Future Software Training Needs: Contrast in Needs as Perceived by Business and Academia

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ABSTRACT: *Most educators agree that anticipating and accommodating continual curricula changes is essential to IS program success. This article reports results from a survey of business firms and higher education schools with undergraduate Information Systems programs. The survey asked the respondents to rank the most urgent hardware needs and software skills requested by employers. Results from the survey indicate that in some areas there was a significant perception difference between the academics and the business groups. Problem solving, PC skills, multimedia, networking, and Geographic Information Systems (GIS) were perceived by the businesses as the most urgently needed skills. In contrast, academia ranked Computer– Aided Software Engineering (CASE) tools, Windows, Unix, and Systems Analysis as the most requested skills. Comparisons are made between the results of this study and the Information Systems '95 model curriculum developed by the Joint Task Force of the Data Processing Management Association (DPMA), the Association for Computing Machinery (ACM), and Academy for Information Systems (AIS).*

INTRODUCTION

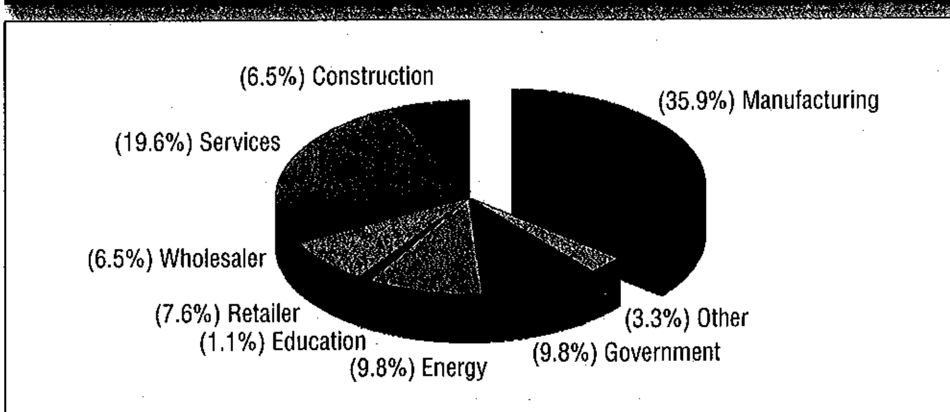
Business educators are challenged and many are concerned about successfully marketing their information systems (IS) graduates. Because change is one of the few constants in technology, the business/academia connection must be revisited often. The DPMA IS Model Curriculum recognizes that the applied nature of the IS discipline suggests a critical link with the practicing professional community [1]. Fosdick found that ten years ago it was fairly simple to determine the technical IS skills most in demand, but today a plethora of approaches to IS application development has become popular [2].

As Kruk found in his study, "Future curriculum planning must be an on-going activity. Schools of business can no longer sit back and allow programs of study to remain fixed for many years. Businesses are spending billions of dollars annually on hardware and software technology. Yet, most are asking why they aren't realizing comparable gains in employee productivity" [3]. Others agree that IS educators must be aware of the constantly changing business environment and develop and produce products that the consumer wants [4,5]. Frey emphasizes, "It is important to know information processing technology (including computer systems), but one cannot start application of information technology without a clear understanding of a business purpose to be served with an information system and of its multiple inputers and users, almost all of whom have to be accommodated" [6]. Minno Amini states that regional universities may need to re-examine their curricula offerings in accordance with the demands of industry and the changing needs of the workforce, in order to prepare graduates to meet those demands. Amini goes on to say that facilitating cooperation and integration between the two sectors so that the strategic objectives of industry can be linked to the mission of the university and curriculum design will take a bridge of communication between the two [7]. Revising curricula to meet the demands of business becomes a continuous process.

Some researchers have concluded that businesses and universities share some similar challenges, and increased cooperation between the two entities will assist in shared solutions for both [8,9].

