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ABSTRACT

Computers are now perceived as a required resource by business, education, and government, as well as in personal life. The rates of adoption of information technologies among these groups (business, education, government, family/individual) have varied, which may have created knowledge gaps. Based on the data collected from a telephone survey in a Midwest city and interviews with recent communication major college graduates, a study focused on the analysis of the gap between the prospective employers and the communication major college graduates. Although the quantitative data do not show a "gap" of computer skills perceived by the majority of the companies surveyed, the "gap" is found in an indirect way which has been experienced by many communication major alumni. It is described as: "Computer literate people get better jobs." Diffusion of innovation concept and models are employed to discuss the findings. Finally, adding a basic computer class as a required course onto undergraduate curricula is recommended. (Contains 21 references; a sample telephone survey, interview questions, and two charts showing relevant data are appended.) (Author/CR)

The Diffusion of Computer Skills in Communication Curricula: Is There a Gap between the Educational Experience and Employers' Needs?

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Abstract:

Computers are now perceived as a required resource by business, education, and government, as well as in personal life. The rates of adoption of information technologies among these groups (business, education, government, family/individual) have varied, which may have created knowledge gaps. Based on the data collected from a telephone survey in a Midwest city and interviews with recent communication major college graduates, the present study is focused on the analysis of the gap between the prospective employers and the communication major college graduates. Although the quantitative data do not show a "gap" of computer skills perceived by the majority of the companies surveyed, the "gap" is found in an indirect way which has been experienced by many communication major alumni. It is described as that "Computer literate people get better jobs." Diffusion of innovation concept and models are employed to discuss the findings. Finally, adding a basic computer class as a required course onto undergraduate curricula is recommended.

Introduction

The Rapid Development of Information Technologies

IBM, in a study conducted after World War II, predicted that "the total world market for electronic computers would be between 10 and 15 units" (Adler, 1995, p. xi). This prediction was based on the vacuum tube technologies used for building computers in the pre-semiconductor period. Obviously, it was very wrong. With the convergence of computing and solid-state electronics, computer technologies have been developing exponentially. The costs of producing hardware (microprocessors, memory, storage devices, scanners, etc.) and developing software (operation systems such as Windows95/98, application packages such as Microsoft Office 95/97, multimedia authoring, graphics/painting, non-linear editing, desktop publishing, the Internet and web authoring, etc.) have been dramatically decreased. As a matter of fact, "the cost of a reasonably state-of-the-art home computer is commonly figured at a constant $2,000...[while] the performance standard doubles every 18-24 month" (Kahin, 1997, p.

57). Nowadays computer technologies are used everywhere, such as by government, education, business, entertainment, as well as in personal life. The desire of learning computer skills diffused from clerical/accountant, and scientific fields to all aspects and levels in contemporary society, and across young and old age groups.

Specially, the convergence of computer, telecommunication, and cable technologies has created the Internet, including World Wide Web, FTP, Email, and other on-line services. As Adler (1995) indicates,

> What is interesting about the Internet as a paradigm is that its architecture is completely open and its structure almost anarchic. No one owns the Internet and no one runs it....[It] is a "network of networks" that is tied together only by a set of standards (most of which have been developed by users of the Internet on a voluntary basis). Virtually anyone who agrees to abide by these standards can use the Internet. Unlike traditional media, the Internet makes little distinction between "consumers" and "producers" of content....[The] Internet is well on the way to creating a new sort of "electronic marketplace" where cybernetic savvy will be as critical to success as traditional skills. (p. xxi)

In the 1997 edition of Technology Forecast, Price Waterhouse asserts that "The Web is a hypertext multimedia system that links computer resources around the world" and is the fastest developing technology. Internet/Web developers are employing interactive databases, three-dimensional graphics, virtual reality, animation, audio/video, Java applets, and other emerging technologies to create "innovative content and services for business, commerce, entertainment, education, information change" and other services (Price Waterhouse, 1997, p. 437).

The Penetration of Computers in American Households

According to the Education and Social Stratification Branch, Population Division, U.S. Bureau of the Census, in 1993 approximately 23 percent (i.e. 22,605 thousand) of the American households had computers. By comparison, 8.2 percent had computers in 1984. Within ten years the owners of home computer increased about 2.8 times. According to Freemen's study (1996), it was estimated that by the end of 1995 about 39

percent of US households owned personal computers, and the forecasts predict that by the year 2000 there will be 60 to 65 percent of US houses having a personal computer.

