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COMPUTER EDUCATION AND COMPUTER RELATED PROFESSIONS OF THE FUTURE

by

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New Directions for Education

The purpose of this paper is to examine current positions in literature with regards to computer education and future jobs related to computer usage.

The expansion of the use of computers has made "computer literacy" as essential as the basic skills of reading, writing and arithmetic. Morf related the rapid expansion in the use of computers as follows: "Among the more widely accepted scenarios of the future at work are those based on the assumption that technology will continue to grow exponentially" (1983, p. 24). Therefore, as technology grows, our educational programs must incorporate the new knowledge necessary to function in the world of the information age. As Hart stated: "We must prepare now to respond to the new technologies that will shape our future" (1983, p. 11).

Several distinguished educators have addressed educational issues relating to technology, education, and the future. Derringer stated: "As the economy evolved, so did the requirements of the work force. High technology, information industries now require workers who can handle complex intellectual tasks and who are willing to continually renew their education. ...The power of the computer to transform learning calls for a new view of what is still fundamental in the curriculum. The resourcefulness of educators in constructing this view will determine, in large measure, the benefits that we as a nation derive from the shift to the information society" (1983, p. 25). Shane related his views: "With the massive changes in production and the new kinds of jobs opening up in the high-tech field, there already are enormous demands on education agencies for the retrofitting, retreading, and re-educating of people; learning experiences which can continue right on through life into our senior years. If our schools do not meet these needs, some other kinds of agencies will -- the kind of agencies that already have taken over portions of the instructional monopoly that schools enjoyed in the 50's" (1983, p. 13).

Houston (1983) discussed the issue concerning planning for learning in the world of tomorrow. Houston suggested that deciding what students will need to know is a giant step toward planning for the future. Troutmann and Palombo suggested it is necessary to: "Incorporate computers and other information technologies as a meaningful part of and vehicle for the education of all students" (1983, p. 49). Dede (1983) studied in detail the likely evolution of computers in schools and concluded that students of the future will be trained by computers and educated by teachers, allowing both computer and teacher to

function in more efficient and cost effective ways. Lipkin stated: "The rapid growth of microcomputer use in the majority of the nations public schools is a tribute to ingenuity, innovativeness and hard work of both educators and the public that has provided support for their efforts" (1983, p. 26).

There seems to be a concensus by the many educators who have studied and researched issues of the future of education as it relates to computers that all of the future programs assume that the study of the computer is vital and to deny one the opportunity to be trained in computers is to deny one a complete education. Glines (1983) compiled an extensive list of resources on the future (over 5000), which are available to educators and teachers.

Changing technology requires adaptation not only in offices, factories, households and government, but also in education. "The university of the future will certainly require all students to be competent in using information technologies" Dunn (1983, p. 59). To require that all students be competent in information technology implies, of course, that it be taught. Computer technology places demands on colleges and universities to make available to the student a much wider body of knowledge.

When universities make available training in information technology they will obviously be preparing themselves as well as their students for participation in the information revolution. To avoid education in information technology would be failing to be on the cutting edge of knowledge. Dunn emphasized: "Many institutions will close over the next 20 years, falling victim to demographic changes, new technologies, funding problems, external degree programs and competition. But exciting days are ahead for those institutions that can make the transition and realize the unlimited potential of the information society...Only those institutions with the ability to adjust to the challenge of the future will survive into the twenty-first century" (1983, p. 55). Where universities fail to supply the needed training, businesses and government agencies will continue to provide education which is needed to equip employees to accomplish their jobs and to grow professionally.

Two professional business organizations, the Association for Computing Machinery (ACM) and the Data Processing Management Association (DPMA) have made recommendations that colleges and universities establish standard curricula to satisfy the needs of students for education in information technology needed for present and future employment.

The purpose of the ACM developed curriculum is to establish a core curriculum that would be required for all computer science majors. After completion of this core material, students would be allowed to make their selection of electives in associated areas for more in-depth study, leading to wide range of potential career paths within the computer field. The basic orientation of the ACM program is to produce personnel who would be educated to become developers of basic computer hardware and system software technology. As shown in the ACM recommended curricula (1981, p. 120) the required eight core courses are:

CS 1. Computer Programming I;
CS 2. Computer Programming II;
CS 3. Introduction to Computer Systems;
CS 4. Introduction to Computer Organization;
CS 5. Introduction to File Processing;
CS 6. Operating Systems and Computer Architecture I;
CS 7. Data Structures and Algorithm Analysis;
CS 8. Organization of Programming Languages.

