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ABSTRACT

In a study conducted to identify the major forces that appear likely to influence vocational education in the next three to five years, a general model or conceptual framework was developed and modified by suggestions from a panel of experts. The following were identified as major influences: (1) a gradual decrease in the number of secondary students, with proportionately more minority and disadvantaged students at all levels and many more adult students with widely varying characteristics at the postsecondary level; (2) rapid technological change making it impossible to keep curricula and equipment up to date; (3) decreased time for vocational education at the secondary level because of stiffer academic requirements; and (4) continuing emphasis from the Federal level on facilitating access to education. The interaction of these and other broad influences indicates that secondary vocational education will have to include more communication and other basic skills; its teachers will have to change to meet the needs of a computer-oriented society; and postsecondary vocational education will be called upon to provide more occupational skills, especially to the disadvantaged, dislocated workers, displaced homemakers, and other adults. Other changes foreseen include greater links between vocational education and employers and an emphasis on providing new skills within existing programs rather than creating entirely new programs. (KC)

ANTICIPATING FUTURE INFLUENCES ON VOCATIONAL EDUCATION

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FOREWORD

The rapid changes that our economy is undergoing have many implications for the role that vocational education will play in coming years. The present project was conducted to identify the major forces and factors that appear likely to influence vocational education in the next three to five years. Once these influences were identified, information concerning them was assembled, analyzed, and implications drawn for use in program planning and policy development. The report is intended to alert planners and policymakers for vocational education of major influences that they should consider when developing plans and programs for the next three to five years.

The project was conducted with support from the Office of Vocational and Adult Education, U.S. Department of Education. It benefited significantly from advice received from fifteen panelists who are listed in appendix A. One of the panelists, Dr. Henry David, in his role as senior consultant to the executive director of the National Center, was especially helpful at many points in the project.

This project was conducted in the Evaluation and Policy Division which is directed by N. L. McCaslin. The project staff included the authors of this report and Mollie Orth who contributed significantly during the first half of the project. Sherri Trayser served as project secretary and was responsible for the word processing of this report.

Critiques of a preliminary draft of this document were provided internally by Steven Gyuro and Joel Magisos. External reviews were conducted by Joseph F. Coates of Joseph F. Coates, Inc., and Robert C. Harris, Indiana University. Ruth Morley and Constance Faddis edited the final draft. Only the authors, of course, are responsible for the final positions presented in this report.

On behalf of the National Center I am happy to acknowledge and express our appreciation to all those who contributed to this report.

Robert E. Taylor
Executive Director
The National Center for Research
in Vocational Education

EXECUTIVE SUMMARY

There is little question that the remaining years of the twentieth century will be a time of rapid change. Responding to the combined influences of technological change and foreign competition, the economy is shifting from one based primarily on the production and distribution of goods to one based primarily on the exchange of information and services. This shift has implications for all of education as is reflected in the various reports by national commissions and task forces that appeared in 1983 examining the condition of secondary education. A recurrent theme in these reports is the uncertainty of the future and the need for a solid educational foundation that will enable today's students--tomorrow's workers--to adapt to the changes they inevitably will face.

In such a period of transition, it is difficult to know how best to prepare young people and retrain adults for rewarding employment in a future whose structure can only be dimly perceived. As difficult as the task is, planners and policymakers must make decisions based on the best available information and this report is designed to help them.

The project described in this report assembled relevant information concerning major influences on vocational education that should be considered in the development of plans and policies. To guide the assembly of this information, a general model or conceptual framework of the major influences was developed. After several internal reviews and revisions, a draft of the model was sent to fifteen external panelists with expertise in a variety of disciplines. The suggestions from these panelists were used to revise the model and then information was assembled on most of the elements in the model. That information is presented in this report, together with an integrative summary of the environments most likely to be encountered by vocational education in the next three to five years.

From the information assembled, the following were identified as major influences on vocational programs:

- Students: a gradual decrease in the number of secondary students; proportionally more minority and disadvantaged students at all levels; many more adult students with widely varying characteristics at the postsecondary level

- Technological change: rapid rates of technological change making it virtually impossible to keep institutional equipment and curricula up to date

- Competing requirements: decreased time for vocational instruction at the secondary level because of increased requirements in English, mathematics, and science

- Federal emphasis: a continuing emphasis in federal vocational legislation on facilitating access to educational opportunities

The interaction of these and other broad influences have different implications for vocational education at the secondary and postsecondary levels. These differences and implications for all levels are summarized in the following sections.

Implications for Planning and Policy

Secondary Programs

The several reports on secondary education have caused many states to consider increasing the credits required in English, science, and mathematics for high school graduation. Such increases, uncertainty about the effects of technology on the skills needed in the labor force, and the fact that only about 25 percent of high school students take intensive occupational preparation are pushing secondary vocational education toward an increased emphasis on broad educational objectives. There is evidence that occupationally relevant instruction can make learning more meaningful, especially for those students who are bored and frustrated in the typical academic classroom. To realize this outcome, specific instruction in communication and computation skills will have to be integrated into regular vocational offerings.

The increasing availability of personal computers and other electronic media are among the influences that are creating the need for a new model of the teacher--a model that stresses managing learning rather than providing information. If this model is to be implemented and secondary programs are to emphasize broad educational objectives, current teachers will be the prime agents in bringing about these changes. Any plans for change must convince teachers of the need for change and involve them in its implementation.

Postsecondary Programs

The same forces that are pressing secondary programs toward an emphasis on broad educational objectives are increasing the need for training in occupational skills at the postsecondary level. This training will be needed by young people seeking

entry-level employment as well as by adult workers to keep pace with technological changes or to obtain new types of employment when their current jobs are eliminated.

Postsecondary institutions are in a favorable position to provide such training because of their geographic accessiblity and psychological acceptability to adults. These features also favor an expanded role for postsecondary institutions in training the economically disadvantaged, displaced homemakers, and other groups with special needs.

Linkage with Employers

While vocational education may play a broader educational role at the secondary level, its unique role will continue to be preparation for employment. The conditions expected during the remainder of the 1980s indicate that this will be a favorable period for developing stronger linkages with employers. Surveys of employers indicate a greater willingness to cooperate with vocational education than has presently been realized. Vocational educators will have to be cautious, however, that they do not let involvement with employers divert them from their primary goal of development of the individual.

Critical Skills

There is a continuing national debate about whether or not shortages exist in critical skills areas within the labor force. The areas of most concern are defense-related industries. Defense expenditures influence certain states and localities far more than others. The U.S. Department of Education should be able to notify states when major defense contracts are awarded. These states should be able to use their own information sources and work with local education agencies to determine if skill shortages are anticipated and if corrective programs are needed.

Responding to Technological Change

Despite the rapid pace of technological change, the evidence this study assembled did not suggest major changes in the types of training needed for the work force in the next three to five years. It takes time for a technological change to spread through a work force of over 100 million workers, and in most cases the technology is incorporated into existing occupations. For example, since many secretaries will be using word-processing equipment, an understanding of the logic of word processing should be an objective of all instruction in keyboard skills. In most cases, this change does not mean that separate courses in

word processing are needed. In a similar manner, workers in most of the trades will need a basic knowledge of electronics as it is applied to their occupational specialty. In the technologies examined for this report, very few completely new programs will be needed in the next three to five years.

Concluding Remarks

Many demands will be made upon vocational education in the next few years. These demands will include continued delivery of traditional services, as well as expanded roles in teaching basic communication and computational skills, training the disadvantaged, and retraining and upgrading adult workers. At the same time, vocational education will have to justify once again its claim as a legitimate component of secondary education. The challenges are many, but they can be met. The broad support that vocational education receives from those who use its services and fund its activities indicates it has met a wide variety of needs in the past, and it can continue to do so in the future.

CHAPTER 1

THE NATIONAL CLIMATE

Introduction

When historians reflect upon the 1980s, they are likely to characterize it as a decade of fundamental change. The basic structure of the economy is moving from one based primarily on the production of goods to one based primarily on the exchange of information and services. As the structure of the economy changes and the wealth of the nation is redistributed, social transformation results. The magnitude of the changes expected during this decade has been compared to that experienced during the Industrial Revolution. In such an environment, basic institutional relationships are affected, and vocational education cannot expect to be immune. Vocational educators must anticipate these changes with as much foresight as possible to enable their programs to be responsive to this changing environment.

This report is intended for use by individuals responsible for long-range planning and policy development in vocational education at the national and state level. The purpose of this report is to provide an early warning of changes that can be anticipated in the next three to five years in the environment in which vocational education operates. To understand the likely impact of these changes, it was necessary to identify and study trends in the economy, technology, and society that appear to influence vocational programs. This report presents an initial model of major influences upon vocational education. The model was developed by the project staff on the basis of previous research on the future conducted at the National Center. It was reviewed by a panel of fifteen experts (listed in appendix A) from a variety of backgrounds and revised on the basis of their critiques. The model is based on expert judgment because there is no body of existing theory that could be used in its development. In its present state, the model serves as a guide to the assembly and subjective integration of information relevant to the environment that influences vocational education. This chapter presents an overview of the model and a discussion of the economic-governmental climate that constitutes a major influence on public vocational education.

The Model

National goals, the economic environment, the role emerging technologies play in determining skill and training requirements, and the impact of the composition of the labor force and long-term demographic trends compose the major components of the environment for vocational education. This report synthesizes the information currently available about these components and

identifies the implications of this information for education and training needs in the next three to five years, particularly as they relate to vocational education.

The components of the model and the relationships between them are displayed in figure 1-1. The model cannot attempt to delineate every interaction between components of the system without becoming hopelessly complicated. Therefore, the model attempts the more modest objective of depicting the most powerful and pervasive of the relationships.

Long-term social and economic values are the foundation for virtually all activity in society. These values are often so fundamental that a discussion of their existence and the support for them seems unnecessary. These values serve as the unstated assumptions and the basic guidelines for society. An example of such values would be citizens' support of the principles of democracy or support for the maintenance of a free enterprise system. The basic values of freedom, equal opportunity, and progress, primarily defined in material terms, constitute this foundation.

The model can be divided into three major sections that have some interactions across sections, with the majority of interactions within each section. The first major section relates to the economic climate and the role of government. The political and economic climate sets the stage for all domestic endeavors. This section includes the interactions between the nation's government and the economy and their relationship to the public's perception of the value of education. Each of these three components is discussed later in this chapter.

The role of technological innovation and the diffusion of that innovation comprise the second major section of the model. Before society feels the impact of any technology, a technological innovation must be commercially feasible as well as commercially diffused (Rosenberg 1976). Historically, the diffusion and application of innovations have first improved upon currently applied processes in society. Later in their application stage, the innovations are applied in ways that have never before been considered. In anticipating the impact of technologies, it is easier to identify those impacts that are improvements to old techniques and processes, but much more difficult to anticipate applications that have never before been considered. Only technologies that are currently in the commerical feasibility or diffusion stage are discussed in chapter 2, for this report is primarily concerned with the impacts upon vocational education within the next three to five years. One of the major interactions across sections is between the diffusion of technology and economic activity. Mensch (1979) has even proposed that spread of basic new technologies through the economy and eventual over-investment in them are the primary causes of long-term business cycles.

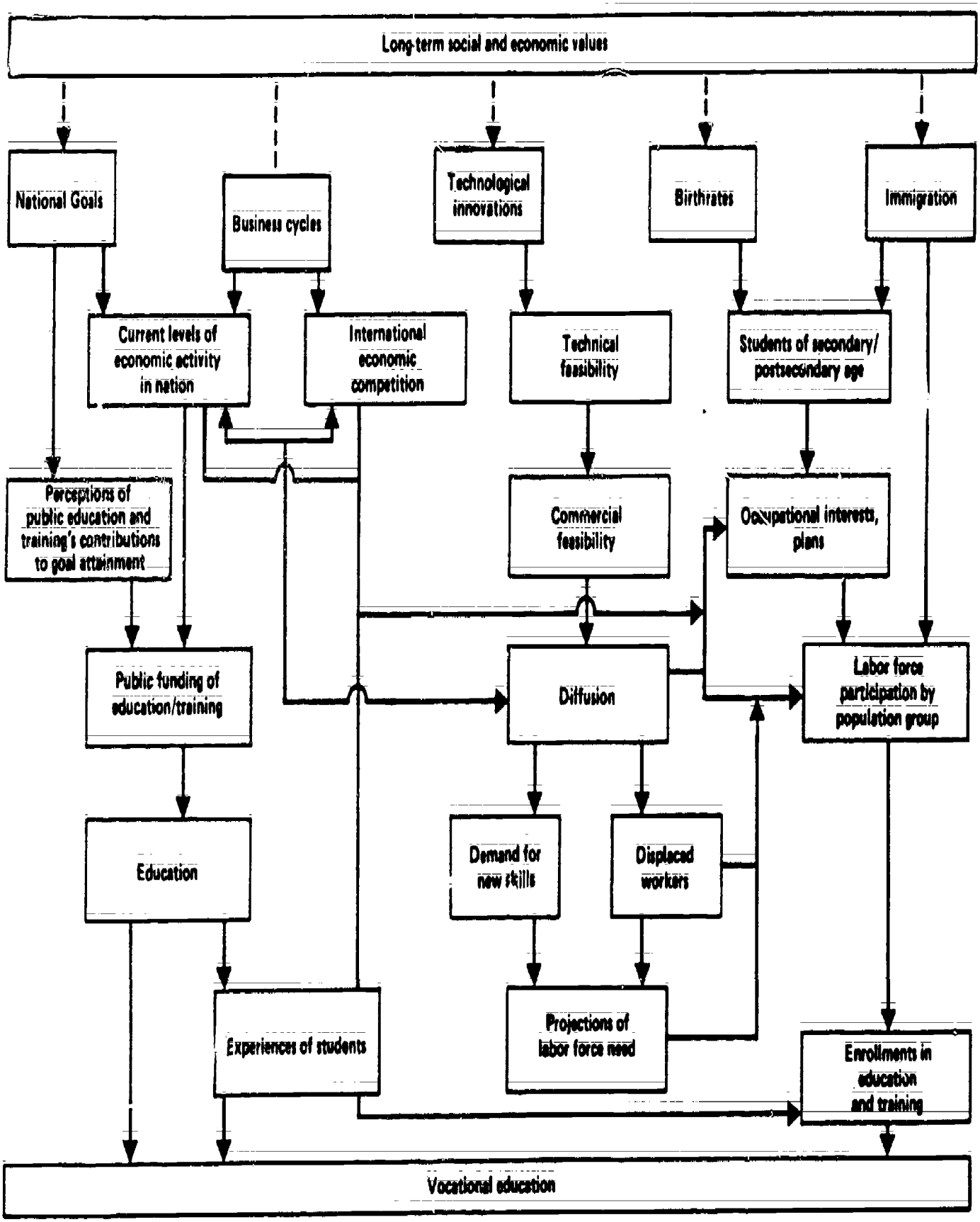


Figure 1-1. Major influences on public education and training programs

Demographic trends and the composition of the labor force comprise the last major section of the model. The aging of the post-World War II baby boom and the changes in the composition of the labor supply are issues which have direct impact upon vocational education, since these forces affect the supply of the potential clients for education and training. Vocational education's share of this training delivery is a continuing concern for vocational education planners. These issues are discussed in chapter 3.

Occupational plans, labor force participation rates, and enrollments in education and training programs are obviously influenced by several of the elements in the other sections of the model. The most significant of these relationships are shown. They include the educational experiences of students, levels of economic activity, projections of labor force needs, displacement of adult workers by technological change, and international competition.

Chapter 4 presents data on the trends in enrollments and funding for vocational education. The discussion considers whether, in times of shrinking federal dollars and shrinking secondary enrollments, vocational education will continue to attract students and receive adequate funding. Chapter 5 discusses the implications of these factors upon vocational education and identifies those factors which must be considered when anticipating changes in the next three to five years.

The Economic and Political Climate

The economic and political climate sets the stage for the delivery of vocational education. The economic activity in the nation and the resulting configuration of industries determine the amount and the content of skills demanded in the labor market. This section discusses national goals regarding defense, the economy, and equity; the economic outlook as of late fall of 1983; and the current attention that public secondary education is receiving.

National Goals

Every nation has a set of principles and values which serve as a yardstick against which the performance of society is measured. These principles and values are the basis of national goals. In the United States, national goals are communicated through the political process with the identification of these goals supplied by statements of the President, through the legislative agenda of Congress, and via various executive commissions (Biderman 1966). The most prominent statement of these goals is the President's annual State of the Union address. The discussion of national goals will address defense, the economy, and

equity. These issues appear to have the most direct implications for vocational education.

Defense goals. The Reagan administration has clearly placed a high priority on maintaining and strengthening our current levels of defense preparedness. In the President's Budget Message to Congress in 1982 he states, "I have proposed strengthening the Nation's defense, to restore our margin of safety and counter the Soviet military buildup" (Executive Office of the President 1982, p. 4). This policy, however, did not originate with the Reagan administration. In 1978, President Carter initiated the biggest peacetime increase in defense spending that Congress had passed up to that time. Subsequent increases under the Reagan administration have been even larger.