The 1993 statistics of U.S. Bureau of the Census also showed that there were 40 percent of 5 years old preschool children using computers. Overall, more children (aged 5 to 17) have used computers than adults (18 and older). The highest percentages (more than 70 percent) were in the age groups of 8-13 years old, i.e. the 3rd to 8th graders. And about 30 to 38 percent of the 3rd to 8th graders had computers at home. As a contrast, only in the18-21, 35-44, and 45-54 age groups about 30 percent or a little more own computers at home. For adults, the experience of using computers was related to their incomes, occupations, and industries. In terms of using computers, however, there were almost no differences among children regardless their parents' socioeconomic status. Further, in each category of income, occupations, or industries, households with children had more computers than those with adults only.

In March 1996 CommerceNet and Nielsen Media Research conducted a survey with 4,200 people aged 16 years and older in the U.S. and Canada. The results show that about 24 percent had access to the Internet, 17 percent had used the Internet in the last 6 months, and 13 percent had used the Web in the last 6 months (Price Waterhouse, 1997, p. 438).

Significance of the Study

Based on the proliferation of information technology, everyone in contemporary society needs to ask him/herself a question: what should I do with computer technology; ignore it, wait to see what will happen to me, or learn it right now? What are the responses of higher education instructors to this situation?

Since the early 90s, many college and universities have been collecting computer fees for up-dating computer hardware and up-grading software. Instructors and professors are encouraged to apply for computer grants, and attend workshops, and become connected to local networks and the Internet. Some of these individuals are using computer technologies for preparing teaching materials, such as PowerPoint, and Internet searching. Some teach computer applications, such as non-linear editing, script writing, multimedia production, and so on. However, basic computer skills, such Windows,

Microsoft Office (Word, PowerPoint, Excel, etc.), and Internet Browsers, are not listed as a general education requirements. Although there are workshops and courses that teach higher level computer applications, basic computer skills were acquired individually. This results in functions/features of operating systems (e.g. Windows) and basic application (e.g. Microsoft Office) not being entirely understood, therefore not fully used. Many students would benefit from instructions in basic computer skills before taking higher level application courses.

On the other hand, the majority of current instructors teaching social science or humanities or fine arts were college graduates before the 80s when computer technologies were not available in schools. Most of these individuals need to learn computer skills themselves before being able to teach students. Almost all are aware of the rapid development of information technologies and many are exploring and learning new computer skills. However, it takes a great deal of time and continuous efforts to learn and to keep up with the rapidly developing computer technologies. Some of instructors, although interested, find difficulty in managing the sophisticate information technologies and reluctant to ask questions or seek guidance. Still others resist making changes, continuing to use typewriters or hand writing.

This paper briefly reviews information technology and its impact on education and the workplace. The terms of "information technology" (IT) and "computer" are used interchangeably throughout this paper. Based on the data collected from a telephone survey in a Midwest city and interviews with recent communication major college graduates, the study is focused on the analysis of the gap between the prospective employers and the communication major college graduates. Interpretations of the findings will be guided by the theoretical explanation about diffusion of innovations. Finally, suggestions will be proposed in order to advance the role of higher education in preparing contemporary college students to meet the challenge of their future job market in the information society.

Literature Review

The Power of Information

It is well known that human society is structured with power relationships. "Power is capability, the ability to get things done that one wants done" (Mason, Mason, & Culnan, 1995, p. 41). Alvin Toffler specifies three major "powershifts" in the development of civilization: (a) violence/ force/weapons, (b) monetary wealth, and (c) knowledg/information (Toffler, 1990, Mason, Mason, & Culnan, 1995). In an information society, information facilitates and empowers people to gain force and money. Information systems are developed to acquire, process, store, disseminate, and use information, so they "have emerged as the most important base of social and personal power" (Mason, et al.,1995, p. 64). No doubt, people or agents who possess important information and who control technologies required to handle information "have much greater capacity to do what they want to do, that is, to exercise their will over others" (Mason, et al.,1995, p. 66).

On the other hand, information technologies have changed the traditional hierarchical system of power relationships. For example, "The Internet business community is not constituted by a few mega-companies; it is, instead, a loose collaboration of millions of free-spirited individuals and thousands of interpenetrating businesses whose disparate members act together like swarms of bees or flocks of birds, aligning to one another and flying in formation for a while, then disrupting their course and exploding into momentary confusion. A moment later—just as suddenly—they reconfigure around a new destination and course" (Moore, 1997, p. 124). A swarm economic system is structured with the interactive relationship between membership and leadership rather than control. It facilitates an environment for members to take "advantages of the intelligence of others around you," and work collaboratively "to create new innovation" (Moore, 1997, p. 123). Therefore, it provides opportunities for the development of new business and the maintenance of small businesses. It opens the door for young people to try their new ideas, exercise their talents and creativity, and to pursue their ambitions.

