General Knowledge Needed by Information Systems Educators in 2001

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Abstract

The problem that this study dealt with was the lack of research conducted to determine the computer competencies needed by information systems educators in the year 2001. This study used a Delphi instrument to determine the general needs for the preparation of computer technology competencies of information systems educators for the 21st century. Twenty-three experts nominated by the National Association for Business Teacher Education (NABTE) contributed to the data. The study consisted of three rounds of a Delphi instrument transmitted over the Internet telecommunications network. An instrument was developed from the responses generated by the first round, the second round involved rating the statements, and the third round was used to determine consensus on items.

The findings of this study present a list of competencies consensus of experts in business teacher education who identified needs for the year 2001. Findings and conclusions of the study include statements about computer competencies that may be included in business teacher education curriculum related to information systems. This paper presents one part of the findings of the study, particularly those dealing with the "general knowledge" about computers. Of the twenty-three competencies identified, nine received scores indicating that the panel judged that these items were very important; eleven items were rated as important; and one item was rated as being moderately important.

Keywords: Computer education, information systems education, Delphi, competencies, general knowledge

1. INTRODUCTION

> *If the progress of manned flight had increased at the rate of computer technology, an astronaut could have orbited the earth nine years after the Kitty Hawk flight (Rosenblum & Frye, 1982).*

This analogy was made shortly after the debut of International Business Machine's Personal Computer (IBM PC) in 1981 at the Annual Microcomputers in Education Conference. The statement may seem outlandish and exaggerated; however, it represents how educators quickly recognized the potential of the microcomputer as a tool to change the way they teach. During the last two decades, the computer has certainly become a very important tool in scientific, business, and governmental institutions, and because of the extreme implications the computer has for the world, an understanding of computer technology and its uses is important for all the members of modern society to be effective producers in the twenty first century.

Since the advent of the personal computer, business-related information systems programs have taken a leading role in preparing users of computer technology (Policies Commission for Business and Economic Education [PCBEE], 1984 & 1993). A large part of computer technology in education during the last two decades has been placed in business programs for teaching courses in computer applications. These applications have been required for many secondary and college students in all disciplines, and information systems educators in business or related programs primarily teach these courses.

It has long been recognized that occupational educators must be involved in curriculum development that considers jobs for tomorrow and what the changing work place will demand (Marshall, 1993). Due to the need to teach computer applications in our schools and the rate at which technology advances are developing new uses for computers, it is important for our curriculum planners to have timely information pertaining to the future computer competencies needs of teachers. "Educators are facing tremendous challenges in identifying, developing, and designing a curriculum that will prepare undergraduates for work in the next century" (Hunt & Perreault, 1999).

2. PROBLEM AND PURPOSE

The problem was that, to date, there was little evidence of research conducted to determine the general knowledge of computer competencies needed by information systems educators for the 21st century.

The purpose of this study, therefore, was to determine the general needs for the preparation of computer technology competencies of information systems educators for the year 2001 and beyond.

Based upon the past models of competencies that are cited in the literature relating to computer competencies needed by business teachers, the following question guided the research:

What general knowledge computer competencies are necessary for an information systems educator to effectively integrate microcomputer technology into the classroom, and will provide them with those fundamental skills and attitudes that can enable them to both apply and adapt their skills to the twenty-first century?

3. THEORETICAL PERSPECTIVE

The theory used in this study to explain the development of curriculum was developed by Robert Mager (1962), who provided a programmed text that demonstrated how to specify instructional objectives by behavior observable in a learner. Known as the "father of criterion-referenced instruction," Mager offered steps involved in defining outcome, accomplishment, and competence (Stoneall, 1992). It is Mager's theory of performance-based objectives that supports defining competencies needed by business and information systems teachers.

The theoretical definition of competencies was important to this study for guidance. John Raven (1984) described the word competency in the following way:

> The word "competency" is used to encompass a motivated pattern of knowledge, skills and abilities deployed to undertake a valued activity. Because values and motivation are so important it is not possible to substitute "knowledge," "skills," or "attitudes" on their own for this word (p. 402).

4. PROCEDURES

This study was completed in four phases, the first of which involved identifying a national panel of experts followed with three rounds of communication using a modified Delphi instrument over a period of nearly two years. The first phase, or identification of the panel participants occurred in May, 1994. The first round of communication began in June and ended in September, 1994. The second round of communication began in October, 1994, and ended in January 1995. The third round began in April, 1994, and was completed in July, 1995.