In 1978 and 1979, defense expenditures represented 5.0 percent of the gross national product (GNP). Since that time, this percentage has increased, with 1982 estimates at 6.1 percent, representing the largest percentage of the GNP devoted to defense since 1972 when the Vietnam War was winding down (U.S. Office of Management and Budget 1983). In the FY 1983 budget, 29 cents out of every dollar spent by the federal government was spent on national defense.

The national defense goals of the United States interact with vocational education in both direct and indirect ways. Critical to the defense goals of the nation is the strengthening of the technical skills of the individuals in the military, as well as strengthening the skills of the individuals employed or potentially to be employed by defense suppliers. "The skills problem that Congress believes is being experienced by the nation's defense industrial base represents one skills problem of national significance for which vocational education is appropriate" (Starr 1984, p. 2). The U.S. Departments of Defense and Education are encouraging cooperation between defense firms and vocational education. Additionally, there is federal interest in having public vocational education assist in providing training for the active military, the reserves, and other components of the defense establishment. Increasing national defense expenditures will require more skilled workers in defense-related industries. Although there is no convincing evidence on how adequate the supply of skilled workers will be, there is widespread concern at the national level that upgrading and retraining of skilled workers may be a serious national problem (ibid.).

The defense budget also has an impact on vocational education directly by competing for limited federal dollars. Both defense and education are considered "controllable" expenditures of the federal government (Jennings 1981). They fall into this category because the threat of legal action to secure funding does not exist as it does with entitlement programs like social

security. With the strong emphasis on defense and the uncertainty about the federal role in education, when these forces compete for the same "controllable" federal dollar, education may well find itself at a disadvantage.

Economic goals. After World War II, the United States became the international leader in the production of goods and services. While Europe and Japan were rebuilding and retooling, the United States established itself as the dominant economic force in international trade. As other countries regained their production capacity, the United States maintained its economic superiority until the early 1970s (Schwartz and Choate 1980). Several interrelated factors contributed to the relative weakening of the United States' economic position at that time.

First, while Europe and Japan were rebuilding and retooling with new industrial equipment, the United States continued to use equipment dating from before the war. In the postwar era, capital investment for manufacturing equipment was not maintained at sufficient levels to keep pace with the new industrial processes used by overseas competitors. Thus, while productivity continued to increase in the United States during that period, increases in productivity were greater in other countries (National Research Council 1983).

Second, after 1973, the rising cost of oil contributed to domestic inflation and the devaluation of the dollar in world markets (Kahn 1979). Although the volume of goods and services generally increased, the total value of these items decreased on world markets. Thus, the same quantity of exports had to be exchanged for a smaller volume of imports, making an negative impact on America's balance of payments.

From the mid-1970s until today, the United States has been struggling to maintain its position in competitive world markets. Growth and prosperity, having long been critical national economic goals, serve as the foundation of government policies. Attempts to "correct" the short-term economic problems of increased international competition have, in some cases, led the government to respond by attempting to decrease the competitive edge enjoyed by products produced in other countries. Additionally, the economy is undergoing a major change in the categories of products which comprise the gross national product, resulting in Americans producing more services than goods.

United States trade policy, rather than encouraging competition and the changing configuration in the manufacturing industries, has responded by establishing protectionist import policies and subsidies to dying industries (Reich 1983). These policies will serve only to slow the eventual demise of non-competitive industries, not change the eventual outcome.

Equity. The legacy of the New Frontier programs and the Great Society programs of the 1960s led the way for the 1970s to be an era when equity was a major national goal as articulated in national legislation. The economically disadvantaged, the handicapped, minorities, and women were all included in legislation to correct inequities in the economy, government, and education (Taggart 1981). While the legislation of the 1970s made inroads into these inequities, the economic situation of the early 1980s has served to divert attention to matters concerning the economic health of the nation. The Job Training Partnership Act of 1982, for example, while retaining the basic purpose of serving economically disadavantaged populations, gives a strong role to representatives of the private sector in setting policy and designing services.

National legislation for vocational education and the funding patterns authorized by this legislation have been the driving force for implementing activities to strengthen equity in vocational education in the United States. The 1976 amendments to the Vocational Education Act of 1963 specified set-aside funding for the handicapped and the disadvantaged. Each state was required to hire a a full-time person and perform certain activities to address issues of overcoming sex discrimination, bias, and stereotyping.

As this is written in the fall of 1983, Congress is considering two bills to reauthorize the vocational education legislation. Senate bill 1039 was introduced by Senator Hatch and reflects the administration's position with regard to economic development, program support, and adult basic education. It proposes to allocate funds for sex equity activities, but does not require the continued utilization of sex equity coordinators. The bill developed by the American Vocational Association and introduced by Representative Perkins for Representative Goodling and twenty-one others (H.R. 4164) has many of the same purposes as the Senate bill but differs considerably in ways to achieve them. It does, for example, require the continuation of sex equity coordinators. Other bills that focus primarily on program improvement and underserved populations are under development in the Senate. Whatever emerges from Congress seems likely to increase the emphasis to be given to economic goals and to the involvement of business, industry, and labor representatives in vocational programs.

The Economic Outlook

Business cycle forecasts are made by analyzing data from indicators of economic activity. These indicators vary in their ability to predict the course of business. The advantage of using an index of indicators is that any single indicator has

biases and is sensitive to fluctuations or unusual activities in business, while an index is less sensitive to these pressures. The Index of Leading Indicators, consisting of a composite of twelve indicators, is produced monthly by the U.S. Department of Commerce. Some of the indicators in the series are used to predict troughs, while other indicators are used to predict peaks in the business cycle. The leading indicator approach generally predicts the peaking of the economy better than it predicts the end of a recession. Peaks are often predicted seven months or more in advance, while the ends of recessions tend to be identifiable three months in advance.

The Business Week Leading Index, a new index, was introduced in November of 1983. Geoffry H. Moore, the same individual who, in 1950, developed the Department of Commerce index, developed this index. Available weekly, the index's timeliness is its major advantage over the government's index. The Business Week Leading Index includes some data six weeks earlier than it can be incorporated into the Department of Commerce's Index of Leading Indicators. Thus, by using this series, weekly changes in economic activity can be identified rather than monthly changes.

As of November 1983, the data from these indexes are predicting the slowing of the expansion currently being experienced in the economy. The gross national product (GNP) is expected to grow at an inflation-adjusted average of 6.0 percent for 1983. This is the highest average yearly increase since 1976. Inflation is expected to remain at moderate levels while the foreign trade deficit remains the major drag on economic growth ("A New Economic Index" 1983). The current expansion is not expected to end before May 1984 ("Another Huge Deficit" 1983). The profits of automobile, aerospace, home building, telephone, hospital management, and pollution control firms are faring best in the economic recovery. The steel, entertainment, paper, construction machinery, cosmetics, and hotel/motel industries are not responding to the increased economic activity of the recovery.

Long-range forecasting of the economy is a risky business at best. Even the experts rarely attempt to make long-term predictions. There are, however, a number of fundamental activities that serve as the backbone for economic activity in the United States.

World trade and the international economic situation have an important impact on the long-term activity of the economy. Increased foreign exchange rates for the dollar have a favorable impact on the export balance sheet, while at the same time making previously competitive goods from American producers overpriced in competitive international markets. Fortune ("The Recovery Is Reshaping the Economy" 1983) predicts that in the next six to twelve months, the dollar will decline in value, easing some of

the pressures on U.S. exporters. The world economy is expected to recover from its current recessionary cycle.

Punishingly high interest rates have exerted a significant force on the management of corporations. Corporations have a stronger commitment to cost control than ever before. Industry's first moves have been to slash labor costs. The need for labor-saving techniques has accelerated the rush by manufacturers and service companies to automate assembly and clerical tasks ("An Inflation-Resistant Economy" 1983).

Factors that emanate from the monetary and fiscal policies of the federal government--interest rates, money supply, and taxes--also have long-term effects on economic activity. Economists are predicting that, unless the unprecedented increases in the federal budget deficit can be controlled, the economy will worsen considerably in 1985 ("Another Huge Deficit" 1983).

As a result of the last prolonged recession, the basic configuration of the economy has changed. Today's economy is grounded more than ever before on personal consumption and less on business investments. During the recession, many service industries never receded, while manufacturing industries were devastated. Since the recovery began, housing and automobiles have recovered with vigor, while steel and other basic industries remain severely depressed.

The Reagan administration's tax policies have attempted to produce just the opposite effects in each of these sectors. Personal savings were supposed to increase due to the decrease in personal taxes, while tax incentives were supposed to stimulate business investment. Instead, the savings rate has fallen and business has not added to its capacity.

Education Climate

One of the major influences on education in the next few years will be the reactions to the various reports on the condition of secondary education in the United States. The most prominent of these is A Nation at Risk: The Imperative for Educational Reform, the report of the National Commission on Excellence in Education (1983). Others that have received considerable national attention include:

Reports by task forces or commissions:

Title	Source
Action for Excellence June 1983	Education Commission of the States, Task Force on Education and Economic Growth, Governor James B. Hunt, Chair.

Title	Source
Educating Americans for the 21st Century September 1983	National Science Board, Commission on Education in Mathematics, Science, and Technology
Academic Preparation for College: What Students Need to Know and Be Able to Do 1983	The College Board
Education for Tomorrow's Jobs September 1983	National Academy of Sciences, Committee on Vocational Education and Economic Development in Depressed Areas, Susan W. Sherman, Editor

Reports by individual authors:

Title	Author/Publisher
The Paideia Proposal: A Educational Manifesto 1982	Mortimer Adler Macmillan
High School: A Report on Secondary Education in America 1983	Ernest Boyer Harper and Row
A Place Called School: Prospects for the Future 1983	John L. Goodlad McGraw-Hill
Horace's Compromise: The Dilemma of the American High School Today (in press)	Theodore R. Sizer Houghton Mifflin

The public high school has periodically been the topic of various studies and reports, but never before have there been so many separate analyses appearing within such a short period of time. This convergence of interest from different sources reflects an emerging concern that the schools, particularly the secondary schools, are not producing students with adequate preparation for adult life. The reasons underlying this concern are diverse and no attempt will be made here to identify and explain them. Nor will any attempt be made to critique the separate reports. Reviews and comparisons are available from several sources including Phi Delta Kappa (1983), the National Education Association (1983), and the American Vocational Association (1983). The following discussion focuses on those aspects of the reports that are of direct relevance to vocational education.

Perhaps the major implication for vocational education is that, for the most part, it is given relatively little attention. Three of the reports from task forces--the Education Commission of the States, the National Science Board, and the College Board--do not refer to vocational education at all and a fourth, the National Commission on Excellence, refers to it only in passing. The three reports by individual authors do discuss vocational education, but give it little or no endorsement. Adler specifically rejects vocational instruction--which he describes as training for specific jobs--as not appropriate for education. Boyer reviews some of the evidence on the effects of vocational education and finds relatively weak support. Goodlad concedes that students like vocational courses and that instructional methods are generally superior to those in academic classes, but questions the rigor of the instruction and the specificity of the training.

The National Academy of Sciences report is the only one that contains an unequivocal endorsement of vocational education at the secondary level. This report states that "it is the responsibility of the public education system to prepare students for both employment and further education" (Sherman 1983, p. 82). It then goes even further:

> We would like to see vocational education become an equal partner with college-preparatory education in the education system as a whole. The most effective vocational programs are deserving of that respect now, and we would like to see all programs raised to that level of quality and esteem (Ibid., p. 83).

Achieving the National Academy of Sciences' goal, however, will be made difficult by the call for more prescribed courses in English, science, and mathematics contained in the other reports. Many vocational educators are concerned that these new requirements will limit or even eliminate the time available for vocational programs. The additional requirements may result in more of the same type of content and instruction that bore and alienate many students. If this happens, the rate of withdrawal from high school is likely to increase. The irony of such a consequence is that more rigorous academic requirements could produce an outcome just the opposite of that intended--a less, rather than better, educated population.

CHAPTER 2

THE IMPACT OF TECHNOLOGY

Technological change in the 1980s, despite its rapid pace, is evolutionary rather than revolutionary. Evolutionary change means that "best practice slowly becomes average practice, and processes and products now in the pilot or demonstration stage come into commercial use" (Ridker and Watson 1980, p. 35). Technological changes have a gradual impact upon the economy. These changes are incremental. Qualitative changes occur only after a considerable gestation time. Discontinuities in the trends in the environment, which indicate qualitative change, are, by their very nature, nearly impossible to anticipate. This discussion will focus on incremental changes rather than on possible qualitative changes.

The 1980s are a time of rapid technological change. A multitude of products and processes have been developed by applying technological innovations to solving problems and improving processes. Technological innovations and applications can be grouped into four categories: biomedical/genetics, information and related technologies, energy, and manufacturing processes.

Biomedical/genetics technologies include genetic engineering, bioengineering, pharmaceuticals, and recombinant DNA. Information and related technologies include semiconductors, the applications of microprocessors, computer software, and electronic information and communications systems. Energy technologies include the development and application of photovoltaics, coal gasification and liquefaction, biomass, and geothermal energy. Manufacturing processes include robotics and other automated technologies, as well as the application of lasers to sensing and cutting processes. These examples are illustrative and are not intended to be exhaustive. A more complete list of promising new technologies is presented in a report from Battelle Memorial Institute (1982).

For technologies to have an impact on society, they must successfully complete the stages of the innovation process. Understanding the stages of this process and the factors influencing this process allows for a more accurate assessment of the potential effects of technology on society.

The Innovation Process

The process that begins with an idea and ends with a new product or process that is accepted in the marketplace is the innovation process. This process is dynamic and intricately interrelated across its various stages and with the state of the

economy. While different writers give the four steps in this process different names, there is agreement about the content of these steps (National Research Council 1983).

The first step, technical innovation, uses research to generate new scientific knowledge or new ideas for application. In the second step, technical innovation is translated into a technically feasible product or process. This usable product is aimed at a defined market demand, using both research input and input from the market to assist in product development. This stage ends when a single prototype product is developed which appears to be suitable for production.

In the next stage, the prototype is adapted until it becomes a commercially feasible product. For a product to be commercially feasible, it must be capable of being produced in quantity with reliable quality, controllable costs, and assurance that the product is serviceable. The production of this product may require retooling the manufacturing plant and setting and enforcing criteria for suppliers.

Once a new product has been produced in quantity, the product is diffused into the marketplace. The diffusion stage addresses the requirements of the consumer using the product. The diffusion activities for a product includes marketing the product, training the customer, and providing any necessary support services, including maintenance.

A number of internal and external factors influence the propensity of companies to engage in innovation (National Science Foundation 1982, U.S. Department of Commerce 1983b). Factors external to companies include the technological base of human resources in the labor market, overall economic conditions including aggregate demand and investment rates, inflation rates and market stability, the composition of the industry including the concentration and size of companies in the industry, government policies which require companies to concentrate on short-term problem solving rather than long-term goals, and incentives for innovation including the perceived riskiness of certain ventures.

Internal factors which effect upon the rate of innovation include corporate goals and specific objectives which guide decisions about engaging in innovative ventures, the type and amount of capitalization, the degree to which all levels of the corporation focus on innovation, the quality of the internal management of the company, and the degree to which the company reward system is based on achievement of long-term rather than short-term results.

Participating in innovation is very risky. Empirical evidence derived from the chemical and drug industry shows that of

all the projects begun, 43 percent were technically feasible. Of the technically feasible projects, 45 percent were not commercially feasible. Of the commercially feasible projects, 62 percent were not economic successes. In this study, for every innovation project that was begun, only 12 percent were considered commercial successes (U.S. Department of Commerce 1983b).

Because of the length and uncertainty of the total innovative process, the model presented in chapter 1 tracks only the commercial feasibility and diffusion stages of innovation. The technologies that have had the widest diffusion are those that provide the greatest increases in efficiency in producing large numbers of goods and services. A discussion of three technology areas which represent varying degrees of diffusion follows.

Technologies

Laser technology, currently being utilized in a variety of manufacturing processes for cutting, fusing, and sensory functions is commercially feasible and, it is expected that the applications of this technology will continue to grow over the next several years. Medical applications, applications in space, and continued development of manufacturing applications will highlight the future of laser technology. Like many technological innovations, lasers are integrated with other functions and do not have a discrete impact on society. However, knowledge about the application of lasers in specific areas will be needed in the future.

The second technological area shows great promise but has few products in the commercially feasible and diffusion stages is biotechnologies. The major areas of biotechnology applications that are currently being developed are in pharmaceuticals, chemicals, energy, agriculture, and food processing. The United States is the leader in recombinant DNA research and cell structure technologies, while Japan is the leader in fermentation technologies. Only a few commercial products are being produced with this technology. Sufficient venture capital is currently available in this area, although as the commercialization of products increase, capital requirements are also expected to increase (U.S. Department of Commerce 1983b). The development of biotechnological process engineering leadership is the critical determinant for long-range competitiveness in industries that utilize biotechnology.

