

Computer Competencies for the 21st Century Information Systems Educator

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This article reports the results of a Delphi study to determine the general need for the preparation of computer technology competencies of business education teachers for the 21st century. The study consists of three rounds of a Delphi instrument using electronic mail as the primary means of communication. Twenty-three experts nominated by the National Association for Business Teacher Education (NABTE) served on the Delphi panel. The responses generated by the first round contributed to the development of an instrument; the second round involved rating the statements; and the third round determined the consensus on items. The findings of the study include 95 statements about computer competencies that should be included in business teacher education curricula. These competencies were grouped in five categories: computer hardware, software, computer programming, computer integration, and general computer knowledge.

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 comparison was made shortly after the debut of International Business Machine's Personal Computer (IBM PC) in 1981 at the annual Microcomputers in Education Conference. At that time, this statement may have seemed exaggerated, but it is representative of how educators quickly recognized the potential of the microcomputer as a tool to change teaching. During the last two decades, the computer has certainly become an important tool. In this short span of time, it has probably been more globally significant in changing the way humans do things than any other contrivance. Business and governmental institutions have become dependent upon the economic advantages presented by the computer. Because of the significance the computer continues to have for the world, an understanding of computer technology and its uses is important for all the members of our society to be effective consumers and producers in the 21st century. Therefore, it was only prudent in 1981 for educators to grasp the possibilities that computers had for the educational society.

Since the advent of the personal computer, business educators have taken a leading role in

preparing end-users of computer technology (Policies Commission for Business and Economic Education 1984 & 1993). Major responsibility for teaching about computers during the last two decades has been placed in business education programs that teach business-related applications such as spreadsheets, word processing, and databases. Courses in computer applications have been required for many secondary and college students in all disciplines, and business educators 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 about the future computer competencies needed by teachers. As Hunt and Perreault (1999) write, "Educators are facing tremendous challenges in identifying, developing, and designing a curriculum that will

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prepare undergraduates for work in the next century” (p. 37). Traditional methods of curriculum development do not take into consideration the changes that may take place before the curriculum is in place. As a result there is a four- to seven-year lag in the process from origination to achievement of curriculum revision (Iverson, 1993). In terms of computer technology and applications, a four- to seven-year process will encompass an enormous amount of change. The amount of time that traditional processes for curriculum development take may be too long to provide accurately for computer education. A consensus among future-minded professionals is, therefore, more appropriate than techniques that may simply analyze current trends in the field of information systems and teacher education.

Problem and Purpose

There is little evidence of research conducted to determine the computer competencies needed by business teachers for the 21st century. The purpose of this study, therefore, is to determine the general needs for the preparation of computer technology competencies of business education teachers for the advent of the new millennium.

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 computer skills, knowledge, and competencies are necessary for business teachers to teach computer applications effectively, are needed to integrate microcomputer technology into a classroom, and will provide them with the fundamental skills and attitudes that can enable them to both apply and adapt their skills to the twenty-first century?

While some teachers are delighted with change or innovation, others are more reluctant to modify their existing programs. Most teachers, however, are more willing to change if

they are convinced that the new program will address the fundamental needs of learners. This study was conducted to provide information that will meet the needs and encourage the positive attitudes of students of business education and information systems.

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 offers steps for 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 competency is important to this study for guidance. John Raven (1984) describes 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).

Traditional strategies of curriculum development to identify competencies, such as the philosophical, introspective, DACUM (*Developing A Curriculum*), task analysis, or critical incident approaches, do not specifically address occupational areas that change with technological advances. The perspective of qualitative consensus gathering is generally followed with the assertion that the traditional methods of applying the theory in developing curriculum are obsolete, and therefore, less effective (Iverson, 1993). The Delphi technique, however, is most useful for forecasting content in emerging occupational

areas and fulfills the need for group consensus (Finch & Crunkilton, 1989).

The following review of the literature is in two parts. The first presents the historical background of the study, while the second is a review of the related research which examines studies of computer competencies as they relates to business teachers.