One forecasting technique used in research to predict future needs and to obtain a professional consensus of those needs is the "Delphi" procedure. The term Delphi comes from a reference to the oracle at Delphi, a place in ancient Greece through which it was believed that the gods answered questions and gave advice concerning the future. In research, the Delphi technique is an organized research methodology for correlating views and information pertaining to an area of strategy and for allowing respondents with such views an opportunity to react and assess differing viewpoints. The technique was introduced in 1958 through "Project DELPHI" which was sponsored by the United States Air Force and directed by the Rand Corporation to obtain the most reliable consensus of a group of experts concerning predictions of alternate national defense futures (Dalkey & Helmer, 1963, p. 458). Because this technique uniquely combines consensus among like-minded professionals with forecasting, it provided a better methodology to answer the research question than other curriculum design methods that depend largely on past reflection rather than future prediction, which rapid technology change warrants.

Three characteristics distinguish the Delphi technique from other methods of group interaction: (1) confidentiality, (2) iteration with controlled feedback, and (3) statistical group response. Because the originator of the original input statement was not identified in the study, the opinion was not associated with a particular person, and with confidentiality assured, the panelists had more freedom to alter opinions and were not swayed by the credentials of fellow participants. The number of rounds of review of responses depends upon a consensus of the panel, therefore, though the study was designed for three iterations, a third would not add value if consensus was met during the second round. The statistical account used in this study was the provision of the median score for each item during second round of the panel along with the individual panelist's rating for comparison.

In 1994, an initial identification of the pool of experts used in this study was based on the following criteria: (1) active professional involvement in business education and (2) active in publication and/or presentation of computer-related educational research in the area of information systems.

A nomination form was mailed to each of the National Association of Business Teacher Education (NABTE) affiliated schools, from which one prospective panel member was identified and nominated from these criteria by representatives from each prospective school. From 97 nominations, 49 prospective panelists were selected after an extensive review of their related research and presentations. These prospective participants were invited first by electronic mail and telephone contact and then through correspondence of a written agreement. Among the prospective panelists,

25 agreed to participate in the study. After the panelists received the instructions for the first round of the study, two members withdrew from the panel due to time constraints, bringing the final number of panelists to 23 participating experts. The panel was composed equably in terms of gender and level of education with 11 males and 12 females, with all 23 participants holding a terminal degree and teaching information systems education at regional universities across the United States. Table 1 illustrates the demographic characteristics of the Delphi panel used for the study.

Table 1: Characteristics of the Delphi panelists.

NABTE Region Served	Gender		Degree	
	Male	Female	Ed.D.	Ph.D.
Eastern	2	0	2	0
Mountain Plains	1	3	3	1
North Central	3	6	2	7
Southern	4	3	5	2
Western	1	0	1	0

5. DATA COLLECTION AND ANALYSIS

The data collection of the study involved three rounds of communications. The first round of communication included a cover letter and the instructions needed to complete the iteration. These items were transmitted both by telephone facsimile and electronic mail to all participants on the same day. To develop the second round instrument, the responses of the first round included statements, which were compared for similarity and collapsed into a survey containing statements representing the collective views of the panelists concerning the general knowledge competencies needed by information systems educators in the year 2001.

During the second round of communication, the experts used in the study rated the importance of each competency according to a 5-point scale. A rating of 1 indicated that the panelist felt the item was not important, 2 that the item was somewhat important, 3 that the item was moderately important, 4 that the item was important, and 5 that the competency was very important. The panelists were also encouraged to make comments to explain their answers.

An electronic mail version of the second round was sent to each of the panelists along with a telephone facsimile of the same questionnaire on the same day. Although the communication did not include return postage or a mailing via the United States Postal Service, nine panelists chose this method of return. Eleven panelists replied via facsimile and the remaining three replied using electronic mail.

The third round of the procedure involved a communication of the instrument in revised format, which provided each panelist's previous response along with the median of the collective responses given by the panel. The inclusion of the group and individual responses from the previous round provided each panelist an opportunity to modify the rating of each item based upon the group response.

Descriptive statistics including the Pearson product-moment correlation coefficients and the number of responses for each rating given for both the second and third rounds of communications were used. The correlations indicated a consensus of the panel for statements about future computer competencies that may be included in teacher education curriculum. Additionally, composite scores were calculated for each item in the second and third rounds by adding the individual responses. Composite scores were used to rank order the items. Responses are considered to be stable when the answers did not change significantly after the prescribed three rounds of the Delphi study. Stability was defined, in this study, as the point when any two distributions show correlation of greater than .50 in a Pearson Product-Moment test.

Using the Delphi methodology, consensus is indicated by the statistical movement of frequency. Movement of responses may be determined by comparing the frequency by item of round two responses with those of round three. The means and standard deviations of ratings were also used to determine stability of each item. The means and standard deviations of all competency items did not change more than the value of 1, indicating stability for each item.

