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ABSTRACT

This report is one of seven that identify major new and emerging technological advances expected to influence major vocational education program areas and to describe the programmatic implications in terms of skill-knowledge requirements, occupations most directly affected, and the anticipated diffusion rate. Chapter 1 considers technology as process, the relation of technology and productivity, and technology as the arbitrator of work. The first of three sections in chapter 2 presents the procedures used to identify and clarify the most innovative, new, and emerging technologies with implications for vocational education. Brief descriptions of the technologies expected to affect distributive occupations are included in section 2. Section 3 contains seven essays describing these new and emerging technologies with implications for distribution occupations: microelectronic monitors and controls, personal computers, inventory control systems, marketing and technology, database systems, advances in household appliances, and videotex systems. Chapter 3 is an annotated bibliography with citations descriptive of new or emerging technologies, their diffusion, or insights as to their vocational implications. (YLB)

TECHNOLOGIES OF THE '80s: THEIR IMPACT ON DISTRIBUTION OCCUPATIONS

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FOREWORD

Productivity is a critical economic concern. Sagging productivity growth coupled with rising costs and heightened foreign competition are placing American business and industry in an increasingly vulnerable position. In an effort to strengthen its competitive position, American business and industry is investing heavily in capital-intensive technology. However, productivity is people-dependent and its improvement conditioned upon their possessing the technical and organizational skills necessary to utilize technology to its fullest advantage. The development of the work skills required to contribute to the revitalization of America is the central challenge to vocational education.

This report is the result of a contract with the U.S. Department of Education, Office of Vocational and Adult Education to investigate the changing role of vocational education resulting from new and emerging technologies. It identifies the major technological advances expected to influence each of the major vocational education program areas and describes the programmatic implications in terms of skills-knowledge requirements, the occupations most directly affected and the anticipated diffusion rates.

An associated project report, "Working for America: A Worker-Centered Approach to Productivity Improvement," is devoted to an examination of worker-centered productivity and a discussion of the organizational and educational strategies for its improvement. A companion monograph entitled "Vocational Education: Its Role in Productivity

Improvement and Technological Innovation" describes the relationship between productivity and technology and presents mechanisms for state vocational education agency use in productivity improvement and technological innovation.

Technologies described in this paper range from the "hard" technologies with industrial applications, (e.g, robotics and computer-assisted design and manufacture), to "soft" technologies such as alternative work scheduling; (e.g., flexitime, job-sharing); or worker participation in management; (e.g., quality control circles, quality of life groups). Both "hard" and "soft" technologies can be expected to bring rapid and radical change to workers involved in their use. Some technologies may affect only one vocational education instructional area. The effects of other technologies will be felt in several or all of the vocational education instructional areas in varying degrees. In either case, vocational educators must take action to assure the inclusion of the skills demanded by these technologies in their instruction in order to meet the job challenges of the near future.

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CHAPTER I

TECHNOLOGY--THE FORCE FOR CHANGE

TECHNOLOGY AS PROCESS

Technology means many things to many people. Some see technology as the driving force propelling society into the future. Others view it as evidence of an engulfing mechanistic materialism that threatens to destroy our humanistic values. Workers fear that technological advancements will take away their jobs and render their skills obsolete.

All of these are in part true. Undoubtedly, technology influences the future growth and direction of society. Technology is mechanistic and may be used to the detriment of human dignity. Indeed, technological advancements do render certain job skills obsolete. These conditions, however, speak more to the results of technology than to the nature of technology itself.

Technology in essence is the application of information, techniques and tools to material resources so as to achieve desired ends. At the societal level, these desired ends translate into a mix of material goods and services required to satisfy society's wants. Technology provides the ways and means for producing the desired stock of goods and services. Since production implies the use of resources to create products of value, technology provides the means to convert natural resources into material wealth.

Technology, then, can be regarded in the abstract as the process used by a work system to convert inputs into outputs. A work sys-

tem can be defined as any organization that expends energy (work) to convert resource inputs into outputs in the form of goods and services. Work systems may be defined at any level from society as a whole to a work group at the department or subdepartment level of firms and organizations.

The notion of a work system as an input/output system is shown in Figure 1.

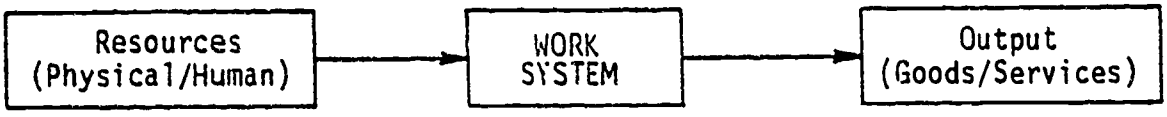

Figure 1. Input/Out Model

As indicated, inputs enter the work system, work in the form of energy expended is performed, and inputs are translated into outputs in the process. The process or rule for translating inputs into outputs is in the essence what is meant by technology. Thus, for any work system, the prevailing technology determines what outputs will be produced as a function of inputs. In the most general sense, technology can be regarded as an input/output function. Technology is not to be equated to either the inputs nor the output products of the work system. Rather, technology is the correspondence rule that determines the outputs resulting from a specific level of input.

Inputs into a work system are the resources used in the process of production. These resources in the most general sense are labor,

capital, materials and energy which are frequently referred to as the factors of production. Output of a work system is measured in terms of goods and/or services produced. Using these definitions of input and output, technology can be regarded as the function that maps or transforms the factors of production into goods and/or services produced. In economic terms, this function is called a production function and expressed as:

$$\text{Technology} = \text{Production function}$$
$$= F(\text{labor, capital, materials, energy})$$

Technology, considered as a production function, constrains the way the factors of production combine to produce an output of goods and/or services. For example, technology as process determines the unique contribution of each factor of production with the other factors held constant and determines the impact of substituting one factor for another. Factor substitution occurs when one factor such as capital is used in increasing amounts as a substitute for another factor, such as labor. The important point is that it is the current technology that determines how the factors are inter-related and the relative output contributions of each factor.

Suppose now that an increase in the output of the work system was observed even though all factors of production were held constant. The only way this could occur would be for the production function itself to change. Since technology is equated with the production func-

tion, this is defined as technological change. Technological change occurs when efficiencies in the production process allow for increased output without the necessity for more input resources to be used. Thus, if a change in output accrues from training workers to work smarter, but not harder, then a technological change can be said to occur, provided that the increase resulted from more output per unit of labor expended rather than more units of labor being expended (working harder). In a similar manner, technological change can result from any alteration in the production process that results in more output per unit of factors of production used.

Typically, technological changes result from the introduction of labor saving devices. These devices, in the form of equipment and/or tools, make it possible to glean increases in output per hour of labor input. The effect is to alter the production function so as to reflect the increased contribution of labor to production output. Technological change can also result from changes in the managerial and work structure that result in improved output contributions from one or more factors of production. Because of the multitude of sources, the technology of a work group is in a continual process of change. Thus, technology evolves through incremental changes as the work system seeks to fine tune the process through improved production efficiencies.

Periodically, conditions arise that substantially alter the organization of work systems. Responsiveness to these conditions requires that the work systems, to survive, must adopt a new production function. Production functions that differ in form are termed techno-

logical innovations and are to be differentiated from technological changes. Whereas technological change is associated with incremental evolutionary changes in the production function, technological innovation signals a discrete shift from one form of production function to another. This discrete break with the past generally is associated with the introduction of a revolutionary new process that allows resource inputs to be combined in an unprecedented manner. Radio, and later television, advertising is one example, allowing distributors to reach new markets beyond the ranks of newspaper readers. The impact of these and other significant innovations is to recombine the factors of production in a totally new and significantly more productive fashion. Thus, whereas technological change is evolutionary, technological innovation tends to be revolutionary in its effects.

TECHNOLOGY AND PRODUCTIVITY

Productivity of a work system is typically defined as the ratio of system outputs to system inputs. Productivity increases when more outputs are produced per unit of input. Increased productivity makes possible an increased amount of goods and services per unit of factors of production used and results in an improved standard of living, increases in real income and strengthened price competitiveness. For an expanded discussion of productivity, see the companion project report "Working For America--A Worker-Centered Approach to Productivity Improvement" (CONSERVA, 1982).

The relation of technology and productivity flows from an examination of the definitions of the two concepts. Productivity of a work system can be defined for all factors of production used simultaneously, or each individual factor of production can be considered separately.