Historical Perspective of the Study

In the early 1980s, in chorus with the advent of the standardized IBM PC, educators were confronted with a declaration that, as far as education was concerned, the United States was a nation at risk (Earle 1993). A report entitled *A Nation at Risk: The Imperative For Educational Reform* stated, "If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war" (1983, para. 2). Reform in education began to develop into an imperative during the decade of the 1980s. In the early 1990s, however, ten years after the declaration, professional educators were questioning whether reform had truly begun or even taken place. According to Fiske (1993, p. 7), the result of "*A Nation at Risk* . . . was like trying to make the Pony Express competitive with the telegraph by mounting a major national research effort to breed faster ponies," because the report used powerful language but failed to call for fundamental changes in the system. In 1998 a follow-up report entitled *A Nation Still At Risk: An Education Manifesto* said, "The state of . . . education is still far, very far, from what it ought to be" (para. 2).

From the reform perspective, computers have the potential to become the single most important element of change in education during the advent of the 21st century. Many educators have used computers to bring all kinds of instructional methods to education, including individualization, discovery, cooperative learning, higher-order thinking, and performance testing (Anderson & Collis, 1993).

The National Association for Business Teacher Education (NABTE) responded to reform and a shift in program emphasis by recommending that business education content courses be positioned as

"service courses." Service courses are those courses that are extensive enough to reach students from a variety of specializations. Included in service courses are computer applications, word processing, and administrative information systems. Because these courses involve technology and computer skills related to business, business educators need to maintain proficiency in these areas (Luft & Noll, 1993).

Since business education is a link between the classroom and the workplace, the use of the computer should be incorporated into every business classroom as either a tool or an application (Chalupa & Sormunen, 1992). Professional organizations have also implied that business educators are responsible for providing leadership in implementing electronic computer information technology (National Business Education Association, 1992; Policies Commission for Business and Economic Education, 1993). Determining the general needs for the preparation of computer technology competencies of business teachers is important to provide the best link between learning and working in the technological environment of industry.

Related Research

Over the last two decades, nine previous studies have appeared that are relevant to the research question in content and methodology. Two additional related studies, one dealing with competencies needed by information processing employees in the year 2000 and a final study which presents computer competencies needed by all educators, have also been published.

Abbot (1985) identified computer literacy competencies for the classroom teacher using the Delphi technique for eliciting and refining the opinions of a group of people. The aim of the research was to find out if business educators had a consensus with respect to computer competencies for the regular classroom teacher and what competencies would be identified as essential, important, desirable, or unnecessary. Rather than using a national panel of experts in the field, the study used a panel composed of teachers from nine districts in one region of the state of Texas. Similar in methodology and results to this study, Abbot's

study identified sixteen competencies such as knowledge of hardware components, knowledge of major computer applications, information processing, programming, and future trends anticipated for computers in business education.

Adams (1985) conducted a study to develop a comprehensive list of computer literacy competencies necessary for business education students. To achieve this purpose, the study included 214 business education teachers and 108 personnel managers from the state of Georgia. A questionnaire requested the participants to identify the computer knowledge, skills, and attitudes needed by students completing a postsecondary vocational-technical business education program. Like the study conducted for this article, Adams's study asked the participants to rate the relative importance of these competencies. The findings presented competencies needed in five areas: (a) attitudes and values, (b) computer capabilities and limitations, (c) computer anatomy and configuration, (d) computer careers and social implications, and (e) computer terms and concepts. Unlike the study presented in this article, Adams did not attempt to identify competencies needed for the future.

Identifying competencies needed by teachers to implement computer technology in the classroom was the purpose of a study conducted by Lacina (1985). Lacina sent questionnaires to 97 computer coordinators in school districts in Texas and 59 program directors in colleges of education throughout the United States. The findings of the study revealed agreement between the two groups about general computer competencies needed by educators. The groups agreed that all educators needed to be able to evaluate software and hardware, use the computer as an instructional tool, and demonstrate knowledge of computer history. Similar to the study presented in this article, Lacina's study focused upon a consensus of participants.

Olson (1986) conducted a study with the purpose of validating 55 computer competencies identified and published as essential for all educators. Like the study reported in this article, the methodology included: (a) confirming the assignment of competencies identified by categories, (b) verifying the clarity of the statements, and (c) ascertaining the importance of the competencies

identified. Rather than using a national panel of experts, Olson relied upon comparing viewpoints of teachers, administrators, college professors, and computer vendors from school districts in the state of Texas. Olson concluded that the participants in the study did not commonly recognize the competencies cited in the study as being essential. This conclusion is important as it demonstrates the importance of using like-minded panelists in a study like the one presented in this article.

