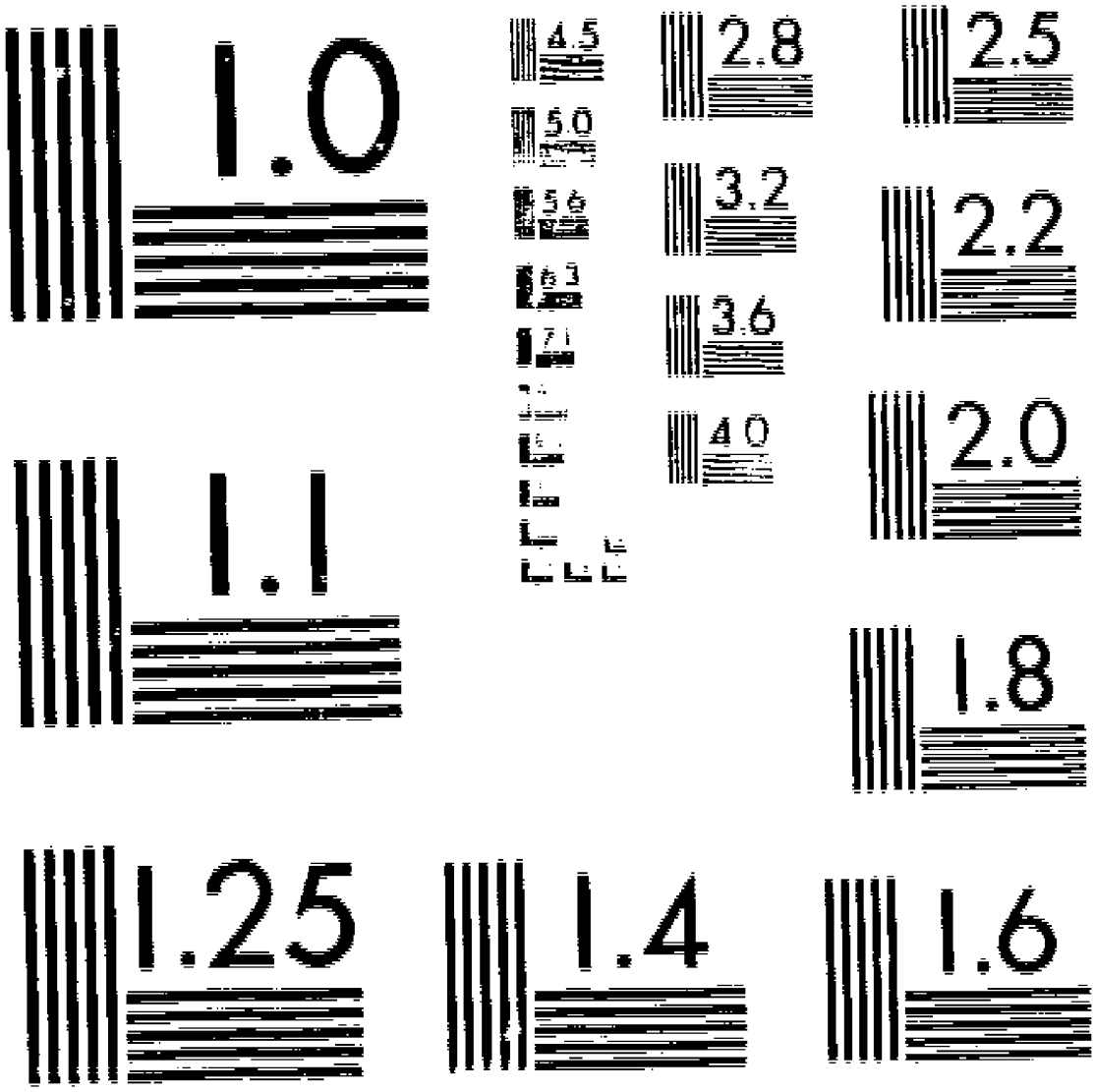

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ABSTRACT

This bulletin summarizes the Bureau of Labor Statistics employment projections which are available and discusses their use in local educational planning. Included are material on projections of future manpower needs, information on occupational training programs, and statistics by occupation on manpower needs, annual openings, training methods, and numbers of graduates. (BH)

Occupational Manpower and Training Needs

BULLETIN 1701

U. S. DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

Occupational Manpower and Training Needs

Information for Planning Training Programs for the 1970's

BULLETIN 1701

U. S. DEPARTMENT
OF LABOR
J. D. Hodgson, Secretary

BUREAU OF
LABOR STATISTICS
Geoffrey H. Moore, Commissioner

1971

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Preface

The Bureau of Labor Statistics has as one of its major tasks the development and dissemination of information on future occupational manpower requirements and supply. The following formats are used to present its projections.

The *Occupational Outlook Handbook*, first issued in 1949 and published biennially since 1957, presents information for vocational counseling of individuals.

Tomorrow's Manpower Needs, a four-volume publication, BLS Bulletin 1606 presents a comprehensive set of national projections to 1975 for use in developing State and area projections for policymakers and planners at the local level.

Occupational Employment Patterns for 1960 and 1975 BLS Bulletin 1599 provides national information on industry occupational patterns for educational and manpower planning.

"America's Industrial and Occupational Manpower Requirements, 1964-75," *The Outlook for Technological Change and Employment*, Appendix Volume I, Technology and the American Economy, The Report of the National Commission on Technology, Automation, and Economic Progress presents data on the impact of technological change on manpower requirements.

Manpower needs for specific occupations have been projected for organizations concerned with policy matters relating to particular occupations. For example, projections for scientists, engineers, and technicians have been prepared at the request of the National Science Foundation, and published in *Scientists, Engineers, and Technicians in the 1960's* (NSF 63-12), *Technician Manpower: Requirements, Resources, and Training Needs* BLS Bulletin 1612, and *Technician Manpower, 1966-80* BLS Bulletin 1639. A set of projections of health occupations, presented in *Health Manpower, 1966-75* BLS Report No. 312, was prepared at the request of the Intradepartmental Committee on Health Manpower.

A systematic set of projections of the economy to 1980 that provide estimates of manpower requirements by occupation for the 1970's have been published by the Bureau in *The U.S. Economy in 1980*, BLS Bulletin 1673 and *Patterns of U.S. Economic Growth*, BLS Bulletin 1672. Ways of using those occupational projections with other manpower information in planning education and training are discussed in this bulletin.

Chapter I illustrates ways to use information on projections of occupational requirements and supply, and training in planning education and training programs. The remainder of the report provides available information.

Chapter II presents material on projections of future occupational requirements.

Chapter III presents information on occupational training and the number of persons completing such programs.

Chapter IV summarizes for each occupation the data on manpower requirements, annual openings, methods of training, and available statistics on training completions.

This bulletin was prepared in the Division of Manpower and Occupational Outlook, Office of Manpower and Employment Statistics, Bureau of Labor Statistics. The report was written by Gerard C. Smith and Michael F. Crowley, under the direction of Neal H. Rosenthal.

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OCCUPATIONAL MANPOWER AND TRAINING NEEDS

Chapter I. Occupational Data Needs in Planning Education and Training

Traditionally, most education and training in the United States have been offered in response to the desire of students or trainees. Underlying the development and utilization of trained workers are many decisions made by individuals to suit their own interests, opportunities, and capabilities. For instance, a high school student may become a carpenter rather than attend college; a chemist may leave his job and teach high school; a secretary may have a child and remain at home temporarily. Decisions by government and educational institutions influence choices of individuals. Examples of such decisions are building a junior college; establishing a training program for the disadvantaged; revising the draft or tax laws; and changing salaries that make one occupation more attractive than another.

In this country, individuals are encouraged to make educational choices. The system has worked reasonably well for most individuals and for the country. Because of this success, the question is asked: Why make projections for use in planning education and training programs if the development and use of manpower resulting from the many decisions are satisfactory and individuals can adjust to market demands?

The ability of the system to work has depended on the flexibility of employers, workers, and educational and training institutions. Employers have adjusted their operations to the available labor supply through a variety of methods including restructuring their work when skilled workers were in short supply; upgrading or training workers on the job; or substituting machinery for scarce labor. Workers have adjusted to the needs of employers, sometimes in response to relative wage levels among occupations, by taking training or moving. Educational and training institutions have responded to changing manpower needs, both in the initial training of workers and in retraining and upgrading programs.

Despite the success of these adjustments, the market has worked less than perfectly. Health officials have complained of shortages of physicians and nurses; consumers have called for more and better trained automobile mechanics and repairmen; industry has needed more engineers, technicians, and other highly trained workers. In general, the market adjusts slowly to changes in demand for occupations that require long training periods. One effect is a disproportionate rise in wage levels which result in costs of some socially essential services, such as medical care rising faster than the ability of people to pay. Sometimes, the progress of socially desirable work, such as education or combating environmental pollution is slowed. In the face of rising demand, shortages of trained workers contribute to inflationary pressures. This situation is made more pointed if occurring at the same time that less-skilled workers—who have high unemployment rates even when total umemployment is low—are unemployed.

These factors create the need for education planning and training, especially when the government contributes to rapidly rising manpower needs in some fields by mounting large programs, such as highway construction or space exploration. Such programs create shortages of trained workers that affect industry and threaten the effectiveness of the government's own programs.

In major legislation on training and education, Congress has been very explicit in indicating that manpower training financed by the Government should be based on future manpower needs. For example, in the Vocational Education Amendments of 1968, Congress declared the purpose of the Act to include assuring that persons who needed it will have "ready access to vocational training or retraining . . . which is realistic in the light of actual or anticipated opportunities for gainful employment" (Public Law 90-576, 90th Congress).

Also, in the Manpower Development and Training Act of 1962, the Congress stated that "improved planning and expanded efforts will be required to assure that men, women, and young people will be trained and available to meet shifting employment needs; that many persons now unemployed or underemployed, in order to become qualified for reemployment or full employment must be assisted in providing themselves with skills which are or *will be in demand in the labor market* (Public Law 87-415, as amended).

Data on projections

To meet needs of officials concerned with planning education and training, this bulletin brings together information on future manpower requirements on more than 230 occupations emanating from research of the Bureau of Labor Statistics. Together, these occupations make up more than 50 percent of all professional and technical workers, 99 percent of salesworkers, 81 percent of craftsmen, and 65 percent of clerical workers.

Occupational projections also are used for purposes other than planning education and training. For example, in 1967 a working group of the President's Committee on Manpower[1] prepared a report enumerating six specific purposes and uses which manpower projections serve:

1. To alert Government (and other interested parties) to emerging manpower problems; commonly, an imbalance between the demand for and supply of workers in the labor force.
2. To help choose between alternative proposed policies.
3. To assist in administering specific Government programs.
4. To provide an essential element for developing other general types of projections by Government and private organizations.
5. To provide information for vocational guidance of young people interested in choosing a field of work.
6. To encourage an informed and responsible public concern for manpower problems; and to help provide the ordinary citizen with information which would be of use to him in his role as a citizen, and apart from that of an economic producer.

Information in this report serves all of these purposes as well as providing information specifically for planning education and training programs. Other Bureau publications, however, focus on some other uses more sharply. For example, the *Occupational Outlook Handbook*, as mentioned before, drawing on the same body of research findings, focuses on providing information for use in vocational guidance.

Data on training

Estimates of future manpower requirements constitute only part of the data needed to evaluate the adequacy of education and training programs. Information also is needed on training. By comparing the approximate number of newly trained workers needed annually and the present output of the various training programs, training efforts can be appraised and plans expanded, if necessary.

Workers receive training from a wide variety of sources: Colleges and universities, junior and community colleges, apprenticeship and other formal employer training programs, correspondence schools, self-study, vocational education programs (secondary and post-secondary), the Armed Forces, and Federal Manpower programs for the disadvantaged, underemployed, and unemployed. Many also "pick up" needed skills informally on-the-job. Informal training is not limited to low skilled jobs. One study,[2] for example, has revealed that only about 40 percent of all craftsmen had learned their current job through formal training.

Many occupations, especially those not requiring a college degree, have no single, well-identified training. Certain paths may be preferred by employers; others may produce a qualified worker in less time. All types of training, however, may not be available to an individual. For example, certain schools are not found in all localities. Training paths are not mutually exclusive. A person may study drafting in a vocational high school, work as a clerk to receive further training, and finally be sponsored as an apprentice in drafting by the company.

Knowledge of the different ways people can train for occupations, however, does not provide the information needed for supply-demand analysis or for assessment of the adequacy of vocational education and training programs. Data are needed on the relative importance and number of individuals completing each type of training, the proportion of those who enter the occupations, and the value employers place on the skill level of workers who enter through each route. Information also is needed on the slippage between completion of training and employment. Although varying among occupations, such information usually is lacking.

For each of the 230 occupations for which projections are presented, an attempt was made to compile statistics on training. During this research, it was found that a major problem confronting manpower analysts is the paucity of data on current output of educational and training programs. Not only are coverage gaps in collecting data significant, but many problems of comparability are involved. For example, much data of the Federal Manpower programs pertain to enrollments over a period of years; little information is available on completions. Additionally, the level of training of various sources differs. Some may be lengthy and theoretical, whereas others for the same occupation may be short and emphasize practical skills. Some training prepares students for the most basic of entry levels. Other programs are designed so that a person can enter the labor force at the professional level.

[1] *Manpower Project. An Appraisal and a Plan of Action* (U.S. Department of Labor, Manpower Administration, August 1967), pp. 22-25.

[2] *Formal Occupation Training of Adult Workers* (U.S. Department of Labor, Office of Manpower Automation and Training, Manpower Administration, Manpower/Automation Research Monograph No. 2), December 1964.

During its research, the Bureau has found that data gaps in training statistics are the most severe restriction to occupational analysis. Major problem areas and data gaps can be grouped for discussion under training source output data; occupational training of the current work force; and entry rates from the various training programs.

Training Sources Output Data. To evaluate whether the present level of training should be expanded, total inputs from all sources must be considered in each occupation. Relatively good data are available for college and university, junior and community colleges, and vocational education programs, but even these have problems. Outputs of community colleges and post-secondary vocational education programs overlap to some degree. In addition, data on community colleges pertain primarily to programs that train students for immediate employment after completing the course of study; many students are trained in the transfer programs of the community colleges. Because of their training persons dropping out of 4-year college programs enter certain jobs and are not counted. For example, many dropouts from engineering take technician jobs.

No agency—public or private—currently collects data on enrollments and graduates of private vocational schools. The contribution of these schools must be assessed before total training needs can be evaluated. Detailed information also is needed on the role of the military in training. Some systematic follow-up is needed for individuals separated from the Armed Forces.

Also needed are better data on specific training of various Federal, State, and local manpower programs. For example, data are available on numbers of persons enrolled in MDTA on-the-job and institutional programs for selected occupations, but data are not available on completion. Even less data are available on other Labor programs. A special survey to determine the occupations of employed WIN program participants in six States showed that 21.5 percent were employed in clerical and sales occupations, but no more detail was provided. The JOBS program has no specific occupational information on the number of persons enrolled; data are available only on major occupational categories and selected occupational groups. In addition, available data show cumulative totals through June 1969 rather than for the year.[3]

Occupational Training of the Current Work Force. The most effective type of training for a particular occupation can be learned by evaluating past methods. To analyze such data, information about types of training taken by new entrants and persons employed for several years is necessary. This area needs considerable research.

Entry Rates from Various Training Programs. Not all graduates of training programs actually enter occupations for which they were trained. For example, electronic technology graduates may become industrial technicians or draftsmen. Some graduates continue their education to train for higher-level occupations. Others accept jobs using only part of their training. Still others enter the Armed Forces and are temporarily out of the civilian labor force. Some women who complete training become housewives and do not enter the labor force.

To develop effective training programs, statistics are needed on the proportion of those completing a training program who actually enter the occupation for which they were trained. High attrition rates may suggest a need for improved programs if employment opportunities exist.

Using Occupational Projections and Training Information

This bulletin presents four key elements to evaluate training needs:

1. Projections of the number of workers required in each occupation.
2. Estimates of needs to replace workers who die, retire, and where data allow, who transfer to another occupation.
3. Data on output from various training programs.
4. Information on ways workers prepare for occupations.

In this report the Bureau has assembled data, including gaps and imperfections, to help those responsible make decisions on education and training programs and to indicate the work that can be done to help the Bureau and others who are concerned do a better job of developing these data.

In addition, projections of manpower needs are built upon assumptions regarding such factors as the international political situation and the direction of Federal Government programs. For example, among the assumptions underlying the Bureau's 1980 projections are that the international climate will improve, the United States will no longer be fighting a war, but a still guarded relationship between major powers will permit no major reduction in armaments; that fiscal and monetary policies will achieve a satisfactory balance between low unemployment and relative price stability without reducing the long-term economic growth rate; and that all levels of government will join efforts to meet a wide

[3]The Manpower Administration already has taken steps to remedy the lack of detailed occupational data for WIN and JOBS.

variety of domestic requirements. (For a more complete presentation of assumptions, see appendix A). Assumptions, however, vary widely over the long run. Should circumstances arise that prove certain assumptions to be off the mark, users should develop alternate assumptions. For illustrative purposes examples of alternative assumptions for construction are presented later in this chapter.

Projections for some types of economic activity and related manpower needs are heavily dependent on the assumptions used. For example, an assumed level of defense expenditures has a great impact on scientific and technical manpower and the assumed level of housing has a great impact on the demand for construction craftsmen.

Meaningful alternative projections, based on different patterns of growth, are possible within a framework of continued economic growth and full employment. Estimates derived from alternative projections, however, may have substantially the same implications for manpower planning officials. The following alternative model for construction craftsmen illustrates this situation. In line with the National Housing Goals embodied in the Housing and Urban Development Act of 1968, the BLS 1980 economic model assumes production of 2.7 million new housing units in the target year. This level may be high in view of the relative low level of housing starts in 1970, experience of the 1960's, and financial problems that may not allow this number of units to be constructed. If the assumption were made that residential construction will grow rapidly but to a level about 10 percent below the 2.7 million units assumed in the original model (2.43 million units), growth requirements for construction craftsmen would of course be lower than the levels initially projected. Among individual crafts, the effect of this alternative projection would be different. (See table 1.) For example, carpenters and painters, heavily involved in residential construction, would feel the greatest impact, whereas, operating engineers, primarily engaged in road building and other heavy constuction, would be limited.

Approximately the same conclusions for individual occupations are implied by the alternative assumption as by the original projection. For example, annual openings for carpenters, the occupation most affected by the housing assumption, was reduced from 39,300 in the primary model to 35,900 in the alternative. Most carpenters are trained on the job rather than in formal programs; for example, between 1961-68 apprenticeship completions averaged 3,256 a year, only 36 percent of estimated entrants during this period. To keep the same ratio of apprenticeship completions to annual openings in the 1970's as in the 1960's would require a significant increase in training under both assumptions. The limited data on other types of formal training (MDTA and vocational education) indicate similar conclusions. Thus, the analysis presented for carpenters later in the report which indicate the need to expand training based on the primary projections (page 6), would be virtually identical to that based on the alternative projection. Nevertheless, alternatives along with primary projections can indicate a range of annual openings on which plans may be based.