The impediments to meeting this challenge, however, are many. G. Rifkin believes the average institution of higher learning is well behind its corporate cousins in embrac-

Figure 1: Distribution of companies by type of business



ing technology [10]. Kimball Marshall agrees that it is not so much that computing technologies are changing, but that the future applications are uncertain [11]. This challenge is complicated by the fact that many universities place special value on research that is highly abstract and theoretical, delegating to lesser status any activity having immediate practical application [12,13]. This is further complicated by the findings of a study conducted by Myra Womble which revealed that among educators there is a consistent diversity of opinion relative to defining the needs of students' potential employers [14]. Regional differences also may come into play. For example, New England employers may prefer COBOL training, whereas Midwestern employers may look for PL/1 capabilities [15].

In spite of these impediments, however, it is imperative to frequently revisit the "buyers of the universities' products." To this end, the authors undertook research to help determine how well universities are meeting the needs of organizations.

METHODS

Two groups were included in the research, higher-education schools with undergraduate IS programs and businesses (practitioners). Mail-survey questionnaires (Please see Appendix) were sent to all schools (70) offering an undergraduate Information Systems program in ten western states. *The Directory of Management Information Systems Faculty* [16] was utilized to choose the schools' group. The business (practitioners) group (1170) was selected randomly from the same ten western states using *Standard & Poor's Registry of Corporations, Director's and Executives* [17] as the reference. The ten western states are Arizona, California, Colorado, Idaho, Montana, New Mexico, Oregon, Utah, Washington, and Wyoming. Questionnaires were addressed to the head of the IS program at each of the schools and to the IS manager/person overseeing computer information resources in the organization. Responses were received from 26 schools and 104 businesses through the first mailing of the questionnaires and follow ups for non-respondents. The response rate for the schools was 37% and for the businesses it was 9%. The question on future needs asked the respondents to rank hardware and software needs by the importance perceived for the future (next five years), using a five-point Likert scale. Topic instrument validity was based on curriculum models proposed by the DPMA, and ACM. A group of IS instructors, students, and IS professionals evaluated the future-needs question for its completeness and relevance. The reliability of the instruments is measured using Cronbach's coefficient alpha [18]. The reliability values of the business group and the schools are .908 and .887 respectively. These values indicate high internal consistencies; therefore, the instrument reliability is quite good.

Figure 2: Distribution of Companies

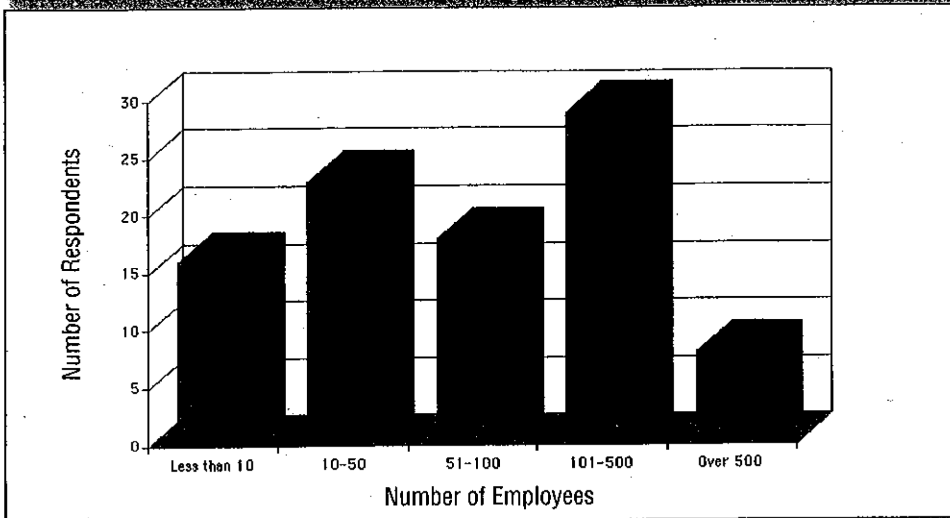


Table 1

Contingency Table for Future Software Training Needs Perceived as Most Urgent by Academics and Practitioners

Type	Academia	Practitioners	Total
Spreadsheets	1	6	7
Word Processing	0	9	9
Database	0	3	3
C Programming Language	1	1	2
Object Oriented Programming Language	1	1	2
COBOL Programming Language	1	0	1
Computer-Aided Software Engineering Tools	6	2	8
Windows	3	1	4
Disk Operating System	0	1	1
UNIX Operating System	2	10	12
Networking	2	8	10
Systems Analysis & Design	2	4	6
4th Generation Languages	0	1	1
Expert and Decision Support Systems	1	0	1
PC Skills	0	11	11
Other*	0	14	14
TOTAL	20	72	92

X2 (Chi-Square) = 40.82 at a .01 level of significance
Critical value = 32
*Other: All others not included in above categories.

