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ABSTRACT

The purpose of a project was to increase the use of vocational education as a means of improving productivity. This purpose was to be accomplished through a two-fold goal: enhancing vocational education responsiveness to technological change and promoting a heightened public- and private-sector awareness of vocational education as a mechanism for productivity improvement. Through a literature review, major new technologies with impact relevance for vocational education were identified. The next step, assessment of the programmatic implications of the new technologies identified, was accomplished by relying upon 37 experts in the field to write 56 working papers. They provided information on job skills and the vocational education equipment and facilities necessary to teach those skills. Project staff prepared a monograph on the role of vocational education in productivity improvement, a paper on the role of state vocational education agencies in productivity improvement, and productivity workshop materials. The 56 working papers were also developed into a series of 7 reports that are each devoted to 1 of the major vocational education program areas: agriculture, distribution, health, home economics, office, technical, and trade and industrial. (A copy of the dissemination plan is provided.) (YLB)

FINAL REPORT

UTILIZING VOCATIONAL EDUCATION TO IMPROVE PRODUCTIVITY

CONSERVA, Inc.
401 Oberlin Rd.
Raleigh, NC 27605

September 1982

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U.S. Department of Education
Office of Vocational and Adult Education

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I. INTRODUCTION AND PURPOSE

PRODUCTIVITY-THE KEY TO PROSPERITY

Productivity is generally regarded as the ultimate determinant of an improved standard of living. Former Chief Economist for the U. S. Chamber of Commerce, John W. Kendrick, in an analysis of the dynamics of productivity writes, "The chief means whereby humankind can raise itself out of poverty to a condition of relative material affluence is by increasing productivity" (Kendrick, 1977, p. 1). The importance of productivity is underscored by George M. Low, former Deputy Administrator, National Aeronautics and Space Administration, who states that "Only an increasing productivity will improve the lot of man on earth and increase the capacity of mankind" (National Academy of Engineering, 1973, p. vii). The noted labor economist, Lester Thurow, warns that "if the U. S. economy is to return to a position of international prominence, Americans must make some crucial compromises to reverse the present decline in productivity growth" (Thurow, 1980, p. 40).

This sense of urgency is shared by the American public. A recent Harris Poll reported that 79 percent of Americans believe that declining productivity "is at least a serious problem for the next several years." Nearly one out of three surveyed indicated that productivity is "one of the two or three most serious problems facing the nation in the next decade" (The News and Observer, May 28, 1981).

As evidence of its central importance, productivity has been held to play a major role in:

- decreasing inflationary pressures;
- improving the competitive position of U. S. goods;
- sustaining economic growth;
- protecting the quality of the environment; and
- enhancing the capabilities to support a growing population of older persons (National Center for Productivity and Quality of Worklife, Final Report, 1978).

Productivity has been conceptually defined as the relationship between the amount of goods and/or services produced (outputs) and the quantities of labor, capital and material resources (inputs) utilized to produce these outputs. Operationally, productivity is measured as the ratio of outputs to inputs. Output per hour of work is the most commonly used measure of productivity.

The relationship between productivity and quality of life is direct. It has been estimated that if productivity were to increase at an annual average rate of three percent over the next twenty-five years, the result would be that three out of every four family units in the United States would move to the next higher level of income (Sibson, 1976, p. VIII). Given the importance of productivity in sustaining an improved quality of life, a review of productivity statistics reveals some disquieting results. From the end of World War II until 1965, U.S. productivity grew at an average annual rate of more than three percent. This growth slowed to 2.2 percent a year during the period 1965 to 1973 and dropped to one percent a year in 1973-1978. In 1979, productivity actually declined by almost one percent (Congressional Budget Office,

1981, p. 1). This situation was unique in American economic history in that it marked the first time that the American economic system had simultaneously experienced rising output and falling productivity (Thurow, 1980, p. 42).