The technological innovation that has had the most impact upon the economy and society has been the development of the microprocessor. This technology is a convergent technology (Rada 1980). Its applications are so widespread that every industry and individual in the United States has felt its influence. The manufacturing processes of assembly, welding, and spray painting have been most heavily automated. Office automation, including

data storage and retrieval, word processing, and electronic mail systems, is affecting the content of jobs in the office.

Applications of the microprocessor in automating the factory and the office and their influence on skills requirements, particularly as they relate to training below the baccalaureate level, are discussed in more detail in the following sections. For a related report that discusses the training implications of robotics and office automation see Robotics and Office Automation: Implications for Vocational Education (Fraser, Unger, and Lewis 1984).

Factory Automation

Robots, numerically controlled machine tools, and flexible manufacturing systems are but a few of the applications of the microprocessor in the factory. Flexible manufacturing systems are the integration of robots, numerically controlled machine tools, and other material handling devices into an automated manufacturing system which can be used to produce a family of diverse parts in batches. All of these machines are linked together with a cental computer. Flexible manufacturing systems require a considerable capital investment, thus their acceptance has been slow. Robots have enjoyed greater acceptance as their application in manufacturing processes has become easier to accomplish.

In 1983 it is estimated that there are seven thousand robots in use in the United States, 50 percent of them in the automotive industry (Hunt and Hunt 1983). Projections for the robot population in 1990 vary from fifty thousand to one hundred thousand. While welding, spray painting, and foundry operations have been the most frequent applications of robots, they are currently being applied to lightweight (less than five pounds) assembly of electronics equipment (Ayres and Miller 1983).

Robots are not an outgrowth of any new technology, but they do require a unique combination of existing technologies. Principles of hydraulics, pneumatics, and electronics combine in the production and maintenance of a robot. Thus, the skills required to manufacture, use, and maintain a robot are a new configuration of skills rather than new skills themselves (Tanner 1982).

The demand for newly-trained individuals with these skills is not anticipated to be significant in the near future (Fraser, Unger, and Lewis 1984). The automotive industry, where half of the robots currently in use are located, will retrain laid-off employees before they will experience a demand for robotics technicians trained below the baccalaureate level. Cincinnati Milacron, a major manufacturer of robots, trains current factory

employees who have a background in electronics in two weeks to perform the use and maintenance functions in robot operations (Tanner 1981). Any significant demand for robotics technicians is not anticipated to materialize in the next three to five years.

Office Automation

Office automation is a generic term for an array of office equipment, much of which is based on microprocessor technology. Specific machines and systems included in this designation are personal computers, word processors and electronic typewriters, copiers and typesetters, private branch exchanges (PBXs), multi-function computer systems, and local area networks which link together a variety of the specific automation devices and functions.

Much of the impetus for automating the office is the need to increase productivity. The economy continues to move toward service industries, such as banking, insurance, and health care, and the information available in these industries continues to grow at phenomenal rates. The need for more efficient handling and dissemination of information provides a strong incentive for information-intensive industries to automate office functions.

The automation of the office involves the full range of activities performed by all levels of management and support staff. Every worker in an automated office setting is affected by the changing environment of the office. The discussion that follows focuses on the impact of office automation on the clerical professions, particularly the impact of word processing on the demand for secretaries and other clerical employees.

The automation of clerical functions will improve productivity of office personnel. There is evidence that the demand for secretaries and other clerical employees will decrease slightly in the near future although these occupations will remain among the forty occupations with the greatest number of new job openings (Silvestri, Lukasiewicz, and Einstein 1983). The changes that will be experienced will be changes in the skills needed in clerical occupations. Keyboarding will remain important. For advancement in the office and mastery of advanced word processing skills, secretarial and clerical personnel will need to possess higher-order skills such as analysis, synthesis, and logical thinking.

As office automation diffuses through information intensive industries and the rest of the economy, the greatest demand will be for workers with higher-order skills. There will still be a demand for workers with more traditional office skills--those who

do not possess the higher-order analysis skills--but there will be a decrease in the number of openings for such workers.

The technologies discussed in this chapter do not represent an exhaustive list of the technological developments that will affect society. The technologies discussed do, represent the technologies that will have the most widespread impact on vocational education in the next three to five years. As other technologies develop commercially feasible products, the impact of these innovations will need to be assessed in terms of their implications for vocational education.

CHAPTER 3

THE LABOR FORCE

Demographic changes in the population and the labor force present important training implications for vocational education. As changes in these areas occur, and as skill-level demands fluctuate as technology advances, vocational education must adapt. This chapter reviews major trends in demography and participation rates that affect the composition of the labor force. These trends influence the types of workers who now, and in the future, are most likely to need vocational education--new entrants, displaced workers, reentrants, or others. The chapter presents projections of job openings and job growth during the 1980s and the number of workers likely to be displaced by automation.

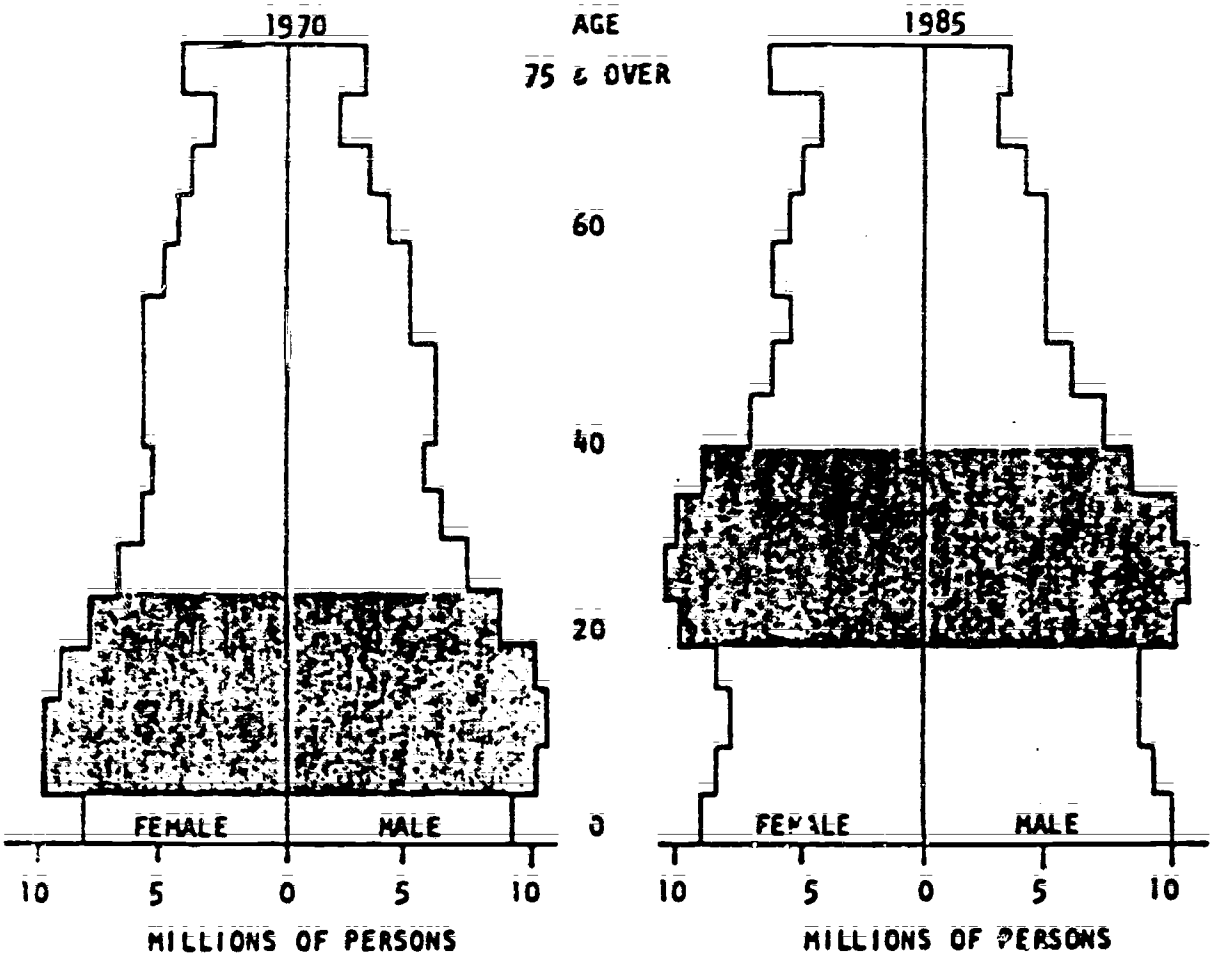
Composition

During the period from 1945 through 1963, an exceptional number of births was recorded in the United States. This period, commonly referred to as the "baby boom", had an increase in fertility rates (annual births expressed in terms of the implied completed fertility of one thousand women) rising from 2.5 in 1945 to 3.7 in 1957. The rate began to decline in 1963 when it dropped to 3.4, and continued to a low of 1.8 in 1975. As a result of the increase of births during this eighteen-year period, a "population bulge" was created that has had and will continue to have a major impact on American life as it moves to maturity. Figure 3-1 illustrates the intensity of the "bulge" as this age group grew older from 1970 to 1985.

Age

As the baby-boom group matures, the number of entry-level workers in the sixteen to twenty-four age group has already declined and will continue to do so. This trend is evident when examining the sixteen to nineteen and twenty to twenty-four age groups comprising the population and the labor force. Figure 3-2 shows a marked decline in the number of sixteen- to nineteen-year-olds in the population by 1985. The decrease in the twenty to twenty-four age group will not be as evident until the late 1980s or early 1990s. These same trends are reflected to a lesser degree in figure 3-3 which shows a moderate decline in the number of sixteen- to nineteen-year-olds entering the labor force by 1985, and a more pronounced decline in the twenty to twentyfour age group by 1990.

These trends have major implications for the significant youth unemployment problem that the nation currently faces. As



Indicates the baby-boom group.

Figure 3-1. The changing age distribution in the United States.

SOURCE: Lewis and Russell 1980, p. 97.

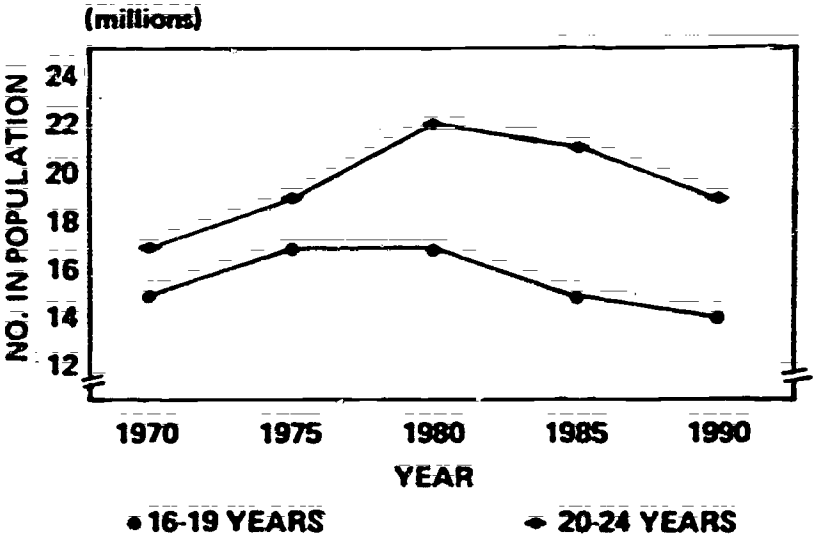


Figure 3-2. Population distribution by selected age groupings, by year.

SOURCE: Appendix table C.1.

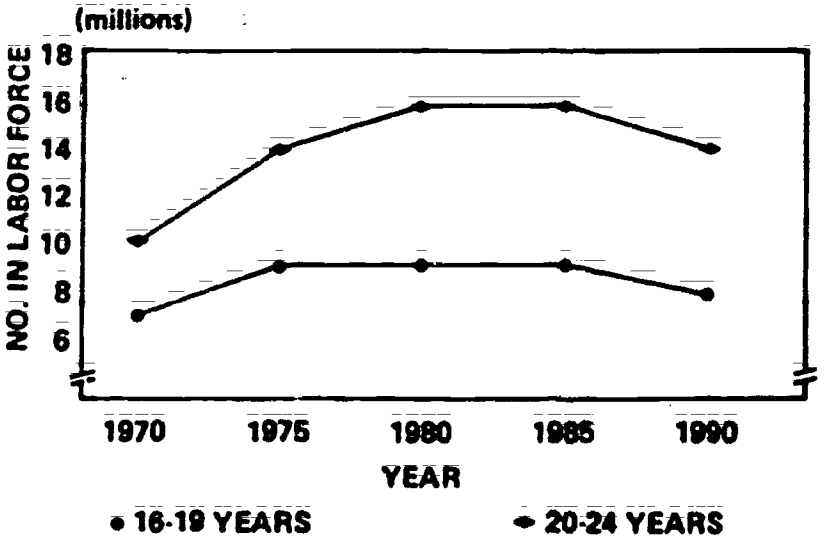


Figure 3-3. Labor force distribution by selected age groupings, by year.

SOURCE: Appendix table C.3.

is noted later in the chapter, declines in these age ranges were not the same in all population groups, and births of racial minorities did not decline proportionally as much as births in the white population. Overall, there will be fewer young people in the sixteen to twenty-four age range for the rest of this century. There will, however, be proportionally more minority young people who in recent years have had the most difficulty obtaining employment.

One point is certain: there will be fewer young people in the fourteen to twenty-four age range from which most of the vocational education students have come in the past.

Sex

Declines are expected in the number of new entrants into the labor force, but future growth in the total labor force is still expected. The United States labor force grew from 83 million in 1970 to 107 million in 1980 and is projected to increase to 122 million by 1990. Increases in labor force participation by women are expected to compensate partially for the decline in new entrants into the labor force. Figure 3-4 shows a small future decrease in the labor force participation rate of men, declining

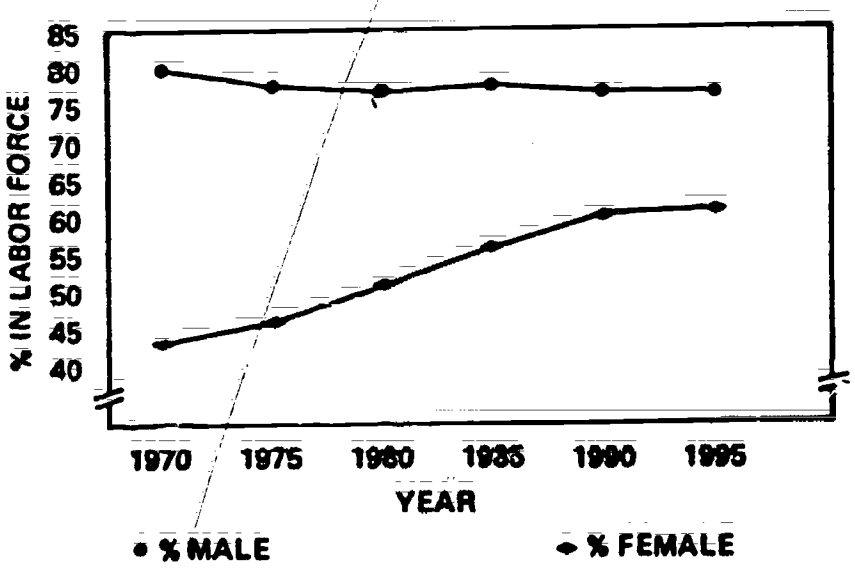


Figure 3-4. Labor force participation rates by sex, by year.

SOURCE: Appendix table C.6.

from 80 percent in 1970 to 77 percent by 1995. By comparison, female labor force participation rates are projected to rise from 43 percent of adult women in 1970 to 61 percent by 1995. Expressed in another way, the percentage of males in the total labor force declined from 62 percent in 1970 to 58 percent in 1980 and is projected to decline to 54 percent by 1990 (figure 3-5). The increased participation of women in the labor force is due, in part, to economic pressures on the family, the increased number of single parent families, and the desires of many women for their own occupations and income. Even if the official projections are too high, it seems very likely that large numbers of women will be seeking training to enter or re-enter the labor force. One of the continuing challenges for vocational programs will be to encourage young women to prepare and obtain nontraditional employment where their opportunities for earnings and upward mobility will be greater than in many traditional "female" jobs.