There are two role models for young people. One is Michael S. Dell who is "the youngest CEO of a company ever to earn a ranking on the Fortune 500" (Price Waterhouse, 1997, p.13). Dell founded Dell Computer Corporation in 1984 "as a student at the University of Texas in Austin, and today is one of the longest-tenured CEOs in the IT industry" (p. 13). The quality of Dell computers have been listed at the top by the PC World magazine. Dell is able to compete with giant computer manufacturers, such as IBM and Apple, in the rapidly growing market of personal computer and networks.

The other is Marc Andreessen who founded Netscape with Dr. James H. Clark in April 1994, one year after earning his bachelor of science degree in computer science at the University of Illinois. Netscape is seen as "the fastest growing software company in history." The company held its initial public offering in August 1995, only 16 months after its founding. It is able to compete with the giant software company Microsoft, founded in 1975, in the most promising field—The Internet technology. Currently Netscape employs more than 2000 people in 17 countries and 92 of the top 100 companies listed on the Fortune 500 are Netscape customers (www.netscape.com, 1998). It reported revenues of $346 million in 1996, as compared to $85 million in 1995.

Information Technology's Impact on Education and Future Workplaces

Information technologies are restructuring our society, especially, in the field of education and the workplace.

Michael S. Dell (1998), CEO of Dell Computer Corporation, believes that it is an era "where physical assets are becoming secondary to information assets" because "rapid information flow saves time and money" and that information technology "transforms organizations by eliminating paper-based functions, flattening organizational layers and integrating global operations" (Dell, 1998). Voget claims that "the convergence of information technologies and the emergence of high-bandwidth networks at the end of this century will likely have a greater impact on the nature of work....we have arrived at a moment in history where work itself is being redefined" (1995, p. 106). He uses the terms of "knowledge work" and "knowledge worker" to characterize future workplaces. "Knowledge work" emphasizes "the cocreation of new perspectives which, in turn, lead to more effective actions" (p. 98), and "Knowledge workers" are involved in information

processes and knowledge-based economy. Now the society is in a transformation stage where people need to rethink "the definition of work, the process of working, and the required competence of the knowledge workers" (p. 107).

The rapid transition in the workplace requires a simultaneous transformation in education systems that prepare "knowledge workers." Krushan and Lenk (1995) believe that "technology affords learners the opportunity to become more active participants in their own learning and encourages collaboration within and outside the classroom"; and suggest that "these changes at a classroom level can have an impact on the structure of schools and districts, and ultimately may change dramatically where and how learning takes place" (p. 131).

Many elementary and secondary schools have installed computer systems and been teaching students to learn new technologies. Some schools link education to students' career practices. In a report released recently by the nonpartisan Committee for Economic Development (CED), a national public policy organization of top business and education leaders, the Committee concludes that "in today's workplace, all but the least-skilled dead-end jobs require working in groups, communicating with others, solving problems, and facility with basic computer technologies." CED promotes the programs which "seek to expand young people's choices, not limit them, by preparing students to succeed both in college and in today's complex workplace." CED advocates the establishment of partnerships between businesses and local schools, and argues that "work-based learning can motivate students to work harder in more traditional academic subjects and make more informed career choices." Some studies also show that school-to-career programs "have demonstrated increased rates of college attendance" (PR Newswire Association, June 16, 1998).

As another example, PR Newswire Association reports that "students attending Colorado's State System community colleges and participating high schools will have the opportunity to enter a program that will teach them to design, build and maintain computer networks for local, national and international businesses -- among the hottest high tech career field in the country....Colorado Community Colleges and Cisco Systems

have formed a true School-to-Career partnership, linking school-based learning and the world of work" (PR Newswire Association, June 16 1998).

Facing to the challenge from information society, what the educators in higher education need to do in order to effectively prepare future "knowledge workers." Craig (1995) asserts, "We must be able to alter our paradigms; we must develop able navigators" (p. vii). However, there are various problems and barriers resulting in the discrepancies between awareness and interests, and between interests and practices.

Problems with Technology Innovation

Technological problems:

Information technologies develop too fast to stay current in all areas of development. Software upgrades are offered every six to twelve months (Midwinter,1995). Software compatibility issues emerge. Because of incompatibility associated with up-grades, computers often deny opening a document that one has saved on a disk just a few months or even a few weeks earlier. Often, a document saved with new versions of a program can not be opened by the old version of the same software. Software upgrading causes users' insecure feeling, and results in bad experience which makes users hesitate to use computers or buy a computer at home.