When compared with foreign countries the picture is not any brighter. For the period 1973-1979, growth in gross domestic product per employed worker grew at an average annual rate of .3 percent for the United States in comparison with 3.4 percent for Japan, 3.1 percent for West Germany, 2.9 percent for France and 1.1 percent for the United Kingdom. This disparity is expected to continue in the near future. The Bureau of Labor Statistics projects annual productivity improvement rates for the period 1980-1985 to be 2.7 percent for the United States, six percent for Japan and four percent for Western Europe.

Substantial research effort has been expended in determining the factors contributing to productivity growth. Kendrick, in an analysis of the productivity trends in the United States, identified the following sources of productivity growth: advances in knowledge, changes in labor quality, changes in quality of land, reallocations of labor and capital as measured by the capital-labor ratio, changes in economies of scale and intensity of demand, impact of governmental services and regulations, ratio of actual to potential labor efficiency and an unexplained residual (Kendrick, 1980, p. 26). Thurow identified expenditures, an inexperienced labor force and inhibiting rules and regulatons as the major sources of productivity decline (Thurow, op. cit.). Nadiri (1980) attributes sectorial productivity slowdown to reduced growth of capital-labor ratios, declines in the utilization of resour-

ces and retardation of technical progress in some industries. Christiansen and Haveman (1981), in a study of public regulations as a source of the productivity slowdown, concluded that federal regulations were responsible for from twelve to twenty-one percent of the slowdown in the growth of labor productvity.

Because of the number of factors identified as influencing productivity--some two dozen or more--attempts have been made to identify a smaller number of fundamental factors affecting productivity change. McCarthy (1978) attributed productivity change to three major sources: changes in the quantity of productive capital goods per unit of labor input; changes in labor quality induced by changes in age, sex, education, industrial and occupational composition of the labor force; and changes in the quality of capital brought about by technological change.

The Congressional Budget Office, in a recent study of the productivity problem, identified five major determinants of productivity growth. The amount of physical capital available for each worker was identified as one of the most important factors. The skill level and health of the work force was identified as a second major determinant of labor productivity. Development and use of efficient technologies and the contribution of research and development to innovation was identified as the third factor. Finally, the rise in international oil prices and the extent and type of government regulations were offered as factors adversely affecting productivity (CBO, op. cit.).

THE CENTRAL ROLE OF TECHNOLOGY IN PRODUCTIVITY

As evidenced by current research results, productivity is influ-

enced by a host of factors. These factors interact in a network of complex relations that make difficult the identification of causal forces contributing to productivity change. Without the identification of the causes of productivity decline, decision-makers are at a loss as to the means to counter their deleterious effects.

Fortunately, the effects of many of these factors are mirrored in a more encompassing factor--that of technology. The central role of technology in productivity growth is well documented. McCarthy (op. cit., p. 979) calls technology "the most visible source of productivity growth." Joseph Coates, former Director of the Office of Technology Assessment, underscores the central role of technology by stating that "Technology is universially recognized as a crucial, if not dominant, consideration in the present and future economy of the United States" (Coates, 1977, p. 58). Technological developments and their applications in industry are referred to by the Congressional Budget Office as "one of the most important determinants of productivity growth" (CBO, p. 65). The linkage of technology and productivity is addressed by Low who asserts that "We are strong because our economy is strong; our economy is strong because our productivity is high, and our productivity depends at least in part on our technology" (National Academy of Engineering, 1973, p. vii).

Technology has been variously defined. These definitions include:

- the means by which people control or modify their natural environment (Spier, 1968, p. 131);
- the information, techniques and tools with which people utilize material resources of their environment to satisfy their various needs and desires (Lenski, 1974, p. 498);

- the major means of a people of adjusting to the environment (Arensberg and Niefhoff, 1971, p. 40);
- a special kind of knowledge which is directed toward practical application in the physical and social world (Popenoe, 1971, p. 61);
- that great growling engine of change (Toffler, 1970, p. 25); and
- a process undertaken in all cultures which involves the systematic application of organized knowledge (synthesis) and tangibles (tools and materials) for the extension of human faculties...(Pytlik, Lauda and Johnson, 1978, p. 6).

These definitions are useful in that they identify the following characteristics of technology: (1) it is the principal means by which mankind alters its environment; (2) it involves the utilization of knowledge techniques and tools; (3) it requires the application of knowledge and skills to solve practical problems; and (4) it is future oriented.