DEMOGRAPHICS

Figures 1 and 2, display information about the practitioners regarding the kind of industry (type) and the number of employees (size) in the business. Over one-third (35.9%), of the respondents are in manufacturing; nearly 20% are in services; and about 10% are in government. Some of the industries in the category, other, include agriculture, marine engineering and newspapers.

Over one-half of the businesses (59%), have from 51 to over 500 employees in their main plant and branches. The remaining have a maximum of 50 employees.

Future Software Needs

Table 1 reflects skills most needed in the next five years ranked by academics and practitioners. Figure 3, uses the data from Table 1 to display the most urgent software training needs perceived by practitioners and Figure 4, shows the same data as perceived by academia. In the category, other, (Figure 3), some of the most urgent software needed as perceived by the practitioners [14], includes problem-solving capabilities, multimedia, computer architecture, hardware maintenance, advanced Geographic Information Systems (GIS), knowledge of new software and software training. The category mentioned second most often by the practitioners [11] is pc skills such as pc conversion to new systems, pc training and basic computer skills. Interestingly, academics did not find these pc skills significant.

Contrary to practitioners, the software ranked as most urgent the most frequently [6] by Academia (Figure 4), is Computer-Aided Software Engineering (CASE) tools. The second most frequently mentioned category by Academics is Windows. For both groups, the third most frequently mentioned most urgent need is UNIX. The same number of academic respondents indicated systems analysis as most urgent. By comparing Figure 3 and Figure 4, it appears there is not general agreement as to what software training needs are most urgent.

The next section reflects whether there is any dependency between the size or type of business and the software training needs ranked as most urgent.

Table 2

Contingency Table by Size of Business Firm Showing Future Software Training Needs Perceived as Most Important by Business Firms

Type	Number of Employees					
	<10	10-50	51-100	101-500	>500	Total
Spreadsheets	2	2	0	1	1	6
Word Processing	2	2	1	0	4	9
Database	0	0	0	2	1	3
C Programming Language	0	0	0	0	1	1
Object Oriented Programming Language	0	0	0	0	1	1
Computer-Aided Software Engineering Tools	0	0	0	0	2	2
Windows	0	0	0	0	1	1
Disk Operating System	1	0	0	0	0	1
UNIX Operating System	1	0	4	3	2	10
Networking	1	0	1	3	3	8
Systems Analysis & Design	0	1	2	0	1	4
4th Generation Languages	1	0	0	0	0	1
PC Skills	1	0	3	2	5	11
Other*	2	2	1	4	5	14
TOTAL	11	7	12	15	27	72

X2 (Chi-Square) = 50.7 at a .01 level of significance

Critical value = 82.265

*Other: All others not included in above categories.

