protocols, ATM, TCP/IP, Frame Relay, ADSL			1.69		1.32		1.44		2.00	1.58
Telephony			2.17		1.74		1.87		2.02	1.94
Systems Integration		**1.72**		**1.13**		**1.39**		**1.81**		**1.50**
Software/Hardware Configuration		1.54		1.20		1.67		1.53		1.54
LAN/WAN			1.72		1.12		1.39		1.62	1.46
Quality Assurance			1.98		1.39		1.61		2.11	1.75
Computer Engineering & Systems		**2.05**		**1.72**		**1.93**		**2.17**		**1.97**
Architectures/Platforms			2.38		1.34		1.76		2.56	1.97
Standards/Documentation		2.25		1.61		1.75		2.49		1.97
Systems Development & Business Integration	**1.59**		**1.05**		**1.74**		**1.83**		**1.62**	
Methodology			1.93		1.61		1.97		2.13	1.93
Data Warehousing			2.12		1.72		1.76		2.22	1.92
Client/Server			1.61		1.38		1.77		1.67	1.66
Design/Programming			1.86		1.11		1.48		2.18	1.64
Decision Support Systems		2.05		1.75		1.83		2.42		1.97
Technology Management		**1.88**		**1.19**		**1.83**		**1.85**		**1.75**
Project Management			1.47		1.16		1.79		1.71	1.61
Business Planning Strategies/Tactics			1.81		1.67		2.13		2.12	1.99
Specific Technical Competencies		1.96		1.38		2.17		2.08		1.99
Technical Marketing		**2.72**		**2.06**		**2.98**		**3.13**		**2.81**
E-Commerce		**n/a**		**1.25**		**1.95**		**2.26**		**1.88**
Development Technologies			n/a		1.41		1.75		2.43	1.84
Security		n/a		1.28		1.36		1.87		1.46
Networking (LAN/WAN/IP)		**n/a**		**1.11**		**1.24**		**1.61**		**1.30**
Protocols – Open and Proprietary		n/a		1.27		1.92		1.83		1.77
Integration			n/a		1.18		1.60		1.74	1.55
Unification, Convergence		n/a		2.15		1.62		1.87		1.78
Servers, Bridges, Routers and Hubs			n/a		1.33		1.38		1.51	1.40
Security, Encryption, Firewalls			n/a		1.44		1.31		1.43	1.36
Continuity, Interruption & Recovery		n/a		1.36		1.21		1.63		1.34

Rank 1 = Most Important 4 = Least Important

A further review of these *Applied Areas* suggests that four major groupings are of major importance to business:

- *Client/Server*, networked platform and related technology, Communication *Protocols*, and the applications that will run on that platform;

- *Business Planning/Re-engineering, Project Management, Technical Management and Quality Assurance* associated with Security; plus the *Continuity*, *Interruption and Recovery* required for the designated maintenance of these hardware and application environments;

- *Data Warehousing, Methodologies, Design/Programming*, associated with expanded strategic expectations from data and systems on emerging platforms;

- *E-commerce*, *Development Technologies and Security* and increased relevance of networking that documents a clear migration in corporate IT strategies, business structure, and focus.

The strength of the scoring in these Applied Areas will continue to be of great interest to area academic institutions.
While major new programs and courses are being developed or are now available — particularly client/server, communications, networking and E-commerce — the business need driven by rapid industry changes is frequently outstripping the availability of desired educational services.

In each study, survey respondents were asked to rank how well area colleges and universities were meeting their needs in each Applied Area. In each of the four studies, the colleges and universities were generally ranked as not meeting the employers' needs. Specifically, in each study, the colleges and universities were not meeting employers' needs in any of the 20+ high-ranked Applied Areas.

In every case, in Applied Areas where colleges and universities were judged as meeting employer needs, respondents ranked the Applied Area in the bottom half of important topics.

Generally, over this period of four studies, however, the gap between employers' needs and their evaluation of colleges and universities meeting those needs has closed somewhat.

TECHNOLOGY AREAS

General Comments

An array of information topics transcends the various *Academic Disciplines* and *Applied Areas* and time. The nature of the issues around these topics change as basic technologies change and the applications evolve. In some cases they are functional issues like data and languages, while in other cases they are the emerging issues within information processing or technologies that allow completely new and different ways to achieve a corporate objective. In many respects, these *Technology Areas* may provide focus to *Academic Disciplines* or *Applied Areas*. To illustrate, E-commerce has an engineering dimension to it. It also has issues of web design, security, legal, graphics, audio, data management, systems integration, multimedia presentation, etc. It also includes technology management and technology marketing issues. It will impact future systems development and will probably become a very important part of the operating structure of a business enterprise.