Table 1. Projected annual job openings for construction craftsmen, 1968-80, under illustrative alternative assumptions

Craft	All industries				Construction industry			
	Primary BLS projection	Alternative projection	Difference	Percent change	Primary BLS projection	Alternative projection	Difference	Percent change
Bricklayers	7.6	7.2	0.4	-5.3	7.2	6.8	0.4	-5.6
Carpenters	39.3	35.9	3.4	-8.7	30.0	26.6	3.4	-11.3
Cement and concrete finishers	3.6	3.2	0.4	-11.1	3.6	3.1	0.5	-13.9
Electricians	21.3	20.8	0.5	2.3	10.5	10.0	0.5	-4.8
Excavating, grading, and road machine operators	14.8	14.4	0.4	-2.7	10.0	9.6	0.4	-4.0
Painters and paperhangers	18.2	17.3	0.9	-4.9	12.3	11.3	1.0	-8.1
Plasterers	0.7	0.7	---	---	0.6	0.6	---	---
Plumbers and pipefitters	19.5	19.0	0.5	-2.6	10.8	10.4	0.4	-3.7
Roofers and slaters	3.0	2.5	0.5	-16.7	2.5	2.1	0.4	-16.0
Structural metal workers	3.9	3.9	---	---	3.0	3.0	---	---

Note: Because of rounding, the sum of individual items may not equal total.

Illustrations of ways information may be used

To illustrate the ways basic information can be used, examples of how the data can be evaluated in planning training for three occupations have been developed and presented below. The occupations in the examples were selected to illustrate: (1) an occupation for which 4 years of specialized college is generally required and preferred, but in which entrants come from a variety of other sources (engineers); (2) an occupation for which formal vocational training (apprenticeship) is recommended but in which many workers nevertheless enter by casual on-the-job training (OJT) methods (carpenter), and (3) an occupation for which formal occupational training generally is not required (waiter and waitress). These examples, given below, are purely illustrative and in evaluating supply and demand individual factors should be considered.

Engineers

1. *Job Openings, 1968-80.* Annual job openings are projected to average 73,000 for the 1968-80 period. This estimate includes average annual needs of 36,000 for growth, 17,000 to replace those who will die and retire, and 20,000 to replace engineers shifting to other occupations.

2. *Supply and Demand Relationships.* New engineering graduates are the primary source of supply of new engineers. However, in recent years the flow of graduates into engineering has not been sufficient to meet manpower needs. This opened up opportunities for significant numbers to enter the field from other sources: workers who shift into the field from other occupations (including technicians who are upgraded); persons not in the labor force (including those in the Armed Forces); immigrants; and college graduates who did not major in engineering. Of course, some of these "other" entrants are not as well qualified as new engineering graduates.

Nevertheless, large numbers of workers are expected to continue to come from these sources, as employers will continue to upgrade their highly qualified technicians, engineers will continue to immigrate to the United States, and some college graduates not majoring in engineering will continue to become employed as engineers either by choice or due to circumstances in the job market.

If the assumption is made that the past patterns of entry to engineering from these other sources would continue, about 36,000 engineers would enter the field from these sources from 1968-80. Under this assumption, only 38,000 new engineering graduates would have to enter the field annually if requirements are to be met. Follow-up studies of college graduates indicate that about 85 percent of all new engineering graduates enter the profession. Therefore, about 45,000 engineering graduates would be needed each year to obtain 38,000 entrants. In 1968, about 41,000 bachelor's degrees in engineering were granted. U.S. Office of Education projections of engineering degrees based on a continuation of patterns of study over the past 10 years indicate that for the 1968-80 period the number of bachelor's degrees in engineering will average slightly above the 1969 level, an increase of only 1,000. To meet requirements, the number of bachelor's degrees granted will have to increase faster than implied by past trends and average 10 percent, or 4,000 above the 1969 level. However, it should be pointed out if graduates were increased to levels averaging even higher than 45,000, we would not only meet requirements but reduce our dependence on those who are less well trained for engineering jobs than college graduates with an engineering degree.

3. *Implications for Training.* Based on an analysis of the foregoing information are a number of implications for training. Many factors should be considered before concluding that more engineering schools should be built or existing facilities expanded. Engineering schools may not be filled to capacity and the problem may revolve around the need to attract students to the field. The retention rates of students who enroll in engineering schools may be relatively low and perhaps changes are necessary in the practices of engineering schools that affect the retention of students. Decisions could be made that relate to the adequacy of engineers who enter the profession from routes other than formal engineering training. For example, studies may be conducted which indicate that a large portion of new engineers who are not engineering graduates are not sufficiently trained and, therefore, the quality of our country's engineers is suffering. Such information could have a major effect on the decisions as to the extent of increase in training that is needed.

Carpenters

1. *Job Openings, 1968-80.* Annual job openings are projected to average 39,000 for the 1968-80 period. This includes average annual needs of 17,000 for growth and 22,000 to replace carpenters who will die and retire.[4]

2. *Training.* In 1968, approximately 3,400 carpenters completed registered apprenticeship training and became

[4] See discussion on alternative projections on page 4.

journeymen.[5] As in other construction crafts many began apprenticeship training but dropped out during the year, some of whom became employed in their trade. In addition, 4,400 persons were enrolled in Manpower Development and Training Act (MDTA) on-the-job, and institutional training programs in carpentry. MDTA programs are short-term skill upgrading programs and if all completed the training presumably they would be job-ready sometime in 1968. About 7,700 persons completed secondary (7,000) and post-secondary (700) vocational education programs in carpentry; there is no information on how many of these enter the occupation. In sum, a maximum potential of 15,500 persons could have been specifically prepared to enter carpentry during the year through formal training; the actual number who entered is most likely lower. Preparation in each of these different programs varies, however, and graduates are not equally well qualified. A 4-year apprenticeship program is most desirable and is recommended by training authorities. In addition, many individuals pick up their skills on the job and qualify as carpenters although statistics are not available on the number.

3. *Implication for Training.* Between 1968 and 1980 an annual average of about 39,000 carpenters will be needed to fulfill requirements. (Note discussion of alternative projections on page 4.) To meet this need through formal training, the number trained annually, therefore, would have to be raised by about 25,000 or more than 150 percent above the number trained in 1968. Many carpenters will continue to be trained on the job or pick up their skills through casual methods and many job openings will be filled by trained workers returning to the occupation who left the trade during periods of reduced construction activity. If preparation for the trade through a training program is better than that obtained through casual methods then the data indicate that an expansion of training is needed to upgrade the carpenter force qualitatively as well as quantitatively. Data for the 1960-68 period which indicated openings averaged 23,900 and apprenticeship completions averaged 3,250 annually illustrate the point. To keep the same ratio of apprenticeship completions to annual openings in the 1970's as in the 1960's would require annual average apprenticeship completions to increase about two-thirds along with the expected increase in annual openings (23,900 to 39,000). To upgrade the quality of the carpenter work force, an even greater increase would be needed.

[5]U.S. Department of Labor, Manpower Administration, Bureau of Apprenticeship and Training, and Cooperative State Apprenticeship Agencies.

In planning training of carpenters and other construction crafts, a special problem is encountered because of the seasonal and cyclical nature of the industry, as well as work time lost resulting from the completion of one project and the shifting to another. The rate of unemployment is well above the national average even when construction levels are high; in 1969, for example, the unemployment rate for construction workers averaged 6 percent, compared to a national average of 3.5 percent. Since construction craftsmen training is long (most apprenticeship programs last 4 years), generally trainees must receive some instruction through troughs and peaks of business cycles. Keeping a smooth flow of trainees to meet long-term manpower needs is difficult. During the troughs of a business cycle employers and organized labor have difficulty being concerned with taking on new trainees when trained workers are unemployed. Since work may not be available during the trough of a seasonal cycle to support the training, taking on large numbers of new apprentices is difficult to rationalize, even during periods of peak activity.

The problem is further compounded because most formal apprenticeships for these trades are given in unionized sectors of the industry; very little is given by nonunion employers or firms which employ workers for "force-account" construction or maintenance and repair.

Waiters and waitresses

1. *Job Openings, 1968-80.* Annual job openings are projected to average 67,000 for the 1968-80 period. This includes average annual openings of 23,000 for growth and 44,000 to replace waiters and waitresses who die and retire.

2. *Training.* Available training data for this occupation indicates that a total of 738 persons completed secondary and post-secondary vocational education programs for waiters and waitresses in 1968. In addition, 1,700 MDTA on-the-job trainees were enrolled in 1968. MDTA programs are short-term programs and if all completed training in which they were enrolled, it is reasonable to assume they would have been job ready sometime in 1968. In sum, a maximum of 2,438 trained waiters and waitresses could have been specifically prepared to enter this occupation in 1968.

Increasingly, employers prefer that beginners have at least 2 or 3 years of high school. Most newly hired waiters and waitresses, however, learn their skills on the job.

3. *Implications for Training.* Only a very small portion of all waiters and waitresses are formally trained

and such training is not needed, although employees with some formal training are of course in a better position in the job market. One possible implication of this information is that this may be a good area to expand training for disadvantaged persons who need jobs that can be learned in a short time and have potential for upgrading to better paying jobs. For example, waiters and waitresses can be trained in a short period of time and after gaining experience move to better paying jobs in larger restaurants; some other career ladder possibilities are cashier, headwaiter, hostess, or restaurant management positions. Since workers are primarily trained on the job, an expansion of training in this occupation is not necessary to meet manpower requirements. Other factors which revolve around the relative attractiveness (due to salary differentials, working conditions, etc.) of the job would come into play in a shortage situation.

Local Use of Data

Data in this report reflect the national situation. However, most educational and training planning is done locally. Methods used to convert BLS national manpower projections to local needs are presented in *Tomorrow's Manpower Needs.*[6] The report indicated that training data and its analysis may be more complete at the local level than at the national level because data may be available locally on the output of private schools, community colleges, public training programs, and individual firms. Local sources also may supply information on the proportion of trainees who actually enter employment in the local labor market.[7]

[6] Bulletin 1606.

[7] See *Handbook for Projecting Employment by Occupation for States and Major Areas* (U.S. Department of Labor, Manpower Administration) in process.

Chapter II. Occupational Projections

Many factors change the occupational composition of our nation's labor force, but the principal influence is the variation in growth among industries requiring different numbers and types of workers. For example, the health service industry can be expected to demand more licensed practical nurses, hospital attendants, and other workers while electronics manufacturers will demand more engineers, assemblers, and inspectors.

Factors not directly related to industry growth also influence occupational structure. Technological changes in machines and processes have a major effect. For example, the computer has changed the occupational composition in production and office operations in many industries by creating new occupations and increasing or decreasing worker demand. Changes in business organization, such as more chain stores and supermarkets, also have altered the economy's occupational structure. Union-management agreements are still another factor influencing the relative demand for different kinds of workers as in the railroad industry. Changes in government priorities also may require different types of workers, for example, space research vs. urban renewal. Even the supply of workers in one occupation affects demand for another. Technicians have been substituted when a shortage of engineers exists.

This bulletin presents projections based on an extensive interrelated program of studies on economic growth, technological change, and industrial and occupational trends conducted in the Bureau of Labor Statistics. More details on economic and industry projections and on the methodology used to develop the 1980 projections are presented in *The U.S. Economy in 1980,* BLS Bulletin 1673, and *Projections of U.S. Economic Growth,* BLS Bulletin 1672.

Growth of Occupations

Many other factors also have caused the nation's job structure to shift. Since World War II, a basic trend has been toward white-collar jobs. In 1956 for the first time in the Nation's history, white-collar—professional, managerial, clerical, and sales—outnumbered blue-collar workers—craftsmen, operators, and laborers. Larger proportions of service workers and smaller proportions of farmers and laborers constitute other significant trends. (See chart 1.)

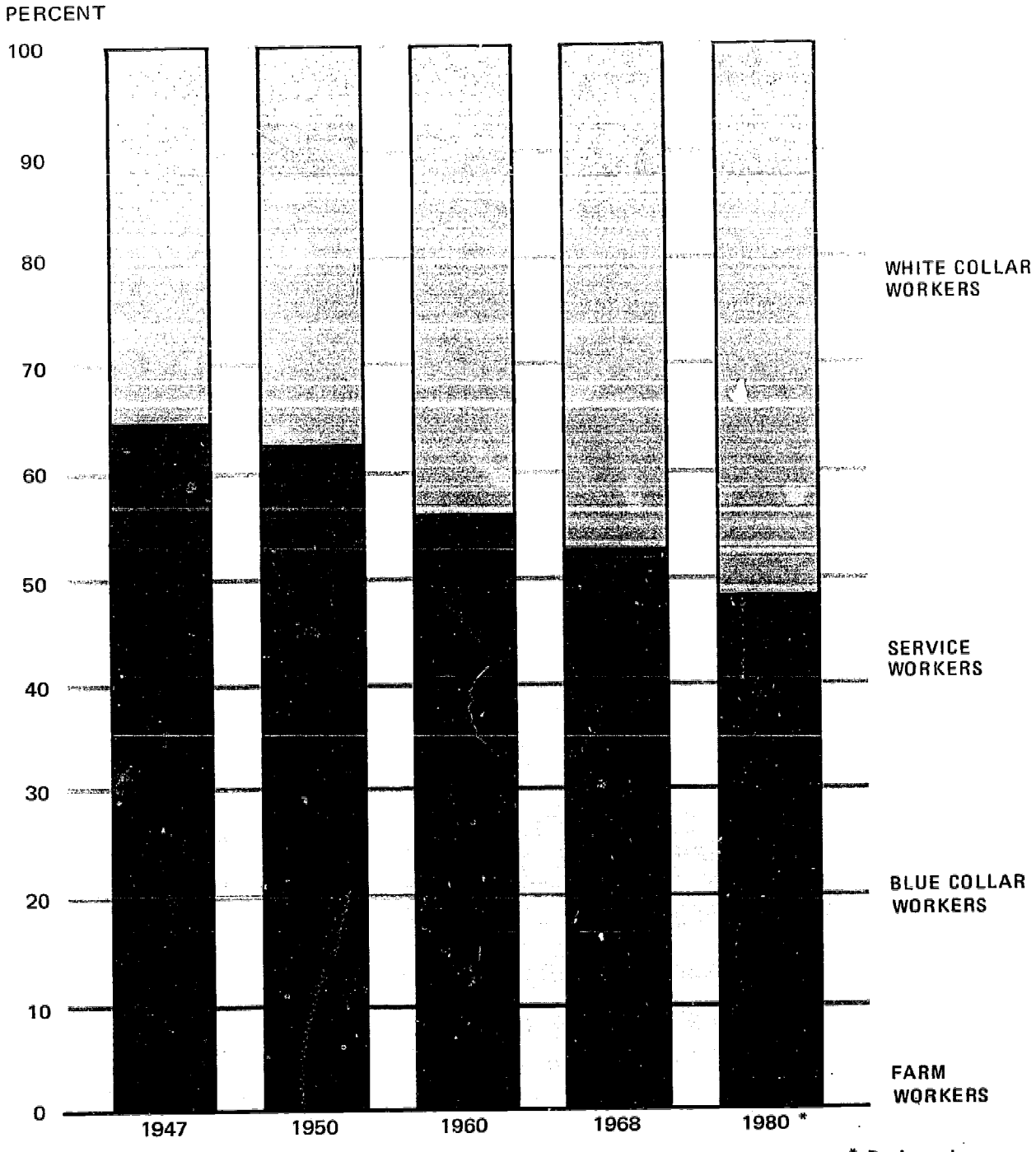
Between 1960 and 1968, employment of white-collar workers rose from about 28.5 million to 35.6 million or by 25 percent compared to a growth in total employment of 15 percent. White-collar workers as a proportion of total employment increased 43 percent in 1960 to almost 47 percent in 1968. Employment of service workers rose from about 8.0 million to 9.4 million, an increase of 17 percent, while employment of blue-collar workers, rising from 24.1 million to 27.5 million increased about 14 percent. The number of farm workers, falling from 5.2 million in 1960 to 3.5 million in 1968 actually declined about one-third.

Through the 1970's, the rapid growth in requirements for white-collar occupations will continue, faster than average growth among service workers, slower than average growth for blue-collar occupations, and farm workers will decline even further.[8] For example, white-collar occupations will constitute about 50 percent of all employed workers by 1980. Requirements in these occupations will rise from 35.6 million in 1968 to 48.3 million in 1980. (See table 2.) By 1980, blue-collar occupations will make up 32.7 percent of the work force, a reduction from 36.3 percent in 1968. Employment, however, will rise from 27.5 million in 1968 to 31.1 million in 1980. Through the 1970's, needs for workers in service occupations will continue to expand and increase nearly 40 percent, more than 1½ times the expansion for all occupations combined. Employment will rise to 13.1 million in 1980, from 9.4 million in 1968. And finally, requirements for farm workers will continue to decline as machines and improved farming techniques take over many more of the production processes on the farm; employment will shrink from 3.5 million in 1968 to 2.6 million in 1980.

The professional and technical occupation group, whose growth rate has outpaced that of all major occupational groups in recent decades, will continue to lead from 1968-80; its estimated rate of increase is 50 percent, compared with 25 percent for all occupations. (See chart 2.) Service workers, who will increase nearly

[8]The Bureau's projections rely strongly on assumptions presented in appendix A, along with the methodology used to develop the projections.