Another problem is the continuous investment in hardware. No doubt, there are two or three old, outdated computers in the homes of "heavy computer users." The term "heavy user" is borrowed from television studies. However, television sets cost much less than computers, and the oldest TV set still can receive Network programs. By contrast, computers cost at least two- to three-times of cost for buying a TV. Also, old computers are totally useless once becoming outdated.

The other problem is with the computer's display or monitor. Midwinter (1995) describes, "the difficulty of reading quantities of text on today's screen, of scrolling pages to search for interesting material, and of waiting for the machine to respond to commands, displays [in terms of resolution, contrast, and portability] have a considerable way to go" (p. 65).

Application processes:

Krushan & Lenk (1995) analyzed the applications of computer technology to learning. They point out that teacher characteristics and school administration are important factors in successful technology applications (p. 119). Their studies show that "experienced teachers expended considerable time and effort integrating computers into their teaching and were supported by their schools"; and that "computer uses had changed their teaching (in particular, they had higher expectations of student performance and presented more complex materials and individualized instruction)." It usually needs "five to six years of classroom teaching with computers" to develop teachers' computer teaching competence. And teachers often face barriers in their practices, "including access to hardware and more time to plan for computer-based lessons" (p. 119).

People's adoption of new technologies--*Diffusion of Innovations*

People are always reluctant to adopt new ideas or applications. In the 40s, communication scholars became interested in the process of diffusing technologies/innovations. Based on previous studies about diffusion of innovation, Rogers (1995) further explains how people accept a new idea, or use a new product or system. The diffusion of information innovation is under the similar process as earlier technological innovations.

Definition of *Diffusion*

According to Rogers (1995), "*Diffusion* is the process by which an innovation [or a new idea] is communicated through certain channels over time among the members of a social system" (p. 2). The concept of *Diffusion* includes the spontaneous, unplanned spread of new ideas, and directed and managed dissemination (Rogers, 1995).

Diffusion and Communication

As the definition described, in order to promote an innovation the idea about the innovation needs to be communicated to individuals as well as the larger society. Therefore, "Diffusion is a special type of communication....The newness of the idea in the message content gives diffusion its special character. The newness means that some degree of uncertainty is involved in diffusion" (Rogers, 1995, p. 2). "*Uncertainty* is the degree to which a number of alternatives are perceived with respect to the occurrence of

an event and the relative probability of these alternatives. Uncertainty implies a lack of predictability, of structure, of information" (p. 2). In order to overcome uncertainty, the attributes of innovation must be fully perceived by an individual who is potentially a user of the innovation. The attributes of innovation include *relative advantage* of an innovation; *compatibility* with existing values and past experiences; *complexity* to be understood and used; *trialability* on a limited basis; and *observability* of the results to others (Rogers, 1995, pp. 15-16).

Process in diffusion of innovation: Time dimension

As mentioned in its definition, the time dimension is critical in the diffusion of innovations. A S-shaped *diffusion* curve (see Figure 1-1 of Rogers, 1995, for details) was found to describe the rate of adoption that "is the relative speed with which an innovation is adopted by members of a social system" (Rogers, 1995, p. 22). The S-shaped curves indicated that "the 'take-off' is at about 10- to 25-percent adoption, when interpersonal networks become activated so that a critical mass of adopters begins using an innovation" (Rogers, 1995, P. 12). However, the "take-off" time of innovations is different from one to the other, depending on the attributes of an innovation, and socioeconomic characteristics in a social system, such as culture, education, norms, and so forth.

Innovation-adoption process: Levels and stages

Diffusion of innovations is analyzed at two levels (Rogers, 1995): the individual member level and the organizational level.

At the individual level, there are five stages: *Knowledge*, *Persuasion*, *Decision*, *Implementation*, and *Confirmation* (see Figure 5-1 of Rogers, 1995, for details). For adopting an innovation, an individual needs to acquire knowledge about the innovation first, then to form an attitude toward the innovation, and subsequently to make a decision to adopt or reject the innovation. If the individual's decision is adoption, the person needs to implement the innovation and finally confirm the adoption or discontinue it if is not satisfied with the innovation.

Summarized by Rogers (1995), the innovation process in an organization consists of a sequence of five stages (see Figure 10-2 of Rogers, 1995, for details), two in the

initiation subprocess (*Agenda-Setting* and *Matching*) and three in the implementation subprocess (*Redefining/Restructuring*, *Clarifying*, and *Routinizing*). Later stages in the innovation process cannot be undertaken until earlier stages have been settled, either explicitly or implicitly.