Scott (1985) elicited the perceptions of computer-using teachers concerning the essential computer skills needed by teachers. The study used a random sample of 200 high school computer teachers in Alabama. Similar to the study reported in this article, Scott identified computer competencies needed by computer teachers; the focus, however, was not specifically about business educators. This study is useful to review in connection with the research question presented in this article, as it comprised the categories of user skills, general knowledge of computers, computer systems' uses, programming, and software. An important conclusion in the Scott study was that programming skills were not considered important for computer teachers overall.

Wentz (1985) identified the competencies needed for computer curricula in teacher training programs and in the formulation of recommendations for state requirements for teacher endorsements in computer literacy. As in the present study, Wentz identified a national group of professors and computer experts. Rather than allowing the experts to identify competencies, however, Wentz used a survey made of predefined statements that the participants rated as essential or nonessential. Of the 36 statements included in the questionnaire, the survey group viewed only 13 items as being essential competencies.

Iwu conducted a study in 1988 that examined the importance of computer competencies needed for the certification of secondary school business teachers in the United States. More precisely, the study was conducted in order to: (a) identify important computer competencies, (b) determine the degree of importance of the competencies, (c) rank the categories of competencies, and (d) determine those who should develop computer competency programs for teachers. Iwu

recommended using a national panel of business education professors to determine the needs of educators for future training and to periodically reassess these determinations to eliminate business practices that become obsolete.

Rickman (1987) used the Delphi technique to identify the emerging competencies needed by information processing employees for the automated office environment in the year 2000. Rickman expected that the competencies determined by the study would be beneficial to business educators planning the curriculum for training future employees being prepared to work in the changing environment of the office. The study used a panel of experts to identify competencies needed by information processing specialists and to determine the degree of importance attributed to these competencies. The methodology used in the Rickman study helped guide the study presented in this article.

Maness (1992) found a national consensus on the computer competencies needed by educators in a Delphi study using nationally representative authorities. Maness identified five domains of computer competencies for educators, including hardware skills, software skills, programming skills, integration skills, and general knowledge skills. The study presented in this paper uses these categories. Another similarity is that Maness used nationwide telecommunications networks (BITNET and AppleLink) to complete the rounds of communication with the panelists. Programming skills were viewed by the participants, as the least essential category needed by educators, which is much like the conclusion presented in this paper.

Methodology

The term “Delphi” comes from a reference to the oracle at Delphi, a place in which the ancient Greeks believed the gods answered questions and gave advice concerning the future. In research, the Delphi technique is an organized methodology for correlating views and information pertaining to an area of strategy which allows respondents an opportunity to react to and assess differing viewpoints. The technique was introduced in 1958 through “Project DELPHI,” 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 alternative national defense futures (Dalkey & Helmer, 1963).

Three characteristics distinguish the Delphi technique from other methods of group interaction: (a) confidentiality, (b) iteration with controlled feedback, and (c) statistical group response. Because the originator of an input is not identified in the study, the opinion is not associated with a particular person. With confidentiality assured, the panelists have more freedom to alter opinions and are 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 this study was designed for three iterations, a third would not add value if consensus was achieved during the second round. The statistical account used in this study is the provision of the median score for each item during second round of the panel along with the individual panelist’s rating for comparison.

Procedures and Data Analysis

This study was completed in four phases. The first phase 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.

Identification of the pool of experts used in this study was based on the following criteria: (a) active professional involvement in business teacher education, and (b) active in publication and/or presentation of computer-related educational research. For the purposes of the study, active research was defined as peer-reviewed, computer-related research not more than two years old. This requirement provided some assurance that the panel comprised participants who were current with computer research. A nomination form was mailed to each of the National Association of Business Teacher Education (NABTE) affiliated schools. One prospective panel member was identified and nominated based on these criteria by representatives from each school. From 97 nominations, the researcher selected 49 prospective panelists after an extensive review of their research. These prospective participants were invited first by

electronic mail and telephone contact and then through mailing a written agreement. To assure that the panel represented the larger population, each expert who declined nominated another professional business educator whom he or she considered to be an expert in the field being studied. 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. Table 1 illustrates the demographic characteristics of the Delphi panel used for the study.