VOCATIONAL EDUCATION AND TECHNOLOGICAL CHANGE

The relationship between technological change and vocational education is pervasive. As described by Lowell Burkett, former Executive Director of the American Vocational Association, "Every job or craft or occupation has been pulled, willingly or reluctantly, under the influence of technology and the influence technology has had on society" (Burkett, 1975, p. 29). Curriculum materials are continually being updated in order to reflect technological changes taking place in occupations. Many vocational educators return to business and industries each summer so that they can become more informed of the changes which have taken place in their vocational fields. Extensive use is made of curriculum advisory committees to provide guidance on keeping voca-

tional programs abreast of technological changes and occupational requirements. Clearly, the success of vocational education is inextricably dependent upon its ability to provide students with the skills and knowledges required in their occupational areas, and those skills and knowledges are constantly changing as new technologies are adopted by business, industry and society in general.

THE PROBLEM

Responsiveness of vocational education to technological change assumes a clear communication of the demands of technology. Unfortunately, the demands induced by technological change are frequently not clearly communicated. Inadequacy or absence of information about technological requirements limits the capability of vocational education to respond to these demands in a timely and efficient fashion. Little information currently exists that provides vocational educators a synopsis of new technologies and their implications for vocational education program services and activities. While curriculum advisory councils are intended to help vocational education respond to technological changes, a recent study concluded that "The effectiveness of these councils...is generally perceived as inadequate to the challenge" (Banchik, et. al., 1979, p. 571).

Existing literature relating vocational education to productivity is devoted largely to a rhetorical advocacy of vocational education as a means for improving productivity but is generally devoid of specific strategies that vocational education might follow to achieve these ends. In contrast to this, what is needed by vocational educators is advice on the actions which they can take to improve the productivity

of vocational education students after they become employed. Therefore, the central problem addressed by this project was the need for information on technological changes that state and local vocational educators could use to make modifications in curricula, facilities and equipment which will enhance their students' subsequent productivity as skilled workers.

PROJECT PURPOSE

The overarching purpose of this project was to increase the utilization of vocational education as a means of improving productivity. This purpose was to be accomplished through the achievement of a two-fold goal: (a) enhancing vocational education responsiveness to technological change and (b) promoting a heightened public and private sector awareness of vocational education as a mechanism for productivity improvement. Attainment of these goals required the achievement of the following objectives:

1. Identify major new technologies with impact relevance for vocational education;

2. Assess programmatic implications of new technologies for job skills and equipment and facilities necessary to teach those skills;

3. Prepare and disseminate for each vocational program area a working paper highlighting forthcoming technological changes impacting on that area and describing implications with respect to knowledges and skills required, equipment and facilities resource requirements, occupations affected and rate of anticipated diffusion.

4. Prepare and disseminate a monograph describing an expanded role for vocational education in productivity improvement; and

5. Provide a basis for ongoing technical assistance to state and local level vocational education agencies' efforts to

increase public and private sector awareness of an expanding vocational education role in productivity improvement.

II. PROCEDURES

The impact which new technology is having on worker productivity represents such a potentially vast subject area that it was realized from the outset of the project that information would have to be drawn from a wide variety of primary and secondary sources. Certainly, existing literature would provide preliminary information concerning new technologies and their possible impacts upon occupations or industries. However it could not be expected that the available literature would provide information that was sufficiently current or detailed to satisfy the objectives of the project. Information also needed to be obtained from organizations and individuals who were knowledgeable of how technologies were influencing worker skill requirements and worker productivity. Finally, experts would need to be called upon to provide the detailed information relating to the impact which a specific technology would have upon a vocational education occupational cluster as well as specific occupational areas.

LITERATURE REVIEW

The initial phase of the literature search focused on the identification of periodical titles which might include articles pertaining to the subject matters of interest to the project. In excess of 6,000 periodical titles were scanned to determine those with potential application to the purposes of the project. Approximately 610 of those periodicals were identified as potential sources of information regarding new/emerging technologies. Periodicals so identified were then classified according to the two-digit Department of Education Instruc-

tional Program Code considered to represent the best match of information and instructional content.