(a) Total Factor Productivity = $\frac{\text{Work System Output (goods/services)}}{\text{Total Resources Used (labor, capital, materials, energy)}}$

(b) Labor Productivity = $\frac{\text{Work System Output (goods/services)}}{\text{Labor Resources Used}}$

(c) Capital Productivity = $\frac{\text{Work System Output (goods/services)}}{\text{Capital Expended}}$

(d) Materials Productivity = $\frac{\text{Work System Output (goods/services)}}{\text{Materials Used}}$

(e) Energy Productivity = $\frac{\text{Used System Output (goods/services)}}{\text{Energy Consumed}}$

Recall that technology was defined as the production function F(labor, capital, materials, energy). Whereas technology is the function itself, a specific output corresponding to an input of L-units of labor, C-units of capital, M-units of materials, and E-units of energy is dictated by the technology and designated as f(L,C,M,E). By substituting for the output, the productivity definitions can be rewritten as:

(a) Total Factor Productivity = $\frac{f(L,C,M,E)}{L+C+M+E}$

(b) Labor Factor Productivity = $\frac{f(L,C,M,E)}{L}$

(c) Capital Productivity = $\frac{f(L,C,M,E)}{C}$

(d) Materials Productivity = $\frac{f(L,C,M,E)}{M}$

(e) Energy Productivity = $\frac{f(L,C,M,E)}{E}$

Technological change influences the productivity of all factors of production by altering the value of the production function f(L,C,M,E). If the change in technology results in a positive increase, then productivity will also increase accordingly. The explanation is that technological change makes possible increased outputs of goods and services without a corresponding increase in resources used. This increase in the stock of goods and services available is translated into an increase in the standard of living as more wealth is available for distribution. An expanded standard of living creates demand for additional products and services which provides work for more people. Additionally, increased productivity allows goods and services to be priced more competitively since increased productivity lowers per unit production costs. Price stability is beneficial in that it is anti-inflationary and contributes to our ability to compete on the international market.

TECHNOLOGY AND WORK

Technology is the great arbitrator of work. It is technology that specifies how capital goods can be used by workers to convert raw materials into finished products. It is technology that determines the range of human skills and abilities necessary to use the capital goods as production tools. It is technology that specifies the appropriate materials for which the tools can be used and the energy required for their use.

Whereas technology sets the stage and writes the script, it is management that directs the production. Management's decisions determine the desired mix of labor and capital, the rates at which labor

and capital will be utilized, the quantity of labor, capital and materials used and the extent of substitutability between elements of labor, capital and energy. It is also management's responsibility to maintain a management climate that facilitates the most efficient and coordinated use of labor and capital. For a discussion of the impact of management climate on productivity and suggested strategies for development of a worker-centered approach to productivity, see the companion project report "Working for America--A Worker-Centered Approach to Productivity Improvement," Chapter III, (CONSERVA, op. cit).

Innovations incorporated in new capital goods tend to spearhead technological change and innovation. The latest advances in knowledge and theory tend to be embodied in the design and structure of new capital equipment. Innovations and capital goods design have direct implications for labor as a factor of production.

These implications affect not only the human skills requirements, but also the very organization of work itself. Human skills requirements may be relatively unchanged in those cases where new advancements were made without basically altering the production process. A typical example might be the development of various paper forms and filing cabinets for easy handling of orders and receipts. In this case, the advancement could be basically incorporated into the existing process and would require minor alterations in human skills requirements. Contrast now the powerful computer systems available to small companies and retail stores that through product number coding (often "read" by a light scanner) can not only itemize and print a bill of sale, but can also produce a printed inventory record or even automatically reorder low stock items. In this example, the very organization of work itself has been drastically changed with consequent

changes in the nature and intensity of human skills requirements. This represents a dramatic illustration of the distinction to be drawn between technological change and technological innovation.

The press for technological innovation is strong and mounting in intensity. Productivity growth is sagging in the country, having fallen from an average annual rate of increase 3.1 percent in the period 1948-58 to a mere 0.7 percent for the period 1974-81. (Statement of the Chamber of Commerce of the United States on Productivity, April 2, 1982). There is near universal agreement that the lack of capital has been one of the major causes of this decline. As Lester Thurow, a noted expert on productivity, states,

> The amount of equipment per worker--the capital-labor ratio--is a key ingredient in productivity growth. Better-equipped workers can produce more output per hour, but new capital is also a carrier of new technologies. To put new, more productive technologies to work, workers must be provided with the equipment that embodies those new technologies. Without this additional hardware, or "physical capital," it is impossible to translate new knowledges into new output (Technology Review, November/December 1980, page 45).

In the area of foreign trade, the United States is in the process of moving from being a net exporter to a net importer in major categories of industrial output. As shown by a study recently conducted by the Department of Labor, of the top 17 U.S. export commodities, losses in the world market were experienced in 14 of the commodities. Between 1962 and 1979, the U.S. trade position had deteriorated such that market losses had been experienced in all 17 of the top export commodities. (Congressional Hearings, December 1980 and January 1981).

The report attributed the decline in U.S. international competitiveness to changing supplies of world resources and diminished technological capabilities. The rate of growth of the capital-labor ratio, a measure of the amount of capital available per worker, declined to such an extent that the United States fell from first to sixth in terms of capital available per worker. The United States' share of world capital fell from 42 percent in 1963 to 33 percent in 1975. During the same time, Japan doubled its capital from 7 to 15 percent of the world's share. As the U.S. stock of physical capital fell, so did its human capital. According to Department of Labor analyses, the United States fell from second to seventh in terms of percentage of skilled workers in the labor force-with the U.S. share of skilled workers falling from 29 percent to 26 percent. (Congressional Hearings, December 1980 and January 1981, op. cit.).

As a compounding problem, the United States is reported to be experiencing a severe shortage in skilled labor. In a widely quoted report, the Department of Labor projects average annual training shortfalls in excess of 250,000 persons per year for the next decade (U.S. Department of Labor, 1980). These are regarded as minimum estimates since they result from inclusion of only the 13 occupations with the greatest projected shortages. The Task Force on the Skilled Trade Shortages, which represents a coalition of 13 metalworking industries, estimates an anticipated need for 240,000 journeyworkers in the metal trades by 1985. (America's Skilled Trade Shortage: A Positive Response, 1981). The American Electronics Association, in a survey of its members, projects a need over the next five years for approximately 113,000 technical professionals in eight job categories and an addi-

tional 140,000 technical paraprofessionals in 13 job categories. (Shortages in Skilled Labor, November 3, 1981).

America stands at an economic crossroad. In the face of impending labor shortages, American business and industry can follow one of two major courses--one will be business as usual. If that philosophy prevails and a labor shortage materializes, per unit labor costs can be expected to increase, leading to increased prices as businesses seek to maintain their profit picture. Continued sluggishness in capital investments, coupled with the shortage of skilled labor, will dim any prospects for productivity improvements. As a result, inflation can be expected to escalate, our standard of living to diminish, our foreign competition to increase, and the United States will be well on its way to becoming a second-rate power.

As an alternative, the United States can make a significant investment in labor-saving capital in an effort to reverse the productivity trends and to regain the competitive edge. If the strategy is undertaken with vigor, the implications can be profound. Unlike the early '60s when the concern for the effects for technology proved to be unfounded, the United States currently stands on the brink of a technological revolution drawing its force from the emergence of the microprocessor and its ubiquitous applications. Microcomputers acting as telephone terminals can now link producers, distributors, even consumers in directly-accessible networks of advertising, sales, and product service.

America is rapidly shifting from a manufacturing to a service-based economy. In 1950, nearly one out of three non-agricultural work

ers was employed in manufacturing, and only one out of eight employed in services. By 1980, only 22 percent of the non-agricultural work force was in manufacturing as opposed to nearly 20 percent in services. In terms of percent change in employment for the three decade period, manufacturing increased a scant 33 percent in contrast with a 231 percent increase for services (Impact of Technological Change, 1981). The shift is being experienced both in international as well as domestic markets. While we are becoming a large net importer of manufactured goods, the United States now exports about $60 billion worth of services a year. This qualifies the United States as the largest exporter of services in the world, exporting nearly 25 percent of the world's service base. (Presentation of Dr. David L. Birch to the Council of Upper Great Lakes Governors, March 5, 1982). As a consequence of our changing service base, capital investments to facilitate handling and communication of office information can be expected to increase. New capital innovations can be anticipated in the areas of advanced word processors, electronic methods of reproduction and transmission of images and other electronically-augmented telecommunication devices.