The data collection of the study involved three rounds of communication. The first round included a letter with 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. From the related literature, the researcher identified five categories of computer competencies needed by future business teachers: hardware, software, programming, integration of technology into the classroom, and general computer knowledge. During the first round of the study the panelists listed statements of competencies for each of these five domains.

The 503 statements collected in the first round formed the basis for the second round instrument. The researcher compared statements that were similar in content and grouped them together. The statement that was most complete in representing the collection of similar statements represented the collection. This process yielded a survey containing 105 statements representing the collective views of the panelists. During the second round of communication, the experts rated the importance of each competency using 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 instrument

encouraged the panelists to make comments to explain their answers. An electronic mail version of the second round instrument 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 require 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. The third round instrument was the same as the second round instrument with the addition of each panelist's previous responses along with the median of the collective responses and comments given by the panelists. The inclusion of the group and individual responses from the previous round provided each panelist an opportunity to re-rate each item based upon the group response.

The study director calculated 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. Stability, in this study, is the point where any two distributions show a Pearson product-moment correlation greater than .50. The correlations indicate a consensus of the panel for 95 statements about future computer competencies that should be included in the business teacher education curriculum. Additionally, the researcher calculated composite scores for each item in the second and third rounds by adding the individual responses. With 23

Table 1: Characteristics of the Delphi Panelists

NABTE Region Served	Gender		Degree		Faculty Rank		
	Male	Female	Ed.D.	Ph.D.	Assistant Professor	Associate Professor	Professor
Eastern	2	0	2	0	0	1	1
Mountain Plains	1	3	3	1	2	1	1
North Central	3	6	2	7	0	6	3
Southern	4	3	5	2	1	3	3
Western	1	0	1	0	0	0	1
<i>Totals</i>	11	12	13	10	3	11	9

panelists, at least 60%, or 14 panelists, had to rate an item as 5, or very important, for that item to be considered in consensus. Therefore, a composite score of 69 (23 x 60% x 5) or greater indicated that the panel was in agreement about the importance of that particular item.

Findings

The research question dealt with describing computer competencies needed by future business teachers. To answer the research question, the panel identified 105 computer competencies needed by business teachers at the advent of the 21st century. A summary of these competencies is displayed in Table 2.

The individual statements of competencies are detailed in rank order by category, or domain, along with the composite (summed score of ratings) and median scores given to each item by the panel in Tables 3, 4, 5, 6, and 7. There were ten items about which the panelists were undecided; however, these items are included in the findings because the ratings indicate they are moderately important to curriculum decisions.

Thirty statements fell in the hardware category, the largest number compared to the other categories. Of these statements, 25 were in consensus. The panel judged six items to be very important. Of the remaining 19 items, the panel considered 15 important; 4 were viewed as moderately important, and the panel was undecided about 5 items. Table 3 reports these statements individually.

The software category included 29 statements compared to 30 about hardware. When compared to the other categories, however, there were more statements about software that the panel considered to be very important for business teachers. Collectively, the panel determined that 19 of these items were very important, while nine items were judged as important. Only one item was undecided by the

panel. Table 4 presents a summary of each individual statement.

The panel identified only five programming-related statements concerning business teachers' competencies, which was much fewer in comparison with the other categories. With only three of these items in consensus and only two judged as important, the panel did not contribute much to the programming category in comparison to the other categories. The panel judged two items as important; panel members rated one item as moderately important. Two items fell below the conditions necessary for consensus, meaning that the panelists were undecided about these items.

Of the 18 items in the integration category, the panel judged 5 to be very important. In comparison with the other categories, integration ranked fourth in the number of items offered by the panel. Twelve items were indicated to be important, and only one item fell below consensus, signifying that the panel members were undecided about this item. Table 6 presents a summary of each individual item.

The general knowledge domain of competencies ranked third when compared with the other categories of competencies. Of the 23 items in the general computer knowledge category, 9 received scores indicating that the panel judged them to be very important. Eleven items were placed in the important category. The panel members were undecided about only one item. Table 7 presents a summary of each individual item.