Table IV shows how Midwestern employers have evaluated 13 different Technology Areas since 1995.

The *Technology Area - Data* has been either the top or the second-ranked issue in each of the four studies. With the emerging technological platforms, new forms of digitized content and issues of security, etc., management of data is still high on the agenda of employers and the substance of the issue is substantially broader then historically covered by traditional academic courses.

Table IV

RANKING OF TECHNOLOGY AREAS				
Technology Area	**1995 n=62**	**1999 n=43**	**2002 n=124**	**2008 n=49**
Languages	2.04	1.87	2.22	2.52
Data	1.60	1.54	1.67	1.54
Telecommunications	1.60	1.72	1.46	1.70
Client/Server	1.74	1.92	1.99	1.76
Human Factors Engineering	2.69	2.39	2.42	2.74
Education Technologies/Learning Services	2.48	2.48	2.45	2.48
E-commerce	2.52	n/a	1.82	2.54
CAD/CAM/CAE	3.28	3.36	2.96	3.15
Object-Oriented Design	2.61	2.04	2.21	2.72
Artificial Intelligence	3.26	3.03	3.18	3.33
Multimedia-Technology	2.72	2.56	2.53	2.48
Multimedia-Presentation	2.41	2.55	2.35	2.44
Virtual Reality	3.60	3.17	3.16	3.20

Rank 1 = Most Important 4 = Least Important

Data, Telecommunications, Client/Server

Table IV shows composite rankings for all firms in the different years that span the four studies, and bring these *Technology Areas* into sharper focus. The highest-ranked cluster of *Technology Areas* was Data, Telecommunications, and Client/Server. This cluster characterizes the rapidly emerging electronic information-processing platform for corporate America that has occurred over this period.

Languages seem to have a somewhat diminished degree of importance to employers over this period. This may reflect the rapid expansion of program and application writing technologies required in the highly diverse technology environment of today's employer. They expect an employee to have the development skill set to move across environments regardless of the attributes of specific development tools.

In each of the studies, the employer was asked to estimate the importance of each of these *Technology Areas* in the next five years. In each study, employers projected that many of the *Technology Areas* would be more important in the "next five years," but this time-series data suggests their importance has, in fact, changed relatively little.

AIM | INSTITUTE

VENDOR CERTIFICATIONS

During this period, *Vendor Certifications* have become a more important part of the IT training plans for many corporations. In the 1999 study, employers stated they spend 14% of their training budgets on *Vendor Certifications*. That number was 27.1% in the 2002 study and 28.6% in the 2008 study. The question was not asked in the 1995 study.

Table V

RANKING OF VENDOR CERTIFICATIONS			
Certification	**1999 n=43**	**2002 n=124**	**2008 n=49**
Microsoft	1.66	2.81	2.26
Novell	3.25	3.45	3.65
Lotus Notes	2.49	3.64	3.67
Cisco	2.48	2.84	2.44
Oracle	1.64	3.17	3.24
PeopleSoft	2.62	3.82	3.59
Linux	n/a	3.88	3.04
Rank 1 = Most Important 4 = Least Important			

Firms were asked to rank seven different *Vendor Certifications*. Table V shows the ranking for each. This data shows:

- Microsoft was the top-ranked vendor certification in each study.
- Cisco was the second highest ranked certification in 2002 and 2008 — showing a very similar pattern to Microsoft.
- The ranking for other certification programs seem to reflect the general popularity or market success (or lack of success) of the vendor. Rank of certifications for Lotus Notes, Oracle, and PeopleSoft all declined significantly.
- Linux was added to the 2002 and 2008 questionnaire. Linux certification ranked as more important in 2008 than in 2002.

Finally, the 2002 and 2008 studies ask employers to rank their desire for education in other special topics such as Technologies, Professional Other, Programming and Development, and Database. Table VI shows the top-ranked disciplines in these special topics. Note that several management issues associated with the emerging E-world are ranked high by firms.