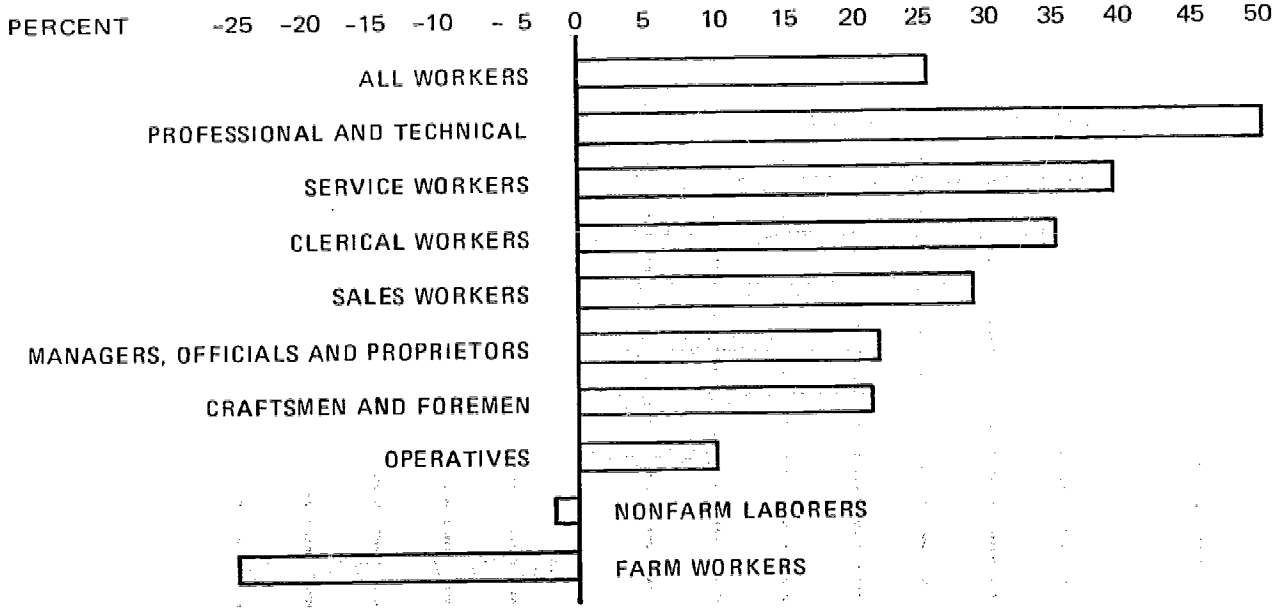
CHART 1.
EMPLOYMENT IS SHIFTING TOWARD WHITE-COLLAR OCCUPATIONS



Source: Bureau of Labor Statistics

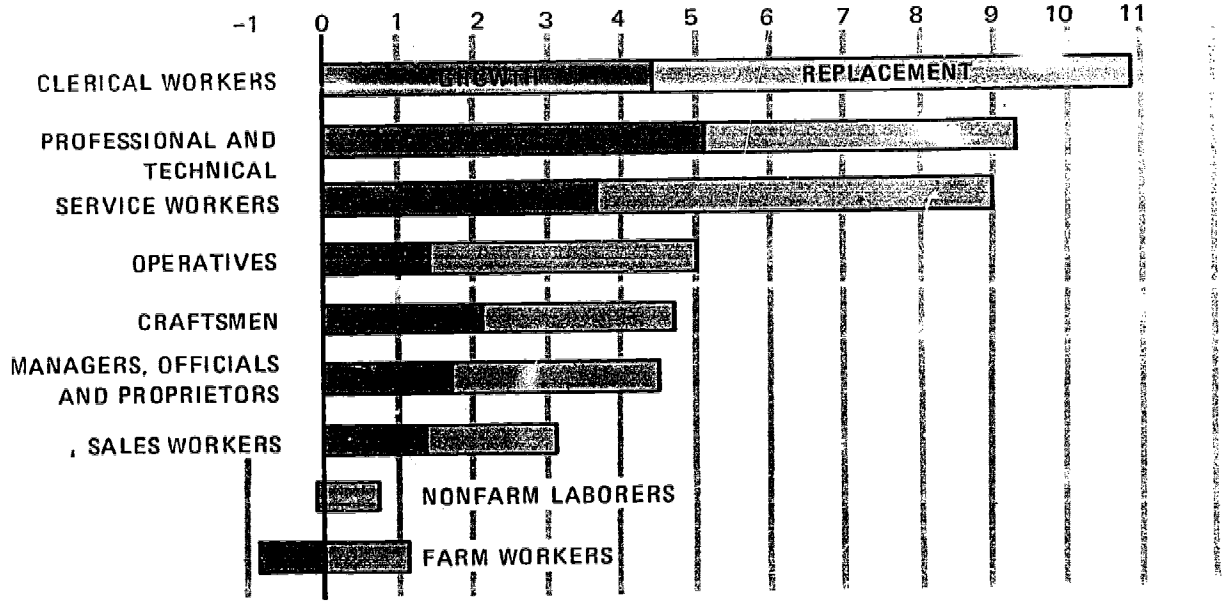
* Projected

CHART 2.
PERCENT CHANGE IN MAJOR OCCUPATIONAL GROUPS, 1968-80 PROJECTED



Source: Bureau of Labor Statistics

CHART 3.
OPENINGS ARE DETERMINED BY GROWTH PLUS REPLACEMENTS (WORKERS NEEDED, 1968-1980, IN MILLIONS)



Source: Bureau of Labor Statistics

40 percent, will be the second fastest growing group. Clerical workers, whose projected growth rate is 35 percent, will be the third fastest growing occupation. They will be followed by sales workers. Managers, officials, and proprietors (22 percent); and operatives (10 percent) are projected to grow less rapidly than total employment; the employment level of nonfarm laborers is expected to be about the same in 1980 as in 1968. Further declines are expected in the number of farm workers.

Selected Occupations

Appendix B presents detailed projections, including estimates of annual average job openings for 232 occupations. These estimates result from growth and replacement of workers who die or withdraw from the labor force, but not from openings resulting from workers who transfer occupations. Such data are available only for a small group of occupations requiring college training and are included in the text of this report and in Appendix B only where specifically stated.

The following discussions highlight projections for many of the major occupations:

Professional and technical workers. Employment requirements for professional and technical workers in 1980 are projected at 15.5 million, 50 percent more than the 10.3 million employed in 1980. This rate represents a slower growth than the annual average between 1958 and 1968. As in the earlier period, demand for goods and services resulting from population growth and rising incomes will be a major factor underlying increasing requirements for these highly cialized workers. Concentration of the population in metropolitan areas also will create new demands for professional and technical workers in fields such as environmental protection, urban renewal, and mass transportation systems. In addition, efforts to develop further the nation's resources and industry and the quest for knowledge—in scientific, technical, and many other fields—will require more professional workers.

Manpower needs will increase in almost every professional and technical occupation, but rates of increase will differ among occupations.

Teaching, the largest profession, is expected to require 2.7 million workers in 1980, compared with 2.5 million employed in 1968. Rates of increase among the three major levels of teaching—elementary, secondary, and college—will vary widely. The smallest growth, about 3 percent, is expected for elementary school teachers. Although more teachers will be required because of the demand to reduce the average class size, declining enrollments in elementary schools between 1968 and 1980 will limit employment growth. The 14-percent increase in requirements for secondary school teachers is primarily attributable to higher enrollments in secondary schools in 1980 than in 1968. Demand for college and university teachers is expected to grow almost 40 percent as the number of 18-21 year olds rises nearly 2.7 million between 1968 and 1980. At the same time rising family income, programs of student financial assistance,

Table 2. Employment by major occupational group, 1968 and projected 1980 requirements
[In thousands]

Occupational Group	1968		Projected 1980 requirements		Change	1968-80
	Number	Percent	Number	Percent	Number	Percent
Total	75,920	100.0	95,100	100.0	19,180	25.3
White-collar workers	35,551	46.8	48,300	50.8	12,749	35.9
Professional and technical	10,325	13.6	15,500	16.3	5,175	50.1
Managers, officials, and proprietors	7,776	10.2	9,500	10.0	1,724	22.2
Clerical workers	12,803	16.9	17,300	18.2	4,497	35.1
Sales workers	4,647	6.1	6,000	6.3	1,353	29.1
Blue-collar workers	27,525	36.3	31,100	32.7	3,575	13.0
Craftsmen and foremen	10,015	13.2	12,200	12.8	2,185	21.8
Operatives	13,955	18.4	15,400	16.2	1,445	10.4
Nonfarm laborers	3,555	4.7	3,500	3.7	-55	-1.5
Service workers	9,381	12.4	13,100	13.8	3,719	39.6
Farm workers	3,464	4.6	2,600	2.7	-864	-33.2

Note: Because of rounding, sums of individual items may not equal totals.
Source: Bureau of Labor Statistics.

and the increasing availability of community colleges will enable larger proportions of youth to attend college.

Requirements in *Engineering*, the second largest profession and the largest profession for men, is expected to increase from nearly 1.1 million to about 1.5 million workers, or 40 percent between 1968 and 1980. New engineers will be needed to meet the demands of a growing population for additional goods and services, and for expanded research and development programs. Particularly rapid growth is expected in industrial, electrical, and civil engineering. Industrial growth, expansion of automated processes, and increasing emphasis on scientific management will result in increased demand for industrial engineers. Mass transit, highway transportation systems, and expanded environmental programs are expected to require more civil engineers. Demand for electrical engineers is tied closely to the growth of automatically controlled production processes and rising consumer requests for electrical and electronic goods.

Physical scientists in many fields will experience rapidly growing demand for their services from 1968 to 1980. Requirements for physicists in 1980 are projected at 75,000, or 64 percent more than the 45,000 employed in 1968. Chemist requirements are expected to grow from 130,000 to 200,000 or 56 percent. Requirements for scientists in each of these fields are heavily predicated on increasing expenditures for research and development although the rate is expected to be slower than that experienced from the late 1950's through the late 1960's. In addition, the demand for chemists will continue to reflect the growing market for plastics, manmade fibers, drugs, nuclear fuels, and other industrial products having a chemical origin.

Employment requirements for life scientists, including botanists, zoologists, and microbiologists, are projected to increase to 240,000 in 1980, or about 41 percent over the 170,000 employed in 1968. Growth is related to expanded research in health and environmental quality control. Needs for biochemists are expected to grow rapidly, primarily as the result of expanded medical research on cancer, heart disease, mental illness, and other health problems.

Oceanographer requirements are projected at 9,700 in 1980, compared with 5,200 in 1968. This 85-percent increase is more rapid than that projected for any other natural science occupation. Growth is linked to expanded research to the potential development of the ocean's resources for food, fresh water, and energy; and long-range weather forecasting.

Engineering and science technicians are expected to grow from 620,000 to 890,000 or more than 40 percent between 1968 and 1980. Their growth needs will be stimulated by the same factors that will increase demand for the engineers and scientists with whom they work. In addition, technicians will be used in increasing numbers to relieve professional engineers and scientists whose duties do not require full professional preparation.

Draftsmen are projected to increase from 295,000 to 435,000 or 48 percent, largely as a result of the increasingly complex design of modern products and processes.

Requirements in *health service occupations* also are expected to increase substantially. Population growth, rising incomes, prepayment arrangements, and government programs such as Medicare and Medicaid, are principal factors underlying projected requirements. Other factors are the rising standards of health care, growing interest in preventive medicine, and the expansion of medical research.

Employment requirements for *physicians* are expected to increase to 469,000 in 1980, a 53-percent increase over 1968 employment of 307,000. To some extent, the rise in the demand for physicians' services is expected to be offset by developments that will enable physicians to care for more patients. For example, new drugs will continue to shorten illnesses and fewer housecalls will be made because of the growing practice of treating patients in hospitals and physicians' offices.

Dentist requirements are projected at 130,000 in 1980, a 32-percent increase over the 100,000 employed in 1968. Requirements for dentists would be higher except for the increasing use of auxiliary workers including dental assistants and dental hygienists. Demand for *dental assistants* alone is projected to grow 50 percent during the period 1968-80, or from 100,000 to 150,000. This level assumes that dentists will employ on the average 1.2 dental assistants in 1980 compared with 1.0 in 1968. Dental hygienists are expected to increase from 16,000 in 1968 to 33,500 in 1980 or 109 percent.

Registered nurses, who constitute the largest occupation group in the professional health field, will be in increasing demand. Requirements for registered nurses are projected to grow from 660,000 to 1 million, or 52 percent between 1968 and 1980.

Medical laboratory worker requirements are expected to expand as physicians increasingly depend upon laboratory tests in routine physical checkups as well as in the diagnosis and treatment of disease. Growth of these workers—including medical technologists, medical laboratory technicians, and medical laboratory assistants—is projected to increase 90 percent, from 100,000 in 1968 to 190,000 in 1980.

Need for *accountants*, one of the largest occupations for men, are expected to increase 43 percent, from 500,000 employed in 1968 to 720,000 in 1980. Greater use of accounting information in business management,

increasingly complex and changing tax systems, growth in the size and number of business corporations required to provide financial reports to stockholders, and the increasing use of accounting services by small firms are the primary factors underlying this projected growth.

Systems analyst and *programmer* requirements are expected to increase steeply in response to the rapid growth in the number of electronic data processing systems used by business, government, universities, and other organizations. Programmer requirements are projected at 400,000 in 1980, a 129-percent increase over the 175,000 employed in 1968. An even more rapid growth rate—183 percent—is expected for system analysts, with requirements increasing to 425,000 in 1980 from an employment of 150,000 in 1968. The faster growth of the more highly trained systems analysts compared with programmers is related to the increasing capabilities of computers for solving complex scientific, engineering, and business problems; extension of systems analysis to new problems; and the growth of computer centers to serve small clients.

Managers, officials, and proprietors. Employment requirements for managers, officials, and proprietors are projected to rise to 9.5 million in 1980, compared with the 7.8 million employed in 1968. This 22-percent increase represents a slightly higher average annual rate of growth than during the 1960-68 period. As in the earlier period, the growth in requirements will be related to the increasing size of firms and the growing complexity of their operations. However, this gross rate conceals sharp differences in the growth of the individual occupations that make up this broad category.

Salaried managers and officials, who make up more than 70 percent of all managerial workers, are expected to grow very rapidly as business and government depend increasingly on trained management specialists. Technological development will contribute further to employment growth of these occupations. For example, an increasing number of technical managers are needed to plan research and development programs and make decisions on the installation and use of automated machinery and data processing systems.

Proprietors are expected to continue to decline as large firms restrict the growth of the total number of firms. Expansion of self-service groceries, laundries, and drycleaning shops, and hamburger and frozen custard drive-ins, however, will restrain the rate of decline.

Clerical workers. By 1980, the clerical group is expected to grow rapidly to 17.3 million, a 35-percent increase over the 12.8 million employed in 1968 but considerably slower than in the 1960-68 period. Increased size and complexity in mail, telephone, and telegraphic communication and in recordkeeping of firms, government, and other institutions will contribute to the growing demand for clerical workers.

Technological developments will limit growth for certain types of clerical workers. To illustrate, electronic computers and bookkeeping machines are expected to reduce the number of clerks in jobs such as filing, payroll, inventory control, and customer billing. On the other hand, growing requirements for clerical personnel to prepare computer inputs will offset somewhat laborsaving innovations.

Requirements for *stenographers and secretaries,* who made up the largest of the clerical occupational groups, are expected to reach 3.7 million in 1980, an increase of 37 percent over the 2.7 million employed in 1968. Rapid growth particularly in finance, insurance, and real estate, which employ large clerical staffs, is a major factor in the projected demand. Furthermore, as both private industry and government continue to grow in size and complexity, paperwork will expand. Technological innovations in offices are not expected to limit demand for stenographers and secretaries. *Typist* demand, on the other hand, which is projected to increase to 930,000 in 1980, up 37 percent from the 700,000 employed in 1968, would be even higher except for duplicating equipment.

Bookkeeping worker needs are expected to increase 19 percent to 1.5 million in 1980 from the 1.2 million employed in 1968 as a result of economic expansion and the increasing complexity of business. Laborsaving innovations, such as automatic data processing and bookkeeping machines, will limit more routine bookkeeping tasks. However, many companies lack the volume of work or capital to automate; others will continue to combine electronic data processing and conventional equipment.

Cashier demand is projected to increase to 1.1 million in 1980, or 51 percent over 1968, when employment stood at 730,000. Growth is related to business expansion plus the increasing adoption of self-service merchandising.

Office machine operator requirements are expected to increase to 460,000 in 1980, or 39 percent over the 325,000 employed in 1968. Growth is based on the tremendous increase in paperwork as the economy grows and firms increase in size and complexity. Automated recordkeeping may displace some tabulating and billing machine operators. In addition, keypunch operator demand may be affected adversely by automatic reading devices in computer systems. On the other hand, demands for some office machine operators, including calculating machine operators, are expected to grow

partly as a result of the need to prepare data for computer processing. The need for *electronic computer operating personnel*, including console and auxiliary equipment operators, is expected to reach 400,000 in 1980, a 129-percent increase over the 1968 employment of 175,000.

Sales workers. Employment requirements for sales workers are projected to increase 29 percent from 1968 to 1980, or from 4.6 million to 6.0 million workers, considerably more rapid than during the 1960-68 period. As in the past, increased sales attributable to population growth, rising income levels, new product development, and business expansion, will be major factors in increased employment of salesworkers.

The need for retail salesworkers, by far the largest sales group, is expected to increase to 3.5 million in 1980, 24 percent more than the 2.8 million employed in 1968. Longer hours in metropolitan and suburban areas will exert some influence on the demand for retail salesworkers; on the other hand, vending machines, self-service, and checkout counters will tend to dampen requirements.

Wholesale salesmen requirements are projected to increase to nearly 700,000, a 30-percent increase over the 530,000 employed in 1968. Growth factors will include the trend for special services to customers and emphasis on sales as centralized purchasing increases the size of accounts.

Manufacturers' salesmen are projected to reach 735,000 in 1980, a 47-percent increase over the 500,000 employed in 1968. This rapid growth reflects in part the continued development of new products and services and heightened competition among manufacturers for sales.

Insurance agents and brokers needs are expected to increase to 480,000, a level of 17 percent above the 410,000 employed in 1968. Population growth, increases in major consumer purchases such as homes and automobiles, and expansion in industrial plant and equipment are major factors in the expected growth.

Service workers. Employment requirements for service workers are projected at 13.1 million in 1980, a 40-percent increase over the 9.4 million in 1968. This growth represents a considerable increase over the annual average growth between 1960 and 1968. As in that period, however, the major factors underlying rising requirements will be a growing population, expanding business, increasing leisure, and more disposable personal income. Rates of growth will fluctuate among service occupations.

Employment requirements for *private household workers*, the largest of the service occupations, are expected to reach about 2.0 million in 1980, a 15-percent increase over the 1.7 million employed in 1968. Demand will grow in response to increasing population, rising family incomes, and the growing proportion of housewives employed outside the home.

Building custodian demand is expected to increase to 1.5 million in 1980, a 33-percent increase over the 1.1 employed in 1968. Employment is expected to grow as increases in population and high levels of economic activity spur construction of new apartments, office buildings, hotels, and hospitals. However, new cleaners, solvents, and laborsaving cleaning equipment will tend to restrict growth of this occupation.

The need for *cooks and chefs* is projected at 900,000 in 1980, a 33-percent increase over 1968, when 670,000 were employed, while *waiters and waitresses* will increase to 1.2 million, a 28-percent increase over the 1968 employment of 960,000. The rapid increase in the population of groups that customarily patronize restaurants—workers, students, and travelers and increasing numbers of patients and hospital personnel—are factors in the growing requirements. Prepared foods and laborsaving devices as well as vending machines will limit requirements for waiters and cooks.

Licensed practical nurse requirements are expected to increase from 320,000 to 600,000 or 88 percent, and *hospital attendants* to 1.5 million in 1980, 88 percent more than the 800,000 employed in 1968. Requirements for these workers, as for the professional health workers discussed earlier, are linked to the rising demand for medical care.

Cosmetologist requirements are expected to increase to 685,000 in 1980, up 43 percent over the 475,000 employed in 1968, while *barber* demand is projected at 260,000, or 24 percent over the 210,000 employed in 1968. Growth in these occupations is linked to increasing population, rising incomes, and, for cosmetologists, growing proportions of women who work outside the home.