Each of the periodicals identified through the above process was then scanned for articles which had appeared between 1979 and 1980 issues. Articles pertaining to new/emerging technologies or productivity were thereby identified for further review and abstracting. Articles were judged to be suitable for abstracting if:

- They described a new technology or a modification of an existing technology that is now in use or appears probable to become quite widespread in the next three to five years;
- The technology described requires acquisition of new knowledges and skills suitable for development at the sub-baccalaureate level; and
- Relevant information is provided; e. g., general descriptions of the technology, applicability in terms of vocational/technical occupations, labor force implications, projections as to diffusion of technology.

Articles selected for inclusion were then abstracted on specially prepared file cards. Information entered on the abstract card included (a) complete bibliographic information, (b) brief summary of relevant information, (c) to the extent possible, description of major technological areas being described; e. g., lasers, CAD/CAM, office systems, (d) names of experts referenced in the article, (e) two-digit instructional code considered most appropriate match, and (f) attached photocopies of materials too detailed or lengthy to abstract.

Computerized literature searches and manual searches of recently released publications other than periodicals were used to augment the review of periodicals. Relevant publications were scanned and abstracted in a process similar to that described above. In total,

approximately 275 articles pertaining to new/emerging technologies were abstracted and another 140 articles pertaining to productivity were reviewed and abstracted for subsequent utilization by project personnel.

In conjunction with the literature review, direct contact was made with organizations, institutions and associations thought to have special knowledge of concern to this project. Such contacts were made with four major types of organizations: (a) federal agencies, (b) regional productivity centers, (c) general purpose institutions, organizations and associations, and (d) state vocational education agencies. The purpose of these contacts was to obtain more definitive information about specific technologies and/or productivity improvement efforts that might not have been identified through the literature search. These contacts served not only as a source of information about technologies and productivity, but also served to increase the organizations' awareness of the project and to promote general public interest. Information obtained from the agencies and organizations contacted was used to verify and update the information gathered through the literature review. Furthermore, written materials documenting productivity efforts were received from many of the states and organizations contacted. These materials were subsequently abstracted and added to the existing collection of literature.

In order to present an overview of the major technologies and their relationship to vocational education, a classification matrix was developed. The columns of this matrix represented two-digit vocational education program areas; the rows represented specific technologies identified by project staff. The cells created by row/column intersec-

tions associated a particular technology with a major vocational education program area. Articles identified by the literature review were numbered and their numbers were entered into the appropriate cell. Also entered into the cell was another number which served to identify the specific (six-digit) vocational education program which would be changed by the technology. A sample of this matrix is presented as the following page.

Bibliographic annotations were prepared to accompany the matrix. The annotations described the general content of the articles cited. Articles were alphabetically arranged and assigned a sequential identification number. Those numbers were used in the matrix and provided the link between the matrix and the bibliography. A total of 203 articles were included in the annotated bibliography.

ASSESS PROGRAMMATIC IMPLICATIONS

Upon completion of the development of the classification matrix the project had achieved its first objective: the identification of major new technologies with impact relevance for vocational education.

The next step was to assess the programmatic implications of the new technologies identified in the matrix. The proposed approach was to rely upon experts in the field to write brief papers concerning the implications of the technologies with regard to job skills and the vocational education equipment and facilities necessary to teach those skills. To facilitate identification of potential contributing authors, the names of candidate authors were assigned to the cells of the technology classification matrix. Candidate authors had been identified