This study dealt with finding the most important computer competencies that business teachers should be able to demonstrate in the classroom. The Delphi panel rated all of the statements in each of the five categories as at least moderately

Table 2: Summary of computer competencies by the order of domain as was presented to the panel

Category	Total	Consensus	Very Important	Important	Moderately Important	Undecided
Hardware	30	25	6	15	4	5
Software	29	28	19	9	0	1
Programming	5	3	0	3	0	2
Integration	18	17	5	12	0	1
General Knowledge	23	22	9	11	2	1
<i>Totals</i>	105	95	39	50	6	10

Table 3: Hardware Computer Competencies Needed by Business Teachers in the 21st Century

Presented in rank order of composite score (≥ 69 = agreement), and median (3= Moderately Important; 4 = Important; and 5 = Very Important)

Item	Composite Score	Median	Competency Statement <i>Preceded by the words: "In the year 2001, business education teachers should be able to..."</i>
1	111	5	Demonstrate knowledge and ability to operate the most current computer components that constitute a microcomputer system. (Central Processing Unit, RAM, ROM, monitor, keyboard, mouse, disk drives, and other peripherals such as scanners, CD-ROM, voice recognition).
2	109	5	Set up a single microcomputer station by installing software, connecting printers, modems, mouse, expansion cards, etc.
3	109	5	Demonstrate competence in purchasing hardware for the classroom. This would include getting the most equipment for the best price (components, computing power, multimedia configurations, fax/modems, printers, etc.)
4	108	5	Demonstrate the ability to use E-mail and voice-mail hardware.
5	107	5	Determine the relationship between hardware requirements and application requirements.
6	105	5	Demonstrate diagnostic and troubleshooting skills in solving computer laboratory environment problems, and the ability to perform routine hardware maintenance.
7	95	4	At a basic level, be able to demonstrate an understanding of how computer hardware works in terms of reading data, processing data, and generating output.
8	94	4	Demonstrate ability to teach keyboarding and formatting skills. (alpha, numeric, and function keys).
9	94	4	Recognize the major types of network configurations and participate in decisions for setting up classroom networks.
10	92	4	Use local and remote host computers.
11	92	4	Use multi-platform microcomputer essentials (from keyboarding and formatting disks to software-based hard disk maintenance and backing up software).
12	91	4	Be familiar with current resources necessary to keep up with constantly changing hardware technology.
13	90	4	Identify the difference between a standard and enhanced keyboard, and discuss ergonomic alternatives in keyboard design.
14	89	4	Demonstrate the ability to operate a scanner and to discuss scanner designs and color capability.
15	89	4	Be familiar with the internal components of a computer, and be able to correctly identify those internal components (power unit, mother board, expansion cards, CPU chip, RAM chips, etc.).
16	87	4	Identify and adapt "adaptive" technologies for special needs students (adaptive keyboards, large lettering software, etc.).
17	87	4	Demonstrate competency using projection panels and discuss projection panel designs, pixel and resolution capacity, and cable schemes.
18	86	4	Apply the knowledge of microcomputer design and capacities to file servers and determine system requirements relative to the number of sites, units, users, and application density.
19	86	4	Describe the limitations of various hardware systems.
20	84	4	Describe and use various printer designs, copy rates, and print densities.
21	83	4	Demonstrate proficiency using sound cards and speakers.
22	75	3	Demonstrate communication abilities and discuss transfer rates of Ethernet and modem transmissions.
23	74	3	Identify and differentiate alternative industry standard microprocessors.
24	73	3	Describe and discuss primary and secondary storage designs, locations, access times, sizes, and configurations.
25	70	3	Describe (network) hub designs and capacities.
26	67	3	Demonstrate the ability to design and install cabling (including null cabling for in-class E-mail).
27	66	3	Discuss the topologies, cabling schemes, and data transfer rates of network access units.
28	66	3	Describe the purpose and implications for performance of cache.
29	64	3	Describe the importance of color palettes and the relationship between pixels and resolution in monitor selection.
30	62	3	Identify and differentiate alternative industry standard bus architectures.