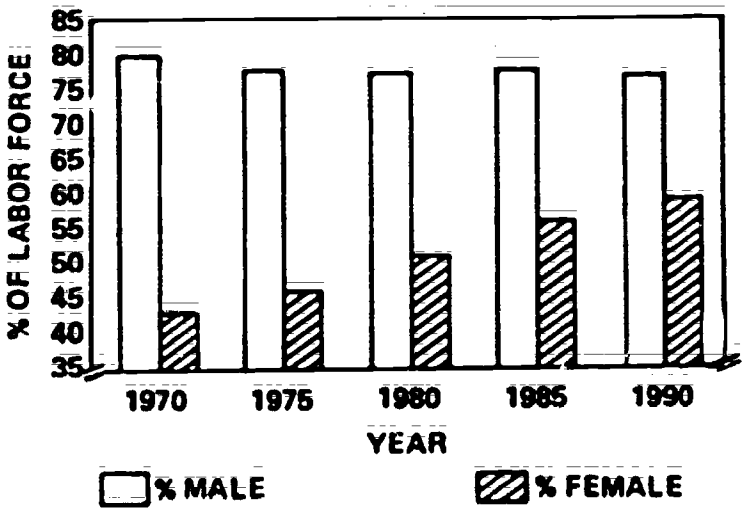


Figure 3-5. Labor force composition by sex.

SOURCE: Appendix table C.7.

Minority Composition

In 1970, minorities (blacks and others) comprised approximately 11 percent of the total labor force (table 3.1). By 1980 minority labor force representation rose to 12.4 percent.

TABLE 3.1

LABOR FORCE REPRESENTATION OF MINORITIES
(BLACK AND OTHER)

YEAR	PERCENT OF TOTAL LABOR FORCE
1970	11.1
1975	11.6
1980	12.4
1985	12.7
1990	13.4

SOURCE: Appendix table C-8.

Projections by the U.S. Bureau of Labor Statistics show minority participation increasing to represent 13.4 percent of the total labor force composition by 1990.

Participation rates among minority men dropped from 76.5 percent in 1970 to 71.5 percent in 1980 and are projected to remain relatively static at 71 percent in the 1990s (figure 3-6).

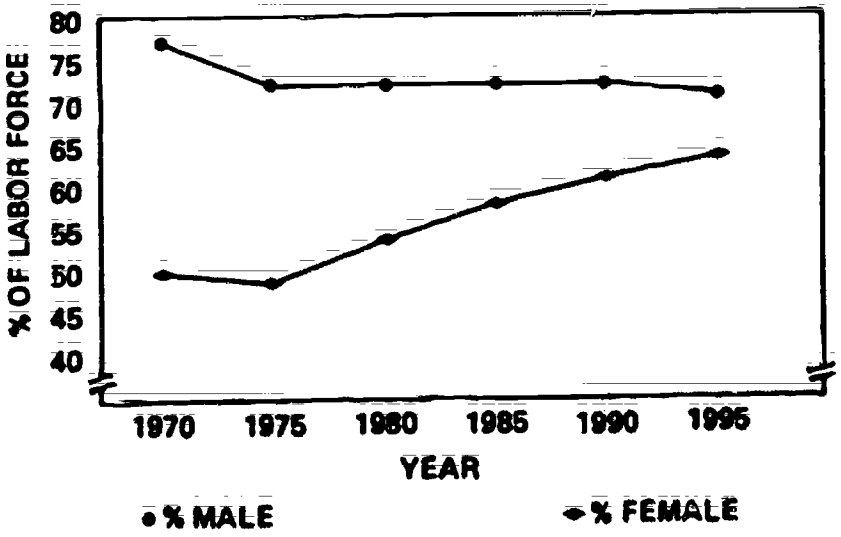


Figure 3-6. Minority labor force participation by sex. (black and other)

SOURCE: Appendix table C-8

Minority female participation rates, however, have progressively increased from 49.5 percent in 1970 to 53.6 percent in 1980, and the U.S. Bureau of Labor Statistics projects that by 1995, minority female participation will be almost 64 percent. Despite higher fertility rates among black women in 1979, labor force participation rates for prime-age (twenty to fifty-four) black women were higher than those of white women.

Educational Preparation of Labor Force

As shown in table 3.2, the percentage of white men and women in the labor force who are high school graduates with no further formal education remained rather static from 1970 to 1979. Increases were noted in the percent of white men and women continuing their education below the baccalaureate level for the period from 1970 to 1979. The percent of white men and women in the labor force that received one to three years of postsecondary education increased about 4 percentage points from 1970 to 1979.

Unlike whites during the 1970s, the percentage of black (and other) men and women in the labor force that are high school graduates increased 8.2 percentage points for men, and 4.1 percentage points for women. Similar increases are also apparent when examining the percentage of black (and other) men and women in the labor force that acquired one to three years of postsecondary education. Black (and other) men showed an increase of 5.8 percentage points and women showed an even greater rise of 7.1 percentage points. Only six years of data were available on the educational attainment of the Hispanic labor force. For the period from 1974 to 1979, the trends were similar to those of the black (and other) men and women but not quite of the same magnitude.

These trends suggest that national educational policy during the 1970s, which was primarily aimed at underserved populations, was at least partially successfully. It is highly unlikely that these policies will be abandoned during the remainder of the 1980s. Whatever other roles shall be expected of vocational education, one of the primary objectives of federal legislation is likely to be special assistance to those groups that have the most difficulty obtaining rewarding employment.

Taken together, the changes in age, sex and racial/ethnic composition of the labor force suggest that, for the rest of this century, vocational education will be serving a more varied clientele. There are likely to be more adults, especially more adult women, and more minority group members who will need training and retraining. Some of the changes that will be necessary to serve these clients are discussed in chapter 5.

TABLE 3.2

EDUCATIONAL ATTAINMENT OF CIVILIAN LABOR FORCE, BY RACE, YEAR, AND SEX

		MALE (%)		FEMALE (%)	
	YEAR	HIGH SCHOOL GRADUATE	1-3 YEARS POSTSEC.	HIGH SCHOOL GRADUATE	1-3 YEARS POSTSEC.
WHITE	1970	35.8	14.1	47.1	13.6
	1973	36.4	15.0	46.4	14.0
	1976	36.8	16.5	45.4	16.3
	1979	36.8	17.7	45.6	17.8
BLACK & OTHER	1970	28.3	8.0	34.5	10.3
	1973	31.1	9.9	36.8	12.4
	1976	33.4	12.0	38.8	13.7
	1979	36.5	13.8	38.6	17.4
HISPANIC	1970	NA	NA	NA	NA
	1974	25.5	10.6	33.3	10.8
	1976	27.1	10.7	37.0	11.6
	1979	27.1	12.9	37.4	12.9

SOURCE: Appendix table C.10

Projected Demand for Workers*

Industrial Trends

Total civilian employment is projected to increase 25 percent during the period 1982 to 1995 from a total of 102 million to 128 million (Personick 1983). Mainly contributing to this increase will be growth in employment in service-producing industries, namely transportation, utilities, trade, finance, insurance, real estate, other services, and government. Within this broad clustering, the fastest growing category is the one labeled "other services." This includes such diverse industry classifications as medical care, business services, recreation, and personal services. This "other services" classification is expected to account for one out of every three new jobs over the period 1982 to 1995 and to employ about one-fourth of the total work force by 1995.

Service industries are not synonymous with service occupations. Service industries employ the full range of occupations. In some service industries such as medical and professional services, large proportions of the work force are professionals and technicians. In other service industries, such as protective services, most of the workers are in actual service occupations. Even in protective services, however, there are workers who are classified as managers, technicians, secretaries, and so forth. With all the discussion of the economy moving away from manufacturing and toward services, it is important for vocational educators to understand that service-producing industries employ all types of workers, not just those in service occupations.

The proportion of the work force expected to be employed in manufacturing industries in 1995 (18.4 percent) is virtually the same as was employed in 1982 (18.8 percent). If this projection holds, the steady decline in the proportion of the work force in manufacturing which has taken place since World War II will not continue. Since the total labor force will be growing, that manufacturing should provide about 17 percent of the new jobs expected in the 1982-1985 period.

The recent attention that high technology industries have received would lead one to believe that they will be the prime sources of economic growth, productivity improvement, and

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*The information in this section is based primarily on articles from the Monthly Labor Review, November 1983, which contains the most recent industry and occupational projections available. The time span of these projections is 1982 to 1995, which is longer than the three- to five-year period used primarily in this report.

employment in the coming years. While these industries will probably stimulate growth and productivity throughout the economy, their direct effect on employment will be more limited. The U.S. Bureau of Labor Statistics has developed three definitions of high technology industries (Riche, Hecker, and Burgan 1983). All three indicate that employment in these industries should increase faster than total employment between 1982 and 1995. Nevertheless, even the widest definition projects that high-technology industries will provide only 17 percent of the new jobs during this period. The second definition suggests high-technology will provide 8 percent, and the narrowest definition yields slightly more than 3 percent. These projections should be a warning to those states and localities that are attempting to deal with unemployment by focusing their economic development efforts on high technology.

Job Growth and Openings

Industrial trends provide the context, but vocational educators train for occupations, not industries. Employment opportunities for program completers are dependent both on growth in the total number of jobs in the economy and on turnover rates in existing jobs. For most jobs, turnover is a far more significant source of openings than is growth.

To highlight these differences, table 3.3 provides two sets of projections from the U.S. Bureau of Labor Statistics. The first column contains projections of average annual job openings for forty selected occupations for the period 1980 to 1990 (Hecker 1983). These projections allow for replacement as well as growth. The second column provides projections of the growth in these occupations from 1982 to 1995 (Silvestri, Lukasiewicz and Einstein 1983). These projections do not include openings due to turnover of workers; they reflect only growth over a thirteen year period.

Recalling that the first column reflects annual openings, for most of the jobs in the table, worker turnover is a far more significant source of employment opportunities than is growth. Only for programmers and lawyers does growth account for almost as many openings as turnover, and only for systems analysts does growth account for more. Occupations that already have large numbers of workers and that experience fairly high rates of worker turnover are in the future--just as they have in the past--likely to provide the most employment opportunities.

Expected Technological Displacement

One area in which the displacement of workers by machines has received much attention is that of robotics. The manufacturing sector will experience the largest displacement effects of

TABLE 3.3

PROJECTED AVERAGE ANNUAL JOB OPENINGS 1980-1990
AND TOTAL EMPLOYMENT CHANGE 1982-1995, BY OCCUPATION

OCCUPATION	PROJECTED AVERAGE ANNUAL OPENINGS 1980-1990 (Thousands)[a]	1982-1995 CHANGE IN TOTAL EMPLOYMENT (Thousands)[b]
Retail trade sales workers	1,999	685
Waiters and waitresses	788	562
Cashiers	648	744
Secretaries	575	719
Cooks and chefs	399	402
Bookkeepers and accounting clerks	373	152
Assemblers	364	333
Typists	299	155
Kindergarten and elementary school teachers	217	511
Carpenters	180	247
Registered nurses	179	642
Engineering and science technicians	168	418
Machine tool operators	155	200
Automobile mechanics	147	324
Bank tellers	125	142
Engineers	120	584
Licensed practical nurses	115	220
Secondary school teachers	107	128
Welders and flamecutters	106	105
Accountants and auditors	104	344
Real estate agents and brokers	104	113
Cosmetologists	77	98
Manufacturers' sales workers	71	386
Social workers	69	71
Computer operators	67	160
Electricians	63	173
Drafters	55	16
Bank officers	55	c
Plumbers and pipefitters	52	130
Insurance agents and brokers	46	91
Dental assistants	44	65
All-round machinists	43	58
Bricklayers and stonemasons	38	39
Programmers	36	205
Lawyers	34	159
Air-conditioning, heating, & refrigeration mechanics	33	55
Systems analysts	28	217
Buyers	26	75
Printing press operators and assistants	26	c
Automobile body repairers	25	41

SOURCE: [a]Hecker (1983, p. 29).

[b]Silvestri, Lukasiewicz, and Einstein (1983, pp. 38-43).

[c]Projections for this specific occupation not available.

this technology. The automative industry, the hardest hit industry within this sector, will experience worker displacement in four major application areas, namely, welding, assembly, painting, and machine loading and unloading. Expected worker displacement ranges from a low of 5 to 10 percent of the total 1980 automotive employment in assembly operations, to a high of 27 to 37 percent of total 1980 automative employment in painting operations (Hunt and Hunt 1983).

Other occupations, including checkers, examiners, packers, and machine operators are projected to experience displacement effects due to robotics technology by 1995, ranging from 10 to 15 percent of all workers employed within these groups (Smith and Wilson 1982). Some regions of the country will be affected far more than others. The Great Lakes states particularly, with their heavy concentrations of steel, automobile, and other high wage manufacturing are likely to experience considerable technological displacement.

Historically, the service industries experience less fluctuation as changes in the economy occur than does the manufacturing sector. Even during the 1979 to 1982 recession these industries, especially the "other services" category, added workers. The increase in other services was 2.4 million workers from 1979 to 1982, a greater increase than the 2.2 million drop experienced in manufacturing during this time (Personick 1983). Thus, employment within the service industries is not likely to be affected by automation as much as manufacturing will be within the next decade.

"True" displacement, defined as becoming unemployed due to automation, does not appear to be a major national problem within the next three to five years, although it may be a severe regional problem. Displacement due to international competition or geographic shifts of employers will be much more common, but much harder to anticipate. The evidence this project was able to assemble does point to continuing shifts in the makeup of the labor force. Barring a major economic downturn, however, there should be no massive displacement that would overwhelm the capacity of the employment and training institutions of this nation to respond.

Another Set of Projections

The source of all of the projections of anticipated employment opportunities presented to this point has been the Bureau of Labor Statistics, U.S. Department of Labor. These projections have been criticized by some as being too conservative and not allowing adequately for the impact of technological change.

There is another set of occupational projections that has been receiving much attention recently. These are the projections made by the futures research organization, Forecasts International, and its subsidiary, Occupational Forecasts. Projections for a variety of occupations have appeared in the Futurist (Cetron and O'Toole 1982), U.S. News and World Report ("The Shifting Job Market" 1982), Newsweek ("When Job Training...a Lifelong Process" 1983) and have been included in testimony presented to a subcommittee of the Senate on Science and Technology Committee (Helms 1983). When one compares these various sources (table 3.4), major adjustments are apparent between the original publication and more recent reports. The adjustments are of such a magnitude that one wonders what kind of changes in their underlying data or assumptions could be responsible.

Even the more recent projections, which are sharply reduced, stand in wide variance with other sources. For example, the projection made in April 1983 for the number of industrial robot production technicians there will be in 1990 was four hundred thousand, a decrease of 1.1 million from the June 1982 projection. As was noted in chapter 2, most other sources estimate that by 1990 fifty thousand to one hundred thousand robots could be in use. If it requires four technicians to service each robot, it does not seem likely that manufacturers are going to realize the savings they are anticipating from robots.

These rather extreme projections are presented to caution against over-reactions to new and exciting technological developments that will eventually have enormous implications for occupations. It takes time for changes in skill requirements to affect a labor force of over 100 million workers. In most cases, new skills tend to be incorporated into existing, related occupations and only occasionally do totally new occupations emerge. At present, for example, most repair of industrial robots is being done by maintenance mechanics who receive a few weeks of additional training from the robot manufacturers. As robots are used more widely, this method may not be adequate, and an increased role for public training may be needed. As that demand grows, public institutions will be more than willing to provide the necessary training. In fact, in the near future, it seems likely that there will be more training capacity than there will be demand for program completers of robotics technician programs.

TABLE 3.4

PROJECTIONS OF FUTURE EMPLOYMENT OPPORTUNITIES
FROM FORECASTING INTERNATIONAL, LTD.
(Occupational Forecasting, Inc.)

SOURCE:	FUTURIST	NEWSWEEK	SCI & TECH SUBCOM. TESTIMONY	U.S. NEWS & WORLD REPORT
DATE PUBLISHED:	June 1982	Nov. 1982	Apr. 1983	May 1983
PROJECTIONS TO YEAR:	1990	1990	1990	2000
OCCUPATION:				
Hazardous waste management technician	1,500,000	300,000 [a]	300,000	300,000
Industrial laser process technician	2,500,000	600,000	360,000	-----
Industrial robot production technician	1,500,000	800,000	400,000	-----
Materials utilization technician	500,000	400,000	210,000	-----
Genetic engineering technician	150,000	250,000	200,000	-----
Holographic inspection specialist	200,000	200,000	160,000	-----
Bionic-electronic technician	200,000	200,000	120,000	65,000
Battery technicians (fuel cells)	250,000	-----	250,000	160,000
Energy conservation technician	1,500,000 [b]	650,000	310,000	400,000
Housing rehabilitation technician	1,750,000	500,000	500,000	490,000
Emergency medical technician	1,300,000	400,000	400,000	375,000
Geriatric social technician	1,000,000	700,000	610,000	300,000 [c]

[a] Called "hazardous waste management" in Newsweek

[b] Called "energy technician" in Futurist

[c] Called "gerontological aides" in U.S. News and World Report

CHAPTER 4

TRENDS WITHIN VOCATIONAL EDUCATION

The past decade has been one of steadily increasing enrollments and funding for public vocational programs. At the secondary level in the last half of the 1970s, vocational education enrollments increased despite the decline in the number of secondary students. Most of the increase in funding for vocational education has been from state and local sources, as federal funding has remained almost constant (whether measured in inflation-adjusted dollars or as a percentage of total federal, state, and local expenditures). This chapter reviews enrollment and expenditure data for vocational education as compared to similar data for all of education during the 1970s and discusses enrollment and expenditure trends for the 1980s.