Area of Technological Growth and Development: COMPUTERS AND AUTOMATED SYSTEMS

TECHNOLOGY	Vocational Education Instructional Program Areas						
	Agriculture 01	Distribution 04	Health 07	Home Economics 09	Office 14	Technical 16	Trade and Industrial 17
Robotics (continued)							.2306 15 49 29 175 40 .2607 49
Database Systems Computer systems and associated program products which may store and retrieve selected subjects of a large volume or variety of data by relatively simple user commands. Includes database management systems (DBMS), and distributed data processing (systems electronically linking many dispersed remote input/output terminals to one or more central computer archives and processors.		.0400 158 .1200 129 .3100 30 129	.0200 103 .0300 157 176 160 190 164 .9900 34 176		.0100 50 .0200 32 158 50 178 103 190 129 .0300 178 .0500 129	.0108 6 .0199 6 11 .0605 32 .9900 160	.9900 6
Software Computer programming techniques, programming languages, and the development and use of general or special purpose computer programs.					.0200 117 161	.0117 62 161 117	

Figure II-1 Sample Page from Technology/Program Matrix

in the course of conducting the literature review. The criteria for inclusion was that the authors must have published in technical and professional literature and/or have been referenced to an extent to establish credibility. The purpose of seeking authors whose expertise had been established by their publication records was to obtain an objective verification of expertise. Also it was felt that established writers would be more likely to produce a quality product.

Allocation of the pool of identified candidate authors/experts to the cells of the technology matrix allowed project staff to make a determination of those areas in which there was an abundance or scarcity of authors meeting the qualification criteria. Authors in cells with multiple author entries were ranked in order of preference. This ranking served both to identify the most preferred author as well as to identify the sequence of contacts in cases where the first author might be unavailable and/or unwilling to participate in the project. Classification of authors by the matrix also identified those cells for which no authors has been identified. In those cases, project staff returned to the literature sources to attempt to identify potential candidates. For those cells in which no potential candidates could be identified, project staff made provisions to identify eligible experts through contact with knowledgeable sources in the field.

Considerable attention was paid to the protocol to be used in contacting potential experts. Project staff devised a preliminary contact protocol to be followed in making the initial contact with field experts. The protocol was revised during the course of several staff meetings and a final protocol selected. Training was provided each staff member in the use of the protocol. An initial telephone contact

was made on a trial basis and the performance of the staff member critiqued by the project team. In this fashion a standardized approach the initial contact was achieved.

Those experts who were contacted and who agreed to serve as contributing authors were forwarded a set of materials. These materials contained a consultant agreement, a detailed set of instructions describing the writing task and its content and format requirements, and a list of descriptions of the key terms that were believed to be useful to writers unfamiliar with vocational education. These materials were submitted to each consenting author with a request that the consultant form be signed and returned as soon as possible.

In those cases where project staff were unable to identify a suitable expert from a review of the literature, a recovery strategy was devised. The strategy consisted of identifying related cells in the matrix containing one or more of selected experts. In the course of contacting these experts, project staff inquired into whether the expert contacted knew of any other parties with expertise in the related area. In some cases the contacted experts indicated that they themselves had expertise in the related area. In cases where there was evidence of expertise across multiple cells, experts were invited to make multiple writing contributions. In only one case was an exceptionally qualified expert asked to contribute to four separate cellular content areas.

Following the above procedure, 37 experts were contacted who agreed to serve as contributing authors. These 37 authors were responsible for the production of 56 working papers addressing the impact of new technologies in vocational program areas. Table II-1 identifies these 37 experts and the titles of the working papers which they authored.

Table II-1. Authors and topics for technology working papers.

Author	Position	Technology Paper Topic(s)
John A. Allocca, Sc.D.	Biomedical Engineer, Mount Sinai Medical Center, New York, NY	Physiological Monitoring
James E. Bath, Ph.D.	Professor and Chair, Entomology, Michigan State University East Lansing, MI	Integrated Pest Management
Rosalie Brosilow	Editor, Welding Design and Fabrication, Cleveland, OH	Welding, Trade and Industrial
John P. Clements, M.D.	Associate Professor of Radiology, University of Vermont Burlington, VT	Diagnostic Imaging
Charlene D. Coco, M.S.N.	Instructor in Nursing, Louisiana State University Medical Center, New Orleans, LA	Controlled Intravenous Infusion
Ruth M. Davis, Ph.D.	President, The Pymatuning Group, Washington, DC	1. Microcomputers in Health Care 2. Microcomputers, Technical 3. Microcomputers, Trade & Industrial
Thomas Drozda, B.S.I.E.	Manager of Reference Publications, The Society of Manufacturing Engineers, Dearborn, MI	Machining, Trade & Industrial
Al Fleming	Industry Editor, Automotive News, Detroit, MI	Automotive Services
Charles E. Hansen	Consultant, Resource and Technology Management Corporation, Alexandria, VA	1. Renewable Energy in Agriculture (co-author) 2. Renewable Energy Technical (co-author)