Table 4: Software Computer Competencies Needed by Business Teachers in the 21st Century

Presented in rank order of composite score (≈ 69 = agreement), and median (3= Moderately Important; 4 = Important; and 5 = Very Important)

Item	Composite Score	Median	Competency Statement <i>Preceded by the words: "In the year 2001, business education teachers should be able to..."</i>
1	115	5	Understand ethics related to the duplication of copyright software programs and accessing materials in cyberspace.
2	113	5	Use technology to enhance classroom instruction.
3	112	5	Knowledge of graphic packages and how to import graphics files.
4	112	5	Demonstrate an ability to apply knowledge of software programs to use in business education courses throughout the curriculum.
5	111	5	Demonstrate ability to use a word processing package.
6	111	5	Demonstrate ability to create and use a spreadsheet.
7	111	5	Demonstrate how to set up your printer with the software package you are using.
8	111	5	Demonstrate ability to perform basic operating system tasks (Macintosh and/or MS-DOS).
9	111	5	Demonstrate the use of software in specific problem-solving situations.
10	111	5	Ability to trouble-shoot routine software problems.
11	110	5	Demonstrate ability to create and use a database.
12	110	5	Demonstrate proficiency in Windows operating environment.
13	110	5	Ability to identify common business software and business applications for various software.
14	110	5	Demonstrate competence in his/her knowledge and application of that knowledge to purchase software for the classroom and apply the applications.
15	110	5	Learn new software using software application manuals and/or textbooks.
16	110	5	Know hardware/software compatibility.
17	109	5	Be able to teach software skills to students.
18	108	5	Use local- and wide-area communications networks for E-mail, group communications, and access to external information sources.
19	108	5	As part of the context for using applications software, understand the business employment roles for which entry-level employment is available and the work responsibilities that require the use of applications software.
20	101	4	Demonstrate ability to export and import information from one software package to another.
21	98	4	As part of the context for using applications software, understand the career opportunities available in business occupations and the hierarchy of skills necessary to advance in these careers.
22	97	4	As part of the context for using applications software, understand the business functions that are supported by different employment roles and the competencies necessary to carry out these functions.
23	94	4	Demonstrate knowledge of types of software purchasing agreements (licensed software, shareware, freeware).
24	92	4	Demonstrate knowledge of the types and uses of various categories of software (instructional, productivity tools, programming languages).
25	92	4	Perform care and maintenance of media.
26	91	4	Demonstrate mastery using MS-DOS as the operating system.
27	90	4	Demonstrate an ability to create and use ASCII files.
28	90	4	Demonstrate understanding of the use of productivity tools to develop higher level thinking skills (organize, categorize, and analyze data).
29	65	3	Demonstrate familiarity with software evaluation databases (EPIE, Only the Best, ISTE: Preview Software).

Table 5: Programming Computer Competencies Needed by Business Teachers in the 21st Century

Presented in rank order of composite score (\approx 69 = agreement), and median (3= Moderately Important; 4 = Important; and 5 = Very Important)

Item	Composite Score	Median	Competency Statement <i>Preceded by the words: "In the year 2001, business education teachers should be able to..."</i>
1	85	4	An understanding of how programs operate, their uses, and the value of programming to the business world.
2	84	4	Be familiar with business needs for programming personnel.
3	70	3	Basic familiarity with programming terms.
4	65	3	Ability to customize software applications for the end user, using authoring tools and fourth generation components of popular software packages.
5	60	3	Understand the potential and limitations of a major applications development language such as Visual Basic, C++ , or Pascal.

important. The data collected and presented in the preceding Tables 2 through 7 present 105 statements, with 95 judged to be in consensus by the experts to be included in training teachers in this field.

Discussion

The findings of this study offer much for educators to consider when developing courses to prepare business teachers to teach and use emerging technologies in computer and information systems. Mager's theory of performance-based objectives supports adding the competencies presented in this study to the universe of competencies for business and information systems teachers. Students and teachers in business education have benefited over the last two decades by preparing for the relatively new careers that computer technology has created. Because this technology is constantly changing, professional leadership is needed to anticipate the direction of curriculum in this area.

The panel of experts used in this study indicated that computer software is the most important domain of computer competencies needed by business teachers. This study presents 29 software competencies that the panel agreed should be included in business teacher training. Nineteen of these statements were considered to be very important by the experts on the panel.

This study presents 30 statements about hardware that the panel agreed should be included in business teacher training. Computer hardware is the second most important domain of computer competencies needed by business teachers. Although this category contains the largest number of statements, the panel considered only 15 to be important as compared to 19 in the software category. In contrast to other studies, this study indicates that competencies involving computer hardware have changed and have become more technical in nature over time.