DATA ANALYSIS AND RESULTS

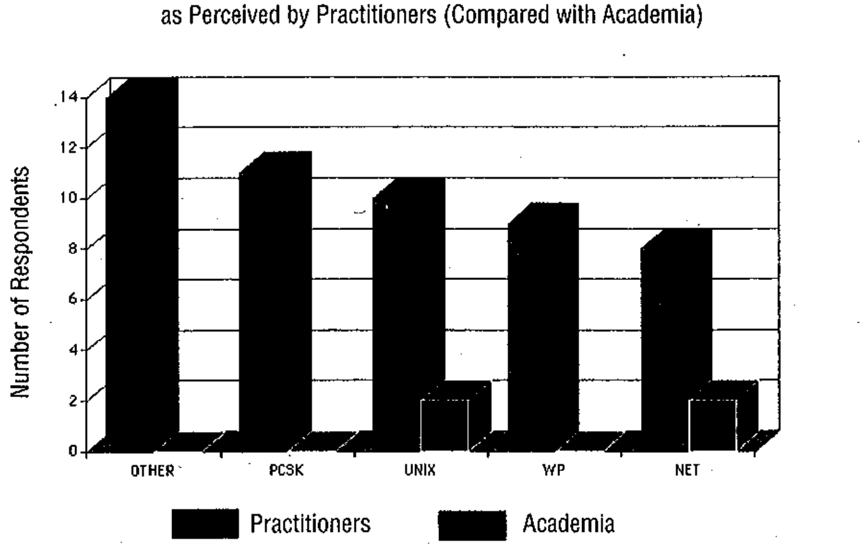
The three null hypothesis in this study are: (1) There is no significance difference in perceptions of academia and business firms about the most important future software training needs. (2) The importance of future software training needs perceived by business firms is independent from the organization size. (3) The importance of future software training needs perceived by business firms is independent from the organization type. The statistical tool used in this study is Chi Square. The Chi Square analysis was performed to see whether significant differences exist between the two groups' perceptions.

As Table 1 reflects, the computed chi-square value of 40.82 does not fall within the acceptance range; therefore, the null hypothesis 1 is rejected at the one percent level of significance.

Then chi-square tests were used to investigate the effects of size and type of organization, on the business firms group. See Table 2 and Table 3 below. In both cases the computed values for chi-square (50.7 and 103.6 respectively) fall within the acceptance range; therefore null hypotheses 2 and 3 were not rejected at the 1% level of significance.

Figure 3: Most Urgent Software Training Needs

as Perceived by Practitioners (Compared with Academia)



CONCLUSIONS

The data analysis results reported in this study indicate there are differences in perceptions of academia and business firms about the most important future software training needs. In some areas (programming languages, database management, DOS and windows), differences are minor; while in other areas (pc

Table 3

Contingency Table by Type of Business Firm Showing Future Software Training Needs Perceived as Most Important by the Business Firms

Type	Const.	Energy	Govt.	Mfg.	Retail	Service	Wholesale	Other	Total
Spreadsheets	1	2	0	1	1	1	0	0	6
Word Processing	1	0	3	1	0	3	0	1	9
Database	0	0	1	0	1	1	0	0	3
C Programming Language	0	0	0	0	0	1	0	0	1
Object Oriented Programming Language	0	1	0	0	0	0	0	0	1
Computer-Aided Software Engineering Tools	0	0	0	0	0	2	0	0	2
Windows	0	1	0	0	0	0	0	0	1
Disk Operating System	0	0	0	0	0	0	1	0	1
UNIX Operating System	1	0	1	2	0	1	3	2	10
Networking	1	0	0	5	0	0	0	2	8
Systems Analysis & Design	0	0	0	2	0	1	1	0	4
4th Generation Languages	0	0	0	0	0	0	1	0	1
PC Skills	1	1	3	4	0	0	1	1	11
Other*	0	2	1	4	3	2	1	1	14
TOTAL	5	7	9	19	5	12	8	7	72

X2 (Chi-Square) = 103.62 at a .01 level of significance
Critical value = 135.8
*Other: All others not included in above categories.