The impending technological revolution will not be expected to be entirely bloodless. The transition from a manufacturing to a service economy can be expected to have severe short-run implications for those whose skills have become obsolete because of changes in technological demands. Whereas job displacements may be regarded as but minor perturbations in society's overall growth, they represent crises of major proportion in the lives of those who are experiencing them. In order to ease the transition and to contribute to the more effective and best productive use of our human resources, it is incumbent that quality

skills training be provided that is attuned to the demands of emerging technology needs and available to all those who can profit from its exposure. The extent to which vocational education rises to meet these needs will determine the contribution that vocational education makes to the revitalization of the economy and the continued prosperity of society.

CHAPTER II

NEW AND EMERGING TECHNOLOGIES

Vocational education to be responsive to the demands of forthcoming technology must become increasingly aware of the nature of these technologies and their associated training requirements. In recognition of this need, CONSERVA, Inc. was awarded a contract by the U. S. Department of Education to identify the most innovative, new or changing technologies and to assess their occupational implications for specific vocational education program areas. The procedures used to identify and clarify technologies are presented in the first section. Brief descriptions of the identified technologies are included in the second section. Cameo reports describing the major new and emerging technologies with implications for Distribution occupations are provided in the third section.

IDENTIFICATION AND SELECTION PROCEDURES

In order to identify new or changing technologies with implications for vocational education, project staff reviewed recent years' issues of several hundred different business, trade/industrial, and technical periodicals seeking information concerning technological change or its impact.

In reviewing published articles for possible relevance, three basic characteristics were considered. First, there must have been evidence that the technology is currently being used in the "real world"--i.e., that it is not still "on the drawing board" or futuristic. Second, the technology must have appeared to have direct or indirect

implications for the way work is performed, and must impact skills within the training domain of vocational education. Finally, trend projections or other indications were sought as evidence that the technology was being increasingly used, implying greater numbers of jobs affected and resulting importance to vocational educational programming.

Having identified a set of technologies which are new or emerging, which promise growth, and which appear to impact job training, project efforts focused on the possible vocational implications of the technology. The implications were defined in terms of job activities affected, knowledges and skills required to carry forward these job activities, and special equipment or facilities (cost considerations) which might be necessary to instruct vocational students in the technology.

As a means of obtaining technology-specific information, outside experts were sought whose backgrounds and performance records qualified them to speak with authority about specific technologies and their training implications. For each of the identified technologies within a specified vocational education program area, a knowledgeable individual was invited to author a brief, nontechnical essay oriented to vocational education.

Since certain technologies have rather broad occupational implications, authors were allowed discretion as to which occupations or tasks they would emphasize. In making their decisions, authors were requested to consider the developing technology from a training and instructional perspective. Specifically, authors were asked to address the following areas:

- Work activities which involve the technology --

  The kinds of major duties or activities that may be new, changing, or developing as a result of the new or changing technology, with reference to the occupations under discussion.

- Knowledges and skills essential or important for productive completion of such activities --

  Knowledges are awareness of facts and process details, understanding of principles, etc., and "skills" are "hands on" abilities actually to carry out functions. The knowledges and skills to be covered were to relate to the work activity demands of the new or developing technology.

- Special equipment or facilities that would be required to teach such knowledges and skills --

  Aside from books, other usual instructional media, and standard educational facilities, any special devices (e.g., simulators or prototypes) or other capital that might be needed for instruction in identified knowledges or skills.

- Growth and trends in the diffusion or expansion of the technology --

  Observations of recent growth, and projections concerning likely near future expansion, of the technological innovations or changes, in business/industry/other applications that involve occupations under discussion.

TECHNOLOGIES EXPECTED TO IMPACT DISTRIBUTION OCCUPATIONS

Technologies selected for inclusion are those determined by application of the criteria to have programmatic implications for Distribution occupations. Brief descriptions are presented below. The purpose of these descriptions is to generally and summarily define the technologies being discussed by the experts.

By Microelectronic Monitors and Controls is meant those components of larger systems which may automatically control parts of the larger system, or which can monitor and display to human operators indications of what's going on within the system and transmit operators' instructions to the system. New graphics, voice recognition and synthesis, and sensor capabilities are among the advances in this technology area.

Microcomputers or Personal Computers, also called "desktop" computers, are by now somewhat familiar to us all. Small-sized and affordable by comparative standards ($5,000 or less will buy a sophisticated system), these machines incorporate many of the logical capabilities of larger computers and can be programmed to perform many of the same sorts of tasks. This is made possible by microprocessor technology. Microprocessors, based on large and very large scale integrated circuits, have sometimes been called "computers-on-a-chip." Microprocessors are used not only in microcomputers but in many other "hardware" systems which can then perform computer-like functions.

Database Systems are computer systems and programs which help organize, update and transmit information, particularly selected subsets of information culled from a much larger set called a database. Databases often contain a large number of "records" which are similar in structure but different in specifics. For example, a record may contain a person's name, age, height, weight, and so forth. If a database is formed from such records, the database system may be used to retrieve all or part of this information for a given individual, to list the

names of all individuals within a specified age range, to change or update records, etc. The master computer program which facilitates these information transactions to take place is called a database management system (DBMS). When information is handled over long distances in coordinated fashion (such as in confirming an airline reservation or in using a bank's teller machine), the process may be referred to as distributed data processing (DDP).

New technologies are influencing the development of Household Appliances. Improvements in energy efficiency, new appliance categories such as convection ovens and induction ranges, and advances in user control capability (for example, the ability to "program" a defrost and cooking cycle within a microwave oven) are of particular interest.

Advances in technologies of Marketing include both technical systems for the advertisement or distribution of products in new and effective ways, and organizational/strategic changes designed to promote the marketing function. The former are illustrated by point-of-sale equipment (product code scanning) and "electronic catalogues," the latter by the intrusion into the automated teller machine services market of non-banking firms such as department store chains.

Inventory Control Systems are technologies which facilitate the efficient and cost-effective movement of supplies and products to and from warehouses associated with sales or manufacturing firms. Computer technology and related advancements have made possible not only automated retrieval and reordering (e.g., through product numbering and scanning), but also more sophisticated methods of paring down inventories to the amounts needed and the better utilization of computational methods for controlling other inventory costs.

Videotex systems use modern television technology, broadcast and cable, to provide information selectively to subscribers--and sometimes to receive information back from them directly. Videotex is used as a generic term for such systems, and incorporates "teletext" and "viewdata." Teletext systems provide information to the viewer, while view-data systems, which depend on cable networks, allow information (such as consumers' product orders) to be sent back to the central system by the subscriber at home.

TECHNOLOGY ESSAYS

The following essays describe the new and emerging technologies identified as impacting Distribution occupations. The essays, while edited for consistency, remain basically the products of their authors. Sincere appreciation is expressed to the following experts who have so generously contributed of their time and expertise:

E. EDWARD HARRIS, Ed.D., is Director of the Office of Business Research in the College of Business at Northern Illinois University, and formerly Chair of the Department of Business Education and Administrative Services at that university. Listed in Who's Who in America, Men of Achievement, Outstanding Educators of America and other compendia, Dr. Harris has authored a number of books, monographs, and articles on marketing and on distributive education. Director of many research projects and consultation activities, Dr. Harris has held executive and board positions in a number of business and distributive education associations.

PAUL C. JORDAN, M.S.I.E., Ph.D., is a consultant in the areas of planning, design, and installation of systems to improve control of labor and other costs. Dr. Jordan is a specialist in engineering problem solving and operations management, and teaches a nationally-recognized seminar on Inventory Management. He is President of Jordan and Associates, Inc., a Raleigh, North Carolina-based consulting firm.

LIZA LOOP, B.A., is President of the LO*OP Center, Inc., a non-profit educational corporation involved in instruction design and technical assistance, Technical Coordinator for "ComputerTown, U.S.A.!" a computer literacy research and dissemination projected funded by the National Science Foundation, and Director of ComputerTown International, a companion project. Ms. Loop has been teaching and writing about education and computers since 1975, and has authored or produced several user manuals and guides for commercial computer and software vendors.

AUDREY S. STEHLE, M.S., is an independent consultant specializing in consumer education and product evaluation. With former positions in corporate home economics and consumer divisions, Ms. Stehle's present professional activities include the development of educational materials and programs, product sales training, and the development of consumer-oriented use and care information for new product lines.