The findings of this study present a categorical foundation of computer skills/knowledge competencies necessary for a business teacher to effectively integrate computer technology into the classroom in the 21st century. The panel used in this study identified 18 statements in the computer integration category, 5 rated as very important. These very important items included the need for business teachers to apply technology to business subjects as well as other academic areas; however, the panelists did not comment about how to apply technology to other academic areas.

Programming received the fewest statements with the lowest rating scores of the five computer domains in this study. As shown by this rating, the experts in the field of business education used for this study no longer consider computer programming to be a very important need for business teachers. The statements provided by the

Table 6: Integration Computer Competencies Needed by Business Teachers in the 21st Century

Presented in rank order of composite score (≈69 = agreement), and median (3= Moderately Important; 4 = Important; and 5 = Very Important)

Item	Composite Score	Median	Competency Statement <i>Preceded by the words: "In the year 2001, business education teachers should be able to..."</i>
1	107	5	Design lessons which challenge students' critical thinking skills using technology, i.e., problem solving using technological applications in business.
2	107	5	Use written skills appropriate to business contexts. These include writing short memos, letters, short reports, reports based on original data sources, and reports based on secondary data sources. Use either paper or electronic communication systems.
3	107	5	Demonstrate competency in instructional and assessment methods appropriate for computer laboratory experiences.
4	105	5	Demonstrate a sufficient grasp of math concepts to enable smooth applications of spreadsheet software.
5	104	5	Demonstrate knowledge of how computers are used in a variety of fields (real world).
6	102	5	Teach keyboarding on the computer.
7	100	5	Assess/determine the value of technology in the educational process.
8	100	4	Demonstrate proficiency in integrating competencies into computer applications classes.
9	99	4	Demonstrate competence in his/her knowledge and application of that knowledge in integrating hardware and software skills into all applicable classes.
10	97	4	Demonstrate proficiency in integrating academic, international, ethical, environmental, and technological concepts into all computer applications classes.
11	96	4	Identify the application of computer knowledge in various business careers.
12	93	4	Work with any other teacher in the school to advise on computer needs and applications. Demonstrating familiarity with the wide range of capabilities technology has with regard to all subjects and curricula.
13	90	4	Demonstrate the ability to apply electronic techniques to the communication process.
14	90	4	Design lessons which challenge students' ability to use, with correct protocol, communications services and applications across international boundaries.
15	88	4	Demonstrate knowledge of how to obtain funding through various means to obtain technology (i.e., grant writing) and where to locate organizations that are interested in provided such funding.
16	87	4	Recognize business problems that require the use of two or more application programs and design a procedure for using these programs for a problem solution.
17	84	4	Analyze student needs and program requirements in order to purchase programs that allow integration.
18	62	3	Integrate science as related to computer environment and operations.

panelists suggested that the knowledge of how programs work and the importance of programs to industry far outweighed the ability to write programs in a programming language.

The findings present nine very important general knowledge items that should be included in business teacher education. The panel believed that

the two most important competencies about general computer knowledge for business teachers are (a) to be able to readily assess the computer skills/knowledge of students, and (b) to show competency in the fundamentals of computers and information processing. These two items confirm the

Table 7: General Knowledge Computer Competencies Needed by Business Teachers in the 21st Century

Presented in rank order of composite score (≈ 69 = agreement), and median (3= Moderately Important; 4 = Important; and 5 = Very Important)

Item	Composite Score	Median	Competency Statement <i>Preceded by the words: "In the year 2001, business education teachers should be able to..."</i>
1	109	5	Assess readily the computer skills/knowledge of students.
2	109	5	Show competency in fundamentals of computers and information processing.
3	108	5	Demonstrate proper use and care of equipment to students.
4	108	5	Identify career opportunities and trends/issues in the information-processing field.
5	108	5	Develop realistic and relevant learning activities for software teaching.
6	108	5	Analyze the technological issues and impact on society of access, privacy, confidentiality, ethics and emerging technologies.
7	107	5	Demonstrate knowledge of "why" computers are important and knowledge of "how" computers are used in business, industry, and personal lives.
8	105	5	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	104	5	Continuously review new texts and learning materials related to computers.
10	101	4	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	98	4	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	97	4	Be aware of future trends in educational computing.
13	96	4	Design and organize ergonomically correct learning environments to maximize learner productivity.
14	92	4	Explore the role of technology in future applications.
15	92	4	Describe and analyze various technology and multimedia uses in education/training and business environments.
16	90	4	Understand the concept of connectivity and its relationship to communication and resource sharing.
17	90	4	Understand the relationship between the concept of hypermedia and application of multimedia.
18	84	4	Know (and be able to explain) the differences among data, information, and knowledge.
19	81	4	Design a major project appropriate for use in workforce education training incorporating several software applications, technologies, or multimedia and a local area network.
20	81	3	Perform a cost/benefit analysis with regard to using technology in the classroom.
21	74	3	Demonstrate understanding of microprocessors in keyboards and advanced applications such as large-screen projection, voice-activated technology.
22	73	3	Understand how different technologies have advanced and/or hindered human well-being.
23	67	3	Be familiar with the history of computing and the effect such advances have had on education.