E. Edward Harris, Ed.D.	Director, Office of Business Research, Northern Illinois University, DeKalb, IL	Marketing Technology
Virgil W. Hays, Ph.D.	Professor and Chair, Animal Sciences, University of Kentucky, Lexington, KY	Animal Agriculture
Jeffrey C. Hecht, M.Ed.	President, Futuretech, Inc. Auburndale, MA	1. Optical Data Transmission: Office 2. Optical Data Transmission: Technical 3. Optical Data Transmission: Trade and Industrial
Donald E. Hegland, M.S.	Associate Editor, Production Engineering, Cleveland, OH	1. CAD/CAM: Technical 2. CAD/CAM: Trade & Industrial
Lee Holder, Ph.D.	Dean of the College of Community and Allied Health Professions, the University of Tennessee, Memphis, TN	Health Care Delivery Systems
Paul C. Jordan, Ph.D.	President, Jordan Associates, Raleigh, NC	1. Inventory Control and Distribution 2. Inventory Control and Office Jobs
John Lamoureux, B.S.E.E.	Research Engineer, IIT Research Institute, Chicago, IL	1. Process Control: Technical 2. Process Control: Trade and Industrial
Frederick H. Lochovsky, Ph.D.	Assistant Professor, Computer Science, the University of Toronto, Ontario	Database Systems in the office
Liza Loop	President, the LO*OP Center, Inc.; Technical Coordinator, Computertown U.S.A. Palo Alto, CA	1. Database Systems in Distribution 2. Personal Computers in Distribution 3. Personal Computers and Consumers

Monte D. Lorenzet, M.B.A.	Manager, Editorial Services, Apple Computer, Inc. Cupertino, CA	Personal Computers in the Office
Anne L. McKague	Manager, Information and Educational Service, Norpak, Ltd. Toronto, Ontario	1. Videotex and Distribution 2. Videotex and the Consumer
Gaines E. Miles, Ph.D.	Associate Professor, Agricultural Engineering, Clemson University, Clemson, SC	Microelectronics in Agriculture
Donovan Dean Moss, Ph.D.	Associate Director, the International Center for Aquaculture, Auburn University, AL	Aquaculture
Lee E. Ostrander, Ph.D.	Associate Professor, Biomedical Engineering, Renssalaer Polytechnic Institute, Troy, NY	Microelectronics in Medical Care
Dietolf Ramm, Ph.D.	Associate Professor, Computer Science, Duke University Durham, NC	1. Software: Technical 2. Software: Office
Diane M. Ramsey-Klee, Ph.D.	Director, R-K Research and System Design, Malibu, CA	Database Systems in Health Care
Larry Reichenberger	Senior Machinery Editor Successful Farming Des Moines, IA	1. Agricultural Equipment 2. Planting Methods
Gail S. Rosenberg	President, National Council for Alternative Work Patterns Washington, DC	Alternative Work Schedules
Stuart H. Shakman	Senior Analyst, Resource and Technology Management Corporation, Alexandria, VA	1. Renewable Energy in Agriculture (co-author) 2. Renewable Energy: Technical (co-author)