FRANK A. VIGGIANO, Jr., Ph.D., is an Associate Professor of Consumer Services with the School of Home Economics, Indiana University of Pennsylvania. Consultant to a number of firms, Dr. Viggiano has also written articles on modern products in popular media, produced and appeared on consumer-oriented television shows and series, and developed curriculum outlines and materials for Consumer Electronics.

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MICROELECTRONIC MONITORS AND CONTROLS IN DISTRIBUTION

by
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The integration of electronics in many products has sharply increased throughout the world in the last decade. Engineers have included microelectronics in many products to 'control' and monitor the device. Microelectronic reliability, cost, servicing, programming and versatility far exceed the mechanical controls to which we are accustomed.

The use of microelectronic technologies to improve the benefits and capabilities of products will spawn an ever increasing need for qualified individuals to distribute these products to the end users. Within the distribution chain each link (work activity) will be dependent upon those before and after it. Distribution positions impacted by the abundance of electronic goods and services will include the following: Manufacturers/Sales Representatives; Wholesale and Retail Sales Representatives; Advertising Representatives; Public Relations Representatives; Marketing Managers; Merchandisers; Warehouse Managers; and Customer Service Representatives.

Each individual position will be vital to the successful total distribution of electronic goods and services. At the same time, electronic goods and services will affect every other distribution network of goods and services (due to microelectronic technological advances in communication, computers, inventory control, record keeping, etc.).

The electronics revolution promises many career opportunities in the future. Even though the electronics industry is still in its infancy, it will rise to one of the top five areas of employment in the next decade.

Basic areas of study in marketing, merchandising, sales, communications and so on, will continue to be essential. In addition to this general core of studies, Consumer Electronics Education will be on the new horizon. Topics should include:

- Audio and video equipment and accessories
- Personal electronics
- Security systems
- Computer technology
- Communications technology
- Digital electronics
- Information technology

Historically, the electronics industry has been dominated by males. Due to the influx of women and homemakers seeking professional employment and careers, the demand for skilled and qualified females to accept positions in the electronics field will mushroom. Traditionally, females have been ever-present in the production of electronic goods due to their psychomotor skills and articulate handwork in the manufacturing process. Because of the electronics revolution women will be needed to facilitate the sales, information, service and marketing of these products (specifically to other female purchasers who will desire these products to facilitate their lifestyles).

Electronic shopping will become a way of life. Time will not allow the purchase of all goods and services on a personal 'face to face' basis. Skilled use of computers, videodiscs, print and non-print media will be essential in order to provide consultation for the prospective buyer. Most goods and services will be evaluated by the common use of diagonal flat screen wall mounted television monitors.

For example, a consumer may be contemplating the purchase of a new appliance. Through the use of a home computer, a 'text' service will be available from manufacturers supplying that product. The consumer will request information instantly regarding the purchase; and, the large flat screen television monitor will provide a visual picture showing and discussing all aspects of the product. After the consumer has viewed the information, she or he will be provided with a toll free number to access additional information from a customer service expert. A list of local dealers or purveyors will also be available for consumer use. If the consumer wishes to order the product, he or she may request the item. Thus, a 24-hour shopping service will be available at all times providing around-the-clock access as well as employment. Innovative marketing, advertising, selling and related services are a few skills manufacturers will seek in employees to facilitate this electronic shopping system.

Concurrently, a full array of electronic products (computers, monitors, identifiers, coders, etc.) will be used by distribution workers. Since most of these products will perform control commands and display information through the use of microelectronics, a basic understanding of electronics terminology will be important. A consumer may ask the salesperson to explain what a 'microprocessor' is and how it

operates. Terms associated with the understanding of electronics should be included in a course of study:

- Analog
- Circuit
- Integrated circuit (IC)
- Digital
- Large scale integration (LSI)
- Metal oxide semiconductor
- Microprocessor (MP)
- Random access memory (RAM)
- Read only memory (ROM)
- Programming

The overall demand for careers in the distribution area will come from the discipline of Consumer Electronics. A multitude of electronic products which will become available will not only provide conveniences and benefits to the consumer; but, it will bring about the maturation of one of the most important industries to impact society in this century.

"PERSONAL COMPUTERS" AND DISTRIBUTION OCCUPATIONS

by
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The term "desktop," "personal" or "portable" computer usually refers to a stand-alone information processing, storage, and retrieval system. Such computers were often marketed and priced toward individual and very small business use. However, larger businesses are finding them to be a cost-effective alternative to the limited-function "dumb terminal" usually connected to a company's large computer. There is little to distinguish the technology of personal computers from those designed for larger business, scientific or engineering use. When you lift off the cover, a personal computer contains many of the same circuits and switches found in its larger brothers. Although many jobs will require workers to use the company's large "mainframe" computer, a working knowledge of how to use a desktop or portable computer will greatly enhance the understanding of each person. Those involved in the "information" end of these businesses will find training in computing to increase their productivity and chances for career advancement.

The distribution industries are being computerized from top to bottom in the 1980's. Much of the work done in distribution involves the handling of information, not physical objects. Here, electronic data processing equipment is replacing "paper work" to keep track of what products and services are delivered where, when. Inventory, sales reports, word processing, reservations, scheduling, and ticketing are all being done "on the computer." In addition, more and more automated equipment is being installed to do the physical moving of things. Computer controlled conveyor belts and vehicles, robots, and automatic

counting and weighing machines are becoming quite common. Direct contact with customers is being streamlined as more people bank through computer tellers, shop by mail, and travel on modern mass transit systems.

Workers in sales occupations will have to learn to teach. This is because jobs dealing directly with customers will undergo a subtle shift. Instead of simply selling and delivering goods and services, workers will be explaining to customers how to use the vast array of automated delivery equipment which will stand between the buyer and the desired item.

Every worker in wholesale and retail sales, advertising and marketing, transportation, recreation and tourism, and other activities involving the movement of goods and services will find his/her job affected by these new technologies. It is imperative that everyone entering these fields have a basic understanding of what computers can and cannot do and of how to operate them.

Personal computers can be the gateway to this understanding. All students headed for jobs in the distribution area need to become "computer literate." The personal or desktop computer is an ideal environment for them to learn to use computer tools and to develop the flexibility necessary to cope with the continually changing automated workplace. Some students will spend the majority of their working hours in front of the same type of computer they used in school. Others will encounter machines which look entirely different but operate according to the same general principles.

Computer technology changes so fast that the most important skill will be the ability to learn a new system easily. Learning to use a computer has much in common with learning a foreign language and with learning to play a musical instrument. These activities require one to acquire a new vocabulary, and to change one's habitual thought patterns slightly. Most important, once one has learned the second language, the third comes easier, and many people consider the fourth no trouble at all! In the same way, once one has learned to use any computer system, a second one will take less effort and the third and fourth won't be a bother at all.

KNOWLEDGE AND SKILLS

It is the computer software, the programs (sets of instructions which the computer follows) which determine what it can do. It is the "user interface," the sequence of buttons and keys to push combined with the messages the computer sends back via its display screen or voice, that determines how much education one will need in order to use the computer system. Even in the technology of software, the similarities between big and little computers are more important than the difference. Distribution workers will need to learn to use both.

The ability to adjust to a new set of symbols displayed on a screen, a different sequence of words to be typed, or a modified machine control panel is a matter of "mind set," of expectation. It does not depend on specific curricular materials. Broad experience with automated office procedures, with the operation of computer controlled devices, and with the limitations of computers in general will provide the

best background for these students. A general "feel" for the way computer hardware/software systems are constructed will permit this flexibility. Writing computer programs is not a skill that will be directly useful to the distribution worker except as a pathway to a different career. However, an understanding of the principles of programming in any language will help a computer user understand the limits of the computer system and dispel any tendency to attribute "magical powers" or "superintelligence" to the machine, allowing for a sophisticated, effective approach to the user interface. This is one meaning of "computer literacy."

Simple machine literacy will also be necessary. This means the student must develop an understanding of the contexts within which all electro-mechanical devices function. Connection to a power source, secure, clean, dry electrical contacts between devices, an unobstructed range of movement for all mechanical parts, knowledge of fuses, switches, speakers, CRTs (cathode ray tubes)--these principles will lead to safety and comfort within the automated workplace.

Also, a mastery of simple troubleshooting principles should be developed. For example, when the main computer system switch is turned on and the screen fails to light up, the student should be able to follow a logical check-out sequence to find out which part of the machine is malfunctioning. Is there power to the screen? Are the brightness and contrast controls within range? Is it connected to the computer? Is the computer really turned on? Is the computer software properly installed?