Table VI

RANKING OF PROFESSIONAL DEVELOPMENT TOPICS		
Professional Development Topics	**2002 n=124**	**2008 n=49**
Technologies		
WAN/LAN	2.08	1.82
TCP/IP	2.07	1.96
VPN	2.88	2.16
Wireless	2.67	2.07
Professional Other		
Project Management (PPM)	2.56	2.26
Security (SANS/CISSP)	2.19	1.89
Disaster Planning & Recovery	2.55	2.00
A+	2.75	2.83
Net +	3.13	2.80
Programming & Development		
XML	3.48	2.67
Java/Java Script	3.38	2.60
HTML	3.22	2.45
C++	3.28	3.11
Visual Basic	3.37	2.96
Database		
Oracle	2.51	3.23
SQL	2.21	2.15
MS-SQL	2.75	2.56
DB2	2.84	2.25
Crystal Reports	3.39	3.06
Rank 1 = Most Important 4 = Least Important		

SUMMARY

When AIM was created in 1992, there was a serious mismatch between the emerging demand for employees with different capabilities and knowledge versus the mainframe-oriented student graduating from most colleges and universities. To facilitate the dialogue between employers and the academic community, AIM Institute — working with an advisory committee of leaders from both communities — developed a survey that would document employer requirements for educational services in information technology. The study findings were written to effectively convey those needs to the academic community.

The initial study, *Greater Omaha Business Requirements for Educational Services in Information Technology* was completed in 1995. Generally, the document was viewed as a fair representation of business requirements for IT employees and was well received by the academic community. A few years later, both employers and academic faculties requested a follow-up study to map progress in meeting employers' needs. Throughout almost 15 years, that same study, with only minor changes in the questionnaire to track changes in technology, has been completed four different times.

Networking (LAN/WAN/IP) was the highest ranked Academic Discipline in each study in which it was ranked (this discipline was not included in the first study in 1995). Systems Integration ranked as the second most important Academic Discipline in each of the four studies. Throughout this period, the convergence of computing and communications technologies has led to the explosive development of web technologies and the demand for connectivity not seen in previous eras. The resulting restructuring of business, commerce, and all forms of human interaction created a demand for educational requirements not generally available in the early 1990's at area colleges and universities.

At the Applied Area- or course-level academic offerings, there was also a high degree of consistency in employer demand for educational services. Ten of the 23 top-scoring Applied Areas were in Networking/E-commerce and Telecommunications areas, documenting the relevance of these disciplines in today's *wired* world. Meanwhile, IT Management issues such as Project Management: Security; Quality Assurance; and Continuity, Interruption, and Recovery were ranked very high by employers. Even the most exquisite technological solutions must be well managed.

Throughout this period, employers said they wanted employees with high levels of education. The data showed the academic achievement of these employees did increase. Nearly 58% of all IT employees held sub-baccalaureate degrees in 1995 compared to only 39% in 2008. The percent of employees with baccalaureate or graduate degrees rose to 61% in 2008.

Vendor Certifications have become a key part of the educational strategies for employers as measured by these training budgets. For employers that reported this data, 14% of the IT training budgets went towards vendor certifications in 1999 (the question was not asked in the 1995 study) compared to 28.6% by the 2008 study. Microsoft and Cisco were the highest ranked Vendor Certification programs. Oracle and Lotus Notes were much more important to employers in 1999 than they were in 2009.

Ranking of other professional Development Topics reveals the rapidly changing IT environment with Networking, Communications, and Management Issues receiving the highest scores.

Each of the studies asked employers to rank how responsive area colleges and universities were in meeting these educational needs. Without exception, the employers ranked colleges and universities most responsive in the Applied Areas they ranked the lowest in importance. Conversely, Applied Areas ranked high in importance to employers received lower scores or measures of responsiveness from colleges and universities. The studies seemed to indicate that the responsiveness gap has closed somewhat over time. The closing of that gap could be attributed to better communications of needs between employers

and academic institutions, plus the strong and proactive steps taken by academic faculties and institutions to increase the relevance of these programs.

In summary, the last 15 years have been a period of dynamic change for all involved in information technologies. It is likely that the rate of change will accelerate over the next 15 years. There will be a continued challenge for employers to communicate their needs in terms of educational services in IT. The challenge of the academic community will continue to be the intellectual and financial resources to continually retool and modify their programs to meet the needs of students and their future employers.