Information technologies emerged with the convergence of computer, telecommunication, and cable technologies, and made global interactive communication possible. Unlike a single product or system, the innovation of information is not completed with individuals' using computers but more importantly is extended to networking individuals' computers. Networking, in both intra-network and inter-network, is the most important and powerful feature of information technologies. It facilitates information flow and makes workplaces more efficient and productive. Organizations' adoption of information technologies, in turn, is a key to the development and diffusion of networking technology. The Internet represents the strongest evidence of this claim.

The following study will examine the status of a Midwest city in the process of diffusing information technologies. The findings will provide references for college educators in the consideration of changing higher education curricula in order to better prepare students to meet the challenge from their future job market.

Research Questions and Methods

Research questions

1. What computer systems and software packages are the local companies currently using?
2. What computer skills do those companies require at the entry level positions for college graduates (communication major)?
3. Is there a gap between college graduates and there future employers, in terms of computer skills?
4. What are those companies' expectations, in terms of college graduates' computer skills?

Research Methods

The study employed a triangulation approach with a telephone survey and interviews. As Frey and his associates indicate (1991), " By combining structured, quantitative measurements with more open-ended, qualitative measurements of the same concept, researchers enhance both the validity and the reliability of their measurements and the credibility of the conclusions they draw" (p. 124).

A telephone survey, with random sampling techniques, was conducted by college students in the area of a medium size Midwest twin city. In March 1998, a total number of 156 companies answered the questionnaires (see appendix A). About twenty communication major alumni, graduated during the 90s, were interviewed (see appendix B). Statistical analyses were run to obtain an overall picture of the businesses in the local community, regarding their use of information technologies, and their expectations of college graduates' computer skills, as well as the relationship between those companies' adoption of computer technologies and their expectations of college students' computer skills. The open-ended and intensive interviews provided the experiences of those who played a dual role as both a communication major graduate and a current employee in the companies where communication major students are looking for employment.

The survey data were analyzed statistically with Frequencies and Crosstabs. The qualitative interviews were transcribed to provide in depth explanations about their use of information technologies and the impact of information technologies on contemporary workplaces and education systems.

Results

Overview

The types of the businesses range from agriculture, auto parts and repair, auto dealer, legal services, medical clinic, computer dealer, graphics, to engineering and plumbing, and so on (refer to Chart 1). The majority of the companies surveyed are small businesses. About 64 percent of the companies have less than 10 employees (refer to

Chart 2). Most of the people who answered the phones believe that over 50 percent of the employees in their companies possess computer skills.

What Computer Systems and Software Packages are the Local Companies Currently Using?

About 70 percent of the surveyed companies have IBM compatible computer systems, 7 percent MAC, and 6 percent specially designed systems. The survey shows that about 17 percent of the companies do not use computers. Those companies are usually in the field of agriculture or food services. About 70 percent of the companies having computers are using Windows95, Microsoft Office, and other general software packages, and about 30 percent use special software packages. Most of the interviewed alumni said that their companies are using either IBM compatibles or mainframes, and that the software used is Windows95, Microsoft Office, desktop publishing, or special designed for their businesses.

What Computer Skills Do Those Companies Require at the Entry Level Positions for College Graduates (Communication Major)?

The survey data show that about 46 percent of the companies need college graduates. Among those, about 86 percent required applicants with basic computer skills, but they believe that college students do possess those basic skills.

The alumni's descriptions indicate that there were/are no specific requirements of computer skills for entry level positions. However, they confirm that good computer skills did help them get their current jobs and they needed to learn computer skills on their own in order to satisfy their job responsibilities.

A Master degree of Communication graduate, who is a Training Coordinator at a company, said that "Most companies look intensively at an applicant's computer proficiency. I believe my PowerPoint and Web skills helped get me this job" (Moore, personal communication, March 24, 1998). One communication graduate advised that to have a computer at one's home would help him/her learn the skills greatly. Another graduate expressed that she/he "wouldn't have gotten the job if didn't know the basic computer skills." A communication major 98 graduate explored the job requirement related to computer skills before graduating. He talked to professional people at the

workplaces during his job searching, and was told to know "as much as possible" (Gansen, 1998). He decided to polish his computer skills before leaving college because he realized that computer literacy is an asset in getting a job. Thus, he added a computer class, entitled "Introduction to Information Systems" that is required for business majors, to his last semester's schedule in college. He said that "the class is very challenging to me, but during my intense job search this semester, I realized its importance" (Gansen, 1998). Another 98 graduate learned different computer skills, such as Lexus-Nexus database, Quark Express and Phtoshop, Pagemaker, etc., when she worked at her part-time jobs as an undergraduate student. These skills helped her to get many job interviews (Iehl, 1998).

Is There a Gap between College Graduates and Their Future Employers, in Terms of Computer Skills?