The easiest way to insure that a student develops these skills is to require that a desktop computer be used as a tool in preparing school assignments. Papers should be composed, edited, and printed by the student him or herself on word processing computers. Accompanying charts and graphs should be computer generated. Class schedules and degree requirements should be kept track of using a small information management system. This experience will be directly transferable to conditions in the workplace. Oddly enough, those controversial time-wasters--video games--provide an exceptionally rich environment for learning some of the motor and information interpretation skills which will be critical to the automated workplace.

SPECIAL EQUIPMENT

Any personal computer will do as a laboratory for computer use. Several different brands will give students an experience of the variety of hardware currently available and permit them to generalize about the characteristics common to all types of small computers.

A variety of application software should be presented--several different information management packages, for example. Users should be aware that there are many different approaches to each problem and that no one program will do everything. A computer program is not a "problem solver." It is one out of many possible solutions to a stated problem. As soon as a computer program is installed in the workplace, programmers begin looking for ways to improve it. Thus workers will discover the need to learn new procedures continually.

GROWTH AND TRENDS IN THE DIFFUSION OR EXPANSION OF THE TECHNOLOGY

Computer systems of all shapes, sizes and capacities are being heavily marketed today and we can expect almost complete penetration into the distribution industries in the next three to five years. Thereafter, the sophistication of the devices will increase. Systems will get smaller, cheaper, less fragile and easier to use. At the same time, jobs will require more reasoned thought, more "creativity," and more human judgement. The number of jobs available in offices and transportation facilities is not likely to change radically but productivity will mushroom and educational level will rise.

INVENTORY CONTROL SYSTEMS

by
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In 1971, a typical company with annual sales of $14 million spent $1 million annually on computer hardware and software. Today, computer hardware costs are less than one-tenth the costs of 1971, and many management information software systems have been "packaged." Small home computers are becoming commonplace. Likewise, small businesses now have the computer hardware technology available, economically, for management assistance. What is not readily available is the vocational training to permit these small businesses to implement systems to control inventory.

The absence of controls on inventories adversely affects the nation's productivity in several ways. First, large swings in the inventories of U.S. producers most often result in a lower utilization of production facilities when inventories are being reduced. Idle production capacity is lost productivity. Another effect of uncontrolled inventories is the tying up of financial resources in excessive inventories, denying these resources for other productive outlets. A third outcome of poorly managed inventories is the "scrapping" of products due to their technological obsolescence. This is true today and conceivably will be more critical in this decade as competition for markets increases; large inventories of rapidly changing products are most vulnerable to technological obsolescence.

Better control of inventory can drastically improve the productive use of resources for hundreds of thousands of businesses. It is

not surprising that Japan has achieved much of its productivity increases through better utilization of its material resources. Providing small business in the U.S. with the knowledge of how better to control inventories can significantly improve national productivity. Implications for work involve the general managers/owners of small businesses, as well as decision-responsible personnel in sales/service, merchandising, and finance, in business enterprises which produce products for sale.

In considering technologies which are of significant importance to the quest for efficient minimization of inventory, attention should be given to the determination of when and how much to order of materials and parts used in the manufacture of products. A discrete materials acquisition scheme called MRP (for Materials Requirement Planning) can be useful. Additionally and in general, both old and new lot sizing techniques deserve examination.

MRP-type systems came into use only within the last several years, made possible by the powerful computer systems newly available to the smaller businesses. Such systems consist of software programs to help schedule materials requirements against both quantity and time period of actual manufacturing needs. In contrast to reorder point systems, where parts and materials are reordered in standard quantities when stock falls below a given level, MRP scheduling attempts to match true "real time" need with specific ordering, thus eliminating the financial penalties of advance-of-use stocking and of potential obsolescence or other change in manufacturing requirements which may decrease the value of pre-ordered stock. MRP systems provide the ability

to produce an expanded bill of materials specifying exact quantities needed and dates required, to meet actual orders and manufacturing deadlines, of the many items that may be used at different stages of production.

The justification of complex MRP-type systems in many companies is weak if the total benefits are weighed against the costs. A recent survey by a consulting firm of 1,480 firms around the world indicated that only 42% of MRP users considered the results satisfactory, and only 12% regarded their effort to improve inventory control as fully effective. One reason for this attitude is the need to control capital costs. The motive behind the provision of these systems by computer companies is not the reduction of inventory for the customer but the sale of computer hardware, and manufacturers of hardware have used software packages to sell it. In many cases these packages tend to be more complex than necessary to justify expensive hardware. Another difficulty with implementing MRP systems is reliance on parts and materials vendors to deliver on time; since the system expects to use the goods on certain dates and does not plan for their acquisition until needed, delay in critical components can bottleneck the larger production schedule.

A separate dimension of useful practice in inventory control also concerns the determination of how much to order, using techniques commonly referred to as lot sizing. Very generally, lot sizing involves cost minimization when both costs of inventory and costs of ordering are considered. The more ordered at one time, the greater the inventory costs but the less the ordering costs per item. Several factors,

including interest rates and anticipated demand, contribute to the computation of minimum joint order/inventory costs. These methods tend to be well-known only in high academic circles. Yet while the economics governing the developmment of advantageous formulae are complex, the resulting equations are usually rather simple. Especially with the advent of small business computers, but even without this commputational assistance, productive use of most appropriate lot sizing techniques is within the potential capability of managers with knowledge of elementary algebra, and they should be more widely taught. While many useful models are available, few companies, including the largest, have been made aware of these techniques. For example, the materials manager of a giant telephone equipment producer, employing 10,000 people at his location, knew only one lot sizing model.

Some forecasters for the 1980's foresee interest rates as high as 40%. Few predict interest rates below 10%. Inventory control for small businesses is essential for their prosperity. The technology is available today to permit rapid employment of these controls. Though the prospects for more widespread use of MRP-type systems remains uncertain due to the problems noted above, business managers should be aware of the philosophy, potential benefits, and difficulties involved with such systems, and how they are implemented. Reorder point inventory systems will remain in widespread use for the near future at least, and distributors should be familiar with the costs and benefits of these operations as well. Finally, those concerned with controlling the costs of ordering and inventory should be taught principles and various methods of lot sizing.

Specific activities related to inventory control technology will include:

- Inputting data into the computer;
- Keeping records of past demand for each item in inventory;
- Providing a discrete identification number for each inventory item;
- Using a reorder point inventory system;
- Using the capabilities of an MRP-type system;
- Employing lot sizing formulas to determine how much to order; and
- Keeping accurate records of all inventory transactions (i.e., receipts, sales, damage).

The skills and knowledge required to support these activities include:

- Working knowledge of a reorder point inventory system;
- Knowledge of the use and limits of MRP-type systems;
- Working knowledge of several lot sizing formulas;
- Knowledge of how to input and retrieve data from a computer; and
- Up-to-date information on interest rates.

The basic hardware required for teaching inventory controls to small businesses is simply a mini-computer, with appropriate software.

MARKETING AND TECHNOLOGY

by
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There will be no shortage of jobs in the next decade in the field of Marketing, only a shortage of creative, imaginative people to fill them. The Bureau of Labor Statistics predicts that by 1990 an active economy will have created almost 20 million new jobs. Much more than half of them will be in white collar occupations including professional and technical workers, managers and sales people. More than two million new jobs will be created for business managers, largely as employees of corporations and chain operations.

The demand for sales people will remain strong despite the increasing automation of sales counters. There will also be almost four million new service jobs created. By 1990, 73.8 percent of the nonfarm work force will be employed in service-producing jobs, with 23 percent of the population employed in wholesale and retail trade; another six percent in finance, insurance, and real estate; 5.4 percent in transportation and utilities; and 21.5 percent in other service businesses. Add to the 20 million jobs created in the 80's, the 47 million to be vacated through death, retirement and other reasons, and the number of jobs increases to a respectable 6.7 million per year.

Marketing, along with production and consumption, is one of the nation's three leading economic activities. Our system of mass production is based on an efficient system of mass distribution. If marketing fails to achieve its maximum efficiency, our national economy will fall short of reaching its full economic potential.

Employment in marketing, now at an all-time high, will increase faster than in most other occupations. By the year 2000, it can be estimated that approximately one-third of people employed will be working in the field of marketing. Moreover, the advancement of technology and growth of incomes will increase this figure, with fewer workers needed to produce goods and services and more needed to market them. The demand for persons trained in marketing, therefore, will continue to be strong and is expected to gather momentum. Employment opportunities in the field of marketing can be most accurately described as being highly diversified. This is brought about partly because of the complexity of the field of marketing. As in most complex occupational fields, there is a wide array of job opportunities in the field of marketing. Some jobs require a few simple competencies while others require extensive training and education.