Robert S. Sowell, Ph.D.	Associate Professor, Biological and Agricultural Engineering, North Carolina State University Raleigh, NC	Personal Computers in Agriculture
Audrey S. Stehle, M.S.	Independent consultant, home economics/consumer education Chesapeake, VA	1. Household Appliances and Distribution 2. Household Appliances and the Consumer
William R. Tanner	President, Productivity Systems, Inc., Farmington, MI	1. Robotics: Technical 2. Robotics: Trade & Industrial
Thomas C. Tuttle, Ph.D.	Director, Maryland Center for Productivity and Quality of Working Life, the University of Maryland, College Park, MD	Quality Circles
Frank A. Viggiano, Jr., Ph.D.	Associate Professor of Home Economics, Indiana University of Pennsylvania, Indiana, PA	1. Microelectronic Controls and Distribution 2. Microelectronic Controls and the Consumer
Kathleen Wagoner, Ph.D.	Professor, Business, Ball State University, Muncie, IN	Word Processing
J. A. Sam Wilson, M.A.	Independent writer and consultant in industrial electronics Miami, FL	1. Microelectronics: Technical 2. Microelectronics: Trade & Industrial
Sylvan H. Wittwer, Ph.D.	Director of the Agricultural Experiment Station Associate Dean of the College of Agriculture and Natural Resources and Professor of Horticulture Michigan State University East Lansing, MI	1. Plant Micropropagation 2. Soil-less Plant Propagation 3. Trickle Irrigation 4. Reduced Tillage Farming
Amy D. Wohl, M. A.	President, Advanced Office Concepts Corporation, Bala Cynwyd, PA	Office of the Future

While the experts were working on the development of their papers, project staff were preparing a monograph on the role of vocational education in productivity improvement. This monograph was designed to communicate to government officials, educational professionals, business and industry leaders, and involved lay citizens the potential contributions which vocational education and training can make to the improvement of productivity of the American work force. The content of this monograph was based on information obtained during the literature review which was previously described.

A second paper prepared by project staff addressed the role of state vocational education agencies in productivity improvement. This manuscript was designed to increase the awareness of state vocational education agency personnel as to alternative strategies for the utilization of vocational education as a means of productivity improvement. Whereas the previously described monograph was intended for a relatively wide audience, this second manuscript was designed specifically to guide state level vocational educators in facilitating productivity improvement through vocational education.

Productivity workshop materials were also produced as an adjunct to the paper prepared for the state vocational education agencies. These materials were intended to assist state agency personnel in conducting local and state-wide productivity workshops. Included in these materials were a workshop plan and samples of suggested transparencies for use during the workshops.

Draft copies of all of the technology working papers, the productivity monograph and the paper on the role of the state vocational

education agency in productivity improvement were submitted to the Department of Education Project Officer for review, suggestions and approval. Based on those comments the papers were revised and prepared in their final format, printed and disseminated.

PROMOTING AWARENESS OF THE PROJECT

Throughout the many months of the development of the above products, project staff made various efforts to create an awareness of the existence of the project and to develop interest in the project products currently under development. Awareness of the project was achieved through a combination of personalized communications and announcements of the project published in newsletters targeted to specific audiences. A preliminary project abstract and accompanying cover letter were prepared and submitted to the Department of Education Project Officer for review and comment. It was then revised in accordance with suggestions and comments obtained from the Project Officer.

The abstract and accompanying cover letter were sent to each of the State Directors of Vocational Education and the RCU Directors in conjunction with a request for information on ongoing productivity activities. It was also sent to editors of periodicals whose readers were thought to have an interest in productivity and/or the impact of technological innovation. In this latter case, a sample press release was included with letters to the editors with a request that a notice of the project award and a brief description of the project be included in a subsequent issue of their publication. National associations with an involvement in technology were also sent the abstract, as were the pro-

ductivity centers which were contacted in an effort to determine research and development efforts of interest to this project. Finally, an abstract on the project and an accompanying letter of introduction was mailed to approximately 4,000 businesses from across the country informing them of the project, requesting their assistance in identifying productivity improvement practices, and inviting them to contact CONSERVA if they would like to be placed on the project's mailing list.

III. RESULTS

PRODUCTS

The activities described in the previous section of this report resulted in the production of nine major documents designed to enhance vocational education's role in improving the productivity of the nation's work force. Seven of these documents represented a series of working papers; one devoted to each of the major vocational education program areas (i. e., Agriculture, Distribution, Health, Home Economics, Office, Technical, Trade and Industrial).