About 17 percent of the businesses were aware of the gap, but the majority did not think it was an important question to answer. No gaps were perceived by the alumni either. The MA graduate said that "There really isn't a gap in the organizations' expectations, as they don't expect much as our systems are pretty old." He became the pioneer for exploring software applications for the company, and the company and his colleagues recognized his computer skills and started to seek information and guidance from him. He provided "one on one training as needed" and also applied for state grants for computer education.

What are Those Companies' Expectations, in terms of College Graduates' Computer Skills?

Among those which need college graduates, only 50 percent provided computer training programs, and the other half expect college graduates to learn computer skills either on their own or on job practices. Among the companies which provided training programs, about 89 percent claimed that college students need to improve their computer skills during their college education.

Most of the companies expect students to know word processing and Microsoft Office. Some companies which are dealing with information technologies have higher expectations. However, they would like to train new employees or hire the ones possessing the skills they need. And those which use special software packages do not

require the skills at the entry level positions. Instead, they will train new employees. The results show that about 32 percent of the total companies surveyed provide computer training programs to their employees.

Nonetheless, training programs are usually designed to meet the average level of attendants in a class. One graduate said that "things have gotten faster." By not having a good background of computer skills, one might have difficulty to catch up in the training class, and fall behind in an ever competitive society.

Overall, many respondents agreed that "Computer literate people get better jobs."

Discussion

The "Take-off" Stage in the Process of Diffusion of Information Technology

According to the 1993 statistics on the use of computers by the U.S. Bureau of the Census, about 60 percent of children were using computers and about 40 percent adults using computers. The rates of adopting computer technology in both adults and children groups have passed the "take-off" stage (10-25%) in the S-shaped curve of diffusion process (see Figure 1-1 of Rogers, 1995, for details). In March 1996 CommerceNet and Nielsen Media Research (Price Waterhouse, 1997) found about 24 percent of people in Canada and the US have access to the Internet, which is in the stage of "take-off." Moreover, the forecasts predict that by the year 2000 there will be 60- to 65- percent of US houses having a personal computer (Freemen, 1996). Apparently, the statistics indicate that public's adoption of information technologies is growing up at the rate of the rising slope on the S-shaped curve.

The results from this study show that over 83 percent of the companies in the medium size mid-western city are using computers in their businesses. Among those companies about 70 percent are using general software, such as Windows95, Microsoft Office, for their office administration work, while only about 18 percent of the companies mention using the Internet. Looking at the figures described above and the S-shaped curve, the diffusion process of computer technologies seems close to completion. However, the numbers need to be looked at carefully. In order to further examine the

impact of information technologies on college education, the present study involved in a relatively in-depth exploration. It asked several open-ended questions about the use of computer on the basis of their daily business practices.

The "Gap" between the Prospective Employers' Expectations and College Graduates

The findings did not show a "gap" of computer skills perceived by the majority of the companies surveyed. Their answers were ambiguous to the questions about their requirements of computer skills and the perceived gaps between their requirements and college graduates' computer skills. With further investigations, the study found that many companies mainly need employees with word processing skills. The types of information technologies currently used by those companies also explain why they thought college graduates possess enough computer skills, or even better than some companies' needs. However, Microsoft Office's functions are far more than word processing. The completion of diffusion process will be evaluated in the sense of a full application of relevant information technologies to the whole range of operation in every business.

Nonetheless, the "gap" was found in an indirect way which has been experienced by many communication major alumni. It is described as that "Computer literate people get better jobs." In order to get a better job or promotion, one needs to continuously learn computer skills by oneself, and further, has the potential to play a leading role in a prospective company.

What are the Diffusion Processes Companies Going Through?

There are two levels of diffusion processes. One is in the individual level and the other is in the organizational level (see Figure 5-2 & Figure 10-2 of Rogers, 1995, for details). These two processes are intertwined and interactively related with each other. Currently, many of the organizations surveyed in this study were not sure what computer technologies they need to adopt. It was hard for them to define their expectations. Their answers usually were that "they [college students] need to learn as much as possible at college." However, employers do pay attention to the computer skills listed in applicants' resumes because they need to hire people who know computers and are able to help employers reduce uncertainty about applying information technologies to their business practices.

In the diffusion process of organizational innovation, hiring a consulting firm is very expensive. The owner of a company needs someone who knows the business and computers to set up an agenda and find the technology matching the business' needs, and then to restructure the company in order to make the business operation more efficient and productive, and finally to integrate information technologies into their routine business practices. As a matter of fact, the diffusion process of information technologies requires more time and effort than the adoption of a new product or a new machine. It not only needs members in a unit to learn the information technology, but also needs to restructure the unit and to connect the unit to outside units, even to the world.