6. FINDINGS

Table 2 reports the findings of competencies related to general knowledge about computers needed by information systems educators in the year 2001 and beyond. The table displays the composite scores, and the Pearson product-moment correlation coefficients.

The panel of experts used in this study believed the two most important competencies about general computer knowledge for information systems teachers are: 1) to be able to assess readily the computer skills/knowledge of students, and 2) show competency in fundamentals of computers and information processing.

Table 2: General Knowledge computer competencies needed by information systems educators in the year 2001.

Item	Pearson r	Composite Score	Competency Statement Preceded by the words: "In the year 2001, information systems educators should be able to…"
1	.851790	109	Assess readily the computer skills/knowledge of students.
2	.968460	109	Show competency in fundamentals of computers and information processing.
3	.776069	108	Demonstrate proper use and care of equipment to students.
4	.767013	108	Identify career opportunities and trends/issues in the information-processing field.
5	.740959	108	Develop realistic and relevant learning activities for software teaching.
6	.705509	108	Analyze the technological issues and impact on society of access, privacy, confidentiality, ethics and emerging technologies.
7	.933940	107	Demonstrate knowledge of "why" computers are important and knowledge of "how" computers are used in business, industry, and personal lives.
8	.968469	105	Be aware that the computer is only a tool; students must be taught to use the tool to accomplish other tasks—not for the sole purpose of learning software and hardware.
9	.677307	104	Continuously review new texts and learning materials related to computers.
10	.552783	101	Demonstrate up-to-date knowledge and understanding of the changing business world, technology and its applications, and have an appreciation to maintain skill and knowledge levels.
11	.962473	98	Apply widely used terminology in the computer field (terminology used by general users and what you would need to purchase hardware, software, and services).
12	.935049	97	Be aware of future trends in educational computing.
13	.754130	96	Design and organize ergonomically correct learning environments to maximize learner productivity.
14	.643750	92	Explore the role of technology in future applications.
15	.937677	92	Describe and analyze various technology and multimedia uses in education/training and business environments.
16	.925995	90	Understand the concept of connectivity and its relationship to communication and resource sharing.
17	.570134	90	Understand the relationship between the concept of hypermedia and application of multimedia.
18	.948339	84	Know (and be able to explain) the differences among data, information, and knowledge.
19	.618036	81	Design a major project appropriate for use in workforce education training incorporating several software applications, technologies, or multimedia and a local area network.
20	.919694	81	Perform a cost/benefit analysis with regard to using technology in the classroom.
21	.779794	74	Demonstrate understanding of microprocessors in keyboards and advanced applications—such as large-screen projection, voice-activated technology.
22	.904174	73	Understand how different technologies have advanced and/or hindered human well-being.
23	.855087	67	Be familiar with the history of computing and the effect such advances have had on education.

The data found adds 23 statements to the universe of competencies for business information systems educators that Mager's theory of performance-based objectives supports for defining competencies. Of the 23 items, 9 received composite scores greater than 103.5 (or more than 4.5 X 23 panelists) and a median of 5, which indicated that the panel judged that these items were very important. Eleven items received a composite score above 80.5 (or more than 3.5 X 23 panelists), indicating that these items should be considered important. One item received a score above 57.5 (or more than 2.5 X 23 panelists) indicating it would be moderately important.

Consensus was reached in three rounds indicating further rounds would not have shown significant change.

7. CONCLUSIONS

Findings from this study should help teachers and curriculum planners develop courses to prepare business teachers to deal with changing pedagogy and emerging technologies. The results suggest additional research to project needs based on change and prediction rather than past functions or needs.

It is recommended that these items should be used to project future direction for the preparation of business teachers in the area of information systems education. The curriculum in this area should be continually updated using industry and academic leaders as resource persons.

Business teachers and information systems educators should be updated on a regular basis as to trends in technology and the development of materials for courses. In-service and pre-service courses should be planned with the consensus of experts from the field of information systems and business education.

There is a need to establish a larger source of computer competencies for all business teachers and information systems educators. The findings of this study present only the area of general knowledge, the universe of competencies needed to teach computers is large and changing constantly. This study and the methodology included should be replicated to discover additional future needs in the information systems area.

The Delphi procedure may be effectively used in researching consensus for program planning needs of the future in information systems education programs. This procedure provides an excellent tool to gain consensus and predict the future nature of training needs for the field of information technology. The Internet and utilization of World Wide Web survey instruments of this type provide a rapid way to gain expert consensus and forecasting for technology.

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