Early events in the decade promise many challenges and more than a few problems, both social and economic: shortages of energy and the related high costs of transportation, environmental problems, lagging productivity, persistent inflation, and a slowdown in research and development. With technology doubling every three to five years, it is little wonder that education of a marketing employee in the 1980's will be obsolete in the near future unless retrainings take place to keep pace with the changing technology. Ultimately, the nation's education system will have to prepare future workers for functioning in an electronic society.

While space does not permit us to review all of the technological changes predicted for the near future that will have impact on

the field of marketing, highlighted below are a few of the technological changes that will have a major impact on the field of marketing.

The utilization of paper could be on the decline as a communication medium and retailers have come to accept changing technology as a way to increase their market share. Firms such as Sears, Roebuck and Company, J. C. Penney Company, and Federated Department Stores are at various states of testing electronic catalogs. Sears, Roebuck and Company, for example, has test marketed its 236-page summer catalog in nine states, in catalog sales offices in the Washington, D.C. and Cincinnati areas, and in 1,000 homes across the country. Customers can browse through the catalog's 5,500 single frames and 17 motion sequences on a television screen, learning how to build a fence or watching Cheryl Tiegs model her line of summer sports wear. Sears already gets 23 percent of its merchandise revenues from its ubiquitous catalogs, and nationally, direct selling by all businesses is growing at twice the rate of store retailing. By 1990, predicts an analyst at Booz, Allen & Hamilton, as much as 50 percent of Sears merchandise sales will be made outside its stores while Management Horizons, Incorporated predicts that 20 percent of all retail sales by 1990 will be done via videotex.

Electronic point-of-sale equipment of various types, from the National Retail Merchant Association recognized Character Recognition-Font A to the food marketing industry's optical scanners with laser beams to read the Universal Product Code printed on grocery items, will continue to have a major impact on retailing. For example, a supermarket in California even has a point-of-sale system that automatically

calls out the price of groceries as it reads and tabulates them. Computer software is being utilized that enables the point-of-sale systems to take on management functions such as calculating the most profitable cuts of meat, keeping track of inventories, and automatically re-ordering.

One of the most exciting applications for scanning equipment is just getting off the ground: inventories can now be replenished electronically without having to rely on manually produced purchase orders. Using the checkout sales data from the scanners, the computer can tally items sold and then automatically subtract them from those in inventory records. A computer-generated order list of items falling below minimum inventory levels can then be transmitted to wholesalers and grocery manufacturers. To standardize these procedures for the entire grocery industry, a group of manufacturers, wholesalers, and brokers are now testing this electronic communications link that would make automatic reordering possible. The six trade associations sponsoring this program hope to make such a standardized system universally available--regardless of the brand of computer or scanner.

Bankers also are getting into the act. A group of banks in the Midwest have teamed up with NCR and a midwestern supermarket chain to launch a program to connect scanner systems in stores with banks. This will permit customers to pay for their groceries at the checkout line by electronically transferring money from their bank account to the store's account. The payoffs are added convenience for shoppers and lower check-processing costs for both the banks and the stores.

Banks and other types of financial institutions are beginning to use the bank-at-home terminals in an attempt to gain a competitive edge in the heated competition going on for depositors' funds. Automated teller machines have extended banking hours by dispensing cash and making other transactions 24 hours a day. Now U.S. banks are exploring ways to use the same 22,000 machines to expand their geographic reach. Within a few years, credit-card and bank-card holders may be able to withdraw cash at machines from Portland, Maine, to Portland, Oregon. Visa intends to include in its world-wide network all 45,000 terminals owned by Visa-member banks. This financial network would stretch the reach of the humblest local bank to such faraway places as Australia.

Outsiders believe it is only a matter of time before Sears also introduces automated teller machines in its stores. One manufacturer confirms that Sears has looked at them, while Richard J. Darwin, manager of bank technology research at Battelle Memorial Institute in Columbus, Ohio, says installing the machines is under active consideration, though perhaps not as an immediate new venture. With its huge system of IBM mainframes and minicomputers linking most of its stores, Sears has the transaction-processing power to create an ATM network that would rival any other.

The uses for ATMs at Sears could be legion. Through agreements Sears could make with banks, customers of those banks could use ATMs at Sears stores to tap their savings or checking accounts, or even pay bills. Or, more important, Sears could hook up the ATMs to bank-like Sears merchandise credit accounts, allowing customers to draw cash, take small personal loans through pre-arranged lines of credit, deposit

money, or make merchandise payments, all in one stop. Eventually, the ATMs could even take mortgage, insurance premimum, or stock purchase payments. While such developments are still speculative, Sears' real integration of merchandise and financial services is certain to occur through marketing.

As a general rule, vocational educators should be aware that "computer literacy" will be the basis for productive work with many of the specific marketing-related technologies discussed in this report. This means that students will do well to become familiar with the use of keyboards, information displays, and sending and receiving information through computer-based systems. The "paperless office", point-of-sale terminals, and electronic funds transfer all have these computer-communication elements in common, and the student to whom terminals and microcomputers are not wholly alien will be at an advantage when entering jobs in the future. To develop these general competencies, microcomputers can be an invaluable tool. The microcomputer not only provides a pnysical configuration similar to that which will be seen on the job (i.e., keyboard, display, printer, etc.), but when appropriately programmed or supplied with pre-programmed business applications software can be used to simulate actual sales, finance, planning, ordering, shipping, or other tasks.

Besides having several microcomputers with appropriate software available, institutions might consider obtaining product code scanners of some kind, in order to simulate actual point-of-sale transactions. But apart from computers and product scanning equipment, there should be no need for elaborate equipment expenditures. Rather, as has been

mentioned, educators can provide general computer literacy experiences which will be supplemented in brief on-the-job training.

From another point of view, technological change in general will impact all areas of marketing. Marketing and distributive educators will need to become increasingly more skillful in developing effective business and education partnerships because of the leapfrogging advances in technology. The electronic communication and technological developments described plus additional advances will require that marketing employees be taught how to apply the technology on their jobs. Competency-based curriculums with specialized data processing and computer applications in such marketing career fields as finance and credit, transportation and warehousing, general retail merchandising, food marketing and industrial marketing will be an essential element of any marketing and distributive education program of instruction. Employees are going to have to be able to demonstrate the specialized technical marketing competencies required by employers.

Marketing and distributive educators in the electronic society will be expected to work with employers to identify the specific competencies needed to perform the job, set up a competency-based curriculum, and then teach or help the students acquire the identified competencies so that they are employable. Marketing executives continue to caution educators not to forget about the fact that with increased technology can come impersonalization that is all too frequently disastrous for a marketing business. Competencies in human relations, communications and leadership will play an increasingly important role in the education of marketing employees.

Research being done to develop competency-based curriculum materials in the field of marketing and distributive education continue to show that marketing employees may perform a wide variety of tasks which can be effectively categorized into the following eleven competency cluster areas: Advertising, Communications, Display, Human Relations, Marketing/Economics, Management, Mathematics, Merchandising, Operations, Product and/or Service Technology, and Selling. Research has also shown that marketing employers continually rank the first level job competencies in the following order of importance:

1. Following directions
2. Acceptance and adherence to company polices and procedures
3. Working with people
4. Oral communications
5. Knowledge of products or services
6. Selling
7. Public relations
8. Mathematics of marketing
9. Decision making
10. Non-selling duties
11.5 Understanding of how goods and services get from producers to consumer
11.5 Written communications
13. Display
14. Job opportunities in marketing
15. Free enterprise
16. Buying
17. Advertising

The most successful marketing employees of the future will not only be technically competent but also increasingly sensitive and responsive to the needs of customers, fellow employees and employers. Skill in electronic communications, while extremely important, can never take the place of effective human relations. Similarly, the marketing leaders of the future will need to acquire and sharpen their leadership competencies.

DATABASE SYSTEMS IN THE DISTRIBUTION TRADES

by
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As discussed in a companion article on personal computers, much of the work done in distribution today involves the movement not of physical objects but of information, and electronic data processing equipment is replacing "paper work" to keep track of products and services. Whether large computers or small are used, database systems provide the wherewithal to perform many necessary order processing and handling operations.