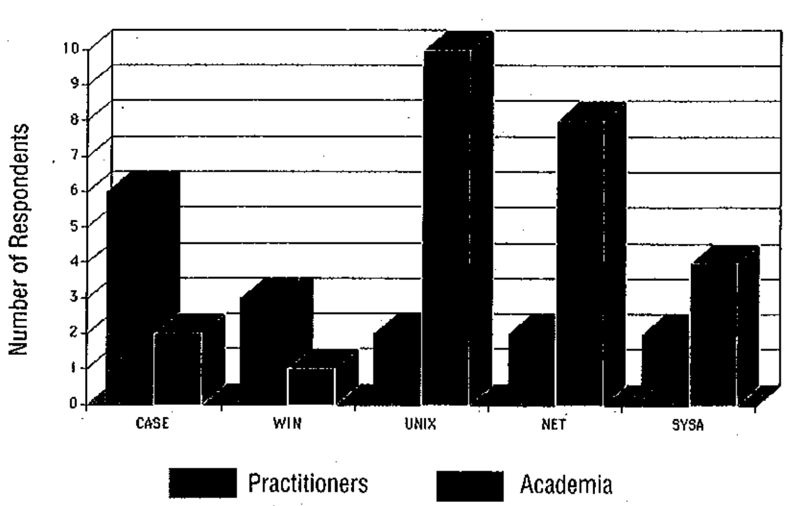
skills, networking, UNIX, word processing, spreadsheets, and the other category), differences are substantial. IS curricula academicians should take information provided by practitioners into consideration where appropriate. Educators should consider when determining future needs not only the first post-graduate position, but students' overall career-path needs as well. This information offers opportunities for improvement of IS curricula; therefore, present curricula should be modified to incorporate practitioners views, such as those reported in this study.

Information Systems '95 Comparison

Information Systems '95, a model curriculum for a bachelor's degree in Information Systems, is the resulting development of collaborative work of a Joint Task Force of the Data Processing Management Association (DPMA), the Association for Computing Machinery (ACM), and Academy for Information Systems (AIS) [19]. Findings of this study were compared to the Task Force recommendations. There was agreement in the recognized critical link between education and industry and in the need for graduates to develop necessary skills to be successful in future IS environments. The characteristics of IS '95 graduates includes "An IS graduate must adjust rapidly to specific hardware, software and communications environments". The results of a Task Force survey conducted early in 1994 compared favorably with this study on the general importance of preparation in programming languages, operating systems and databases and their applications. However, the responses of Academics and Industry in the Task Force study revealed very little difference between industry expectations and the standards set by IS academics. This finding contrasts the results of the rejected null hypothesis number 1 in this study, that is that there is no significant difference in perceptions of academic and business firms about the future software training needs.

Figure 4: Most Urgent Software Training Needs

as Perceived by Academia (Compared with Practitioners)



SUGGESTIONS FOR FUTURE RESEARCH

Due to the rapid changes in the information systems field, the research presented here needs to be repeated periodically. The benefit would be to evaluate any changes that have occurred in educational needs over a specific period. It is suggested that a replication of this study be undertaken in two or three years to

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Case Feedback

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back is possible while for other rules only guided feedback is possible. The framework presented can be considered an upper bound on feedback (i.e., most restrictive) and can be used as a benchmark for comparing CASE tools for academic adoption.

A second study by Jankowski [19] examined two CASE tools that are frequently utilized to support information systems course work: Intersolv's Excelerator 1.9 and Visible Systems' Visible Analyst Workbench 3.1. Each CASE tool was used by eight student project teams to develop a functional specification for a hotel information system. For each structured analysis rule involving data flow diagramming, minispecs, and the data dictionary, the number of rule violations in the system specification were recorded. The results indicate that the level of feedback provided by the CASE tool does not impact the rules applying to a particular data flow diagram (e.g., a process must not be free-standing). However, for the rules that apply to the parent-child relationships between the diagrams, and the relationships between the diagrams, the data dictionary, and the minispecs, rule violations were recorded less frequently when restrictive feedback was supplied by the CASE tool than when passive guidance feedback or no feedback was supplied.

CONCLUSION

Future work in this area may reveal that CASE, when providing the proper feedback, may be an appropriate tool for students and professional analysts learning a systems development methodology. Further, the results might also point the way toward the establishment of CASE tools that offer variable feedback that is dependent upon the experience of the user. Based upon previous research in the area of CAI, and encouraging preliminary results in MIS research, it may soon be possible to disprove the notion that a systems development methodology must be thoroughly understood before attempting to support it with a CASE tool.

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examine the shifting needs of both business and academia.

Further, expanding this research region by region until all fifty states have been surveyed, and comparing the findings would make the results more inclusive and reliable.

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