Municipal police officer employment requirements are projected at 360,000 in 1980, up 28 percent over the 285,000 employed in 1968. Primary growth factors will be population and economic growth, which create a need for more officers to protect life and property, and to regulate traffic. The growth concentration of the population in urban areas and rising crime rates in many cities will further increase demands.

The need for *firefighters* is projected to grow to 245,000, an increase of 34 percent over the 180,000 employed in 1968. Requirements for firefighters will increase to meet the needs for fire protection in growing urban communities.

Craftsmen, foremen, and kindred workers (skilled workers). Requirements for craftsmen and foremen are expected to reach 12.2 million in 1980, a 22-percent increase over the level of employment in these occupations in 1968. The rate of growth projected is the same as in the 1958-68 period. As in the earlier period, the demand for skilled workers will continue to be spurred by population increase, the rapid formation of new families, the anticipated increase in such industries as construction and manufacturing, and the increasing ownership of consumer durables. Rates of employment growth will continue to differ among skilled occupations. *Carpenters,* the largest occupation in the building trades, are expected to increase to almost 1.1 million in 1980, up 24 percent over the 869,000 employed in 1968.[9] Demand would exceed the projected level except for the growing use of prefabricated building components, power tools, and improved materials such as stronger adhesives and nails having improved holding properties.

Plumber and pipefitter requirements are expected to increase to 475,000 in 1980, a 44-percent increase over the 330,000 employed in 1968.[10] The trend toward more bathrooms per dwelling unit is likely to continue. Increasing sales of appliances, such as washing machines for clothes or dishes, and waste disposal units, as well as automatic heating and cooling systems will require additional plumbers for installation and servicing. In addition, pipework is growing in importance in industry, especially in the chemicals industry and in other industries that are automating more of their production. Increasing industrial activities related to atomic energy and greater use of refrigeration and air-conditioning equipment also will result in more work for plumbers and pipefitters. On the other hand, technological developments such as prefabricated plumbing assemblies are expected to limit the growth of jobs for plumbers and pipefitters.

Needs for *construction machinery operators*—cranemen, bulldozer operators, derrick operators, and others—are expected to increase to 410,000 in 1980, up about two-fifths over the 285,000 employed in 1968.[11] This growth rate is higher than for any of the other large construction occupations. The growing volume of highway construction, resulting from the Federal Government's long-range, multi-billion dollar highway development program, is particularly important in increasing demand for these workers.

[9] See discussion of alternative projections for construction craftsmen on page 4.

[10] Ibid.

[11] Ibid.

Motor vehicle mechanics, the largest of the mechanic and repairmen occupations, are expected to reach 1 million in 1980, a 21-percent increase over 1968 employment of 825,000. Growth of requirements is related primarily to the increasing number of automobiles, trucks, and buses, and the growing proportion that will be equipped with air-conditioning, power brakes, and devices that reduce exhaust fumes—all of which increase maintenance. Growth will be partially offset by the greater use of test equipment, such as dynamometers and engine analyzers, and the growth of diagnostic centers.

Aircraft mechanic requirements are expected to increase to 230,000 in 1980, a 70-percent increase over the 135,000 employed in 1968. The anticipated increase in the number of aircraft is a major growth factor.

Business machine servicemen will experience a very rapid growth in demand as requirements rise to 200,000, about three-fourths more than the 115,000 employed in 1968. The expected increase in the use of many types of office machines, more complex equipment requiring increased maintenance, such as electric typewriters and the rapid expansion of data processing are major factors behind the rising demand for business machine servicemen. The fastest growing occupations in this group are expected to be typewriter servicemen, data-processing equipment servicemen, and duplicating and copying machine servicemen.

Semiskilled workers (operatives). Semiskilled worker employment requirements are projected at 15.4 million in 1980, a 10-percent increase over the almost 14.0 million employed in 1968. This rate appears to be much lower than that experienced from 1960-68 according to employment levels at the beginning and end of that period. However, employment of operatives, after fluctuating between 11.8 million and 12.8 million in the 12 years following the end of the War, dropped to 12.0 million in 1960 then increased significantly beginning in 1961 primarily because of the increase in manufacturing.

Three of every 5 semiskilled workers in 1968 were employed as factory operatives in manufacturing industries. Large numbers were assemblers or inspectors and many worked as operators of material moving equipment such as powered forklift trucks. Among the nonfactory operatives, drivers of trucks, buses, and taxicabs made up by far the largest group.

Employment trends among the individual semiskilled occupations since World War II have reflected the different rates of growth of the industries in which the workers were employed as well as the differing impact of technological innovations on occupations. For example, the rapid decline in employment of spinners and weavers

reflected not only the relatively small increase in the demand for textile mill products, but also the increased mechanization of spinning and weaving processes. Increases in production and growing motor truck transportation of freight will be major factors in expanding demands for operatives in the 1968-80 period.

Local truck drivers, the largest of the operative occupations, are expected to increase to 1.5 million. Growth is linked to the anticipated increase in local freight volume, and the wider area served as suburbs expand. However, the use of radio telephones to instruct drivers enroute will reduce the time needed for making deliveries.

The need for *over-the-road truck drivers* is expected to increase to 800,000 in 1980, up 25 percent from the 640,000 employed in 1968. Growth in demand is related to increased commercial and industrial activity and the continued decentralization of industry. Increased demand also is expected to result from improvements in trailer design that make it possible to ship frozen goods and livestock over long distances, as well as new trucking methods that reduce handling, such as the use of two trailers hitched in tandem. Other recent freight transportation innovations, however, will limit somewhat the demand that otherwise might be anticipated.

Requests for *assemblers*, who put together parts or finished products in manufacturing plants, are expected to grow to 850,000 in 1980, an increase of 8 percent over the 785,000 employed in 1968. Demand for these workers will be restricted by further increases in the use of automatic assembly processes, the increasing use of printed circuits in the manufacture of radio and television sets, and the increasing adoption of other technological changes.

Inspectors (manufacturing) are expected to increase to 635,000, a 9-percent growth over the 585,000 in this occupation in 1968. Industry growth, the increasing complexity of manufactured products, and rising quality standards will create additional demand for these workers, although the increasing use of mechanized and automatic inspection equipment will partially offset growth factors.

Welders and oxygen and arc cutters, one of the largest occupations in the operative group, are expected to increase more rapidly than most others in this major group. Employment requirements are projected at 675,000 in 1980, up 41 percent over the 480,000 employed in 1968. Growth is related to the generally favorable longrun outlook for metalworking industries and the wider use of the welding process.

Gasoline service station attendant requirements are projected at 475,000 in 1980, up 16 percent from the 400,000 employed in 1968. Growth is related to the expected increase of motor vehicles as the population of driving age grows, incomes rise, multiple-car ownership expands, and the move to suburbs continues.

Nonfarm laborers. Employment of laborers, reaching a low of 3.3 million in 1961 and a high of 3.7 million in 1965, fluctuated around 3.5 million between 1960 and 1968. Between 1968 and 1980, employment requirements are expected to change little despite the rapid rise anticipated in manufacturing and construction, the primary employers of laborers.

Increases in demand are expected to be offset by rising output per worker resulting from the continuing substitution of mechanical equipment for manual labor. For example, power-driven equipment such as forklifts derricks, cranes, hoists, and conveyor belts, will take over more and more materials handling in factories, at freight terminals, and in warehouses. Other power-driven machines will do excavating, ditch digging, and similar work. In addition, integrated systems of processing and materials handling equipment will be installed in an increasing number of plants in the years ahead.

Job Openings

Up to this point this chapter has discussed the relative growth in requirements for occupations from 1968-80. Although growth is a key indicator of employment outlook, more openings will result over the 1968-80 period from deaths, retirements, and other labor force separations than from employment growth. Replacement needs will be particularly significant in occupations having large proportions of older workers or women, since many women leave the labor force each year because of family responsibilities. Furthermore, large occupations that have no or little growth may have more openings than faster growing small occupations. Among the major occupational groups, for example, openings for operatives resulting from growth and replacement combined will be greater than for craftsmen, although the rate of growth of craftsmen will be more than twice as rapid as for operatives. (See chart 3.)

Many job openings also are created because of occupational shifts. For example, when a technician is upgraded to an engineer, a technician job opening is created. Of course, this shift also adds to the supply of engineers. Data for estimating transfer losses and gains generally are not available. Estimates of job openings in this bulletin (appendix B), therefore, do not include transfers except for some professions for which data are available, as indicated in a footnote.

Rather than show data for the entire 1968-80 period, appendix B presents annual openings which can be easily compared with annual training output as presented in appendix C. Annual data present openings for the entire 1968-80 period divided by 12.

Chapter III. The Status of Occupational Training

Each year occupational training is needed by millions of young people who must bridge the gap between school and work, persons whose skills have become obsolete as a result of technology, and the disadvantaged who need to qualify for entry level jobs and progress up the occupational skill ladder.

As was shown in the preceding chapter, the Nation increasingly is shifting from producing goods to producing services, and hence, from blue-collar to white-collar jobs—jobs that require higher levels of education and skill acquired through formal training. Furthermore, an increasingly larger proportion of blue-collar workers will become craftsmen who require more training than other blue-collar workers. Additional factors that will influence training needs include technological developments that create new jobs requiring much training and that eliminate jobs requiring little training. The need for specialized training will cover more jobs than ever before. In addition, the goals of occupational training are being broadened to include more than specific preparation for a job or career, such as training given that facilitates a worker's adaptation to constantly changing demands of his job or the labor market.

This chapter discusses available training for occupations. Chapter IV discusses kinds of training needed to enter each of the 232 occupations for which estimates of manpower requirements are presented. Appendix C presents statistics on training completions for the most recent year data are available on each occupation for which the Bureau has projected manpower requirements.

Types of Occupational Training

Vocational education. Vocational education in public school provides training opportunities "so that persons of all ages in all communities of the State . . . will have ready access to vocational training which is of high quality, which is realistic in the light of actual or anticipated opportunities for gainful employment and which is suited to their needs, interests and ability to benefit from such training."[12] The 1968 amendments to the Vocational Education Act emphasized vocational training related to current job markets. The amended act emphasized national, state, and local planning for the expansion of instructional programs. Future vocational education must consider market needs and employment opportunities so that greater cooperation will result among schools, business and industrial organizations, and the public employment service.

In 1969, approximately 8 million persons were enrolled in federally aided vocational-technical education programs.

During fiscal year (FY) 1969, enrollments in post-secondary vocational and technical programs numbered 960,000, and secondary programs 4.6 million. Except for agriculture and distributive fields, enrollments increased from FY 1968 in all fields of education; the greatest increase was in the health and office fields.

Graduates of secondary and post-secondary programs have good job placement records. About 75 percent of all graduates who sought jobs in 1968 obtained employment in the field for which they were trained or in a related field.[13] Many others found work not related to their training. Placement rates for students completing post-secondary programs were 87 percent compared with 72 percent for secondary school graduates.

Of the 885,000 persons who had completed vocational education programs in 1968, approximately 480,000 were available for placement—365,000 at the secondary level and 116,000 at the post-secondary level. Of the 304,500 not available for placement, about 210,000 or 69 percent continued school full time and 53,000 or 17.4 percent entered the Armed Forces.[14]

Although vocational education programs generally prepare students in a specific occupation, e.g., dental assistant programs train dental assistants, many programs

[12] Vocational Education Amendments of 1968 Public Law 90-576.

[13] Source, *Manpower Report of the President*, 1970, p. 68.

[14] Based on data from *Manpower Report of the President, 1970* (U.S. Department of Health, Education, and Welfare, Office of Education), p. 69.

Table 3. Enrollments in federally aided vocational-technical education, by field of education, fiscal year 1969 [Number in thousands]

Field of education	Number	Percent distribution
Total	7,981	100.0
Agriculture	851	10.7
Distributive	566	7.1
Health	176	2.2
Home Economics	2,449	30.7
Office	1,837	23.0
Technical	315	3.9
Trades and Industry	1,723	21.6
Other	64	.8

SOURCE: U.S. Department of Health, Education, and Welfare, Office of Education.

prepare students for employment in several related occupations, e.g., machine shop and blue-print reading.

Private vocational schools. Private vocational schools prepare students for employment in many areas, but the three main types of schools are business, trade and technical, and cosmetology and barber schools. In 1966, about 3,000 trade and technical schools enrolled over 800,000 students; 1,300 business schools enrolled more than 400,000 students; and nearly 2,800 barber and cosmetology schools enrolled nearly 300,000 students.[15]

Such schools vary in size from 10 to over 1,200 students; the length of courses and types of programs offered also vary. Some schools have many courses leading to certificates in several different occupations. Some business schools, for example, offer refresher courses in shorthand, a full program in beginning secretarial work; and the fundamentals of accounting. About 230 different courses were taught in 544 trade and technical schools.[16] The six categories offering the widest range were: automobile maintenance and related services; data processing; drafting; electronics, medical services; and radio-television. Business schools teach all types of clerical work—typing, shorthand, filing—as well as accounting, data processing, and related fields. The number of graduates of private vocational schools is not available.

Federal apprenticeship programs. Apprenticeship training combines theory and on-the-job instruction to prepare journeymen in skilled crafts. The Department of Labor registers but does not finance such programs. It provides technical assistance to employers and unions in establishing programs. Of the almost 240,000 apprentices in 1969, over 55 percent were in construction, 24 percent in metalworking, and 5.4 percent in printing.

In addition to federally registered programs, many programs are provided whose sponsors have chosen not to register. Many of these are of high quality. No information is available, however, on the number of such programs or of apprentices involved.

Employer training. Employer training may be formal or informal. Generally, workers receive on-the-job formal training in conjunction with classroom work.[17] A 1963 Department of Labor study showed that only a small proportion of workers had learned their skills in such programs.[18] The likelihood of a firm having formal training varies directly with the size of the firm; larger firms can better afford monetary and manpower costs involved in training.[19]

In most instances, training is informal and takes place mainly in the work environment. Most workers, according to the 1963 study, had "just picked up" their current skills informally on the job.

Current statistics on completion of employer training programs are not available. Furthermore, the feasibility of collecting such data raises some question. The Bureau of Labor Statistics, with the support of the Manpower Administration, currently is embarking upon a study to determine the feasibility of collecting statistics on occupational training in private industry.

Armed Forces. The Armed Forces offers training in electronics, aircraft maintenance, metalworking, and other skills to help young men obtain civilian jobs upon separation. Military personnel also may enroll in voluntary off-duty academic and technical programs. Approximately 200 such correspondence courses range from elementary school through the second year of college.

Project Transition, an Armed Forces-wide training program, prepares men who have between 1 and 6 months left in service for employment in civilian life. In operation for 2 years, Project Transition is a joint effort

[15] Belitsky, A. Harvey, *Private Vocational Schools and Their Students* (Schenkman Publishing Company, Inc., Cambridge, Mass.), 1969.

[16] Belitsky, op. cit.

[17] Apprenticeship programs fall into this category but were discussed in the preceding sections.

[18] *Formal Occupational Training of Adult Workers—Its Extent, Nature, and Use* (Washington: U.S. Department of Labor, December, 1964, Manpower/Automation Research Monograph No. 2).

[19] *Training of Workers in American Industry* (Washington: U.S. Department of Labor, Bureau of Apprenticeship and Training, 1962).

of private industry and the government. It provides training in many skills, including Post Office positions. Participants volunteer and may take only courses offered at the bases where they are stationed. When openings are limited, preference is given to those who have combat disabilities and then to those who have no civilian skills. Although some statistics are available, data on the number trained and entering civilian jobs are not available.

Federal manpower programs[20]

Job Opportunities in the Business Sector (JOBS). The JOBS program was begun in 1968. Initial commitment was by the business community in about 50 metropolitan areas to hire and give on-the-job training and other services, such as counseling and health care, to thousands of disadvantaged persons. The Department of Labor recruits job applicants, provides technical support, and meets extra costs of employing persons who have special problems and needs; the National Alliance of Businessmen (NAB) enlists the support of the private business sector and secures job pledges. The program is built on the premise that immediate placement in jobs at regular wages, followed by training and supportive services, provides superior motivation for disadvantaged persons. Through January 1970, only 80,000 persons had been hired under JOBS contracts with the Department of Labor. Independent companies had taken on 300,000 without Federal financial assistance. Of the 380,000 hired, 200,000 were still on the job in January 1970. About 20 percent of those in JOBS programs were in clerical and sales occupations; another 15 percent worked in machining occupations; and nearly 20 percent were engaged in structural work.

Manpower Development and Training Act (MDTA). This act was passed primarily to retrain workers whose skills were obsolete; however, that portion of the program initially devoted to youth has been expanded, and major emphasis has been placed on training the disadvantaged.

Two basic types of training are authorized under the MDTA: institutional instruction (classroom), and on-the-job training (OJT). Most training, conducted primarily in public vocational schools, has been institutional. MDTA programs are sponsored jointly by the Department of Health, Education, and Welfare and the Department of Labor. Under OJT, training is provided at the jobsite by an employer under contract with the Department of Labor. Private businesses, trade associations, labor unions, and public agencies sponsor such programs.

OJT programs are designed to equip workers with entrance level skills; to provide remedial training for the underemployed and those subject to job displacement; and to provide training for workers from minority groups, the disadvantaged, and other hard-to-train persons. In addition, training programs are offered in occupations in short supply which are deemed critical to the economy and to national defense.

OJT is sometimes coupled with classroom training; such instruction usually covers directly related technical subjects, but may include academic education essential to effective job performance. In 1969, approximately 135,000 persons were enrolled in MDTA institutional training programs. The largest number, over 33,000, were being trained for clerical occupations, mostly in stenographic and typing fields. More than 30,000 recieved training in the machine trades as machinists, machine tool operators, and business machine repairmen. Another 6,400 received training in benchwork occupations such as TV assembly and repair, and upholstering. (See table 5 for statistics on enrollments by occupation.) Over 23,000 were enrolled in structural occupations such as transportation equipment assemblers, bodymen, arc welders, and combination welders. Over 18,000 received professional and managerial training including refresher courses for professional nurses.

Approximately 85,000 persons were enrolled in MDTA on-the-job training programs in 1969. Training was provided for many occupations including motor vehicle mechanics, machinists, waiters and waitresses, bodymen, carpenters, and salesmen.

Job Corps. The Job Corps trains high school dropouts 16 through 21 years of age who have records of low educational achievement, have been out of work for at least 3 months, or need full-time employment. The program provides financial assistance while youth are being introduced to work requirements and basic manpower skills. In fiscal 1967, universities or nonprofit organizations ran seven of the urban centers and private firms ran the remaining 21. Job Corps centers generally are located in former hotels, hospitals, military bases, or similar facilities. Besides living space, including dormitory facilities and a cafeteria, centers have classrooms, vocational shops, a clinic, a library, and recreational facilities.