A database, in its simplest form, can be thought of as a computer-readable collection of records ("file" information) of the same kind. Customer records, telephone book entries, airline schedules, stock inventories, and receipts are all potential entries in databases. A database management system (DBMS) is a group of related computer programs which enable the user to manipulate a database that is to store, retrieve/display, or change records. Some of the functions which a data base management system make possible include:

- storing large quantities of information in an organized manner for later retrieval and/or manipulation;
- sorting the entries in the database on any element; for example, a mailing list entered in a DBMS could be ordered on the first initial of the person's last name, for an alphabetic listing, or on the zip code, for bulk mailing;
- searching for information of a specified description in several different data bases;
- retrieving entries on the basis of specified characteristics; for example, a DBMS can allow airline reservations workers to retrieve from a database information on all flights from San Francisco to Boston which leave

after 10 a.m. on a weekday and involve no more than one change of planes;

- retrieving specific entries, for example, the recipe for Swedish Meatballs from a personalized computer "cookbook";
- retrieving a range of entries, for example, all articles in a library file which were published between 1978 and 1981;
- producing summaries of any selection of elements in the data base, either on the screen or in printed form.

Jobs involving database management systems, and the related Management Information Systems (MIS) which include database processing, will usually require workers to use the company's large "mainframe" computer in a timesharing "real time" environment. The main computer may be housed in a remote location, for access by various local offices through a distributed data processing (DDP) system; branch banks and ticket agents, for example, may use such systems. Since smaller computers and intelligent terminals will often be used as entry points into the large computer, a working knowledge of how to use a desktop or "personal" computer will greatly enhance the workers' capabilities. Moreover, local minicomputers and even desktop machines can use database software directly to provide small businesses with computer-assisted recordkeeping.

Some jobs dealing directly with database management in the distribution trades are:

- travel agent
- reservation clerks (hotel, airline, railway, etc.)
- stock clerks
- sales personnel and managers

- credit and collection clerks
- parts and service department workers

The DBMS in these job settings serves an important management function, enabling the worker to keep track of large quantities of information, and to find specific pieces of information quickly and easily. Stock clerks can use a DBMS to keep track of stock on hand, predict inventory requirements more accurately, inform sales personnel about the availability of specific items, and manage ordering of additional inventory. Sales personnel can use a DBMS to keep track of their client contacts. Many field sales people have already learned to organize and "work" a client base manually. A DBMS can serve these functions more quickly and efficiently. Subsets can be selected by date of last contact for a list of the day's prospects, by date of last purchase for a personalized mailing, or by "problem" for referral to customer service. Sales personnel also make use of DBMS to answer questions about products not on the showroom floor. Airlines and travel agencies are making increasingly heavy use of DBMS for speedly solutions to travel needs--automatically generating itineraries to satisfy the unique requirements of each customer.

KNOWLEDGE AND SKILLS

It is the computer software, the programs (sets of instructions which the computer follows) which determine what it can do. A DMBS is software. It is the design of the DBMS "user interface" (the sequence of buttons and keys one must push combined with messages the computer ends back via its display screen or voice (see article on personal com-

puters) that determines how much education will be needed in order to use the DBMS. Some software is self-explanatory (friendly), other designs are quite complex and demand extensive training to use effectively. But in general, computer technology changes so fast that the most important skill will be the ability to learn a new system easily.

The ability to adjust to a new set symbols displayed on a screen, a different sequence of words to be typed, or a modified machine control panel is a matter of "mind set," or expectation. It does not depend on specific curricular materials. Broad experience with automated office procedures, with the operation of computer controlled devices, and with the powers and limitations of computers in general will provide the best background for these students. Since most companies are likely to have customized software for their particular needs, students can only receive final training on the job. A general "feel" for the way database systems are constructed will permit the needed flexibility. Also, students should become "computer literate" and "machine literate" in the sense described in the essay on personal computers.

SPECIAL EQUIPMENT

A variety of DBMS/MIS software should be presented, if possible. There are quite a few DBMS's available now, ranging from simple file management programs to sophisticated relational database management systems, which can be implemented on desktop computers or on common educational minicomputer systems. Packages should be chosen which reflect a range of complexity and which the students can apply directly to the management of their school records and other current needs, as well

as in simulation examples. Users should be aware that the DBMS will not actually organize their data for them. It merely serves as a storage and retrieval method for information they organize themselves. As always, a computer program is not a "problem solver". It is one out of many possible solutions to a stated problem. A DBMS, like any other piece of software, is not a fixed entity. As soon as it is installed in the workplace, programmers begin looking for ways to improve it--thus the need to continually learn new procedures.

GROWTH AND TRENDS IN THE DIFFUSION OR EXPANSION OF THE TECHNOLOGY

Database systems of all shapes, sizes, and capacities are being heavily marketed today and we can expect this trend to continue. The sophistication of these systems will increase. Systems will also get cheaper and easier to use. At the same time, because tedious computation and tabulation will be taken over by machines, jobs will require more reasoned thought, more creativity, more human judgement. The number of jobs available in sales offices, warehouses, and transportation facilities is not likely to change radically, but productivity will mushroom. The use of DBMS packages, properly applied, will be central to this increase in productivity.

The one area which will demand larger numbers of people and will not be automated is direct human services. Customer service, determining client needs, resolving complaints, settling disputes, and ensuring customer satisfaction cannot be done by machines. Also, more business managers, as compared to clerical workers, will be needed. These people may rely heavily on computers as tools but not as final decision-

makers. Database management can be seen as a tool which will enable the distribution worker to do his job more effectively (accurately) and efficiently (speedily).

HOUSEHOLD APPLIANCES: DISTRIBUTION

by
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Along with changes in feature development and technologies, the distribution system, retail sales approach, service and repair options and the secondary facilities associated with household appliances is also changing.

One of the most recent and dramatic changes in the distribution of household appliance has been a decrease in the number of full-line appliance manufacturers, and the number of appliance models available to consumers. Rising energy costs, higher interest rates, and a decline in the number of housing starts have combined to create a difficult situation for a number of appliance manufacturers. Several have dropped specific models, modified their line and eliminated features. Others have merged with other complementary manufacturers, or sold their manufacturing facilities.

The system of appliance distribution has changed from a series of wholesale warehouses located in moderate to major sized cities all over the country . . . to direct shipment from the factory to retailers.

This shift in distribution has created:

- Large buying groups who may have joint venture warehouses from which several retailers will draw appliances, either majors, portable or both.
- Increase in the sale of household appliances at catalog and discount type store. This type store utilizes a limited number of retail sales staff. Package information, photos and display items are the vital sales tools.
- A network of franchise retailers, many specializing in one or two major appliances geared toward a very stratified market and consumer. One example of this type retailer is the store

which specializes in appliances offering convenience, like microwave ovens and food processors, and the accessories which are complementary to them.

- Factory-operated service facilities which are maintained by the manufacturer. Almost all manufacturers maintain factory-run service facilities to perform both in-warranty and out-of-warranty service. Almost all manufacturers report a need for competent service personnel who can relate to consumers and perform a diversity of service and repair jobs.

WORKER AND WORK IN THIS CHANGED DISTRIBUTION SYSTEM

This emerging system of appliance distribution will require workers to have some or all of the following skills and knowledges:

A sound, firm understanding of computer basics. As appliances become more intelligent, the retail sales representative must be able to translate the various capabilities offered by the household appliances into consumer benefits. Sales personnel must be able to translate the advantages of precise controls, and improved features to consumers who may lack the basic knowledge of computer technology.

In addition to computer technology found on household appliances, the system of ordering, shipping, tracking and billing appliances will also be dominated by the computer. As this technology becomes more widely used, warehouse operators and workers must be able to meet the challenge of reading and interpreting reports and memos generated by computers.

In specialty retail stores, particularly those selling microwave and food processors, there will be a great need for sales and service personnel who can learn and interpret consumer-oriented information to a generation of users who will need education. As the number of microwave

consumers reaches the 50 percent saturation point by 1985, this need for education will also increase. Microwave ovens and convection ovens promise to be major factors in the growth in household appliance sales.

As the roles of consumers and homemakers change, their shopping habits related to appliance selection will also change. They will continue to be conscious of price and will expect sales personnel to be:

- Well informed
- Able to answer complex questions
- Provide information about energy use and operating costs of appliances
- Able to answer questions about life-cycle cost for the appliance being purchased

Consumers are likely to keep appliances for longer periods of time and will continue to personally perform a range of repairs to keep appliances operating. This means that distribution systems must provide:

- Parts for repair and replacement needs
- Information on installation and repair
- Brochures and printed information for consumers to follow in effecting repairs

The development of pertinent well-prepared package information related to appliances and household equipment will become even more necessary as the distribution system depends more heavily on packaging to provide consumer information. Display equipment and facilities will assume an important role in meeting this need, also.