APPENDIX

ACADEMIC DISCIPLINES & APPLIED AREAS
By Study and Weighted Composite Average

	Study Averages				
	1995 n=62	1999 n=43	2002 n=124	2008 n=49	1995-2008 n=278
Electronic Engineering	**3.07**	**2.39**	**2.59**	**3.22**	**2.78**
Computer Systems/Architecture	2.42	2.83	2.45	2.57	2.52
Directories, Circuits & Systems	3.33	2.51	3.09	3.15	3.06
Comm's, Control & Signal Processing	3.09	2.60	2.97	2.92	2.93
Telecommunications	**1.93**	**1.36**	**1.72**	**2.30**	**1.81**
Protocols, ATM, TCP/IP, Frame Relay, ADSL	1.69	1.32	1.44	2.00	1.58
Wireless	2.49	2.08	2.27	2.02	2.25
Telephony	2.17	1.74	1.87	2.02	1.94
Fiber Optics	2.35	1.66	1.92	2.45	2.07
Systems Integration	**1.72**	**1.13**	**1.39**	**1.81**	**1.50**
Software/Hardware Configuration	1.54	1.20	1.67	1.53	1.54
LAN/WAN	1.72	1.12	1.39	1.62	1.46
Technical Purchasing (RFI, RFP, ROI)					
Applied Mfg, Production, Operations					
Installation/Implementation					
Quality Assurance	1.98	1.39	1.61	2.11	1.75
Computer Engineering & Systems	**2.05**	**1.72**	**1.93**	**2.17**	**1.97**
Operating Systems/Compilers/Tools	2.16	1.32	2.17	2.17	2.04
Language/CASE	2.42	1.70	2.18	2.90	2.90
AI/ES/Inference Engines	2.94	2.08	3.16	3.40	2.99
Architectures/Platforms	2.38	1.34	1.76	2.56	1.97
Capacity and Performance Planning	2.24	1.58	2.01	2.54	2.09
Numerical Computing, Algorithms	3.22	2.12	1.97	3.23	2.49
Operations Research	3.15	2.26	2.84	3.13	2.87
Standards/Documentation	2.25	1.61	1.75	2.49	1.97
Systems Development & Business Integration	**1.59**	**1.05**	**1.74**	**1.83**	**1.62**
Methodology	1.93	1.61	1.97	2.13	1.93
Data Warehousing	2.12	1.72	1.76	2.22	1.92
Client/Server	1.61	1.38	1.77	1.67	1.66

	Study Averages				
	1995 n=62	1999 n=43	2002 n=124	2008 n=49	1995-2008 n=278
Business Planning/Re-Engineering	2.00	1.77	2.16	2.30	2.09
Human Factors Engineering	2.57	2.34	2.28	2.73	2.43
Design/Programming	1.86	1.11	1.48	2.18	1.64
Decision Support Systems	2.05	1.75	1.83	2.42	1.97
Technology Management	**1.88**	**1.19**	**1.83**	**1.85**	**1.75**
Project Management	1.47	1.16	1.79	1.71	1.61
Business Planning Strategies/Tactics	1.81	1.67	2.13	2.12	1.99
Specific Technical Competencies	1.96	1.38	2.17	2.08	1.99
Communications Law Regulation	2.89	2.22	2.20	2.71	2.45
Legal/Ethical/Human Resource Management	2.63	2.14	2.06	2.42	2.26
Technology & Social/Economic Change	2.83	2.27	2.10	2.62	2.38
Technical Marketing	**2.72**	**2.06**	**2.98**	**3.13**	**2.81**
Business Planning, Strategies, Tools	2.06	2.09	2.61	2.53	2.39
Technical Competencies	2.20	1.82	2.49	2.44	2.31
Marketing Concepts	2.56	2.30	2.68	2.91	2.64
E-Commerce	**n/a**	**1.25**	**1.95**	**2.26**	**1.88**
Development Technologies	n/a	1.41	1.75	2.43	1.84
Legal/Public Policy Issues	n/a	2.15	2.26	2.60	2.32
Business Opportunity/Risk	n/a	1.90	2.26	2.47	2.24
Management % Control	n/a	1.74	2.08	2.43	2.09
Security	n/a	1.28	1.36	1.87	1.46
Networking (LAN/WAN/IP)	**n/a**	**1.11**	**1.24**	**1.61**	**1.30**
Protocols – Open and Proprietary	n/a	1.27	1.92	1.83	1.77
Integration	n/a	1.18	1.60	1.74	1.55
Unification, Convergence	n/a	2.15	1.62	1.87	1.78
Servers, Bridges, Routers and Hubs	n/a	1.33	1.38	1.51	1.40
Security, Encryption, Firewalls	n/a	1.44	1.31	1.43	1.36
Continuity, Interruption & Recovery	n/a	1.36	1.21	1.63	1.34

Rank 1 = Most Important 4 = Least Important