The Job Corps emphasizes programs coupling the unique residential services of Job Corps centers with

[20] Information on Department of Labor sponsored Federal manpower programs are based on information appearing in the *Manpower Report of the President,* 1970, and on unpublished Labor Department records. Most of the specific occupational statistics shown for Labor Department programs are based on unpublished records.

other programs. For example, the Job Corps may refer ex-corpsmen to MDTA skills training, as well as to JOBS programs. Approximately 53,000 first-time enrollees were served in fiscal 1969. Job Corpsmen are trained for a variety of occupations, including air conditioning mechanic, cook, heavy equipment operator, and meat cutter.

Little data are available on training by occupation. Furthermore, because Job Corps training is remedial rather than strictly occupational, information cannot be presented in the format used in appendix C of this report.

Neighborhood Youth Corps (NYC). This program provides work experience and, in some cases, related training to help young persons from low income families stay in school, return to school, or increase employment possibilities of those out of school who do not plan to return. Training and work experience help enrollees acquire habits and attitudes necessary to hold a job. The out-of-school program is currently being restructured to deal with problems that confront unskilled 16- and 17-year old dropouts attempting to enter the labor force. For example, in fiscal 1969, about 120,000 young adults 18 years and over were enrolled in out-of-school projects. The restructured program will channel out-of-school youths 18 years old and over to other programs and provide extensive academic and occupational pre-vocational training for 16- and 17-year olds. To date, reliable data on job placements are not available.

Work Incentive Program (WIN). This program stresses economic independence for all employable persons ages 16 and over in families now receiving Aid to Families with Dependent Children. By the end of 1969, about 62,000 persons were enrolled in WIN projects. Depending on their degree of job readiness, clients are referred by local welfare agencies to employment service offices for interviewing, testing, counseling, and placement in jobs, training, or special work experience. Clients are helped to obtain meaningful jobs as rapidly as possible at not less than the minimum wage. Some potential participants have been denied enrollment because child care, though provided, is not available. Limited data indicate that WIN participants have found employment primarily in clerical, service, and structural occupations.

Public Service Careers Program. Formally known as the New Careers Program, this operation is designed to develop entry-level jobs in government service agencies for disadvantaged workers, and also, to help upgrade employees who are in dead-end, low-paid positions. Approximately 3,800 persons were first-time enrollees in 1969. Examples of occupations for which disadvantaged persons have been readily trained are mail clerk, guard, switchboard operator, messenger, and payroll clerk. In general, under this program a government agency hires and trains persons on the job. Public Service Careers funds pay the extra cost of training and supportive services such as child care and transportation for disadvantaged workers. Other Federal Programs. A number of other federally funded programs, including "Operation Mainstream" and the "Special Impact Program," are designed to provide work experience and related services to the disadvantaged. For example, in fiscal 1969, about 11,000 persons were first-time enrollees in Operation Mainstream programs. No information is presented on specific occupational training in these programs, which are quite small.

Home study courses

Nearly 5 million persons were enrolled in home study or correspondence courses in 1969. Offered in many different types of institutions, the courses range from kindergarten through post-college refresher. These courses may not be occupationally related and are set up by trade associations as well as high schools. In 1969 about 1.8 million students were enrolled by private schools; nearly 2.5 million through the Federal Government, mostly persons in the Armed Forces; 300,000 by colleges and universities; over 100,000 by religious schools; and 40,000 were taking home-study courses related to business and industrial training.[21] Not all students complete the courses and much of the training is part of an employer training program. Thus, even if statistics on completion were available, data would not represent new entrants to an occupation. Nevertheless, in evaluating occupational training, home study programs cannot be discounted.

Junior colleges or community colleges

Originally called junior colleges and now more commonly called community colleges, these institutions serve a variety of educational needs. For some students they provide the first 2 years of academic training leading to a bachelor's degree, so that students may take their first 2-college years at, or closer to home, and thereby reduce the costs of a college education; such students transfer to a 4-year college for the last 2 years of undergraduate work. A second need met by community colleges is for adult education, not necessarily

[21] Information based on data supplied by the National Home Study Council, Washington, D.C.

oriented to completion of a formal college education or to vocational preparation. A third educational need they serve is for "terminal occupational education," programs designed to prepare students for entry into specific occupations immediately upon graduation.

Junion colleges have a large number of programs to prepare students for specific occupations immediately after graduation. These courses vary from 6 months to 3 years, but most are 2-academic years. Types of career education are: science and engineering technologies; public services that emphasizes transportation planning and social service-aide occupations; business and commercial fields where food service and distribution are receiving increasing attention; allied health and medical fields, and many other types of training including data processing and graphic arts.

Junior colleges increased rapidly during the 1960's. Between 1961 and 1968, about 50 new institutions opened each year, and enrollments increased 200 percent between 1958 and 1968. Nearly 40 percent of the more than 6 million students in junior colleges in 1968 majored in career-education programs and were employed immediately after graduation.

College and university training

College training differs from vocational training in several ways. For example, the market for college graduates is nationwide whereas vocational school graduates generally begin work in the geographic area of their training. Furthermore, college students receive a more general education than those enrolled in vocational training.

More data are available for workers who attend college than for workers trained in other methods. As a result, development of detailed supply-demand analysis is possible for noncollege graduates but not for other workers. This section of the report presents an overview of prospective supply-demand conditions for college graduates for the 1970's rather than data on training output. Persons interested in greater detail should see *College Educated Workers, 1968-80.*[22]

Supply and demand for workers having bachelor's and advanced degrees

The number of bachelor's degrees awarded between 1968 and 1980, will increase 48 percent; the number of master's degrees, 95 percent; and the number of doctorate degrees, 117 percent. In numerical terms, about 13.3 million degrees are expected to be awarded between 1968 and 1980: 10.2 million bachelor's degrees, 2.7 million master's degrees, and 400,000 doctorates.[23]

Not all degree recipients enter the labor market when they receive their degrees. Over the 1968-80 period, about 9.3 million of the 13.3 million new degree recipients will enter the civilian labor force upon graduation. Bachelor's degree recipients will constitute 8.4 million; master's degree holders, 900,000; and those holding doctorates, 18,000.

The supply of new college graduates will be augmented by persons who received degrees before 1968, but were not in the labor force at that time and can be expected to enter or reenter the labor force between 1968 and 1980. Immigrants are another source of supply. Reentrants, delayed entrants, and immigrants are expected to provide about 1.2 million additions to the supply of civilian workers having 4 years of more of college training. This number added to that available from new degree recipients brings total expected additions to the college educated work force during the 1968-80 period to 10.5 million.

The need for workers with college degrees over the 1968-80 period will stem from two sources: growth in demand and the need to replace workers who die, retire, or leave the labor force for other reasons. Another factor that must be considered in estimating the demand for college trained workers is the increasing entry requirements for occupations that make a college degree necessary for jobs once performed by workers with less education.

An assessment of these three factors—growth, replacement, and rising entry requirements—indicates a need for about 10.4 million college graduates over the 1968-80 period, 6.1 million to meet growth needs and 4.3 million for replacements.

The statistical analysis of supply and demand thus indicates the likelihood of a rough balance between the overall supply of and demand for college educated personnel for the 1970's as a whole (10.4 million v. 10.5 million). However, this overall picture does not imply that imbalances between supply and demand in individual occupations will not exist; prospective imbalances are in the offing in several occupations unless corrective measures are taken. When possible, discussions of occupations presented in chapter IV include a supply-demand analysis. Additional information is presented in *College Educated Workers,* 1968-80.[24]

[22] *College Educated Workers, 1968-80* (BLS Bulletin 1676, 1970).

[23] Projections of degrees in this report are based on those prepared by the U.S. Office of Education and appear in *Projections of Educational Statistics.*

[24] Op. cit.

Chapter IV. Relating Training to Occupational Needs

This chapter presents information on ways workers qualify for jobs in each of the 232 occupations for which the Bureau of Labor Statistics has presented projections in appendix B. Each discussion of occupational training requirements is followed by statistics on 1968 employment, projected 1980 requirements, percent growth 1968-80, annual openings for growth and replacement (as presented in appendix B), and known data on the number of persons completing training (as presented in appendix C). In addition, data are presented on annual openings and apprenticeship completions for the 1960-68 period for occupations whose data are considered valuable to officials concerned with apprenticeship training and upgrading skilled occupations. (See discussion on carpenters on p. 6) for illustrative uses of historical data.) Whenever possible, a brief supply-demand analysis is presented for occupations requiring at least a bachelor's degree. For other occupations a discussion is presented if data are complete or such a discussion is meaningful, as in scientific, technical, and health occupations. However, anthropology graduates enter other occupations because openings in that field are few, and a discussion of training needs would have little relevance to educational planning. Discussions generally are not presented for occupations, such as busdriver, when training is given on the job and all persons physically normal can enter; in developing special programs which require little formal training, statistics on annual openings of such occupations should be valuable.

Training completion data are those available when the report was prepared. Data for each type of training reflects the following time period:

Junior college graduates—academic year 1968-69
MDTA enrollments—fiscal year 1969
Vocational education completions—1969 fiscal year
Apprenticeship completions—calendar 1969
College graduates—academic 1968-69

Professional and Related Occupations

Although most jobs in professional and related fields require a bachelor's degree, some demand one or more advanced degrees; others require only 2 years of training in a junior college, technical institute, or specialized school. Still other professional jobs emphasize skill or creative talent rather than academic training. For occupations of this type, on-the-job training ranging from several months to a few years is sufficient. When a professional or related job requires a license or certificate, the candidate generally must complete a recognized training program and pass an examination by a State examination board.

Employment 1968	10,325,000
Projected 1980 requirements	15,500,000
Percent growth, 1968–80	50.1
Annual openings, 1968–80 total	777,000
Growth	431,000
Replacements	346,000

Business administration and related professions

Accountants. Although junior college, business school, or correspondence course training is acceptable for some accounting jobs, many positions require the bachelor's degree with a major in accounting, and sometimes a master's degree. All States require "certified public accountants" to be certified by the State board of accountancy. In nearly all States at least 2 years of public accounting experience is necessary before CPA certification can be issued. About half of the States do not require the CPA candidates to be college graduates.

Employment 1968	500,000
Projected 1980 requirements	720,000
Percent growth, 1968–80	43.4
Annual openings, 1968–80 total	33,000
Growth	19,000
Replacements	14,000
Available training data:	
Junior college graduates	4,741
Bachelor's degrees	20,032
Master's degrees	1,333
Doctorate degrees	40

Advertising workers. In hiring advertising trainees, most employers seek college graduates who have liberal arts, marketing, journalism, or business administration training. Majors in other college fields also can enter advertising. Many successful advertising workers do not have a college degree.

Employment 1968	140,000
Projected 1980 requirements	155,000
Percent growth, 1968–80	8.1
Annual openings, 1968–80 total	5,700
Growth	950
Replacements	4,750
Available training data	—

Marketing research workers. Marketing research trainees usually need a bachelor's degree; a master's degree is helpful for advancement. Marketing, statistics, psychology, speech, English composition, and economics are helpful. Sometimes specialized training is needed, such as sales experience or a background in engineering or data processing techniques.

Employment 1968	20,000
Projected 1980 requirements	42,000
Percent growth, 1968–80	105.8
Annual openings, 1968–80 total	2,700
Growth	1,800
Replacements	900
Available training data:[1]	
Bachelor's degrees	868
Master's degrees	62
Doctorate degrees	1

[1] Marketing degrees only.

Personnel workers. Although many employers prefer college graduates who have majored in personnel administration, general business, or liberal arts, many college majors are adaptable to personnel work. Specialized knowledge or graduate training may be needed for some jobs involving employee counseling, testing safety standards, or labor-management relations.

Employment 1968	110,000
Projected 1980 requirements	155,000
Percent growth, 1968–80	42.9
Annual openings, 1968–80 total	6,900
Growth	3,900
Replacements	3,000
Available training data	—

Public relations workers. A college education is the best preparation for a career in public relations. Although employers differ about the field of study, courses in journalism, social sciences, business administration, psychology, and public speaking are recommended. Secretarial skills also are useful, especially in small firms.

Employment 1968	100,000
Projected 1980 requirements	165,000
Percent growth, 1968–80	64.0
Annual openings, 1968–80 total	8,800
Growth	5,300
Replacements	3,500
Available training data	—

Clergymen. Because the data on numbers being trained are not available separately by religion, the requirements and training statistics for clergymen are presented after the discussions of training.

Protestant clergymen. Educational requirements for the ministry have a broad range. Some religious groups have no formal educational requirements; others require training in a college, Bible Institute, or theological seminaries. Some clergymen complete a 3-year course in theological seminaries after college graduation. Institutions accredited by the American Association of Theological schools admit only candidates having a bachelor's degree or its equivalent. Preseminary studies in liberal arts, natural and social sciences, religion, philosophy, English, and history are recommended.

Rabbis. Entrance requirements for admission to a program of Rabbinic studies vary, but almost all seminaries require completion of a 4-year college course plus prior preparation in Jewish studies. The Rabbinic course in a Jewish theological seminary generally is completed in 3 to 6 years. Some seminaries grant advanced academic degrees in fields such as Biblical or Talmudic studies.

Roman catholic priests. Roman Catholic priests study 8 years or more beyond high school. Study for the priesthood may begin in the first year of high school, at the college level, or in theological seminaries after college graduation. The seminary college program stresses behavioral sciences, history, philosophy and religion, natural science, and mathematics. Seminary courses, which provide the remaining 4 years of preparation, include sacred scripture, theology, church history, liturgy, and canon laws.

Requirements and training data for all clergymen

	Total	*Protestant clergymen*	*Rabbis*	*Catholic priests*
Employment 1968	312,000	244,000	6,000	62,000
Projected 1980 requirements	377,100	295,000	7,100	75,000
Percent growth, 1968–80	20.1	20.1	20.1	20.1
Annual openings, 1968–80 total	14,100	11,000	300	2,800
Growth	5,200	4,100	100	1,000
Replacements	8,900	6,900	200	1,800
Available training data:[1]				
Bachelor's degrees	5,276			
First professional degrees	4,338			
Master's degrees	2,884			
Doctoral degrees	346			

[1] Includes all degrees granted in religion. Data on those trained for specific denomination are not available.

Conservation Occupations

Foresters. A bachelor's degree with a major in forestry is the minimum preparation for a professional career as a forester. Teaching and research generally require advanced degrees. College curriculums in forestry include courses in methods of growing and improving crops; forest protection and management; and forest economics and utilization. Most colleges require that students spend a summer in a field camp operated by the college.

Employment 1968	25,000
Projected 1980 requirements	32,000
Percent growth, 1968–80	28.0
Annual openings, 1968–80 total	1,000
Growth	600
Replacements	400
Available training data:	
Bachelor's degrees	1,921
Master's degrees	563
Doctoral degrees	124

Forestry aids. Young persons qualify for beginning positions as forestry aids through work experience or by a 1- or 2-year post-high school curriculum. Specialized courses include forest protection, wood utilization, surveying, and mathematics. In addition, time is spent in a forest or camp operated by the school.

Employment 1968	13,000
Projected 1980 requirements	20,000
Percent growth, 1968–80	57.3
Annual openings, 1968–80 total	900
Growth	600
Replacements	300
Available training data:	
Junior college graduates	596

Range managers. A bachelor's degree with a major in range management, range conservation, or a closely related field usually is required for employment as a range manager. Graduate degrees generally are needed for teaching and research. A curriculum in range management usually includes botany, animal husbandry, soils, mathematics, and other specialized areas. Many colleges students obtain important experience through summer jobs with such Federal Government agencies as the Forest Service or Bureau of Land Management.

Employment 1968	4,000
Projected 1980 requirements	5,200
Percent growth, 1968–80	30.0
Annual openings, 1968–80 total	200
Growth	100
Replacements	100
Available training data	—

Counseling occupations

Employment Counselors. A bachelor's degree plus 15 semester hours in counseling and related courses is the accepted minimum requirement for a position as an employment counselor. For higher level jobs employers require an advanced degree in vocational counseling or a related field, such as psychology, personnel administration, or education. All States require counselors in their public employment offices to meet State civil service requirements that include certain minimum educational and experience standards and written or oral examinations, or both.

Rehabilitation counselors. The minimum educational requirement for entry into this occupation is a bachelor's degree with courses in counseling, psychology, and related fields. Most employers prefer a master's degree in vocational or rehabilitation counseling or a related discipline, such as psychology; some seek candidates having a doctorate in counseling psychology. In the majority of State Rehabilitation Agencies, applicants must comply with State civil service regulations that require a written competitive examination.

School counselors. Most States require counselors to have both a counseling and a teaching certificate. An applicant generally must complete graduate work and have from 1 to 5 year's teaching experience to be issued a counseling certificate; specific requirements for certification vary considerably among the States.

Supply-demand analysis. In addition to new college graduates, the supply of counselors will be augmented by counselors who have been out of the labor force. If past trends of entry from master's degree programs continue and if reentry patterns follow the reentry pattern of women in teaching, about 12,000 graduates with master's degrees in counseling and guidance, and related fields would be needed annually to meet projected annual requirements of 5,550. Thus, over the 1968-80 period the average annual output from these programs will have to increase at least 15 percent above 1969 levels to meet manpower needs.

	Total	*Employment*	*Rehabilitation*	*School*
Employment 1968	71,300	5,300	12,000	54,000
Projected 1980 requirements	106,800	10,800	21,000	75,000
Percent growth, 1968–80	49.8	102.3	72.6	41.8
Annual openings, 1968–80 total	5,500	700	1,050	3,800
Growth	3,050	450	700	1,900
Replacements	2,500	250	350	1,900
Available training data:				
Bachelor's degrees	129			
Master's degrees	10,474			
Doctoral degrees	442			

Engineers. A bachelor's degree generally is required for entry positions as an engineer. However, some persons become engineers after long experience in a related occupation, such as draftsman or engineering technician, plus some college level training. Graduate degrees are necessary for beginning positions in teaching and research; and in some engineering specialties, such as nuclear engineering training is generally available only at the graduate level. All 50 States and the District of Columbia require licenses as registration for engineers whose work may affect life, health, or property, or those who offer their services to the public.

New graduates are the primary source of new engineers but for many years graduates have not fully met the need. Significant numbers come from other sources: workers who shift occupations (including technicians who are upgraded); persons not in the labor force (including those in the Armed Forces); immigrants; and college graduates who did not major in engineering. Limited data on past patterns of entry[25] indicate that large numbers of workers have entered from sources other than new engineering graduates. Although patterns of entry from these other sources are affected by the availability of engineering graduates, large numbers of workers are expected to continue as employers upgrade highly qualified technicians, engineers immigrate to the United States, and college graduates who are non-engineer majors enter engineering either by choice or circumstances resulting from economic conditions. If past patterns continue, about 36,000 engineers would enter the field from these sources from 1968-80. Under this assumption, only 38,000 new engineering graduates would have to enter the field annually to meet requirements.