Enrollment Trends

Secondary school enrollments will continue to decline during the 1980s as secondary schools experience the effects of the lower birth rates in the late 1960s and the 1970s. As shown in figure 4-1, total secondary enrollment in 1975 was approximately 20.5 million, declining to 18.1 million in 1980. Projections indicate that, by 1990, total secondary enrollment will decline to 15.6 million.

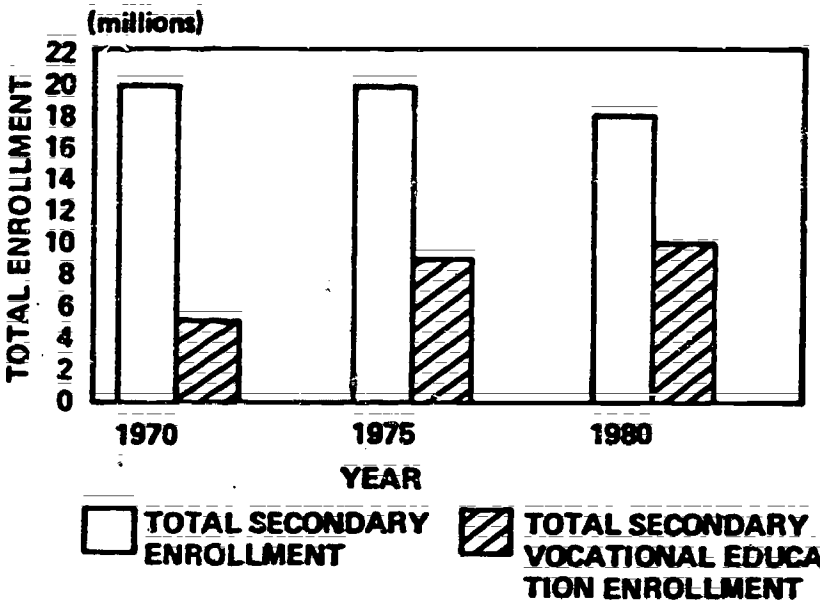

Figure 4-1. Total secondary enrollment vs. total secondary vocational education enrollment.

SOURCE: Appendix table C-11.

In contrast, total secondary enrollment in vocational education increased by over 100 percent in the period from 1970 to 1980. The number of secondary vocational education students as a percent of the total number of secondary students more than doubled from 26 to 58 percent in the period of 1970 to 1980.

As a percentage of total vocational enrollments, secondary enrollments have remained static over the decade, ranging from 58 percent in 1970 to 62 percent in 1980. Total secondary vocational enrollments doubled during the 1970s, increasing from 5.1 million students in 1970 to 10.5 million in 1980 (see figure 4-2).

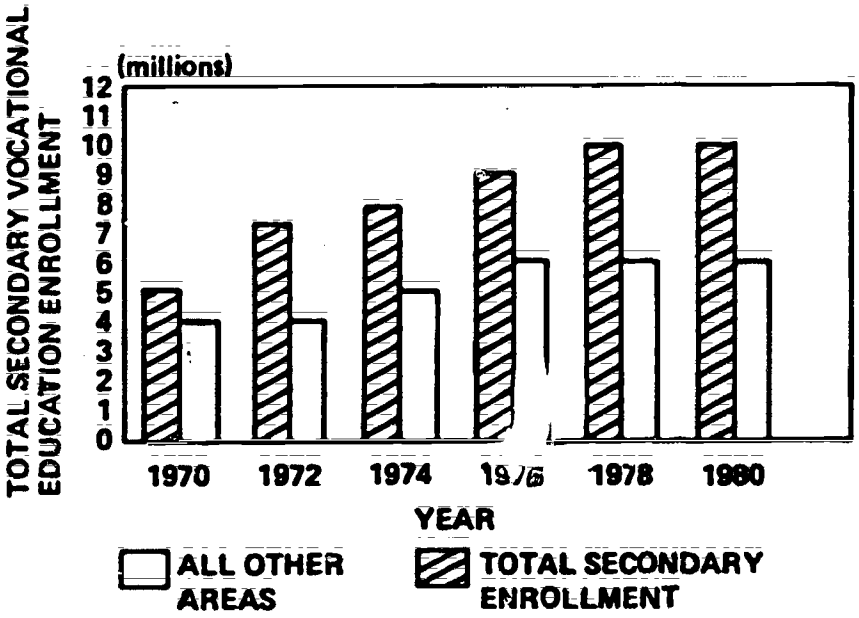

Figure 4-2. Enrollment in vocational education by level.

SOURCE: Appendix table C-12.

Although secondary vocational enrollments remained steady during the final years of the 1970s, it seems unlikely that this pattern will continue. Total secondary enrollments will drop throughout the 1980s at a rate of about two hundred and fifty thousand per year. By 1990, there will be 2.5 million fewer students in secondary schools than there were in 1980. In addition, most states are likely to increase the number of required credits in English, mathematics, and science. These increased requirements will make it difficult for many students to schedule elective vocational courses. A decline in the number of secondary students in vocational education seems almost inevitable during the remainder of the 1980s.

Occupationally Specific Enrollment

Occupationally specific enrollments, a category that was initiated with the Vocational Education Data System (VEDS), have remained around 28 percent of total secondary vocational education enrollments from 1978 to 1980 (see table 4.1). "Occupationally specific programs are those offered at or above grade 11 which purport to impart entry-level job skills for a specific gainful occupation" (Golladay and Wulfsberg 1981, p. 16). Programs excluded from the occupationally specific category include industrial arts, consumer and homemaking, prevocational, counseling and guidance, and cluster programs. An examination of occupationally specific enrollments thus provides an indication of the number of vocational students who could potentially enter the labor market and find employment related to their training.

TABLE 4.1

OCCUPATIONALLY SPECIFIC ENROLLMENT
IN SECONDARY SCHOOLS

	ENROLLMENT			
YEAR	TOTAL SECONDARY (Millions)	SECONDARY VOCATIONAL EDUCATION	OCCUPATIONALLY SPECIFIC	PERCENT[a]
1978	18.9	10,236,117	3,039,407	29.6
1979	19.1	10,095,884	2,926,260	28.9
1980	18.1	10,466,231	2,857,759	27.3

[a]Occupationally specific enrollments as a percent of total secondary vocational enrollments

SOURCE: Golladay and Wulfsberg 1981, p. 47; U.S. Department of Education 1983c, 1983d.

Two other sources contain data on national vocational education enrollment against which the VEDS data can be compared. These sources consist of two national probability samples: the 1980 self-report of high school curriculum from the High School and Beyond database, and data from high school transcripts available for the National Longitudinal Survey Youth Cohort (Campbell, Gardner, and Seitz 1982).

Self-report of vocational curriculum has been shown by Campbell, Orth, and Seitz (1981) to be in substantial disagreement with other methods of classifying students. Nevertheless, self-report can be assumed to reflect students' own perceptions of the major focus of their course of study. As such, it probably identifies students who consider themselves to be preparing for employment. Campbell, Gardner, and Seitz (1982) developed a system based on patterns of course taking. From these patterns, two groups, called "concentrators" and "limited concentrators," appear to be using their high school education to prepare for employment.

Figure 4-3 presents a comparison of the percentages of ninth- through twelfth-grade students who can be considered to be preparing for employment according to the VEDS definition, High School and Beyond self-report, and transcript patterns. It is interesting that the most rigorous method, analysis of transcripts, yielded the highest percentage, and the method that has been most often criticized for unreliability and duplication (Benson and Hoachlander 1981; Brown et al. 1980), the VEDS reports, yielded the lowest. All three sources indicate that approximately 25 percent (probably a fairly accurate estimate) of the students are preparing to enter the labor market directly after high school.

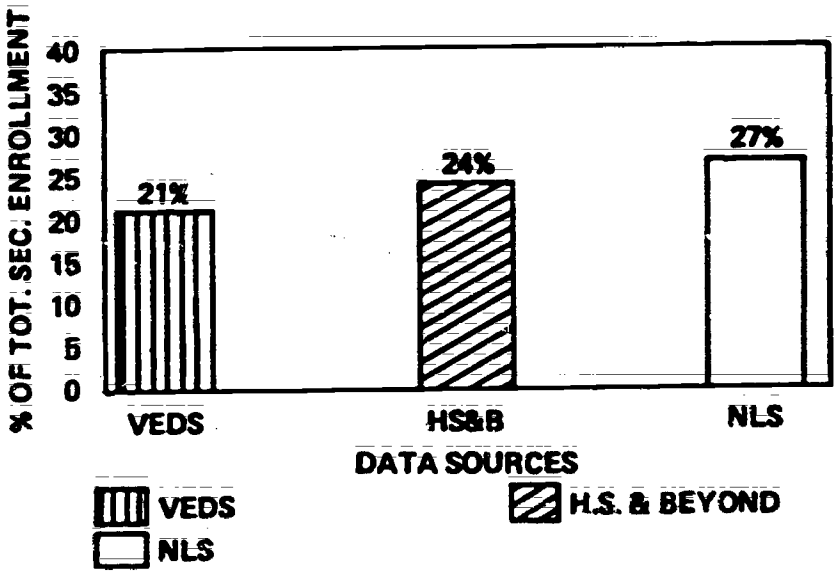

Figure 4-3. Occupationally specific enrollment by data source.

SOURCE: Appendix table C-13.

Cooperative Education

Currently one of the major policy thrusts for all publicly supported training is increased involvement with private sector employers. Private Industry Councils (PICs) were established by the Job Training Partnership Act (P.L. 97-300) to give employers and other private sector representatives formal roles in decision making for employment and training programs. A bill introduced into the U.S. House of Representatives (H.R. 4164) to reauthorize federal vocational education legislation also has a strong emphasis on increased involvement of employers in vocational programs.

Since its earliest days, vocational education has been committed to linkage with employers. The two primary methods of fostering this linkage have been advisory committees and cooperative education. Unfortunately, there are no national data on how prevalent or active advisory committees are. Virtually all programs claim to use them, but their involvement appears to vary from vigorous continuing interaction to token committees.

There are data on enrollments in cooperative education programs, and these are presented in table 4.2. Cooperative enrollments increased over the 1970s at about the same rate as total vocational enrollments. Consequently, the percentage has remained stable. Cooperative enrollments as a percentage of total vocational enrollments are deceptively low since total vocational enrollments include students below grade eleven, consumer and homemaking students, and adults in short-term programs. Cooperative enrollments as a percentage of occupationally specific enrollments are a better indicator of how many of those preparing for employment are receiving on-the-job experience. Using occupationally specific enrollments as a base, about one in ten is receiving such training. This is more encouraging but is still far below levels many consider desirable.

There does seem to be a potential for increasing cooperative enrollments. Surveys of manufacturers (Nunez and Russell 1982) and of representive national and state samples of employers (Hemmings 1982; Owens and Monthey 1983) reflect a widespread willingness to provide work experience for vocational students. Nunez and Russell found, for example, that 21 percent of a sample of members of the National Association of Manufacturers currently provide work experience and an additional 53 percent report they are "quite likely" to do so. If the economic recovery continues to reduce employment, and given that there will be fewer new entrants in the labor market, the remaining years of the decade should be an especially favorable time to involve employers in cooperative education programs.

TABLE 4.2

COOPERATIVE VOCATIONAL EDUCATION ENROLLMENTS
AS A PERCENTAGE OF
TOTAL VOCATIONAL EDUCATION AND
OCCUPATIONALLY SPECIFIC ENROLLMENTS, BY YEAR

YEAR	COOPERATIVE ENROLLMENTS	AS PERCENT OF	
		Total Vocational Enrollments	Occupationally Specific Enrollments
1971	379,414	3.6	NA
1972	459,614	3.9	NA
1973	508,409	4.2	NA
1974	605,140	4.4	NA
1975	518,071	3.7	NA
1976	611,480	4.0	NA
1977	628,150	3.9	NA
1978	580,316	3.4	10.2
1979	597,564	3.5	10.0
1980	623,741	3.7	10.8

SOURCES: Lee and Fitzgerald (1975, p. 46, 64); U.S. Office of Education (1979, p. 68); U.S. Department of Education (1983c, p. 343, 1983d, p. 175).

Funding of Vocational Education

Total expenditures for education have more than doubled since 1969, increasing from $70 billion to an estimated $200 billion in 1981. When viewing total education expenditures as a percent of the gross national product (GNP), however, a reverse trend is evident. In 1969, total education expenditures represented approximately 7.5 percent of the GNP (see figure 4-4). After peaking in 1975 at 8 percent, total expenditures for education have slowly decreased to an estimated 6.8 percent of the GNP in 1981.

Federal funding for vocational programs more than doubled in current dollars between 1970 and 1981, from $300 million in 1970 to approximately $854 million in 1981. State and local expenditures more than quadrupled during this same period, from $1.5 billion to $6.6 billion in current dollars. Since 1979, growth in state and local expenditures has slowed.

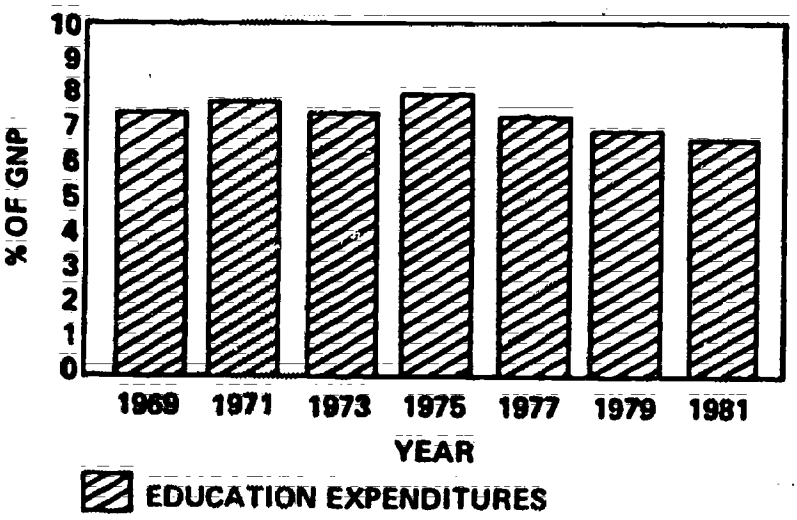

Figure 4-4. Total education expenditures as percentage of total GNP, by year.

SOURCE: Appendix table C.14.

Expressed in constant 1981 dollars, total federal vocational education expenditures actually decreased from $981 million in 1972 to $854 million in 1981 (see figure 4-5), representing a 13 percent decrease over the ten-year period. In constant dollars, state and local vocational expenditures increased by 44 percent during the period of 1972 to 1981, increasing from $4.6 billion in 1972 to $6.6 billion in 1981.

Figure 4-5. Vocational education expenditures (VEA), by source, by year (constant 1981 dollars).

SOURCE: Appendix table C.16.

Historically, state and local expenditures have comprised approximately 85 to 90 percent of total vocational education funding, whereas federal expenditures have represented the other 10 to 15 percent. In 1975, for example, state and local expenditures accounted for approximately 87 percent of total vocational education funding (see figure 4-6).

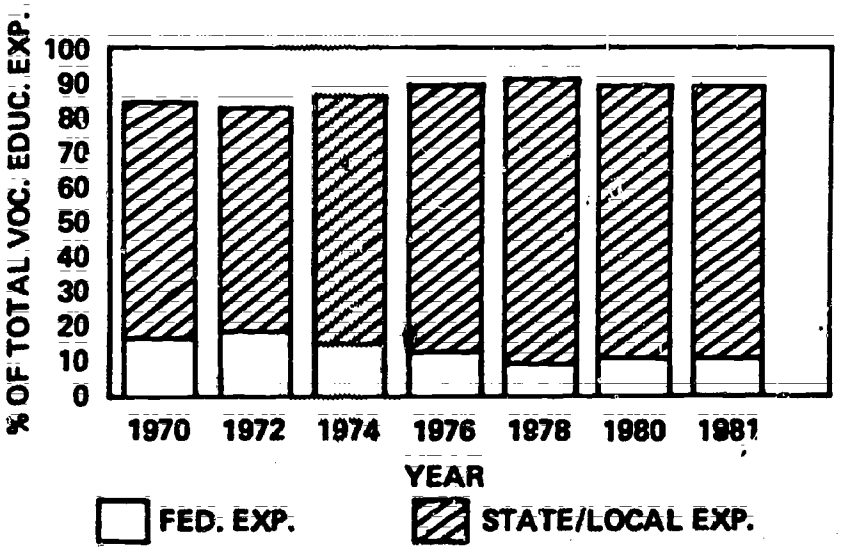

Figure 4-6. Federal, state/local expenditures as a percentage of total vocational education expenditures.