What are the Diffusion Processes College Students Going Through?

As mentioned in the Literature Review section, information technologies are restructuring society. Economic infrastructure, especially in the fields related to information and knowledge, has been transformed from a traditional *hierarchical* system to *swarming* relationships. Information gains power of wealth and force. And *swarm* economic structure opens the door for young people's success.

For communication majors, the career opportunities are in such areas as teaching, broadcasting, public relations, consulting, health service, fund raising, human resources development, personnel work, law, webpage design and operation, corporate video, politics, advertising, journalism, printed media, sales, press agency, multimedia authoring, and so forth. All these are related to information processing, i.e. "knowledge work." The study found that many of the interviewees, who are communication major graduates, have been learning information technologies on their own. They believe that spending $2,000 dollars to buy a computer system and $20 dollars to hook up to the Internet is worthwhile for getting a better job. The two 98 graduates' experience may represent the stance of current college students. They became aware of the "gap" between the challenge of future job marketplaces and their computer skills. Thus, they realized that they needed to take action before leaving college and tried to use the up-dated computers and software in labs, and attended the courses or workshops to better their computer skills.

Recommendations for the Consideration of College Education

There are huge knowledge gaps among college students. Some students are very good with computers and able to keep up with the up-grading software development. In the *Swarming economic* system described earlier, they will be able to open their own businesses as Dell (CEO of Dell Computer Corporation) and Andressssen (co-founder of Nestcape) did. Another portion of students are capable of using computers to do research work and complete assignments. Still, some may only know how to type a paper. The diffusion process in higher education needs to be further promoted at both the individual level and the organizational level. At the individual level, college students need to be educated about the information technologies and their impact on contemporary society, computer skills should be seen as an essential background of college education. At the organizational level, many colleges and universities have gone or are going through the stages of Agenda-setting, Matching, and Redefining/Restructuring (see Figure 10-2 of Rogers, 1995, for details). The diffusion needs to be advanced to the stages of Clarifying and Routinizing. It means that learning and teaching computer skills must be integrated into higher education curricula. Computer skills have became as important and essential as math, speaking, and writing abilities.

This study also served as a class project. Students were introduced to up-to-date information technologies, their impact on various aspects of contemporary society, and the concept about diffusion of innovations. They participated in the data collection, and were guided to discuss and interpret the results from the perspectives of information technology's impact on college education, local businesses, and students themselves. As a result, on one hand, most of the student participants became aware of the urgency of learning computer skills during their college education. One the other hand, they saw the opportunities of getting a first job in small businesses that need pioneers and leaders in the application of information technologies. As suggested by the alumni, students strongly recommended to add a basic computer class as a required course onto undergraduate curricula, either as a general education course or a core course for communication majors. Like other general education courses, the computer class needs to be carefully designed based on the information what computer classes offered in high school education.

Conclusion

As the title suggested, the present study examined the gap between the expectation of communication major's prospective employers and communication graduates' computer skills learned in college, and tried to find solutions to reduce the gap. The quantitative findings did not show a gap directly perceived by the companies surveyed. However, the gap was implicitly revealed by the information collected from the answers to other relevant questions by the companies and the conversations with communication major alumni. The "Gap" exists at the experience of communication major graduates, i.e. "Computer literate people get better jobs."

With the change in the workplace caused by the power-shift from traditionally defined force and wealth to contemporary recognized knowledge and information, communication major students realized that they need to learn more computer skills at school in order to operate their future jobs competently, and to be a leader in the continuing process of diffusing information technologies.

Although this study employed a survey method to collect data and analyzed the data statistically, it is not intended to generalize the results to the larger society. However, the findings provide references for administrators, faculty members, and students in higher education, and will hopefully make them ponder about their responsibilities and preparations for meeting the ever growing challenge from public's education needs and workplaces' expectations in information society.

Moreover, in order to further discuss this issue, the present study needs to explore more information about in-school college students' expectations of learning computer skills, and faculty members' perspectives of curriculum changing.

Although the concept about diffusion of innovation was applied to explaining the process of companies' using information technologies and college education, this study also can serve as part of "Diffusion of Innovation" research if it will be repeated over time.

Finally, this study is not going to give resolutions. Instead, its goal is to initiate discussions on this issue. The solutions will be reached successively in the discussion and with the progress of information technologies.