Followup studies of new college graduates indicate that about 85 percent of all new engineering graduates enter the profession. Therefore, about 45,000 engineering graduates would be needed annually to obtain 38,000 entrants.

In 1969, about 41,000 bachelor's degrees were granted in engineering. U.S. Office of Education projections of engineering degrees based on patterns of study over the past 10 years indicate that for the 1968-80 period the number of bachelor's degrees in engineering will average slightly, an increase of only 1,000, above the 1969 level. To meet requirements, the number of bachelor's degrees granted will have to increase 10 percent or 4,000 above the 1969 level. However, if graduates increase to levels averaging above 45,000, not only would requirements be met but less dependence would be placed on those who are less well trained for engineering jobs than graduate engineers.

Employment 1968	1,100,000
Projected 1980 requirements	1,500,000
Percent growth, 1968–80	40.2
Annual openings, 1968–80 total	73,400
Growth	36,000
Replacements	37,400
Available training data:	
Bachelor's degrees	41,248
Master's degrees	15,240
Doctoral degrees	3,377

Health Service Occupations

Physicians. A license to practice medicine is required in all States and the District of Columbia. To quality for a license, the physician must graduate from an approved medical school; pass a licensing examination; and, in some States, serve a 1-year hospital internship. Most students who enter medical school have earned the bachelor's degree; most medical schools require applicants to complete at least 3 years of college. Increasingly, physicians acquire training beyond a 1-year internship. To specialize, physicians must pass specialty board examinations. To be eligible for these examinations, a candidate needs 2 to 4 years in advanced hospital residency, followed by 2 years or more of practice in his specialty.

If over the 1968-80 period the annual number of immigrant physicians does not change significantly from the level of recent years (about 2,000), each year medical schools would have to graduate on the average more than twice as many physicians as in 1969 to meet annual manpower needs of 20,000.

Employment 1968	295,000
Projected 1980 requirements	450,000
Percent growth, 1968–80	53.1
Annual openings, 1968–80 total	20,000
Growth	13,000
Replacements	7,000
Available training data:	
M.D. degrees	8,025

Osteopathic physicians. All States require osteopathic physicians to be licensed. A candidate must graduate from an approved school of osteopathy and pass a State board examination to qualify for a license; many States require a 12-month internship at an osteopathic hospital. A minimum of 3 years' preosteopathic college work is

[25] Data on past patterns of entry are available from *2 Years After the College Degree–Work and Further Study Patterns* (NSF 63-26, 1963) and the *Postcensal Survey of Professional and Technical Personnel*–a followup study of persons who were reported in professional and technical occupations in the 1960 Census. Selected data from the study are presented in BLS Bulletin 1512, 1966. Data on scientists and engineers from abroad has been published by the National Science Foundation based on special tabulations prepared by the Immigration and Naturalization Service of the Department of Justice. Also see: "Projections of Manpower Supply in a Specific Occupation" by Neal Rosenthal, *Monthly Labor Review*, November 1966.

needed for entrance to a school of osteopathy; however, most entrants have earned the bachelor's degree. Osteopathic physicians who specialize must complete 2 to 5 years' of training after internship, followed by 2 years of supervised practice in their specialty.

Employment 1968	12,000
Projected 1980 requirements	18,500
Percent growth, 1968–80	54.2
Annual openings, 1968–80 total	800
Growth	500
Replacements	300
Available training data:	
D.O. degrees	427

Dentists. All States and the District of Columbia require a license for the practice of dentistry. A candidate must graduate from an approved dental school and pass a State board examination to qualify for a license. In 10 States, dentists cannot be licensed as specialists without 2 or 3 years of graduate education; several years of specialized experience; and passing a special State examination. The minimum educational requirement for graduation from an approved dental school is 2 years' predental college work, followed by 4 years' professional dental school training.

To meet projected needs between 1968 and 1980, an average of about 5,000 new dentists would have to graduate each year over the 12-year period. Thus, to meet requirements the average annual number of dental school graduates will have to increase about 17 percent above 1969 levels.

Employment 1968	100,000
Projected 1980 requirements	130,000
Percent growth, 1968–80	31.7
Annual openings, 1968–80 total	4,900
Growth	2,600
Replacements	2,300
Available training data:	
DDS. or D.M.D. degrees	3,408

Dental hygienists. Dental hygienists must pass a licensing examination in the State where they plan to practice. In all States except Alabama and Georgia, only graduates of accredited dental hygiene schools are eligible for licensing. Most schools of dental hygiene accredited by the Council of Dental Education of the American Dental Association provide 2-year certificate or associate degree programs. Some offer 4-year programs leading to the bachelor's degree; others offer both. For dental hygienists interested in practicing in private dental offices the 2-year program usually is sufficient; for work in research, teaching, and public or school health programs, completion of a 4-year program is required.

Employment 1968	16,000
Projected 1980 requirements	33,500
Percent growth, 1968–80	109.4
Annual openings, 1968–80 total	2,400
Growth	1,500
Replacements	900
Available training data:	
Junior College graduates	1,456
Vocational Education:	
Completions:	
Post Secondary	929

Dental laboratory technicians. No minimum formal educational requirements are required to enter the occupation, but a high school diploma is recommended. Most technicians learn the craft through on-the-job training which may take 3 to 4 years' time. Some technicians take courses in dental laboratory work at public vocational high schools and junior colleges; or at schools offering 1 to 2-year programs in dental technology. Regardless of educational background, actual work experience is necessary to qualify as a technician.

Employment 1968	27,000
Projected 1980 requirements	37,500
Percent growth, 1968–80	38.9
Annual openings, 1968–80 total	2,100
Growth	900
Replacements	1,200
Available training data:	
Junior College graduates	364
Vocational Education:	
Completions:	
Secondary	96
Post Secondary	246

Registered nurses. A license is required to practice professional nursing in all States and in the District of Columbia. Graduation from a school approved by a State board of nursing and successful completion of a State board examination are necessary for licensing. All schools of nursing require a high school diploma for admission. Nursing education programs vary in length from 2 to 5 years. Nurses who complete 2-year courses earn associate degrees; those in 3-year programs a diploma; and students in 4- or 5-year courses are awarded the bachelor's degree.

Employment 1968	660,000
Projected 1980 requirements	1,000,000
Percent growth, 1968–80	51.5
Annual openings, 1968–80 total	65,000
Growth	28,000
Replacements	37,000
Available training data:	
Diplomas	28,197
Associate degrees	6,213
Bachelor's degrees	9,186
Master's degrees	1,249
Doctoral degrees	4

Licensed practical nurses. Licenses usually are issued only to candidates who have completed a State board

approved course in practical nursing and passed a licensing examination. To enroll in a State-approved training program, young people generally must be at least 17 years old and have completed at least 2 years of high school or its equivalent. Some States accept candidates who have completed only eighth or ninth grade; others require high school graduation. An approved program in practical nursing generally is 1 year in length; junior colleges, local hospitals and health agencies; and public schools offer this training.

Employment 1968	320,000
Projected 1980 requirements	600,000
Percent growth, 1968–80	87.5
Annual openings, 1968–80 total	48,000
Growth	23,000
Replacements	25,000
Available training data:	
Junior College Graduates	5,564
Vocational Education:	
Completions:	
Secondary	2,192
Post-Secondary	19,586

Optometrists. A license is required to practice optometry in all States and the District of Columbia. Applicants for licenses must graduate from an accredited school of optometry and pass a State board examination. Students should choose a school approved by the Board of Optometry in the State where they expect to practice. At least 6 years of college are needed to become an optometrist—2 years of preoptometry education in an approved college, followed by 4 years of training in optometry school leading to the degree of Doctor of Optometry. A master's or Ph. D. degree in physiological optics or a related field usually is required for teaching or research.

Approximately 17,000 optometrists were employed in the United States in 1968. Employment requirements are expected to increase by nearly one-fourth to 21,000 over the 1968-80 period. In addition to these growth needs of almost 4,000, 5,800 optometrists will be needed to replace those who die or retire.

To meet projected needs for 9,600 optometrists between 1968 and 1980, each year schools would have to provide about 800 graduates over the period. Thus, the annual number of graduates must average about 350 above 1969 levels, an increase of more than 70 percent over 1969 levels. Thus, training in optometry must be increased much faster than current trends if requirements for optometrists are to be met.

Employment 1968	17,000
Projected 1980 requirements	21,000
Percent growth, 1968–80	23.5
Annual openings, 1968–80 total	800
Growth	300
Replacements	500
Available training data:	
O.D. degrees	463

Pharmacists. A bachelor's degree in pharmacy is the minimum educational requirement for most positions in this profession. In addition to the necessary education, a license is required to practice pharmacy. To obtain a license, one must graduate from an accredited pharmacy college, pass a State board examination, and, in most States, also have 1 year of practical experience or internship. The master's or doctor's degree in pharmacy or a related field usually is required for research or college teaching, and is desirable for work in hospitals.

To meet the projected needs over the 1968-80 period would require an annual average of 4,400 graduates from colleges of pharmacy. Therefore, the annual number of graduates must increase 10 percent above the 1969 level. U.S. Office of Education projections show the annual number of bachelor's degrees in pharmacy increasing even faster and averaging about one-fourth above the 1969 level. Thus, expansion of training in pharmacy could be curtailed somewhat and manpower needs for pharmacists could probably still be met.

Employment 1968	121,000
Projected 1980 requirements	130,000
Percent growth, 1968–80	7.0
Annual openings, 1968–80 total	4,400
Growth	700
Replacements	3,700
Available training data:	
Bachelor's degrees	4,073
Master's degrees	232
Doctoral degrees	74

Podiatrists. A license is required for the practice of podiatry. An applicant must graduate from an accredited 4-year program in a college of podiatry and must pass a State board examination. Michigan, New Jersey, and Rhode Island require applicants to serve a 1-year internship in addition to obtaining a license. Oklahoma requires 1 year of practice under direct supervision.

Employment 1968	8,500
Projected 1980 requirements	9,500
Percent growth, 1968–80	11.8
Annual openings, 1968–80 total	200
Growth	100
Replacements	100
Available training data:	
D.P.M. or D.P. degrees[1]	204

[1] 1967 data.

Chiropractors. Most States and the District of Columbia regulate the practice of chiropractic by granting licenses to applicants who meet certain educational requirements and pass a State board examination. The

educational requirements differ between States but most require completion of a 4-year chiropractic course.

Employment 1968	16,000
Projected 1980 requirements	19,000
Percent growth, 1968–80	18.8
Annual openings, 1968–80 total	900
Growth	250
Replacements	650
Available training data:	
D.C. degrees[1]	589

[1] 1967 data.

Occupational therapists. A degree or certificate in occupational therapy is the minimum requirement for entry into the profession. After graduation and completion of clinical practices, therapists may register with the American Occupational Therapy Association and become Occupational Therapist Registered (O.T.R.). A graduate degree is often required for teaching, research, or administration.

Employment 1968	7,000
Projected 1980 requirements	19,000
Percent growth, 1968–80	171.4
Annual openings, 1968–80 total	1,500
Growth	1,000
Replacements	500
Available training data:	
Bachelor's degrees	566
Master's degrees	43

Physical therapists. All States and the District of Columbia require an applicant to have a degree or certificate from a school of physical therapy. In addition, all but two States require applicants to pass a State board examination. A graduate degree, combined with clinical experience, increases advancement opportunities, especially in teaching, research, and administration.

Employment 1968	14,000
Projected 1980 requirements	36,000
Percent growth, 1968–80	157.1
Annual openings, 1968–80 total	2,800
Growth	1,800
Replacements	1,000
Available training data:	
Bachelor's degrees	1,071
Master's degrees	41

Speech pathologists and audiologists. Most States require a master's degree in speech pathology or audiology or its equivalent for beginning jobs. Other States require the bachelor's degree for entry positions. Persons who wish to work in public schools should complete the educational and other requirements for a teacher's certificate. Persons intending to work with handicapped children must fulfill special requirements in some States.

Employment 1968	18,000
Projected 1980 requirements	33,000
Percent growth, 1968–80	83.3
Annual openings, 1968–80 total	2,300
Growth	1,300
Replacements	1,000
Available training data:	
Bachelor's degrees	3,879
Master's degrees	1,785
Doctoral degrees	200

Medical laboratory workers. For medical technologists, the usual minimum beginning requirement is 3 years of college plus completion of a specialized training program in medical technology, which usually requires 12 months of study and laboratory work. Some States require licensing examinations. Medical laboratory technicians generally require 1 or more years of post-secondary training in a junior college or vocational school. Medical laboratory assistants may take post-secondary training of 1 year or more; many are also trained on the job.

Employment 1968	100,000
Projected 1980 requirements	190,000
Percent growth 1968–80	90.0
Annual openings, 1968–80 total	12,800
Growth	7,500
Replacements	5,300
Available training data:	
Junior college graduates	772
Vocational education:	
Completions:	
Secondary	600
Post secondary	1,058

Radiologic technologists. Training programs conducted by hospitals or medical schools, and junior colleges for radiologic technicians usually take 24 months to complete. A few schools offer 3- or 4-year programs. Some master's degree programs also are available.

Employment 1968	75,000
Projected 1980 requirements	120,000
Percent growth, 1968–80	60.0
Annual openings, 1968–80 total	7,300
Growth	3,800
Replacements	3,500
Available training data:	
Bachelor's degrees	16
Master's degrees	10
Junior College graduates	570
Vocational education:	
Completions:	
Secondary	93
Post Secondary	442

Medical record librarians. Medical record librarians need about 1 year of specialized academic training. The prerequisites for specialized training vary from 2 to 4 years of college level work.

Employment 1968	12,000
Projected 1980 requirements	20,000
Percent change, 1968–80	66.7
Annual openings, 1968–80 total	1,400

Growth	700
Replacements	700
Available training data:	
Total number trained in AMA-approved programs[1]	118

[1] 1968 data.

Dietitians. The minimum educational requirement for dietitians is a bachelor's degree with a major in foods and nutrition or institution management. To qualify for professional recognition, the American Dietetic Association recommends completion of internship programs lasting 12 or 18 months or 3 years of preplanned experience.

Employment 1968	30,000
Projected 1980 requirements	42,100
Percent change, 1968–80	40.3
Annual openings, 1968–80 total	2,700
Growth	1,000
Replacements	1,700
Available training data:	
Bachelor's degrees	1,206
Master's degrees	224
Doctoral degrees	28

Hospital administrators. Educational requirements for hospital administrators vary among institutions. Most employers prefer individuals having at least a master's degree in hospital administration. Other employers look for formal training in social or behavorial sciences, industrial engineering, or business administration plus extensive experience in the health field. A few institutions require their administrators to be physicians or register professional nurses. The Ph.D. degree in hospital administration is especially helpful for those interested in teaching and research.

Employment 1968	15,000
Projected 1980 requirements	22,000
Percent change, 1968–80	46.7
Annual openings, 1968–80 total	900
Growth	600
Replacements	300
Available training data:	
Bachelor's degrees	37
Master's degrees	403
Doctoral degrees	2

Sanitarians. Although a bachelor's degree in a basic science generally is acceptable, a bachelor's degree in environmental health is preferred for a beginning job as a professional sanitarian. A graduate degree in some aspect of public health usually is required for high level positions. In some cases, sanitarian technicians having 2 years of college and work experience can advance to professional sanitarian positions.

Employment 1968	10,000
Projected 1980 requirements	14,000
Percent change, 1968–80	41.0
Annual openings, 1968–80 total	600
Growth	300
Replacements	300
Available training data	—

Veterinarians. A license is required to practice veterinary medicine. To obtain a license, an applicant must have the degree of Doctor of Veterinary Medicine (D.V.M.), pass a State board examination, and in some States have some practical experience under supervision. In addition, research and teaching positions require the master's or Ph. D. degree in a field such as pathology, physiology, or bacteriology. The minimum requirements for the D.V.M. degree are 2 years of preveterinary college work followed by 4 years of professional study in a college of veterinary medicine.

Employment 1968	24,000
Projected 1980 requirements	34,000
Percent change, 1968–80	41.7
Annual openings, 1968–80 total	1,400
Growth	800
Replacements	600
Available training data:	
D.V.M. degrees	1,146

Mathematics and related occupations

Mathematicians. The minimum educational requirement for most beginning positions is the bachelor's degree with a major in mathematics, or with a major in an applied field and a minor in mathematics. Advanced degrees are required for research and in many areas of applied mathematics. The Ph. D. is necessary for full faculty status at most colleges and universities.

About 70,000 persons were employed as mathematicians in 1968. Employment requirements are expected to increase by 60 percent to 110,000 in 1980. In addition to these manpower needs of almost 42,000 resulting from growth, nearly 60,000 mathematicians will be needed to replace those who die, retire, or transfer to other fields of work. Over the 1968-80 period, openings are, therefore, expected to total more than 100,000, an average of about 8,400 a year.

Annual requirements for mathematicians may be met by persons who shift to occupations in mathematics from other occupations; from persons not in the labor force; from immigrants; from new college graduates who did not major in mathematics; as well as from the major source, new college graduates receiving degrees in mathematics.

Limited data on patterns of entry[26] indicate that in the past a significant number of workers have entered mathematics from sources other than new college graduates majoring in the field. Although a variety of

[26] Ibid.

factors affect the number of these "other entrants," including the availability of mathematics graduates, significant numbers probably will continue to enter. If past patterns of entry from other sources and of new mathematics graduates continue, an average of about 22,000 bachelor's degree graduates in mathematics would be needed annually to meet projected requirements. Therefore, to meet requirements the number of degrees granted annually in mathematics could decline below 1969 levels. Projections of the U.S. Office of Education based on past trends of study patterns of college studies show the average annual number of bachelor's degrees in mathematics increasing about 40 percent above 1969 levels during the 1968-80 period. Thus, the very rapid growth of training in mathematics could be curtailed and manpower requirements could still be met.

Employment 1968	65,000
Projected 1980 requirements	110,000
Percent change, 1968–80	60.4
Annual openings, 1968–80 total	8,400
Growth	3,500
Replacements[1]	4,900
Available training data:	
Bachelor's degrees	26,905
Master's degrees	5,217
Doctoral degrees	956

[1] Includes an estimated 3,800 replacements for those who transfer to other occupations.

Statisticians. A bachelor's degree with a major in statistics or mathematics is required for many entry positions. For other beginning positions, a major in economics or other subject matter fields and a minor in statistics is preferred. A graduate degree in mathematics or statistics is essential for faculty positions at colleges and universities.

Employment 1968	23,000
Projected 1980 requirements	33,000
Percent change, 1968–80	45.9
Annual openings, 1968–80 total	1,600
Growth	900
Replacements	700
Available training data:	
Bachelor's degrees	304
Master's degrees	496
Doctoral degrees	141

Actuaries. A bachelor's degree with a thorough foundation in calculus, probability, and statistics is required. Persons with majors in mathematics, statistics, economics, or business administration can usually qualify for beginning positions. After entering a beginning actuarial position, 5 to 10 years are required to complete the entire series of examinations required for full professional status.