The monograph on productivity improvement, entitled "Working for America--A Worker-Centered Approach to Productivity Improvement," provides educators and non-educators alike with a better understanding of the dynamics of productivity improvement. Major topics addressed in the monograph are as follows:

- Productivity--The Key to Continuing Prosperity
- Productivity Measurement
- Measurement Problems
- Benefits of Productivity Improvement
- The Productivity Problem
- International Comparisons
- Problem Diagnosis
- Productivity Improvement Strategies
- Education and Productivity

The role of the state vocational education agency in productivity improvement was addressed in the paper entitled "Vocational Education: Its Role in Productivity Improvement." Major topics discussed in this paper included:

- Productivity--Its Meaning and Measurement
- Benefits of Productivity Improvement
- The Productivity Problem
- Technology and the Production Process
- Major Technological Innovations
- Skills Implication
- External Forces to be Reckoned With
- Intervention Strategies
- State Level Strategies

To further assist state vocational education agencies in promoting productivity improvement through vocational education, the project provided each state vocational education agency with materials describing the content and procedures for state use in conducting productivity workshops. Those materials are intended to guide state-level vocational educators in the planning and implementation of workshops which will enhance participants' awareness of vocational education's role in productivity improvement and stimulate creative strategies for productivity improvement.

DISSEMINATION ACTIVITIES

To ensure that the results would be available to appropriate target audiences, a dissemination plan was included in CONSERVA's original proposal submitted to the Department of Education. Shortly after the award of the contract to CONSERVA, the Project Director met with the ED Project Officer to review the proposed activities including the dissemination plan. Based on that review, a final plan for dissemination of products was agreed upon. That plan is presented as Figure III-1 on the following two pages.

Complimentary copies of the documents were provided to the organizations identified in Figure III-1. While the terms of the contract limited the number of complimentary copies which could be made available, two alternatives were selected for making the documents available on a continuing basis. First, camera copy of each of the

FIGURE III-1. DISSEMINATION LIST FOR PRODUCTIVITY MONOGRAPH, WORKING PAPERS, STATE PAPER AND PROMOTIONAL MATERIALS

Target Groups	Number of each Document	Rationale
State Directors of Vocational Education	57	Awareness and involvement of chief vocational administrative officers of prime importance
State Supervisors of Community and Technical Schools	57	Awareness and involvement of agency chief in charge of postsecondary occupational program of prime importance
Vocational Area Supervisors	57 (Technology Working Papers)	Responsibility for statewide leadership in area of expertise
State Advisory Councils on Vocational Education	57 (State Paper Only)	Mandated advisory responsibility for State vocational education programs
Directors of federally supported curriculum coordination centers	6	Integration and coordination of curriculum development efforts
American Vocational Association	1	Represents linkage with vocational education professional groups
National Advisory Council on Vocational Education	1	Mandated advisory responsibility for national vocational education programs
American Association of Community and Junior Colleges	1	Provides a linkage with postsecondary institutions
AFL-CIO	1	Organized labor should be aware of vocational education's role in productivity improvement

FIGURE III-1 cont'd.

DISSEMINATION LIST FOR PRODUCTIVITY MONOGRAPH, WORKING PAPERS, STATE PAPER AND PROMOTIONAL MATERIALS

Target Groups	Number of each Document	Rationale
Employment & Training Administration (DOL)	1	Recognition of the importance to maintain linkages with Department of Labor at national level
American Society for Training & Development	1	Prime source to communicate project products to business community
National Alliance of Business	1	Represents a nationwide linkage with business community
Department of Education	15	Provides a supply for dissemination in response to requests

documents was provided to the Department of Education so that it could produce and disseminate copies of the documents to the extent deemed appropriate. Secondly, CONSERVA intends to make the documents available for sale to interested parties. Notification of the availability of these documents through CONSERVA will be provided to individuals and organizations which previously requested to be included on the project's mailing list.

In addition to the dissemination of the documents themselves, the results of the project have also been shared with vocational educators through several presentations at state-sponsored workshops and seminars. CONSERVA and the Project Director intend to continue to offer such presentations to the extent that state and local interest supports it.

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