The DPMA also has a recommended curriculum that is tailored for the business environment. The DPMA curriculum portrays the requirements by education, knowledge, and abilities--tempered by the employment realities demanded by the data processing profession.

Adams and Athey stated the objective of the DPMA curriculum was to: "provide graduates with the knowledge, abilities, and attitudes to function effectively as applications programmer/analysts, and with the educational background and desire for lifelong professional development. Specific curriculum objectives that contribute to this overall objective are:

1. to provide understanding of the goals, functions, and operations of business organizations;
2. to provide understanding of the information needs and the role of information systems in these organizations;
3. to provide the analytical and technical skills for identifying, studying, and solving information problems within organizations;
4. to provide communications and human relations skills for effective interaction with organization members, especially with the users and developers of information systems;
5. to provide knowledge and ability for effective management of information systems projects;
6. to instill a professional attitude and seriousness of purpose about Computer Information Systems as a career field; and
7. to provide the background for further study of and professional advancement in the field of Computer Information Systems.

The model curriculum presented here operationalizes these objectives through an integrated set of courses corresponding generally to the major activities of the systems development life cycle, along with other courses dealing with the hardware, software, applications, organizational managerial, and business aspects of systems development" (1981, p. 10).

To fulfill the selected objective, the DPMA has specified seven required computer courses, eight required business courses, and a selection of electives to complete the DPMA Computer Information Systems Curriculum.

In addition to the recommended curricula, both the ACM and

the DPMA have established criteria to be used in evaluating and certifying colleges and universities that meet the requirements for preparing students in information technology.

At the time this report was prepared, there was no universal college or university established standard curriculum for either computer science or information processing.

Dunn (1983) points out that presently, industry and government agencies are spending about 100 billion dollars annually for in-house training of their employees. This means that they are using thousands of educators to ready their employees for job success. Cetron (1983) pointed out several high-tech areas in which educators at all levels should be concerned about the present and future curricula in preparing students for the next decade.

Some academic areas of universities have responded to the need in information high-tech by developing and offering programs. Computer courses have been included in many business schools for more than a decade. Other professions by necessity will follow this trend according to Hudson (1982).

Just as businesses have adapted to many rapid technological changes, universities must also adapt in order to prepare students for careers in our information age post-industrial society.

The necessity for change within education seems certain according to excerpts from the Task Force Reports (TFR) on "Action for Excellence". Hunt concluded that "It is the thesis of this report that our future success as a nation -- our national defense, our social stability and well-being, and our national prosperity -- will depend on our ability to improve education and training for millions of individual citizens" (1983, p. 15).

Hudson emphasized the need for high-tech education by saying: "To manage technological change, we must manage our human resources better" (1982, p. 824). Rider stated "Today's automated office systems and their electronic work stations require trained, professional personnel to staff them. This places new demands on educators to prepare their students for the workplace" (1983, p. 215).

Technological changes are requiring more training for the average employee than was true in the past. As sociologist Baldridge indicated "Service industries require more skills, so your job will probably require more education and training than your father's" (1975, p. 373). Cetron (1983) asserted that many computer-related areas will require changes in current curricula if educational institutions are to make available graduates educated for the future. The increased need for education in high-tech areas has given education an important and significant place in preparing persons for the future.

Developing knowledge and skills with computers must be made a fundamental part of any university's performance. Estes and Watkins stated: "Information, our most precious resource in education, can be better managed, more creatively configured, and more comprehensively retained than ever before through the use of computers" (1983, p. 28).

Computer Related Professions of the Future

The information revolution and the associated technological developments have created and will continue to create many new opportunities for employment for those who are able and willing to acquire the necessary skills. The emerging careers of the information age will be different in many ways from those of the past, and will require skills and training which have been in short supply.