findings of earlier research studies that are cited in this paper.

The Delphi technique used in this study offers a procedural tool that may be effectively used in researching consensus for the planning needs of

business teacher education programs. Consensus in this study was reached in three rounds, indicating further rounds would not have shown significant change. This shows that the use of “like-minded” experts in a field of study provides probable consensus.

Implications and Recommendations

This study could help teachers and curriculum planners develop courses to prepare business teachers to deal with changing pedagogy and emerging technologies in computer and information systems. The results could enable additional research to determine needs based on prediction rather than extrapolating from past functions or needs with their obsolete skills. To maintain current skills in the increasingly competitive global economy that computer technology has developed, teachers and trainers must insure that their educational curriculum addresses contemporary skills. The advent of the 21st century confirms the predictions made by educators during the birth of the personal computer over twenty years ago. The number of computers and information applications has constantly increased and continues to do so. So have the number of computer users and the demand for educational programs to meet this increase. The results of this study provide information to help expand the knowledge of predictors and training methods that are needed to meet the demand for computer users in the 21st century.

Although additional conclusions may be drawn from the findings presented in this study, the researcher makes the following seven specific recommendations:

1. The items on which consensus was reached using the Delphi technique could be used to project future direction for the preparation of business teachers.
2. The curriculum in business education could be continually updated using industry and academic leaders as resource persons for forecasting studies.
3. Business teachers could be informed on a regular basis as to trends in technology and the development of materials for courses. In-service

and pre-service sessions could be planned with the consensus of experts in the field of business education.

4. There is a need to establish a larger base of computer and information systems competencies as a resource for all business teachers and information systems educators. This study could be replicated with this focus, and the base should be continually updated and revised due to rapidly changing technology as well as trends in educational reform.
5. This study could be replicated using panelists who are teaching at all levels. All teachers should be encouraged to be a part of the curriculum planning process.
6. This study could be followed with research to validate the items identified by the expert panelists. Information technology professionals could be used on a similar panel to validate the findings of this study.

Although this study used the Internet as a means of communication, it did not use current World Wide Web tools to provide the surveys to determine group consensus. The interface capabilities of the World Wide Web could facilitate survey instrument design and administration; therefore, researchers could be able to use this method with much more ease than this researcher experienced during the data collection for this study.

Conclusion

The planned learning activities of a school or educational program are the curriculum. In theory these activities are meant to give students the skills they will need for the future. Technology is rapidly changing to meet the needs of society and the industries that will employ the students of our information systems programs. In many cases different groups within our society adapt to these changes, allowing the technology to lead the changes they make. Curriculum is, by its very nature, a prediction of future needs. The challenge for educators and curriculum planners is to plan for the future when change is taking place at an ever-increasing rate. This is confounded even more when the curriculum deals with technology.

In the past, planning curricula for the future has been based largely upon past experience. Generally, planners have assumed that the future would be much like the past. Jobs transform with the changing technology or tools used to accomplish the work to be done; therefore, planning curricula for occupational studies should be based upon changes that our experts anticipate.

The problem that this study dealt with was the lack of research conducted to determine computer competencies needed by business teachers in the future. The purpose of this study was to determine the general needs for the preparation of computer technology competencies of business education teachers in the area of information systems for the advent of the 21st century.

Without some recognized set of skills to use as a base, curriculum development lacks a foundation from which to design an effective course of study to prepare for the future. This study was designed to determine a national consensus on recommended computer competencies for business teachers. The consensus presented in this study may contribute to course design and content for preparing these teachers. This study may also encourage the additional research needed to keep curriculum current for future business and information systems educators.

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