Employment 1968	4,000
Projected 1980 requirements	6,700
Percent growth, 1968–80	59.5
Annual openings, 1968–80 total	300
Growth	200
Replacements	100
Available training data	combined with statisticians

Environmental science occupations

Geologists and geophysicists. A bachelor's degree in geology is adequate for only a few entry jobs in geology. A master's degree is required for beginning positions in research, teaching, and sometimes exploration. A Ph. D. is usually required for high-level research and administrative posts.

A bachelor's degree with a major in geophysics or geophysical specialties is required for many beginning jobs as geophysicists. A bachelor's degree in a related science or in engineering is adequate for some entry jobs. Graduate education in geophysics or in a related physical science is required for responsible positions in exploration and some other specialties. Teaching and research in geophysical work generally require a Ph. D. in geophysics or a related science.

Although new earth sciences college majors are the major source of supply of new earth scientists, new college graduates who did not major in geology and geophysicists, immigrants, persons not in the labor force, and persons employed in other occupations may enter the field. Limited data on patterns of entry[27] indicate that in the past a significant number of workers have entered geology and geophysics from sources other than new college graduates majoring in these fields. Although a variety of factors affect the number of these "other entrants" including the relative availability of geology and geophysics graduates, significant numbers probably will continue to enter. If past patterns of entry from other sources and of new geology and geophysics college graduates continue, an average of about 2,100 bachelor's degree graduates in geology and geophysics would be needed annually to meet projected requirements.

In 1969, about 2,100[28] bachelor's degrees were granted in earth sciences. To meet requirements, the average number would have to remain at 1969 levels. Projections of the U.S. Office of Education, based on past trends, show the average number of bachelor's degrees in sciences declining slightly from 1969 levels

[27] Ibid.

[28] Represents degrees in earth sciences which includes some fields in addition to geology and geophysics.

over the 1970's. Therefore, to meet requirements action must be taken so that the number of geologist and geophysicist graduates will not decrease.

	Total	*Geologists*	*Geophysicists*
Employment 1968	29,600	22,800	6,800
Projected 1980 requirements	35,700	27,100	8,600
Percent growth, 1968–80	22.7	18.9	26.5
Annual openings, 1968–80 total	1,100	800	300
Growth	550	400	150
Replacements	550	400	150
Available training data:			
Bachelor's degrees	2,013	1,973	40
Master's degrees	675	620	55
Doctoral degrees	314	288	26

Meteorologists. A bachelor's degree with a major in meteorology is the usual minimum requirement, however, a bachelor's degree in a related science or in engineering is acceptable for many positions if the applicant has credit for courses in meteorology. An advanced degree is essential for research and teaching, and many top-level positions in meteorology.

Employment 1968	4,000
Projected 1980 requirements	5,500
Percent growth 1968–80	34.1
Annual openings, 1968–80 total	200
Growth	100
Replacements	100
Available training data:	
Bachelor's degrees	228
Master's degrees	140
Doctoral degrees	46

Oceanographers. The minimum educational requirement for beginning professional positions is the bachelor's degree with a major in oceanography, biology, mathematics, engineering, geo-science, or one of the other basic sciences. Graduates training in oceanography or one of the basic sciences is usually required for research, teaching, and advancement to high-level positions.

Employment 1968	5,200
Projected 1980 requirements	9,700
Percent growth, 1968–80	85.4
Annual openings, 1968–80 total	500
Growth	400
Replacements	100
Available training data:	
Bachelor's degrees	113
Master's degrees	123
Doctoral degrees	43

Life Science Occupations

Life scientists. A bachelor's degree with a major in one of the sciences is adequate for many beginning jobs, but promotion for those without graduate training may be limited to intermediate level positions. A master's degree is required for most entry positions in applied research and for some types of positions in college teaching and basic research. A Ph. D. generally is required for higher level college teaching positions, independent research, and the administration of research programs.

Although new graduates who majored in life sciences are the major source of supply of new life scientists, workers also enter the field from other sources; immigrants, persons not in the labor force; graduates with majors other than in life science; and workers who shift into the field from other occupations. Limited data on entry[29] indicate that a significant number of workers have entered the life sciences from these "other" sources. Although a variety of factors affect the number of these "other entrants" including the relative availability of life science graduates, significant numbers probably will continue to enter. If past patterns of entry to the life sciences from other sources and of new graduates continue, an average of about 15,000 bachelor's degree graduates in the life sciences would be needed annually to meet projected requirements.

In 1969, about 45,000[30] bachelor's degrees were granted in the life sciences. Therefore, to meet requirements, the number of bachelor's degrees granted annually in the life sciences could be as much as two-thirds below 1968 levels. U.S. Office of Education projections show the average annual number of degrees granted increasing by about one-third above the 1969 levels over the 1968-80 period. Thus, the rapid expansion of training in the life sciences could be curtailed and manpower requirements still could be met.

Employment 1968	170,000
Projected 1980 requirements	240,000
Percent growth, 1968–80	41.1
Annual openings, 1968–80 total	15,200
Growth	5,800
Replacements	9,400
Available training data:	
Bachelor's degrees	35,308
Master's degrees	5,743
Doctoral degrees	3,051

Physical science occupations

Chemists. A bachelor's degree with a major in chemistry is usually the minimum requirement for entry positions. New graduates having this degree usually qualify for positions in analysis and testing, quality control, technical service and sales, or assist senior

[29] See footnote 25.

[30] Includes some degrees awarded in general science programs not specifically identified as life science degrees.

chemists in research and development. Graduate training is essential for many positions, particularly in research and college teaching, and is helpful for advancement in all types of work. Chemists having the master's degree often qualify for applied research positions in government or private industry. A Ph. D. generally is required in a college or university, and advancement to top-level positions in administration.

Although the major source of supply of chemists is from new graduates majoring in chemistry, requirements may also be met from other sources: persons not in the labor force; immigrants; and graduates who did not major in chemistry. Limited data on entry[31] indicate that a significant number of workers have entered chemistry from these other sources. Although a variety of factors affect the number of "other entrants" including the relative availability of chemistry graduates, significant numbers probably will continue to enter. If past patterns of entry from other sources and of new chemistry graduates continue, an average of about 17,000 bachelor's degree graduates in chemistry would be needed annually to meet projected requirements.

In 1968, about 10,800 bachelor's degrees were granted in chemistry. To meet requirements, therefore, this number would have to average almost 65 percent above 1968 levels. U.S. Office of Education projections indicate that the number of bachelor's degrees awarded in chemistry annually would average about 5 percent above 1968 levels for the 1968-80 period. Therefore, to meet requirements for chemists we will have to take action to increase the number of graduates even faster than past trends.

Employment 1968	130,000
Projected 1980 requirements	200,000
Percent growth, 1968–80	55.7
Annual openings, 1968–80 total	12,800
Growth	6,000
Replacements[1]	6,800
Available training data:	
Bachelor's degrees	11,702
Master's degrees	2,023
Doctoral degrees	1,895

[1] Includes an estimated 3,700 replacements for those who transfer to other occupations.

Biochemists. The minimum educational requirement for entry positions is the bachelor's degree with a major in biochemistry or chemistry, or a major in biology and a minor in chemistry. For most entry positions in research and teaching, graduate training in biochemistry is required. Graduate work is needed for advancement to most high-level positions.

[31] Ibid.

Employment 1968	11,000
Projected 1980 requirements	17,000
Percent growth, 1968–80	55.5
Annual openings 1968–80 total	700
Growth	500
Replacements	200
Available training data:[1]	
Bachelor's degrees	347
Master's degrees	269
Doctoral degrees	471

[1] Degrees in biochemistry only.

Physicists. A bachelor's degree in physics qualifies an applicant for jobs in applied research and development in private industry or the Federal Government. A master's degree qualifies applicants for many research jobs and instructor's jobs in colleges and universities. A doctor's degree usually is required for full faculty status at college and universities and for most positions involving research and development.

Although new physics graduates are the major source of supply of new physicists, entrants also come from other sources: immigrants; college graduates with majors other than physics; persons reentering the labor force; persons in other occupations. If past patterns of entrants from these sources continue, only about 3,600 physics graduates would have to enter each year. Fewer than half of those who receive bachelor's degrees in physics actually enter the field. Therefore, if past trends continue, 8,000 physics graduates would be needed annually to meet projected requirements.

In 1969, about 5,500 bachelor's degrees were granted in physics. To meet requirements, the average annual number of degrees would have to increase 45 percent. Projections of the U.S. Office of Education based on patterns of study over the past 10 years indicate that the average annual number of bachelor's degrees in physics is likely to remain roughly at 1969 levels during the 1968-80 period. Therefore, to meet requirements for physicists the number of graduates in this field will have to increase much faster than current trends indicate.

Employment 1968	45,000
Projected 1980 requirements	75,000
Percent growth, 1968–80	63.9
Annual openings, 1968–80 total	4,600
Growth	2,400
Replacements[1]	2,200
Available training data:	
Bachelor's degrees	5,518
Master's degrees	2,252
Doctoral degrees	1,296

[1] Includes an estimated 1,400 replacements for those who transfer to other occupations.

Astronomers. A bachelor's degree in astronomy, physics, or mathematics with a physics minor is the

minimum educational requirement. The Ph. D. usually is required for high-level positions in teaching and research and is important for other types of work. An advanced degree should be obtained for professional careers.

Employment 1968	1,400
Projected 1980 requirements	1,900
Percent growth, 1968–80	35.7
Annual openings, 1968–80 total	100
Growth	50
Replacements	50
Available training data:	
Bachelor's degrees	115
Master's degrees	80
Doctoral degrees	87

Performing artists

Actors and actresses. Formal training in acting is increasingly necessary. Young people should get as much acting experience as possible in school plays or working with little theater or other acting groups.

Employment 1968	14,000
Projected 1980 requirements	18,500
Percent growth, 1968–80	32.4
Annual openings, 1968–80 total	900
Growth	400
Replacements	500
Available training data	—

Dancers. Serious training traditionally begins by age 12 or earlier. Girls wishing to become ballet dancers should begin lessons at the age of 7 or 8. Professional training typically takes from 10 to 12 lessons a week for 11 or 12 months and many additional hours of practice.

Employment 1968	23,000
Projected 1980 requirements	27,500
Percent growth, 1968–80	18.3
Annual openings, 1968–80 total	1,400
Growth	400
Replacements	1,000
Available training data	—

Musicians and music teachers. Music related positions require intensive training either through private study with an accomplished musician, in a college or university which has a strong music program, or in a conservatory of music. An audition frequently is required to qualify for advanced study in a music conservatory or in a college or university school of music. A bachelor's degree and State certification are required for elementary and secondary school music teaching. Advanced degrees usually are required for college teaching.

Employment 1968	166,000
Projected 1980 requirements	190,000
Percent growth, 1968–80	13.8
Annual openings, 1968–80 total	8,600
Growth	1,900
Replacements	6,700
Available training data	—

Singers and singing teachers. Singers who plan to teach music in public elementary or secondary schools need at least a bachelor's degree with a major in music education and must meet the State certification requirements for teachers. Young people can prepare for careers as singers by enrolling in a music conservatory, a school or department of music conducted with a college or university, or by taking private voice lessons.

Employment 1968	60,000
Projected 1980 requirements	70,000
Percent growth, 1968–80	14.2
Annual openings, 1968–80 total	3,100
Growth	700
Replacements	2,400
Available training data	—

Social scientists

Anthropologists. College graduates with bachelor's degrees can obtain temporary positions and assistantships in graduate schools when they are working for advanced degrees. A master's degree, plus field experience, is sufficient for many beginning professional positions, but promotion to top positions is generally reserved for individuals holding a Ph. D. Many colleges and most universities require a Ph. D. for permanent teaching positions.

Employment 1968	3,000
Projected 1980 requirements	4,100
Percent growth, 1968–80	36.4
Annual openings, 1968–80 total	200
Growth	100
Replacements	100
Available training data:	
Bachelor's degrees	2,990
Master's degrees	507
Doctoral degrees	180

Economists. The bachelor's degree with a major in economics is sufficient for many beginning research jobs. A master's degree generally is required for appointment as a college instructor. A Ph. D. is required for a professorship in a high-ranking college or university and is an asset in competing for other responsible positions.

Employment 1968	31,000
Projected 1980 requirements	48,000
Percent change, 1968–80	54.6
Annual openings, 1968–80 total	2,200
Growth	1,400
Replacements	800
Available training data:	
Bachelor's degrees	16,867
Master's degrees	2,108
Doctoral degrees	634

Geographers. The minimum educational requirement usually is a bachelor's degree with a major in geography. Most positions in research and teaching and advancement in many other types of work require graduate training.

Employment 1968	3,900
Projected 1980 requirements	5,200
Percent change, 1968–80	32.0
Annual openings, 1968–80 total	200
Growth	100
Replacements	100
Available training data:	
Bachelor's degrees	3,338
Master's degrees	563
Doctoral degrees	124

Historians. A bachelor's degree with a major in history is sufficient for some beginning jobs, although persons in such positions may not be regarded as professional historians. A master's degree in history is the minimum requirement for a college instructor. A Ph. D. is essential for high-level college teaching, research, and administration.

Employment 1968	14,000
Projected 1980 requirements	19,000
Percent growth, 1968–80	35.7
Annual openings, 1968–80 total	800
Growth	400
Replacements	400
Available training data:	
Bachelor's degrees	40,939
Master's degrees	5,271
Doctoral degrees	826

Political scientists

Although the bachelor's degree qualifies young people as trainees in public relations or research work, graduate training generally is required for employment as a political scientist. The master's degree is required for administration and research. The Ph. D. generally is required for advancement to college professor.

Teachers

College and university teachers. At least a master's degree is required for most beginning positions, although a Ph. D. is generally preferred. For many positions all requirements for the doctorate except the dissertation must have been completed. A number of States require State certification to teach in public 2-year colleges. Specialization in some subject field is necessary to enter college teaching.

Manpower needs for full-time college teachers of degree credit courses between 1968 and 1980 are expected to average about 17,000 annually. To meet the demand from Ph. D. recipients only, colleges and universities would have to grant an average 34,000 doctoral degrees each year for the 1968-80 period to obtain 17,000 if, as in the past, about one-half of all Ph. D. recipients enter college teaching. The U.S. Office of Education projects that the number of doctorate degrees will average about 43,000 annually over this period. Thus, the current level of Ph. D.'s will more than provide the needs for college teaching.

Employment 1968[1]	286,000
Projected 1980 requirements	395,000
Percent growth, 1968–80	37.8
Annual openings, 1968–80 total	17,000
Growth	9,000
Replacements	8,000
Available training data	—

[1] Full time for resident degree-credit courses.

Elementary and secondary school teachers. All States require public elementary school teachers to have a certificate. Several States require a certificate for teachers in parochial and other private elementary schools. Most States issue a certificate only to persons having at least 4 years of approved college preparation, including a number of professional education courses. Many States also require work toward a fifth year or master's degree within a certain number of years. Emergency or temporary certificates may be issued to partially prepared teachers. However, these certificates must be renewed annually until all requirements for regular certification have been met. Student or practice teaching are included in the 4-year teacher preparation curriculum.

A certificate is required for public secondary school teaching in every State. To qualify for this certificate, the teacher must have at least 4 years of approved college preparation, including one-half year of education courses, practice teaching, and professional courses in one subject or more taught in secondary schools. Some States require a fifth year of study or qualification for a master's degree within a specified period following the teacher's beginning employment. Temporary certificates are issued to teachers who are preparing to meet all requirements for full certification.

To meet the projected need of about 2.4 million elementary and secondary teachers (200,000 for growth, 2.1 million for replacement, 90,000 not meeting certification requirements) between 1968 and 1980, an annual average of 200,000 persons must enter the profession over the 12-year period.

New degree recipients, reentrants, and delayed entrants[32] are primary sources of teacher supply. Almost

[32] College graduates not entering the field in the year they graduate from college.

11 million bachelor's degrees are expected to be awarded between 1968 and 1980. In the recent past, more than one-fifth of all recipients of bachelor's degrees have met high school teachers' certificate requirements, and nearly 15 percent have met certificate requirements for elementary school teaching. However, for many reasons including higher salaries, better working conditions, and preferred locations, not all who have certificates become teachers. For the past several years, about 4 out of every 5 who met elementary school requirements taught in elementary school; two-thirds of those who met high school requirements taught in high school.[33] If these trends continue, 2.7 million new graduates could enter teaching between 1968 and 1980.

About two-fifths of all entrants in the past few years have come from other sources. If the re-entries each year through 1980 should be governed by the number of teachers who separated 8 years previously since the average separation is 8 years, about 1.4 million re-entering teachers would be added to the supply over the 1968-80 period. Altogether, elementary and secondary school teachers could number about 4.1 million, more than three-fourths above the 2.4 million needed.

The above analysis indicates that teacher training could be curtailed sharply and manpower requirements still met. Because of the very large number of individuals involved in this "potential surplus," education planning for elementary and secondary school teachers may well be the most pressing problem for educational planners in the 1970's.

	Elementary	*Secondary*
Employment 1968	1,230,000	940,000
Projected 1980 requirements	1,270,000	1,065,000
Percent growth, 1968–80	3.3	13.6
Annual openings, 1968–80 total	99,000	101,000
Growth	3,300	11,000
Replacements	[1]95,700	[2]90,000
Available training data[3]	77,000	101,500

[1] In addition to 53,000 deaths and retirements each year, the estimates include 38,000 to replace those who leave the profession annually, and 4,700 annually to replace sub-standard teachers.

[2] In addition to deaths and retirements of 29,000 per year, the estimates include replacements for almost 58,000 who leave the profession annually, and 2,800 annually to replace sub-standard teachers.

[3] Represents the number of bachelor's degree recipients who are prepared to teach and actually entered the profession.

Technicians

Engineering and science technicians. At least some post-high school technical training is required for most engineering and science technician jobs. This training may consist of 1 to 4 years of full-time study. Most training programs continue 2 years and lead to either an associate of arts or science degree. Training is also available on the job and in the Armed Forces. Training for such occupations as tool designer and electronics technician may be obtained through a formal apprenticeship.

Employment 1968	620,000
Projected 1980 requirements	850,000
Percent growth, 1968–80	43.2
Annual openings, 1968–80 total	31,000
Growth	22,000
Replacements	9,000
Available training data:	
Junior college graduates	30,018
Vocational education completions:	
Secondary	12,332
Post-secondary	30,149

Draftsmen. Post-high school technical training is generally required. Necessary skills may also be obtained on-the-job combined with part-time schooling or through 3- or 4-year apprenticeship programs.

Employment 1968	295,000
Projected 1980 requirements	435,000
Percent growth, 1968–80	48.1
Annual openings, 1968–80 total	15,300
Growth	11,800
Replacements	3,500
Available training data:	
Vocational education completions:	
Secondary	12,853
Post-Secondary	3,099

Writing occupations

Newspaper reporters. Although some opportunities do exist for talented writers who have little or no academic training beyond high school, most newspapers will consider only applicants having a college education. Graduate work is increasingly important. A degree in journalism or liberal arts usually is required.