SOURCE: Appendix table C.15.

When viewing total vocational education expenditures as a percentage of total education expenditures, a slight increase is evident over the period 1972 to 1981. In 1972, total vocational education expenditures represented 3.2 percent of total education expenditures, whereas in 1980 they increased to 4.1 percent (see table 4.3).

Despite a decreasing percentage of GNP being allocated for education expenditures, and despite the decline in the population of young people in the prime sixteen to twenty-four age group, vocational education enrollments and expenditures have increased. The renewed interest in education reflected in the various reports discussed in chapter 1 should serve to maintain or perhaps even increase funding for public education in the next few years. If there are any increases, they probably will come from state and local sources. The large federal deficit and continuing efforts to control nondefense spending have caused Congress to be reluctant to increase funding for any domestic programs, including education. The contending trends that will influence programs in the next few years are discussed in the next chapter.

TABLE 4.3

VOCATIONAL EDUCATION EXPENDITURES AS PERCENT
OF TOTAL EDUCATION EXPENDITURES
(CURRENT DOLLARS)

SCHOOL YEAR	FISCAL YEAR	EXPENDITURES (MILLIONS) Total Education	EXPENDITURES (MILLIONS) Vocational Education	VOCATIONAL EDUCATION AS PERCENT OF TOTAL
1971-72	1972	$ 82,999.0	2,660.7	3.2
1973-74	1974	98,019.4	3.433.8	3.5
1975-76	1976	121,603.8	4,713.5	3.9
1977-78	1978	140,367.5	5,673.5	4.0
1979-80	1980	169,615.1	6,914.0	4.1

SOURCES: U.S. Department of Education (1982, p. 23, 1983a, p. 152)

CHAPTER 5

IMPLICATIONS FOR VOCATIONAL EDUCATION

What do the trends reviewed in the previous chapters mean for program planning and policy development in vocational education? Some implications have been mentioned in the preceding chapters. This chapter presents an integrative summary of these chapters and uses this summary to draw implications for planning and policy development. Although all levels of vocational education operate in the same environment, the implications are different at the secondary and postsecondary levels. The nature of these differences are discussed following a description of the most likely environment for vocational education during the remainder of the 1980s.

The Environment for Vocational Education

Economy/Government

As this chapter is written, at the very beginning of 1984, the economic recovery from the 1979 to 1982 recession has been in progress for about one year. Sales of several products basic to the economy have risen dramatically and productivity has increased in many industries. Unemployment has declined and inflation rates have held steady. The nation appears to be emerging from the mood of pessimism that accompanied the long period of "stagflation" when inflation remained high despite decreased levels of economic activity ("Consumers More Optimistic" 1983; "Public More Trusting" 1983).

Many problems still remain. Although unemployment has declined from its post-World War II peak, it is still much higher than during most of the past four decades. One out of every two minority teenagers who wants a job cannot find one. Large budget deficits and trade imbalances remain. The default of billions of dollars in foreign loans is a continuing possibility. Certain basic industries are not competitive in world markets, and vigorous efforts are underway in many foreign countries to capture markets for products where the United States still has an advantage (Reich 1983).

Maintaining the economic recovery and enhancing the productivity and competitiveness of the American economy will remain high on the national agenda, as will national defense. Even if there is a major shift in national defense policy, the contracts for defense procurement that have been signed in the past five years will be honored. This means a substantial commitment of federal funds and the possibility of defense-related industries in some geographic areas competing with the civilian sector for

workers in critical skills occupations such as metalworking and electronics.

Educational climate. Another topic high on the national agenda is education. The Nation at Risk (National Commission on Excellence in Education 1983) report has brought increased visibility to the problems of secondary education as have several other reports that examine these problems. The attention given to this topic by President Reagan has further served to focus national interest and debate.

The primary concern of these reports is the quality of secondary instruction. The consensus reflected in several of them is that high school students are not obtaining a solid foundation in the communication and computational skills that underlie all future educational and occupational efforts. The main recommendation is to increase the number of credits required for high school graduation in English, mathematics, and science. If this recommendation is widely adopted and courses in these subjects are taught in the usual manner, the most likely outcomes are either a significant increase in the number of high school dropouts or a proliferation of diluted "less demanding" courses in these subjects. Neither outcome is desirable.

Technology

Underlying many of the economic problems and the educational debate is the continuing transition of the American economy from one based primarily on manufacturing to one based primarily on services and information. A primary cause of this transition is the applications of computer and communications technologies that enable more to be produced with fewer workers and simultaneously create and fill a demand for more information.

The major educational question arising from these technological developments is whether their net result is to create a need for a more or less technically skilled work force. Those who advocate a strong emphasis on science, mathematics, and technology include most of the commissions and task forces that have examined secondary education, particularly the National Commission on Excellence in Education (1983), the Task Force on Education and Economic Growth of the Education Commission of the States (1983), the National Science Board Commission on Precollege Education in Mathematics, Science, and Technology (1983), and the College Board (1983). All of these sources cite the rapid diffusion of advanced technology throughout society. They claim that technological literacy, especially computer literacy, will be fundamental to most of the preferred jobs in the work force. Some also point to the much stronger science and mathematics emphasis in other industrialized countries and imply

that weaknesses in our education system may be one of the sources of our declining productivity and lack of competitiveness in international markets.

There are others, however, who claim that future advances will require fewer, not more, highly trained technicians (Levin and Rumberger 1983). They see a work force composed not of highly skilled technical workers, but mainly of low-skilled service workers. Even many of those who will have technical jobs will work with "friendly" computers that require no specialized programming and that self-diagnose their own malfunctions.

If projections of this type are correct, the skill distribution in the labor force of the future is likely to assume the shape of a highly disproportionate hourglass. In the top of the hourglass will be a relatively small number of highly educated scientists and engineers who develop and translate new knowledge into the technology that the rest of the work force, the very large bottom of the hourglass, uses in almost all occupations. These workers at the bottom, however, will not have to understand the technology, just how to use it in their particular jobs.

Occupational projections. Regardless of which side one takes in this debate, it seems fairly clear that most jobs during the rest of this decade will not involve high levels of scientific or mathematical skills. High-technology industries, even when defined quite broadly, are expected to account for only 17 percent of the new jobs created between 1982 and 1995 (Riche, Hecker, and Burgan 1983). The five occupations that the U.S. Bureau of Labor Statistics expects to grow the most by 1995 (in absolute numbers, not percentage growth) are building custodians, secretaries, cashiers, general office clerks, and sales clerks (Silvestri, Lukasiewicz, and Einstein 1983).

The projected growth in these occupations is in addition to the numbers that will be needed to replace those who leave these occupations. In 1982, for example, there were about 2.5 million secretaries. The projected increase by 1995 is 719,000 or an average increase of 55,000 per year. The best estimates of the replacement need for secretaries who change occupations or leave the labor force is about 500,000 job openings for secretaries each year.

Some critics claim that the U.S. Bureau of Labor Statistics' forecasting methodology essentially projects past trends and does not incorporate the effects of technological change. The demand for secretaries may be influenced more by the adoption of word processors and related technologies for the electronic storage and retrieval of information than the present projections indicate. Even if the projections are wrong by 50 percent, there still will be far more demand for secretaries than for any of the computer-related occupations, despite their faster rates of growth.

Demography/Labor Force

The major demographic trend influencing vocational education for most of the rest of this century is the decline in the number of secondary students. Almost all of the young people who will be in high schools before the year 2000 have already been born, and all projections point to a steady decline through the early 1990s. Historically most vocational students have been at the secondary level. Throughout the 1970s, the percentage at this level held steadily around 60 percent. In the 1980s, the actual number of secondary vocational students is expected to decline as the total secondary school population declines.

The decline in births has not been uniform through all segments of our society. Birthrates in racial minority groups in the United States have traditionally been higher than in the white population, and the rate for minorities did not decline as much as the rate for whites during the late 1960s and the 1970s. Thus, although there will be fewer young people in high schools for the next ten years, there will be proportionately more from racial minority groups. Furthermore, proportionately more minority group members come from financially disadvantaged families. It is young people from these backgrounds who often have the most difficulty in school and who are likely to need special services. Provision of such services is a major focus of federal vocational legislation, and the bills currently before both branches of Congress for reauthorization of the legislation indicate that this focus will continue. Equalizing access to educational opportunities will, in all likelihood, continue to be the prime objective of federal education legislation.

The decline in births after the early 1960s also means there will be fewer new labor market entrants. This should have favorable consequences for vocational programs. It should be easier for young job seekers to find employment, and employers should be more willing to participate in cooperative education programs.

There is also a negative consequence of the decline in births. Since the baby-boom generation has largely completed its education, there are fewer people with members of their family directly involved in education. This means that there are fewer taxpayers, fewer school board members, and fewer state legislators with a direct stake in the quality of education. As the 1980s progress, there will be fewer students in schools and increasing demands upon public funds. With such a combination, education could well find itself receiving progressively smaller shares of public funds.

If the preceding scenario is accepted as the most likely description of the environment for the next three to five years, vocational educators should begin now to prepare their programs

for this environment. To summarize, the major influences on vocational education will include the following:

- Student characteristics: a gradual decrease in the number of secondary students; proportionately more minority and disadvantaged students at all levels; many more adult students with widely varying characteristics at the postsecondary level

- Technological change: rapid rates of technological change making it virtually impossible to keep institutional equipment and curricula up-to-date

- Competing requirements: decreased time for vocational instruction at the secondary level because of increased requirements in English, mathematics, and science

- Federal emphasis: a continuing emphasis in federal vocational legislation on facilitating access to educational opportunities

Although these influences will affect all levels of education, their implications are likely to be quite different at the secondary and postsecondary levels. The implications at these levels are discussed in the following sections.

Secondary Vocational Education

Regardless of the recommendations of national commissions, basic educational decisions are made at the state and local levels. The decisions made in the next few years regarding secondary education will have a major impact on secondary vocational programs for the remainder of the century. These decisions could give increased attention to the contribution of occupationally relevant instruction to the attainment of broad educational objectives--a role that advocates of vocational education have emphasized since its earliest origins (Commission on National Aid to Vocational Education 1914).

Virtually every vocational instructor with a few years' experience can recall several students who were bored and frustrated in academic classes. When in a vocational classroom, however, they saw a reason to learn and to increase their basic skills while studying occupational skills. Most instructors would like to think this occurs naturally and requires little special attention. Unfortunately, the research evidence (Corman 1980; Lotto 1983; Weber et al. 1982) does not support this assumption. The evidence does suggest, however, that when a focused effort to teach the basics is combined with occupational

instruction, the performance of underachieving students improves. Occupational content provides interest, relevancy, and a chance for successful performance that is denied many students in the academic classroom (Berryman 1980). If increasing credits in required subjects limits these opportunities, the likely result will be to compound, not solve, many current problems in secondary education.

One thing seems certain: In the coming years, high schools will have to ensure that, at a minimum, students master basic communication and computational skills. Of course, vocational education cannot assume the main responsibility of ensuring that all students have such skills, but common observation and some research indicates that it can contribute.

In addition, the evidence on occupationally specific training presented in chapter 4 indicates that only about 25 percent of secondary students use vocational courses to prepare themselves to enter the labor market directly out of high school. The other 50 percent who take some vocational courses are apparently taking these courses for other reasons such as occupational exploration or personal interest.

Finally, what effect will technological change have on the level of technical skills needed in the labor force? The question is at present unanswered. Where evidence is available, technology appears to de-emphasize manipulative skills and stress cognitive and analytic skills. Robots, for example, are displacing assemblers and operatives, but increasing the demand for technicians (Hunt and Hunt 1983). Computer-assisted design requires few lettering or drawing skills, but considerable conceptualization skills. Word processors make it easy to correct a keyboarding error, but requires conceptual skills to avoid errors such as erasing material that has been placed in temporary storage (Fraser, Unger, and Lewis 1984).

Even those who contend that technology is deskilling jobs do not advocate less education. Instead, they advocate less specific training and more general education to prepare young people to adapt to the many occupational and technical changes they will experience in future years (Levin and Rumberger 1983).

The convergence of these various considerations appears to be pushing secondary vocational education toward a greater emphasis on broad educational functions and a decreased emphasis on preparation for entry-level employment. The responses of vocational educators to these pressures will depend on what they consider most appropriate for their particular circumstances. If broad educational functions are to be emphasized, changes will be needed in what is taught and how it is taught.

Development of Integrated Offerings

At present, most vocational courses spend little time on basic communication and computational skills (Halasz and Behm 1983). If improving skills in these areas is to be an objective of vocational courses, methods of providing instruction must be integrated into regular vocational offerings. Individual instructors can not be expected to accomplish such integration on their own. They have neither the time nor the expertise. Instructional units on basic skills and techniques for integrating these units into vocational courses will have to be developed, tested, and disseminated, and teachers will have to be trained in their use. The development and testing of the units could most efficiently be carried out at the national level, whereas dissemination and inservice training of teachers are appropriate state and local activities.

New Model of Teaching

With a declining number of secondary students, relatively few new vocational instructors will be hired in the next ten years. If secondary programs are to change, current teachers must assume responsibility for this change. In this effort, they will need considerable assistance and support. What is needed more than anything else is a new model of teaching.

The primary role of the teacher has been as a provider of information. In the coming years electronic media, such as videodiscs and personal computers, will increasingly replace this traditional role. Teachers will still identify learning needs, direct students to resources, evaluate progress, and assist when problems are encountered. These activities, however, constitute a basically different role for the teacher--a role that stresses managing learning rather than providing information. Teachers will need considerable assistance in making this shift.

As the certifying agent for teachers, the state department of education is in the most powerful position to change the role of vocational instructors to meet the needs of the coming years. Competency-based instruction provides a model for individualizing instruction, but future and present teachers need to learn how to plan and manage such instruction. Requirements for teacher training institutions should be developed to emphasize the instructor as a manager of learning. Inservice programs and staff development material should stress this new role.

Research on Electronic Instruction

One of the major causes of the change in the role of the teacher--the personal computer--can also be one of the major aids

in bringing this change about. The personal computer is the ideal device for individualizing instruction. Programs can be developed for personal computers to assess competencies, guide students to sources and activities, provide information, and simultaneously keep an ongoing record of student's progress. All of the record-keeping that burdens most current individualized programs can be computerized.

Considerable research and development will be needed, however, to realize the full potential of this and other new electronic technologies. To what degree can electronic media teach manipulative skills? What is the proper blend of computer-assisted instruction and hands-on experience? The development of instructional material for electronic delivery is often very expensive. Is there sufficient market demand to expect commercial suppliers to develop appropriate material or will public funds need to be used?

Obtain the Support of Teachers

More than the development and application of integrated offerings, a new model of teaching, or electronics media, if secondary vocational education is to change, its instructors must understand and accept the need for change. Each state and locality that intends to moves its secondary programs toward a broader education role should develop a specific strategy for informing teachers of the reasons for the changes and the roles they will play in implementing them. An acceptance of the necessity of change by instructors is essential to the success of all efforts. If teachers play a role in planning and carrying out the changes, a sense of ownership will be developed and implementation will be much easier.

Postsecondary Vocational-Technical Education

The environment that postsecondary vocational-technical education will face for the next three to five years will be much the same as that facing secondary programs: fewer young people in the age range traditionally served, rapid rates of technological change, and a federal emphasis on serving groups with special needs.

The other major influence on vocational education--increased requirements for high school graduation--should exert the opposite pressure on postsecondary programs than it does on secondary. If secondary vocational programs move toward a broader educational role, postsecondary programs will be called upon to provide more training in specific occupational skills. These demands will come not only from young people preparing for

entry-level employment, but also from adult workers who need upgrading and from displaced workers.

Rapid rates of technological change suggest that much of the current work force will have to acquire new skills. Office automation, for example, will affect a very large proportion of the work force within the next ten years. Office workers at all levels will need training in how best to use this new technology (Fraser, Unger, and Lewis 1984). Rapid rates of economic change, due both to technology and foreign competition, are also likely in coming years. This will cause some permanent displacement of adult workers who will need retraining for new occupational skills.

Postsecondary institutions are well situated to provide both upgrading and retraining. They are geographically accessible to most of the work force and have an aura of "higher" education that increases their psychological acceptability to adults.

Postsecondary institutions can also position themselves to play a major role in training the economic disadvantaged, displaced homemaker, and other groups with special needs. The Job Training Partnership Act (JTPA) specifies that "Appropriate education agencies in the service delivery area shall be provided the opportunity to provide education services" (Sec 107 (c), PL 97-300). This requirement and other provisions in the act emphasize the need for coordination of JTPA activities with regular state education and training agencies. It is highly likely that the reauthorization of federal vocational legislation will have comparable language stressing coordination of vocational education with JTPA.

If the administrators of postsecondary institutions wish to expand their role in providing services to special needs populations, present conditions are favorable. Postsecondary institutions must assure that their capacity and willingness to play this role are well represented at the state level on JTPA coordinating councils and vocational advisory councils and at the local level on Private Industry Councils.