Hart (1983) stated that by the year 2000, approximately 45 million positions will have been affected by the computer revolution. Cetron (1983) predicted that the information age participants in the United States will require 112.4 percent more computer systems analysts and 77.2 percent more computer programmers by 1990. Furthermore, Maloney related: "by 1990 this county will need 60 percent more computer programmers, 80 percent more systems analysts, and more than twice the number of computer service technicians available today" (1983, p. 120). The number of personnel involved in computer usage will increase significantly in the next 10 years. The 1984-85 edition of the U. S. Department of Labor's Bureau of Labor Statistics, Bulletin 2205, stated that "Employment of programmers is expected to grow much faster than the average for all occupations through the mid 1990's" (1984, p. 179). Bulletin 2205 also contained the following: "Job prospects should be best for college graduates who have had computer related courses, particularly for those who have a major in computer science or computer information systems and experience or training in an applied field such as accounting, management, engineering, or science" (1983, p. 180).

Maloney predicted: "Individuals with computer based training will prosper in the years to come" (1983, p. 120). Business Week related the following description: "More than programming is needed. Business graduates with problem solving skills who have computer training are what is wanted now" (1982, p. 29). Dunn (1983) pointed out that the complexity of today's world necessitates a systems analysis perspective to problem solving, taking into account the total knowledge base. Feingold explained that those who teach information science "Educate others in the planning, design, management, evaluation, and use of the total information process" (1983, p. 10).

Training for future jobs as a programmer, programmer analyst or systems analyst will require a minimum preparation of a four year degree according to Athey and Wagner (1979). According to Crawford a practical step for a university, faced both with the overwhelming needs of the future for properly trained employees and also with the obsolescence of some of the currently taught subjects, should be to develop "a core of courses in applications programming, systems design and systems analysis" (1980, p. 37).

Computer programmers are usually responsible for writing the step by step instructions a computer must follow to do some required task, such as organize data or solve a problem.

Crawford stated that programming: "Requires a background emphasizing the technical skills and knowledge areas associated with a computer and its system software" (1980, p. 35).

In systems design, one must know not only programming activity, but also up-to-date knowledge of the technology available for use as systems components. Systems analysis requires the training of a systems designer plus an emphasis on problem solving.

Feingold (1983, p. 10) noted that throughout history, new careers have emerged and others have become obsolete. At this time, the change in careers is most dramatic. Cetron presented his viewpoint as follows: "One thing is certain about tomorrow's job market: dramatic shifts will occur in employment patterns" (1983, p. 15).

One possible conclusion to the foregoing analysis could be, that currently as well as in the future, what will be needed is more than just computer literacy. Couger defines computer literacy as consisting of the following, "A basic understanding of what a computer is and what it can and cannot do. The achievement of a minimum level of skill in the programming of a computer in an easy to learn language. A basic understanding of the application potential of the computer to a student's discipline and major, including computerized analysis and support for decision making. A basic understanding of the impact upon society, both positive and negative, brought about by fast yet inexpensive computers. The curriculum would include legal and ethical issues" (1982, p. 2).

Quinn, Kirkman, and Schultz emphasized what will be needed is beyond computer literacy. They stated: "Unfortunately, computer literacy is already a ghost of education past. Students and adults of the information society need knowledge, skills, and attitudes far more generic and pervasive than simply those required to operate a computer terminal or use a basic computer language to program a microcomputer. Most important, they need to focus on the concepts and skills of information management rather than on a body of content reflecting today's microcomputers" (1983, p. 38).

Some colleges and universities, particularly in business schools, are taking appropriate steps to train the professionals of the future. A major study by Horn, Pierson and Nord has concluded by stating "Survey findings reveal that Computer Information Systems programs now exist in the majority of participating AACSB-accredited schools which participated in the study. The percentage of the schools offering such programs will increase by more than 33 percent over the next three years if current institutional plans are implemented (1984, p. 15).

In conclusion, the future expected increase in computer usage is bringing with it an increased demand for properly trained personnel, particularly programmers and systems analysts. We anticipate universities, businesses and government agencies to facilitate the computer revolution by providing the necessary training. Their training must go beyond simple computer usage to an understanding of total information management.

Though a general outline of basic courses has been suggested by the ACM and the DPMA, further study should be done in two areas. These are:

1. Assessment of needs of individual sectors, such as business, government, and education in order to tailor training to satisfy their specific needs.
2. How to better integrate computer usage and applications into various fields of study within colleges and universities.

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