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Appendix A

Telephone Survey Questionnaire **Page No.** **Telephone No.**

1. What types of entry level jobs for college (or communication major) graduates are there in your company?
2. What computer skills do those entry level positions require? For example, Microsoft Office (Word, Excel, PowerPoint, Schedule); WordPerfect; Web Authoring; the Internet (Email, FTP, WWW); Multimedia Authoring; Non-linear Editing; Graphics, Computer Programming, Desktop Publishing; Other (please explain)
3. According to your hiring experience, what computer skills do college graduates, who apply for those positions, usually possess?
4. What is your perceived gap, in terms of computer skills, between your company's needs and college graduates' competence? If yes, please describe the specific computer skills that your company needs but college graduates are lacking.
5. What computer system does your company currently use?
   Hardware:
   Software:
6. What computer skills, software packages, does your company currently use?
7. What training programs are provided by your company? How often?
8. What if anything could college students do to improve computer skills necessary in the job market?
9. Who is responsible for college graduates' basic computer skill training?
   a. Educational institution b. Employer
   c. Students selves d. other (explain)_____
10. Demographics
    Types of Industry Size:
    Parent Company's Name
    How long has your company been using computers?
    Percentage of employees possess computer skills _____
11. The job title of the person who answers the questions (option)_____

Appendix B

Interview Questions

I. *Demographics*:

Graduation Date: 19____. Major: _____; Miner: _____
Current Position/Company: _____
First Job/Company: _____
The relevant academic training to your current job was _____

II. *First Job After Graduation from University*

1. When you got the first job in an entry level position after graduation, what were your company's expectations, in terms of computer skills?
2. How well did the university and department prepare you to meet your company's expectations relating to computer skills?
3. What do you wish you would've done at university in relations to the development of computer skills?
4. Do you have any suggestions about the University's or the Department's curriculum in relation to the development of computer skills?

III. *Current Job*

1. What are your company's current expectations of an entry level position in your professional field, in terms of computer skills? What has been changed in terms of computer skills in your professional field since you got the first job?
2. What computer system does your company currently use?
3. What computer skills, software packages, projects do you need to perform your current job well? What computer skills should a college graduate possess to be a competent employee in your company?
4. What training program does your company provide today, in terms of computer skills?
5. Is there a gap between your organization's expectations and its employees' computer skills?

IV. *Individual Experience of Learning Computer Skills*

Types of Business

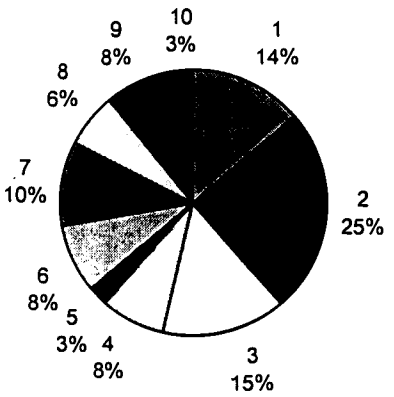

Chart 1

1—agriculture, plumbing & heating, food
2—suppliers
3—financial, chamber of commerce, legal service
4—medical clinic
5—radio, tv & cable
6—graphics & photo
7—computer
8—band, dating service, rental
9—engineering
10—factory

Size of the Company

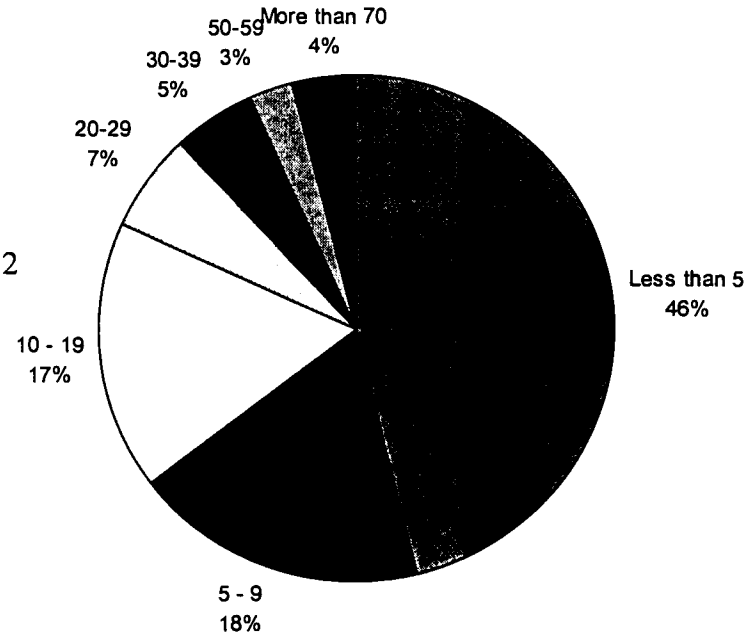

Chart 2

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