Implications Affecting All Levels

In addition to the varying implications at secondary and postsecondary levels, there are others that affect all levels. Three of these, linkage with employers, responding to critical skills needs, and responding to technological change are discussed in this section.

Linkage with Employers

Although the broader objectives of secondary vocational education are likely to receive increased attention in coming years,

preparation for employment will continue to be the unique role of vocational instruction. At all levels, developing closer ties with employers will help vocational education provide better preparation for employment and respond to anticipated conditions in the next few years.

Several surveys of employers (Hemmings 1982; Nunez and Russell 1982; Owens and Monthey 1983) reflect a large untapped potential. Many employers express a willingness to furnish equipment, provide summer employment to update instructors, loan personnel to teach classes, and provide work experience for students. These are all in addition to their customary role of serving on advisory committees.

Close ties with the private sector can simultaneously serve several purposes. First, these ties can keep programs and instructors up-to-date. Second, they can cut equipment costs. Third, they can provide motivation and experience with the realities of the workplace for students. Fourth, they can generate an influential constituency supportive of vocational programs. And fifth, cooperation with employers can move instructors toward the manager of learning model of individualized instruction for each student.

If unemployment continues to fall, the coming years should be a favorable time for increased linkages with employers. The national administration has been encouraging private volunteer action instead of government programs. Federal tax legislation has been passed to encourage employers to hire cooperative education students from disadvantaged families and many states provide tax incentives for donating equipment to public education programs.

As they work more with business and industry, vocational educators will have to be cautious that they do not serve employers more than students. If vocational education is to continue to be education and not job training for employers, the development of the individual must remain its primary goal. Cooperation with employers should be a means of achieving the goal of individual development, not a goal in itself.

Critical Skills

There is much debate about whether there are or are not shortages in critical skills areas in the labor force. Two studies conducted at the National Center for Research in Vocational Education (Starr 1983, 1984) have found little support for such shortages either in national data sources or through the experiences of state and local vocational educators. Still the concern remains, especially among defense-related industries and civilian industries that use the same skills.

Since expenditures for national defense influence certain states and localities far more than others, the U.S. Department of Education could work with the U.S. Department of Defense to identify those areas likely to experience major increases in demand for skilled workers as a result of defense contracts. Work has already been done to develop methods for identifying such areas (Matland 1983).

When a state is informed that a large contract has been awarded, the state vocational education agency could facilitate planning to respond to projected skill needs. The state, through its State Occupational Information Coordination Committee (SOICC) should be able to identify occupational staffing patterns in the industries and labor market areas that will be affected and compare these to projections of the supply of workers in these occupations.

If serious shortages are apparent, the state agency could contact local institutions and alert them to these potential shortages. The local institutions could then check the state projections against their own planning data and, if needed, plan programs to meet anticipated shortages. The state agency could play a coordinating role to prevent duplication of effort.*

Responding to Technological Change

In an age of rapid technological change, it may seem surprising to find this topic the last to be addressed. It is true that we are living through a period of rapid change stimulated primarily by international economic competition and the application of microelectronics to a wide variety of industrial and commercial processes. These developments will undoubtedly have a far-reaching impact on how the economy is organized to provide goods and services, as well as on the skills needed in the work force. In the next three to five years, however, the best evidence this project could assemble suggests that the impact will be evolutionary, not revolutionary.

Project staff examined two technological areas in depth: automated manufacturing and office automation. In these areas, anticipated need does not currently justify program development specifically for robotics. The broader area of automated manufacturing has greater potential need, and industry representatives suggest that curricula be developed for training in flexible automation technology. The justification for such a

*Responding to Defense Industrial Base Training Needs by Starr (1984) discusses these and related procedures in much more detail.

curriculum is discussed in a companion report, Robotics and Office Automation: Implications for Vocational Education (Fraser, Unger, and Lewis 1984).

Other evidence indicates keyboard skills will continue to be critical in the automated office for the next three to five years. If workers have adequate keyboard skills (i.e., approximately fifty words per minute with fewer than two errors per page), employers are willing to train them in the operation of specific machines. Developing an understanding of the logic of word processing should be an objective of all instruction in typing. Identification and dissemination of an exemplary instructional module to teach this logic should be a national priority.

Electronics in the trades. The metalworking, automotive, and appliance repair trades have already felt the effects of electronics technology. In the near future, knowledge of electronics will be needed in most of the building trades. Workers in these occupations need not be electronics technicians, but they do need to understand basic principles and be able to use computer-assisted design equipment. Research is needed to determine whether the changes in the occupational areas being affected by electronics are of sufficient magnitude to warrant the development of instructional modules in electronics for the separate trades.

Concluding Remarks

Those who came to this report expecting it to chart a brave new direction for vocational education may be disappointed. The suggestions provided to help vocational educators prepare for the most likely future are, to a large degree, restatements of sound educational practices--practices that are more often honored than observed. For example, all new teachers are taught (often in large lecture halls) that they should individualize instruction. Logistics and record-keeping have, however, been formidable barriers. The diffusion of personal computers throughout education should help to overcome many of the obstacles to establish true individualized instruction. Differentiated functions for vocational education at the secondary and postsecondary levels would be a more fundamental change, but once again congruent with what many have long advocated.

The next few years will place many demands upon vocational education. It will be called upon to conduct traditional entry-level instruction, to help ensure that students have basic communication and computational skills, to play an expanded role in training the disadvantaged, and to retrain and upgrade more adult workers than ever before. At the same time, it will be called

upon once again to justify its claim as a legitimate component of secondary education. The challenges are many, and many program adjustments will be needed. Nevertheless, the broad support that vocational education receives from students, parents, employers, school board members, and legislators indicates it has served a wide variety of needs in the past and that it can continue to do so in the future.

APPENDIX A

CONSTRUCTING THE MODEL OF THE INFLUENCES ON VOCATIONAL EDUCATION

CONSTRUCTING THE MODEL OF THE INFLUENCES ON VOCATIONAL EDUCATION

Background

The model of the environment within which vocational education operates was built upon previous research completed at the National Center and synthesized other information deemed relevant to understanding the context of vocational education.

Previous research included a report generated by the Institute for the Future (1979) under contract with the National Center, which identified variables within the categories of demography, the labor force, the economy, societal expectations, and education that were expected to affect vocational education. This report contained forecasts of a number of trends that were judged to be significant for vocational education. It also analyzed the policy implications of these trends in educational environments and assessed the vulnerability of these policy decisions to further changes. That report differs from the report presented here in that no model or framework as to how these variables fit together was presented.

Lewis and Russell (1980) conducted a Delphi study of the probability and potential impact of possible future events on vocational education. They also held a conference of selected participants to discuss major policy influences on vocational education and to develop three alternative futures: best, worst, and standard world scenarios.

Ruff, Shylo, and Russell (1981) conducted a cross-impact study that incorporated three expanded world scenarios. They identified significant trends, and asked experts to identify possible policy decisions that could be made about these trends. The experts then identified the probable interactions between the policy decision and the trends.

Although these previous studies are valuable in identifying the relevant trends for consideration, no systematic attempt was made to integrate these trends and relationships into a model or conceptual framework. The model presented in figure 1-1 represents the first attempt to identify the relevant relationships in the environment for vocational education.

Procedures

Building on previous research at the National Center, a draft model of the environment for vocational education was constructed. It consisted of three major sections: economic and governmental influences, technological influences, and demographic/labor force influences. A brief discussion of the contending scenarios of the future proposed by major writers in the

field was also prepared. These two items were submitted to a panel of experts for review. The panelists were selected on the basis of national prominence and peer nomination to represent a variety of perspectives, including political science, sociology, government, vocational education, and scholarly specialization in futures research and research on technological change.

Conversations were held with each panelist individually so that their critiques were not influenced by interaction among them. The panelists were asked to critique the discussion of the contending scenarios of future developments and the extent to which the elements in the model and the relationships among them accurately reflect the environment for vocational education. The comments of each expert were summarized and the panelists were asked to review the summary for accuracy. All comments were then analyzed and a revision of the model prepared. The revised model appears as figure 1-1 in the main body of this report.

This model does not attempt to specify the mathematical relationships between the components. To construct a mathematical model, well-confirmed, time-independent theorems about the nature of the relationships must be available. In vocational education, no such theorems exist. Thus, for this report information has been assembled about the elements of the model, and conclusions have been drawn using a judgmental (subjective) integration approach. "The pragmatic approach of timeliness [takes] precedence over the intellectual desire for a more complete theoretical understanding of all of the underlying factors" (Helmer 1983, p. 103).

A forecast is defined as "a statement about future events which is based upon assumptions which are either explicit or able to be determined" (Sylvan and Thorson 1980, p. 267). The model serves as an explicit statement of the assumptions about the relationships in the vocational education that are the basis of the judgmental integration approach employed in this report.

PANELISTS
Model of Influence on
Vocational Education

Specialists in Technological Change

Dr. Robert Ayers
Carnegie-Mellon University
Pittsburgh, PA

Dr. Fred Rossini
Georgia Institute of Technology
Atlanta, GA

Sociologists

Dr. Robert Kaufman
University of Texas at Austin
Austin, TX

Dr. Thomas Daymont
Temple University
Philadelphia, PA

Political Scientists

Dr. Jon Miller
Northern Illinois University
DeKalb, IL

Dr. Nazli Choucri
Massachusetts Institute of
Technology
Cambridge, MA

Futurists

Dr. Earl Joseph
Private Consultant
St. Paul, MN

Dr. Warren Johnson
San Diego State University
San Diego, CA

Dr. Henry David
Private Consultant
Washington, DC

Vocational Educators

Dr. Gene Bottoms
American Vocational
Association
Arlington, VA

Dr. John Light
Hocking Technical College
Nelsonville, OH

Mr. Bernard Ferreri
City Colleges of Chicago
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Federal Government

Mr. Neal Rosenthal
Occupational Outlook Division
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Dr. Thomas Johns
Office of Vocational and
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U.S. Department of Education
Washington, DC

Mr. Thomas Corwin
Office of Planning and Budget
U.S. Department of Education
Washington, DC

APPENDIX B

DATA SOURCES

ECONOMIC-GOVERNMENT COMPONENTS

National Goals:
- State of the Union
- Budget of the United States

Business Cycles:
- Survey of Current Business

International Economic Competition:
- U.S. Department of Commerce

Current Levels of Economic Activity in the Nation:
- Business magazines; Business Week, Fortune
- U.S. Department of Commerce index of leading indicators

Perceptions of Public Education and Training's Contribution to Goal Attainment:
- Commission reports
- U.S. Congress Testimony
- Budget of the United States

Public Funding of Education/Training:
- Budget of the United States
- U.S. Office of Education reports
- Other legislation

Education:
- U.S. Department of Education reports
- National reports and commission reports

Experiences of Students:
- National Longitudinal Study of the High School Class of 1972
- National Longitudinal Surveys of Labor Market Experience New Youth Cohort
- High School and Beyond

Vocational Education:
- U.S. Office of Education report
- Project Baseline (University of Northern Arizona)
- National Longitudinal Surveys of Labor Market Experience Youth Cohort
- Vocational Education Data System (VEDS)
- National Longitudinal Survey Youth Cohort
- High School and Beyond

TECHNOLOGY COMPONENTS*

Commercial Feasibility:
- Office of Technology Assessment, U.S. Congress

Diffusion:
- Trade journals
- Predicasts forecasting abstract service
- Trade associations

Demand for New Skills
- U.S. Department of Labor reports
- Trade journals

Displaced Workers:
- Studies of specific technologies
- Data on displacement due to international competition and geographic shifts will be assembled during second year of project

Projections of Labor Force Needs:
- U.S. Department of Labor

DEMOGRAPHY-LABOR FORCE COMPONENTS

Birthrates and Immigration:
- Population estimates, U.S. Bureau of the Census

Students of Secondary/Postsecondary Age:
- Projections of the population, U.S. Bureau of the Census

Occupational Interests, Plans:
- (Data not assembled, will be examined in second year of project)

Labor Force Participation by Population Groups:
- U.S. Department of Labor

Enrollments in Education and Training:
- U.S. Office of Education
- Job Training Partnership Act

*Technological innovation and technical feasibility are not being tracked because the influences of these components are too remote and uncertain for the planning of education in the next three to five years.

APPENDIX C

DETAILED TABLES OF LABOR FORCE AND VOCATIONAL EDUCATION TRENDS

TABLE C.1

POPULATION DISTRIBUTION BY YEAR
AND SELECTED AGE GROUPINGS

	YEAR	TOTAL POPULATION (Thousands)	16-19 YEARS (Thousands)	20-24 YEARS (Thousands)
a	1970	205,052	15,289	17,202
	1971	207,661	15,687	18,159
	1972	209,896	16,040	18,153
	1973	211,909	16,446	18,521
	1974	213,854	16,769	18,975
	1975	215,973	17,016	19,527
	1976	218,035	17,195	19,986
	1977	220,239	17,275	20,499
	1978	222,585	17,287	20,946
	1979	225,055	17,242	21,297
	1980	227,658	17,131	21,605
	1981	229,807	16,679	21,938
b	1982	231,997	16,191	21,920
	1983	234,193	15,612	21,852
	1984	236,413	14,999	21,687
	1985	238,648	14,652	21,282
	1990	249,731	13,703	18,567

SOURCES: [a]U.S. Department of Commerce (July 1982, p. 24)

[b]U.S. Department of Commerce (October 1982, p. 5)

NOTE: The data in this table include individuals in the armed forces who are overseas.

TABLE C.2

POPULATION DISTRIBUTION BY YEAR, SELECTED AGE GROUP, AND SEX

	YEAR	TOTAL POPULATION (Thousands)	16-19 YEARS (Thousands)			20-24 YEARS (Thousands)		
			Total	Men	Women	Total	Men	Women
a	1970	205,052	15,289	7,755	7,535	17,202	8,655	8,547
	1971	207,661	15,687	7,957	7,730	18,159	9,130	9,029
	1972	209,896	16,040	8,135	7,904	18,153	9,130	9,023
	1973	211,909	16,446	8,345	8,100	18,521	9,320	9,202
	1974	213,854	16,769	8,514	8,254	18,975	9,554	9,421
	1975	215,973	17,016	8,640	8,377	19,527	9,839	9,688
	1976	218,035	17,195	8,734	8,460	19,986	10,071	9,915
	1977	220,239	17,275	8,780	8,497	20,499	10,332	10,167
	1978	222,585	17,287	8,789	8,500	20,946	10,557	10,389
	1979	225,055	17,242	8,773	8,469	21,297	10,736	10,560
	1980	227,658	17,131	8,723	8,406	21,605	10,900	10,705
	1981	229,807	16,679	8,496	8,183	21,938	11,096	10,842
b	1982	231,997	16,191	8,250	7,941	21,920	11,104	10,816
	1983	234,193	15,612	7,958	7,655	21,852	11,082	10,770
	1984	236,413	14,999	7,646	7,353	21,687	11,006	10,681
	1985	238,648	14,652	7,473	7,180	21,282	10,800	10,482
	1990	249,781	13,703	6,999	6,703	18,567	9,433	9,134

SOURCES: [a]U.S. Department of Commerce (July 1982, p. 24)

[b]U.S. Department of Commerce (October 1982, p. 5)

NOTE: These data include individuals in the armed forces who are overseas.

TABLE C.3

LABOR FORCE DISTRIBUTION BY YEAR AND SELECTED AGE GROUPINGS

	YEAR	TOTAL LABOR FORCE (Thousands)	16-19 YEARS (Thousands)	20-24 YEARS (Thousands)
a	1970	82,771	7,249	10,597
	1971	84,382	7,470	11,331
	1972	87,034	8,054	12,130
	1973	89,429	8,507	12,846
	1974	91,949	8,871	13,314
	1975	93,775	8,870	13,750
	1976	96,158	9,056	14,284
	1977	99,009	9,351	14,825
	1978	102,251	9,652	15,370
	1979	104,962	9,638	15,769
	1980	106,940	9,378	15,922
	1981	108,670	8,988	16,099
b	1982	109,672	9,233	15,981
	1983	111,552	9,005	16,024
	1984	113,301	8,723	16,021
	1985	114,985	8,563	15,883
	1990	122,375	8,410	14,197

SOURCES: [a]U.S. Department of Labor (1982b, p. 140)
NOTE: These data are annual averages for the civilian labor force.