These changes should create more jobs of the following type:

- Advertising sales representative

- Display and graphic designer
- Warehouse operator
- Customer service representative
- Factory and service repair staff
- Ad copy writer
- Specialty sales representative
- Retail sales specialists

KNOWLEDGES AND SKILLS

As distribution systems have changed, the needs at wholesale and retail have also changed. Workers in this area will need extensive training in meeting these changing needs. There will be a need for greater training dealing with:

- How to sell. As consumers make hard choices about replacing old appliances they will ask some extremely difficult questions.
- How to relate to consumer and homemaker problems dealing with appliances. As service and repair problems occur, special skills are needed by repair personnel. They must be aware of how to handle the problems related to actual appliance repair as well as deal with interpersonal problems created by this situation.
- How to communicate with consumers and homemakers at various levels. These include package information, ad copy, display materials and personal communications.
- How to interpret and calculate energy and operating costs. This variable will continue to impact on consumers for the coming years.

The needs of this segment of the household appliance industry will continue to change for the next five to ten years as the housing

industry and the economy return to a growth pattern. These two variables will have the greatest effect on the sales and distribution of appliances and ultimately the work and workers involved in the industry.

VIDEOTEX IN THE DISTRIBUTIVE TRADES

by

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"Videotex" is the generic term used to describe an electronic communications system which enables the user to receive and display graphics and textual information on a television screen. Sometimes it is a two-way system, with which the user may interact with the computer sending the messages. This is known as interactive or two-way videotex. In other configurations the user may only choose what information to view, but not send messages back to the computer. Usually this is because the information has been encoded into a broadcast signal. This type of videotex transmission is known as broadcast videotex, or teletext.

The new information technology of videotex will touch the lives of everyone in the United States. Those in advertising, merchandising or marketing will be especially affected. Videotex can be seen, essentially, as a new communications medium. Therefore, a part of the duties of those who work in advertising--be they sales personnel, graphic artist, or writers--will involve working with videotex in order to present a client's message in the best way possible in that medium. At the present time, an advertising firm offers its clients the opportunity to communicate their mesage through print, television, radio, posters and billboards. But we have already begun to see some forward-looking businesses ask that their message be communicated through videotex. In the highly competitive world of advertising, the sales

representative cannot simply refuse; he or she may lose the account. Therefore, some of this new knowledge must consist of an awareness of the possibilities of computer graphics which are basic to videotex. Sales representatives must also be aware of what videotex databases exist, or be prepared to advise clients as to how to start up their own videotex databases.

The graphic artist and the writer in turn must have an understanding of the limitations and/or possibilities of presentation through videotex; what's more, the graphic artist must be trained to operate a videotex "page creation" device. If the artist cannot, then the advertising agency would have to hire a videotex input operator just to translate the artist's message to this medium.

In the areas of sales, customer services, recreation, tourism, and finance, credit, insurance and real estate services, the videotex "shoe" may be seen to be on the other foot. One major impact that the widespread acceptance of videotex will have upon retail businesses is that videotex provides the option of "teleshopping." If a two-way videotex service is in operation, the viewer or user may interact, usually either through a keypad or keyboard, with the computer that is delivering the videotex information. This computer may be far away, connected to the user through his ordinary telephone line. If the computer is being maintained by a large department store, or perhaps a consortium of retail stores and service operators, these stores can have videotex "pages" created which represent their merchandise to the user pictorially, much like a catalogue does today. The implications here are varied: if the store decides not to use the facilities of an adver-

tising agency, then they must retrain their own artistic or writing staff on the videotex equipment. Further, they must acquire the equipment and also create or find a videotex computer database to use.

But let's go back to the shopper. From home, the shopper can, with a small box or "decoder" attached to the family television set, a telephone line, and a keypad, call up for display a picture, say, of a toaster. There is text on the screen as well, giving the price and order code. The press of a key on the keypad indicates a desire to place an order. The computer displays a message on the TV screen: Which item please?" The customer enters the order code number, and his or her account number. Back at the computer, this information is received, sent to the store's shipping department, and a day or two later the customer receives the toaster, for which he or she is billed by that same computer at the end of the month.

Retail stores, be they large or small, must carefully evaluate the impact of teleshopping on their staffing needs. While this scenario implies that sales people would become obsolete, this is hardly the case. Everyone still has a desire to see the prospective merchandise in person, and to have it demonstrated, if possible. However, it may serve the retailer's purpose to have salespeople well-trained in the use of videotex equipment. They could put decoders right in the stores (many large chains in North America are now doing this), so that after the salesperson finishes with the customer, the customer may order the item directly from the computer, instead of lining up at a cash register. The salesperson, not writing up orders, will have more time to serve other customers (but if work is on a commission basis, the retailer may

have to change the reward system). In any case, the management, advertising and sales staff of the store which engages in teleshopping must have an awareness of videotex.

The recreation and tourism industry has found videotex an ideal way of distributing information. In some instances, the user can get a printout of a videotex map which was viewed on-screen. In other instances, plane or hotel reservations can be made directly.

For all such work activities, several themes of training needs emerge. Management must make educated decisions about whether to use videotex to reach customers, or potential customers, and if so, in what form. The sales staff or those who deal directly with clients or the public at large must be knowledgeable about how to operate the user-end equipment (the decoder) and to what uses the equipment can be put to benefit the client. Artistic, writing or advertising staff must not only have an awareness of all of the options and potential impact of videotex, but also be able to operate the videotex creation equipment.

The hardware involved is not complicated to learn and use, but a training period is requisite. The creation equipment--often called "information provider system"--enables the operator to "draw" videotex computer graphics and to type in text. Operators must choose from many colors available and must compose the page just as an artist composes a painting. However, electronic media are different from oil paints, and working with computer graphics requires that the artist have skills in visualizing how the page will display to the user, and how to soften the computer-bright colors. In general, artists will need little or no specific computer training, but must feel open and friendly towards the

concept of using computer devices. Some people are "afraid" of computers and this can block them from learning to use videotex page creation devices effectively.

The sales staff and management must receive more generalized training. An overview course in the history and development of videotex, its possibilities as a marketing tool, and its future trends would be necessary. Sales staff should feel familiar with the decoding equipment and know how to effect minor repairs.

Future expansion will see all of the major distributors of catalogues "translate" these catalogues to videotex. The consumer will become increasingly sophisticated and accustomed to using decoders to request information and to order goods. Therefore, some minimal awareness training in videotex for all potential workers in retail, tourism, advertising or any other job which involves serving the public, will help to maintain their future employability.

CHAPTER III

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There's a revolution happening in our supermarket aisles and it promises to have longlasting effects. Some supermarkets are now including delicatessens, bakeries, restaurants, houseware departments, clothing boutiques, florists, newsstands, gift shops, consumer information centers, and cooking schools. At the other extreme, box or warehouse stores offer generic brands and no frills.

Computer stores--Tantalizing opportunity selling computers to customers. Business Week, September 28, 1981, pp. 76-82.

Companies considered computer giants have turned to independent retailers to sell their new personal computers in addition to using their own sales forces and building chains of their own. They need new distribution channels to reach ever-broadening audiences with lower-priced machines.

But many industry officials are questioning whether the new breed of retailer can handle the boom. Few of the current 1,500 computer stores offer the support, service and expertise that customers will demand.
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Cotton's electronic market. Data Processor, June 1979, 22 (3), 8-11.

Describes a system automating cotton trading and marketing in a large cotton exchange serving 24,000 producers.

Fibre optics heads for the bright lights. New Scientist, July 9, 1981, p. 89.

Economists at Stanford University in California and engineers in Japan have teamed up to devise a replacement for the neon sign. The novel design, which is based on thousands of short lengths of optical fibers, costs about 20 percent more than a neon display to construct, but is cuts energy consumption by between 40 and 80 percent and lasts twice as long between services, say the designers. The new system, called IMTECH, has only a small number of light sources and is weatherproof. It combines the versatility of bulb displays with the color of neon or argon displays.

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Electronic equipment is becoming a vital force in all facets of the retailing industry: electronic point-of-sale cash registers; computers; communication systems; universal product numbering; computerized or automated warehousing; word processing; facsimile systems; lighting, fire detection, and security systems; and OCR systems.

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