[b]U.S. Department of Labor (1982a, p. 128)

TABLE C.4

LABOR FORCE DISTRIBUTION BY YEAR, SELECTED AGE GROUPS, AND SEX

	YEAR	TOTAL LABOR FORCE (Thousands)	16-19 YEARS (Thousands)			20-24 YEARS (Thousands)		
			Total	Men	Women	Total	Men	Women
a	1970	82,771	7,249	4,008	3,241	10,597	5,717	4,880
	1971	84,382	7,470	4,172	3,298	11,331	6,233	5,098
	1972	87,034	8,054	4,476	3,578	12,130	6,766	5,364
	1973	89,429	8,507	4,693	3,814	12,486	7,183	5,663
	1974	91,949	8,871	4,861	4,010	13,314	7,387	5,926
	1975	93,775	8,870	4,805	4,065	13,750	7,565	6,185
	1976	96,158	9,056	4,886	4,170	14,284	7,866	6,418
	1977	99,009	9,351	5,048	4,303	14,825	8,109	6,717
	1978	102,251	9,652	5,149	4,503	15,370	8,327	7,043
	1979	104,962	9,638	5,111	4,527	15,769	8,535	7,234
	1980	106,940	9,378	4,999	4,381	15,922	8,607	7,315
	1981	108,670	8,988	4,777	4,211	16,099	8,648	7,451
b	1982	109,672	9,233	4,809	4,424	15,981	8,441	7,540
	1983	111,552	9,005	4,663	4,342	16,024	8,400	7,624
	1984	113,301	8,723	4,491	4,232	16,021	8,343	7,678
	1985	114,985	8,563	4,387	4,176	15,883	8,205	7,678
	1990	122,375	8,410	4,216	4,194	14,197	7,066	7,131

SOURCES: [a]U.S. Department of Labor (1982b, p. 140)
NOTE: These data include the civilian labor force only.

[b]U.S. Department of Labor (1982a, p. 128)
NOTE: These data include the civilian labor force only, middle growth projections.

TABLE C.5

SIZE OF THE U.S. LABOR FORCE BY AGE AND SEX, 1950-2000

	MEN BY AGE GROUPS (IN MILLIONS)							
YEAR	14-15	16-17	18-24	25-34	35-44	45-54	55-64	65 & over
1950	.6	1.1	7.0	11.0	10.0	8.2	5.8	2.5
1960	.6	1.3	6.9	10.9	11.3	9.6	6.4	2.3
1970	.9	1.8	9.9	12.0	10.8	10.5	7.1	2.1
1977	.9	2.1	11.7	15.7	10.9	10.4	6.8	1.8
1980	.8	2.0	11.9	17.1	12.0	10.2	7.7	1.8
1990	.7	1.8	9.7	19.3	17.0	11.1	7.3	1.6
2000	.8	2.4	9.6	16.1	19.1	15.3	7.9	1.2

	WOMEN BY AGE GROUPS (IN MILLIONS)							
YEAR	14-15	16-17	18-24	25-34	35-44	45-54	55-64	65 & over
1950	.3	.6	3.8	4.1	4.2	3.3	1.8	.6
1960	.3	.8	3.8	4.1	5.3	5.3	3.0	.9
1970	.6	1.3	6.8	5.7	6.0	6.5	4.2	1.1
1977	.7	1.7	8.8	9.2	6.8	6.7	4.3	1.1
1980	.6	1.7	9.3	9.6	7.4	7.1	5.2	1.3
1990	.6	1.7	8.3	12.7	11.7	8.8	6.2	1.4
2000	.6	2.5	9.2	12.2	15.0	14.6	8.0	1.4

SOURCE: Anderson (1978, p. 802).

TABLE C.6

LABOR FORCE PARTICIPATION RATES BY SEX
(PARTICIPATION AS A PERCENT OF ALL PERSONS OVER 16)

	YEAR	MEN	WOMEN
a	1970	79.7%	43.3%
	1975	77.9%	46.3%
	1980	77.4%	51.5%
b	1985	77.7%	56.5%
	1990	77.2%	59.6%
	1995	76.8%	61.2%

SOURCES: [a]U.S. Department of Commerce (1983a, p. 377)

[b]U.S. Department of Labor (1982a, p. 128)
NOTE: These data include the civilian labor force only, middle growth projections.

TABLE C.7

LABOR FORCE DISTRIBUTION BY YEAR AND SEX

YEAR	TOTAL LABOR FORCE[a] (Thousands)	PERCENT MEN	PERCENT WOMEN
1970	82,771 [b]	62.0 [b]	38.0 [b]
1971	84,382 [b]	62.0 [b]	38.0 [b]
1972	87,034 [b]	61.5 [b]	38.5 [b]
1973	91,756	62.0	38.0
1974	94,179	61.5	38.5
1975	95,955	60.9	39.1
1976	98,302	60.2	39.8
1977	101,142	59.7	40.3
1978	104,368	59.0	41.0
1979	107,050	58.5	41.5
1980	109,042	58.1	41.9
1981	110,812	57.7	42.3
1982	112,364 [c]	57.2	42.8
1985 [d]	114,983	55.3	44.6
1990	122,375	53.8	46.1

SOURCES: [a]U.S. Department of Commerce (1983a, p. 376)
NOTE: These data include individuals in the armed forces.

[b]U.S. Department of Labor (1982b, p. 140)
NOTE: These data include annual averages for the civilian labor force, sixteen years and over.

[c]NOTE: These data are seasonally adjusted figures.

[d]U.S. Department of Labor (1982a, p. 128)

TABLE C.8

LABOR FORCE DISTRIBUTION BY YEAR, RACE, AND SEX
(AGE 16+)

	YEAR	TOTAL LABOR FORCE (Thousands)	WHITE (Thousands)			BLACK AND OTHER (Thousands)		
			Total	Men	Women	Total	Men	Women
a	1970	82,771	73,556	46,035	27,521	9,218	5,194	4,024
	1971	84,382	74,963	46,904	28,060	9,418	5,276	4,142
	1972	87,034	77,275	48,118	29,157	9,761	5,437	4,323
	1973	89,429	79,151	48,920	30,231	10,280	5,705	4,575
	1974	91,949	81,281	49,843	31,437	10,668	5,895	4,772
	1975	93,775	82,831	50,824	32,508	10,942	5,976	4,967
	1976	96,158	84,767	51,033	33,735	11,391	6,141	5,250
	1977	99,009	87,144	52,033	35,108	11,8[illegible]	5,[illegible]62	5,505
	1978	102,251	89,634	52,955	36,679	12,[illegible]	[illegible],[illegible]	5,951
	1979	104,962	91,923	53,856	38,067	13,038	6,870	6,168
	1980	106,940	93,600	54,473	39,127	13,340	6,980	6,359
	1981	108,670	95,092	54,895	40,197	13,616	7,079	6,539
b	1982	109,672	95,131	54,916	41,215	13,541	6,932	6,609
	1983	111,552	97,625	55,409	42,216	13,927	7,089	6,847
	1984	113,301	98,995	55,838	43,157	14,306	7,234	7,072
	1985	114,985	100,316	56,228	44,088	14,669	7,372	7,297
	1990	122,375	105,867	57,800	48,067	16,508	8,080	8,428

SOURCES: [a]U.S. Department of Labor (1982b, p. 140)
NOTE: These data include annual averages for the civilian labor force sixteen years and over.

[b]U.S. Department of Labor (1982a, p. 128)
NOTE: These data include individuals in the civilian labor force only, middle growth projections.

TABLE C.9

LABOR FORCE PARTICIPATION BY MINORITIES, BY SEX
(BLACK AND OTHER)

	YEAR	MEN	WOMEN
a	1970	76.5%	49.5%
	1975	71.9%	49.4%
	1980	71.5%	53.6%
b	1985	71.9%	58.3%
	1990	71.5%	61.1%
	1995	71.3%	63.5%

SOURCES: [a]Department of Commerce (1983a, p. 377)

[b]U.S. Department of Labor (1982a, p. 129)
NOTE: These data include individuals in the civilian labor force only, middle growth projections.

TABLE C.10

EDUCATIONAL ATTAINMENT OF CIVILIAN LABOR FORCE, BY RACE, YEAR, AND SEX

	YEAR	PERCENT MEN High School Graduate	PERCENT MEN 1-3 Years Post Secondary	PERCENT WOMEN High School Graduate	PERCENT WOMEN 1-3 Years Post Secondary
WHITE	1970	35.8 %	14.1 %	47.1 %	13.6 %
	1971	36.4	14.5	46.6	14.4
	1972	36.7	14.4	45.9	13.6
	1973	36.4	15.0	46.4	14.0
	1974	36.5	15.4	45.2	15.5
	1975	36.8	15.9	45.8	15.6
	1976	36.8	16.5	45.4	16.3
	1977	36.4	16.7	45.6	16.6
	1978	36.4	17.2	45.7	17.3
	1979	36.8	17.7	45.6	17.8
BLACK & OTHER	1970	28.3 %	8.0 %	34.5 %	10.3 %
	1971	29.2	9.0	37.1	10.1
	1972	29.2	8.6	36.4	10.3
	1973	31.1	9.9	36.8	12.4
	1974	31.5	10.8	37.4	13.6
	1975	31.7	11.7	38.3	13.2
	1976	31.4	12.0	38.8	13.7
	1977	33.1	12.4	38.2	13.5
	1978	33.2	14.5	38.6	15.2
	1979	36.5	13.8	38.2	17.4
HIS-PANIC	1970	NA	NA	NA	NA
	1971	NA	NA	NA	NA
	1972	NA	NA	NA	NA
	1973	NA	NA	NA	NA
	1974	25.5 %	10.6 %	33.3 %	10.8 %
	1975	25.2	11.0	34.0	11.8
	1976	27.1	10.7	37.0	11.6
	1977	26.4	12.5	34.3	13.5
	1978	26.4	13.0	34.7	13.5
	1979	27.1	12.9	37.4	12.9

SOURCE: U.S. Department of Labor (1980, p. 136)

TABLE C.11

TOTAL SECONDARY VOCATIONAL EDUCATION ENROLLMENT
AS A PERCENTAGE OF TOTAL SECONDARY ENROLLMENT

YEAR	TOTAL SECONDARY ENROLLMENT (Millions)	TOTAL SECONDARY VOCATIONAL EDUCATION ENROLLMENT (Millions)	% OF TOTAL SECONDARY ENROLLMENT
1970 [a]	19.7	5.1	26%
1971	19.7	6.5	33%
1972	19.7	7.2	36%
1973	20.3	7.3	36%
1974	20.0	8.4	42%
1975	20.5	9.4	46%
1976	20.3	8.8	43%
1977	20.0	9.6	48%
1978	18.9	10.2	54%
1979	19.1 [c]	10.1 [d]	53%
1980 [b]	18.1	10.5 [e]	58%
1981	17.6	NA	NA
1982	17.3	NA	NA
1985 [c]	16.8	NA	NA
1990	15.6	NA	NA

SOURCES: [a] U.S. Department of Education (1980, p. 20)

[b] U.S. Department of Education (1983b, p. 28)
NOTE: These data reflect actual enrollments.

[c] U.S. Department of Education (1983b, p. 28)
NOTE: These data reflect projected enrollments.

U.S. Department of Education (1983c, p. 6)

[d] U.S. Department of Education (1983d, p. 5)

TABLE C.12

ENROLLMENT IN VOCATIONAL EDUCATION, BY LEVEL

YEAR	TOTAL VOCATIONAL EDUCATION ENROLLMENT[a]	TOTAL SECONDARY VOCATIONAL EDUCATION ENROLLMENT[a]	PERCENT OF TOTAL VOCATIONAL EDUCATION	ALL OTHER AREAS OF VOCATIONAL EDUCATION	PERCENT OF TOTAL VOCATIONAL EDUCATION
1970	8,793,960	5,114,451	58%	3,679,509	42%
1971	10,495,411	6,494,641	62%	4,000,770	38%
1972	11,602,144	7,231,648	62%	4,370,496	38%
1973	12,072,445	7,353,962	61%	4,718,483	39%
1974	13,555,639	8,433,750	62%	5,121,889	38%
1975	15,340,426	9,426,376	61%	5,914,050	39%
1976	15,133,322	8,860,947	59%	6,272,375	41%
1977	16,134,979	52,836	59%	6,572,143	41%
1978	16,704,926	10,236,117	61%	6,468,809	39%
1979	16,725,111 [b]	10,095,884 [b]	60%	6,629,227 [b]	40%
1980	16,861,828 [c]	10,466,231 [c]	62%	6,395,593 [c]	38%

SOURCES: [a]U.S. Office of Education (1975, p. 4)

[b]U.S. Department of Education (1983c, p. 6)

[c]U.S. Department of Education (1983d, p. 5)

TABLE C.13

TOTAL SECONDARY VOCATIONAL EDUCATION AND OCCUPATIONALLY SPECIFIC ENROLLMENT BY YEAR (SECONDARY)

YEAR[a]	TOTAL SECONDARY VOCATIONAL EDUCATION ENROLLMENT[b]	OCCUPATIONALLY SPECIFIC ENROLLMENT
1970	5,114,451	NA
1971	6,494,641	NA
1972	7,231,648	NA
1973	7,353,962	NA
1974	8,433,750	NA
1975	9,426,376	NA
1976	8,860,947	NA
1977	9,562,836	NA
1978	10,236,117	3,039,407 [c]
1979	10,095,884 [d]	2,926,260 [d]
1980	10,466,231 [e]	2,857,759 [e]

SOURCES: [a]NOTE: Years 1970-1978 are fiscal years; 1979 is school year 1979-80; 1980 is school year 1980-81.

[b]U.S. Office of Education (1979, p. 4)

[c]Golladay and Wulfsberg (1981, p. 47)
NOTE: These data are for grades eleven and twelve only.

[d]U.S. Department of Education (1983c, p. 6, 75)
NOTE: These data include total secondary enrollments.

[e]U.S. Department of Education (1983d, p. 5, 75)
NOTE: These data include total secondary enrollments.

NOTE: Occupationally specific enrollment figures were not compiled until 1978.

TABLE C.14

GROSS NATIONAL PRODUCT RELATED
TO TOTAL EXPENDITURES FOR EDUCATION

YEAR	GNP (Millions)	SCHOOL YEAR	TOTAL EXPENDITURES FOR EDUCATION (Thousands)	AS A PERCENT OF GNP
1969	$ 935,541	1969-70	70,400,980	7.5%
1971	1,063,436	1971-72	82,999,062	7.8%
1973	1,306,554	1973-74	98,019,834	7.5%
1975	1,528,833	1975-76	121,603,841	8.0%
1977	1,899,508	1977-78	140,367,563	7.4%
1979	2,413,900	1979-80	169,615,149 [a]	7.0%
1981	2,925,500 [a]	1981-82	199,800,000 [b]	6.8%

SOURCE: U.S. Department of Education (1982, p. 23)
NOTE: [a]These data are preliminary data.
[b]These data are estimates.

TABLE C.15

VOCATIONAL EDUCATION EXPENDITURES (VEA), BY SOURCE, BY YEAR (CURRENT DOLLARS)

Fiscal Year	VOCATIONAL EDUCATION EXPENDITURES (Millions) Total	Total Federal	Total Federal/Local	FEDERAL AS PERCENT OF TOTAL
1970 [a]	$1,841.8	$300.0	$1,541.8	16.3%
1971 [b]	2,399.0	393.9	2,005.0	16.4%
1972 [c]	2,660.7	466.0	2,194.7	17.5%
1973	3,033.6	482.4	2,551.3	16.0%
1974	3,433.8	468.2	2,965.6	13.6%
1975	4,037.2	536.1	3,501.1	13.3%
1976	4,713.5	543.2	4,170.3	11.5%
1977	4,962.5	533.6	4,428.9	10.7%
1978	5,673.5	499.1	5,174.4	8.7%
1979	6,657.2	658.1	5,999.0	9.8%
1980	6,914.0	745.5	6,168.6	10.7%
1981	7,513.5	853.6	6,659.9	11.3%

SOURCE: [a]Golladay and Wulfsberg (1981, p. 135)

[b]The National Center for Research in Vocational Education (1979, p. 154, 156, 157)

[c]U.S. Department of Education (1983a, p. 152)

TABLE C.16

VOCATIONAL EDUCATION EXPENDITURES (VEA), BY SOURCE, BY YEAR (CONSTANT 1981 DOLLARS)

FISCAL YEAR	TOTAL EXPENDITURES (Millions)	TOTAL FEDERAL EXPENDITURES (Millions)	TOTAL STATE/LOCAL EXPENDITURES (Millions)	FEDERAL AS PERCENT OF TOTAL
1970	$3,933.2	$641.0	$3,292.5	16.3
1971	4,885.5	802.2	4,083.1	16.4
1972	5,600.0	980.8	4,619.2	17.5
1973	6,137.0	975.8	5,161.2	16.0
1974	6,376.3	869.4	5,506.9	13.6
1975	6,750.7	896.5	5,854.2	13.3
1976	7,359.3	848.1	6,511.2	11.5
1977	7,323.2	787.4	6,535.8	10.7
1978	7,845.3	690.2	7,155.2	8.8
1979	8,415.4	831.9	7,583.4	9.9
1980	7,713.3	831.6	6,881.7	10.8
1981	7,513.6	853.6	6,659.9	11.4

SOURCE: U.S. Department of Education (1983a, p. [5z])

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