Employment 1968	37,000
Projected 1980 requirements	45,000
Percent growth, 1968–80	21.6
Annual openings, 1968–80 total	1,800
Growth	650
Replacements	1,150
Available training data:[1]	
Bachelor's degrees	5,197
Master's degrees	785
Doctoral degrees	22

[1] Journalism degrees only.

Technical writers. The bachelor's degree is the desired entrance requirement, although talented and experienced writers having less academic training may

[33] Source: National Education Association.

qualify. Degrees may be in engineering or science that includes writing courses, or in English or journalism that includes scientific and technical courses.

Employment 1968	30,000
Projected 1980 requirements	35,000
Percent growth, 1968–80	29.2
Annual openings, 1968–80 total	1,300
Growth	700
Replacements	600
Available training data	—

Other professional and related occupations

Airline dispatchers. An FAA certificate is required for airline dispatcher jobs. To qualify for this certificate, an applicant (1) must spend at least a year in dispatching work under the supervision of a certified dispatcher; (2) complete an FAA-approved dispatcher's course at a school or airline training center; or (3) spend 2 of the 3 previous years as an air-traffic controller, dispatch clerk, assistant dispatcher, or radio operator. Although assistant dispatchers may not need certification, 2 years of college or an equivalent amount of time working in some phase of air transportation is required.

Employment 1968	1,200
Projected 1980 requirements	1,600
Percent growth, 1968–80	33.3
Annual openings, 1968–80 total	50
Growth	25
Replacements	25
Available training data	—

Air traffic controllers. Applicants must have an air traffic control certificate. This certificate is obtained after 9 weeks of formal training to learn the fundamentals of airway systems, Federal Aviation Regulations, and radar and aircraft performance characteristics. An additional 2 to 3 years on the job is required at the FAA control tower or center.

Employment 1968	14,600
Projected 1980 requirements	18,000
Percent growth, 1968–80	23.5
Annual openings, 1968–80 total	425
Growth	225
Replacements	200
Available training data	—

Architects. A 5-year curriculum leads to the bachelor of architecture degree from an architectural school. A license, which is needed to practice architecture, may be obtained by graduates of these curriculums after 3 years of practical experience in an architect's office and the passing of a State examination. As a substitute for formal training, most States accept 10 to 12 years of practical experience for admission to the licensing examination.

Based on past relationships between graduates and registration, approximately 4,200 architectural graduates would be needed annually to meet projected requirements of 2,300 a year. In 1969, about 3,300 bachelor's or first-professional degrees were granted in architecture. Therefore, to meet requirements over the 1968-80 period, degrees granted will have to be about 27 percent above 1969 levels. U.S. Office of Education projections show the average number of bachelor's degrees in architecture increasing roughly at the required level.

Employment 1968	34,000
Projected 1980 requirements	50,000
Percent growth, 1968–80	47.1
Annual openings, 1968–80 total	2,300
Growth	1,300
Replacements	1,000
Available training data:	
Bachelor's degrees	3,331
Master's degrees	579
Doctoral degrees	7

Broadcast technicians. A Radiotelephone First Class Operator License from the Federal Communications Commissions is required to become a broadcast technician. To obtain this license, applicants must pass a series of written tests covering the construction and operation of transmission and receiving equipment; the characteristics of electromagnetic waves; and Federal Government and international regulations and practices governing broadcasting. Training at a technical school or college is useful.

Employment 1968	20,000
Projected 1980 requirements	23,000
Percent growth, 1968–80	14.9
Annual openings, 1968–80 total	400
Growth	250
Replacements	150
Available training data	—

College placement officers. A bachelor's degree is generally the minimum requirement for college placement officer employment. Important undergraduate courses for the prospective placement officer include psychology, sociology, counseling, and personnel administration or related business subjects.

Employment 1968	2,500
Projected 1980 requirements	4,000
Percent growth, 1968–80	60.0
Annual openings, 1968–80 total	200
Growth	125
Replacements	75
Available training data	—

Commercial artists. Two or 3 years of professional study in an art school or institute is usually required for commerical artist positions. A growing number of art

schools, especially those in or connected with universities, require 4 years or more of study and confer a bachelor's of fine arts degree. Limited training may also be obtained through public vocational high schools, private schools, home-study, and practical experience on the job but supplemental training is usually needed for advancement.

Employment 1968	50,000
Projected 1980 requirements	57,000
Percent growth, 1968–80	13.0
Annual openings, 1968–80 total	1,900
Growth	500
Replacements	1,400
Available training data	—

Flight engineers. Flight engineer applicants must qualify for an FAA flight engineer's certificate after 2 years of training or 3 years of work experience in the maintenance, repair, and overhaul of aircraft and engineers, including four engine piston and jet aircraft. The applicant may also qualify with at least 200 hours of flight time as a captain of a four-engine piston or jet airplane, or with 100 hours experience as a flight engineer in the Armed Forces. Completion of an FAA course of ground and flight instruction is the most common qualification.

Employment 1968	7,500
Projected 1980 requirements	12,000
Percent growth, 1968–80	59.3
Annual openings, 1968–80 total	225
Growth	125
Replacements	100
Available training data	—

Ground radio operators and teletypists. A second-class radio-telephone or radio-telegraph operator's permit issued by the Federal Communications Commission is preferred. However, a third-class operator's permit is acceptable. A high school education, a good speaking voice, the ability to type at least 40 words a minute, and a knowledge of standard codes and symbols used in communications are important qualifications for this work.

Employment 1968	8,200
Projected 1980 requirements	10,000
Percent growth, 1968–80	21.6
Annual openings, 1968–80 total	225
Growth	125
Replacements	100
Available training data	—

Home economists. A bachelor's degree in home economics is required. A master's or a doctor's degree usually is needed for college teaching and research.

Employment 1968	100,000
Projected 1980 requirements	30,000
Percent growth, 1968–80	30.0
Annual openings, 1968–80 total	7,800
Growth	2,500
Replacements	5,300
Available training data:	
Bachelor's degrees	8,979
Master's degrees	1,149
Doctoral degrees	102

Industrial designers. The usual requirement for industrial designer positions is the completion of a 4- to 5-year course in industrial design in a college or art school. Persons with engineering and architecture degrees may qualify if they have appropriate experience and artistic talent.

Employment 1968	10,000
Projected 1980 requirements	11,500
Percent growth, 1968–80	15.0
Annual openings, 1968–80 total	300
Growth	100
Replacements	200
Available training data	—

Interior designers and decorators. The usual requirement for this job is completion of either a 2- or 3-year course at a recognized art school or institute specializing in interior decorating and design, or a 4-year college course leading to a bachelor's degree with a major in interior design and decoration. In most cases, 1 to 3 years of on-the-job training also is required.

Landscape architects. A bachelor's degree in landscape architecture is usually the minimum requirement for employment. The degree curriculum requires 4 to 5 years of study. Many States require a license. To obtain this license requires 6 to 8 years' experience, or a degree from an accredited school plus 2 to 4 years' experience.

Employment 1968	8,500
Projected 1980 requirements	11,500
Percent growth, 1968–80	33.3
Annual openings, 1968–80 total	500
Growth	250
Replacements	250
Available training data (combined with architecture)	—

Lawyers. Most lawyers have completed 4 years of college followed by 3 years of law school. Applicants must be admitted to the bar for court practice. Four years of part-time law study usually is required to complete the night school curriculum.

Based on past relationships between law school graduates, numbers taking and passing bar examinations, and numbers actually entering the occupation, an average of about 20,000 law school graduates would be needed

annually over the 1968-80 period to meet projected requirements of 14,500 a year.

In 1968, almost 17,000 persons received bachelor's or first professional degrees in law. Thus, to meet requirements, the average number of law degrees granted annually will have to increase roughly 20 percent above 1968 levels. U.S. Office of Education projections based on trends in the study patterns of college students show the average number granted increasing roughly at this required level.

Employment 1968	270,000
Projected 1980 requirements	335,000
Percent growth, 1968–80	22.7
Annual openings, 1968–80 total	14,500
Growth	5,500
Replacements	9,000
Available training data:	
Bachelor's degrees	415
First professional degrees	17,053
Master's degrees	830
Doctoral degrees	18

Librarians. Usually 4 years of college followed by 1 year of training in library science is required for librarians. This training qualifies them for the master's degree.

Employment 1968	106,000
Projected 1980 requirements	135,000
Percent growth, 1968–80	28.6
Annual openings, 1968–80 total	8,200
Growth	2,500
Replacements	5,700
Available training data:	
Bachelor's degrees	1,000
Master's degrees	5,932
Doctoral degrees	17

Models. Although no formal educational requirements exist for models, many employers require a high school diploma, and a few prefer some college. Training in a modeling school or modeling experience also are good qualifications.

Employment 1968	50,000
Projected 1980 requirements	64,000
Percent growth, 1968–80	15.9
Annual openings, 1968–80 total	1,700
Growth	700
Replacements	1,000
Available training data	—

Photographers. A wide education range exists for photographer positions. Many persons work on the job 2 or 3 years. Others train through 3-year apprenticeship programs. In addition, several colleges and universities offer 4-year curriculums leading to a bachelor's degree with a major in photography. A few institutions offer 2-year photography curriculums.

Employment 1968	60,000
Projected 1980 requirements	72,000
Percent growth, 1968–80	18.0
Annual openings, 1968–80 total	2,200
Growth	900
Replacements	1,300
Available training data	—

Pilots and copilots. All pilots must be licensed by the FAA. Copilots and most pilots employed in general aviation must have a "commerical airplane pilots" license. An "instrument rating" also is often required. To qualify for a commercial airplane pilots license or an instrument rating license, applicants must be at least 18 years and have 200 hours of flight experience. All captains must have an "airplane transport pilots" license. Applicants for this license must be at least 23 and have 1,200 hours of flight time including night flying and instrument flying time. Training may be obtained from a private flight school, airline flight school, or through military service.

Employment 1968	52,000
Projected 1980 requirements	114,000
Percent growth, 1968–80	116.9
Annual openings, 1968–80 total	1,800
Growth	1,100
Replacements	700
Available training data:	
Vocational education completions:	
Post-secondary	791

Programmers. Although educational requirements vary, most employers prefer applicants having a college degree. Graduate degrees may be required for some high-level programming positions.

Employment 1968	175,000
Projected 1980 requirements	400,000
Percent growth, 1968–80	129.0
Annual openings, 1968–80 total	23,000
Growth	19,000
Replacements	4,000
Available training data	—

Psychologists. Generally, the master's degree with a major in psychology is required for these positions. The Ph. D. is needed for many entrance positions and is important for advancement. Psychologists entering independent practice must meet certification or licensing requirements in many States.

Employment 1968	32,000
Projected 1980 requirements	58,000
Percent growth, 1968–80	81.3
Annual openings, 1968–80 total	3,100
Growth	2,200
Replacements	900
Available training data:	
Bachelor's degrees	29,332
Master's degrees	4,011
Doctoral degrees	1,551

Radio and television announcers. Educational requirements vary for radio and television announcers. Training may be obtained in high schools, vocational schools, or college. Announcer positions with the national networks usually require a college degree and experience.

Employment 1968	14,000
Projected 1980 requirements	16,000
Percent growth, 1968–80	14.9
Annual openings, 1968–80 total	600
Growth	200
Replacements	400
Available training data	—

Recreation Workers. Most employers prefer applicants having a bachelor's degree with a major in recreation, social science, or physical education.

Employment 1968	40,000
Projected 1980 requirements	70,000
Percent growth, 1968–80	75.0
Annual openings, 1968–80 total	4,100
Growth	2,500
Replacements	1,600
Available training data	—

Social workers. A bachelor's degree, preferably in social welfare, is the minimum requirement for social workers. A master's degree is required for many beginning jobs. Jobs in teaching and research usually require an advanced degree. After 2 years' experience social workers are eligible for certification as members of the Academy of Certified Social Workers.

The primary source of entrants into the profession are new college graduates having degrees in social work and experienced social workers reentering the occupation after a period outside the labor force. If patterns of reentry of women in social work follow the reentry patterns of women teachers, and if past patterns of entry to the profession continue, approximately 20,500 graduates with bachelor's and master's degrees in social work would be needed annually to meet projected requirements.

In 1968 about 7,200 bachelor's and master's degrees were granted in social work. To meet requirements, the average number granted annually would have to increase by 185 percent. Projections developed by the U.S. Office of Education based on trends in patterns of study show the average annual number of bachelor's and master's degrees in social work increasing by 60 percent above 1968 levels over the 1968-80 period. Therefore, the training in social work will have to be increased much faster than trends indicate if requirements are to be met.

Employment 1968	160,000
Projected 1980 requirements	270,000
Percent growth, 1968–80	66.7
Annual openings, 1968–80 total	16,700
Growth	9,000
Replacements	7,700
Available training data:	
Bachelor's degrees	3,367
Master's degrees	5,037
Doctoral degrees	90

Surveyors. The most common way to prepare for surveying is through a combination of post-high school courses in surveying and extensive on-the-job training. A professional career in photogrammetry usually requires a bachelor's degree in engineering or the physical sciences. Many States require 4 to 8 years' experience in surveying and successful completion of an examination for licensing.

Employment 1968	45,000
Projected 1980 requirements	68,000
Percent growth, 1968–80	50.2
Annual openings, 1968–80 total	2,600
Growth	1,900
Replacements	700
Available training data	—

Systems analysts. Although systems analysts have no single acceptable way of preparing, most employers prefer applicants having college backgrounds and experience in computer programming. Many employers seek candidates who have mathematics, science, engineering, or business backgrounds; others stress a graduate degree. Systems analyst trainees can learn to use data processing equipment on the job or through special courses offered by colleges and manufacturers.

Employment 1968	150,000
Projected 1980 requirements	425,000
Percent growth, 1968–80	183.0
Annual openings, 1968–80 total	27,000
Growth	23,000
Replacements	4,000
Available training data	—

Urban planners. For some jobs, a bachelor's degree in urban planning or a related field is acceptable; but a master's degree in urban planning is increasingly desired.

Employment 1968	7,000
Projected 1980 requirements	13,500
Percent growth, 1968–80	93.0
Annual openings, 1968–80 total	800
Growth	600
Replacements	200
Available training data	—

Managerial Occupations

Employers increasingly require beginning managers to have a college degree. A bachelor's degree in business administration and a major in accounting, economics, or finance are desired by some employers. Other firms seek applicants having technical training in engineering, science, or mathematics. Still others train liberal arts graduates on the job. The number of formal management trainee programs is relatively small. Advancement to high-level management jobs often occurs after several years of progressively more responsible work experience.

Employment 1968	7,776,000
Projected 1980 requirements	9,500,000
Percent growth, 1968–80	22.2
Annual openings, 1968–80 total	380,000
Growth	144,000
Replacements	236,000

Bank officers

Bank officer positions are filled by promoting either experienced clerical employees or management trainees. A business administration curriculum and a major in finance or liberal arts that includes accounting, economics, commercial law, political science, and statistics courses are excellent preparation for trainee positions.

Employment 1968	125,000
Projected 1980 requirements	193,000
Percent growth, 1968–80	53.8
Annual openings, 1968–80 total	11,600
Growth	5,600
Replacements	6,000
Available training data	—

Conductors (railroad)

Qualified brakemen are promoted to conductors on a seniority basis. To qualify, a man usually must have several year's experience as a brakeman and pass examinations covering signals, air brakes, time tables, operating rules, and related subjects.

Employment 1968	38,000
Projected 1980 requirements	39,000
Percent growth, 1968–80	2.7
Annual openings, 1968–80 total	2,500
Growth	1,000
Replacements	1,500
Available training data	—

Industrial traffic managers

Experience in traffic departments enables some persons having only a high school education to qualify for these positions. However, a college education is becoming increasingly important. When college training is required, some employers prefer business administration graduates who have majored in transportation; other employers prefer liberal arts majors who have taken courses in transportation management, economics, statistics, marketing, or commercial law.

Employment 1968	15,000
Projected 1980 requirements	17,000
Percent growth, 1968–80	10.4
Annual openings, 1968–80 total	500
Growth	150
Replacements	350
Available training data	—

Managers and assistants (hotel)

Hotel experience is generally the first consideration to selecting hotel managers; however, employers increasingly emphasize a college education. The best college preparation is provided by specialized 4-year curriculums in hotel and restaurant administration. Some large hotel organizations have special management trainee programs both for college graduates and persons promoted from within.

Employment 1968	150,000
Projected 1980 requirements	198,000
Percent growth, 1968–80	27.6
Annual openings, 1968–80 total	9,500
Growth	3,600
Replacements	5,900
Available training data:[1]	
Bachelor's degrees	520
Master's degrees	22

[1] Degrees in hotel and restaurant administration.

Purchasing agents

For these jobs, employers often prefer to hire graduates of schools of business administration or engineering who have had courses in accounting, economics, and purchasing; and some require applicants to have graduate training in business administration. Other employers prefer experience with the company, whether or not applicants have a college education.

Employment 1968	140,000
Projected 1980 requirements	185,000
Percent growth, 1968–80	27.2
Annual openings, 1968–80 total	6,700
Growth	3,300
Replacements	3,400
Available training data	—

Clerical and Related Occupations

All but the most routine clerical positions require graduation from high school. Most employers regard instruction in business subjects as a particularly good qualification. The instruction may be obtained in high school or special schools, or in cooperative work-study programs.

Employment 1968	12,803,000
Projected 1980 requirements	17,300,000
Percent growth, 1968–80	35.1
Annual openings, 1968–80 total	912,000
Growth	375,000
Replacements	537,000

Bank clerks

High school graduation is adequate preparation for most beginning clerical jobs in banks. For most jobs, courses in bookkeeping, typing, business arithmetic, and office machine operation are desirable.

Employment 1968	400,000
Projected 1980 requirements	512,000
Percent growth, 1968–80	28.8
Annual openings, 1968–80 total	29,500
Growth	9,500
Replacements	20,000
Available training data	—

Bank tellers

Banks prefer high school graduates with experience in related clerical positions when filling teller positions. Applicants also must meet bonding standards.

Employment 1968	230,000
Projected 1980 requirements	337,000
Percent growth, 1968–80	46.2
Annual openings, 1968–80 total	20,000
Growth	8,000
Replacements	12,000
Available training data	—

Bookkeeping workers

For bookkeeping jobs, most employers prefer high school graduates who have taken business arithmetic and bookkeeping courses. Some prefer applicants who have completed a post-high school business training program or junior college.

Employment 1968	1,200,000
Projected 1980 requirements	1,500,000
Percent growth, 1968–80	18.9
Annual openings, 1968–80 total	78,000
Growth	20,000
Replacements	58,000
Available training data	—

Cashiers

For cashier jobs, employers prefer people who have completed high school. Courses in business arithmetic, bookkeeping, typing, and other business subjects are good preparation for this work.

Employment 1968	730,000
Projected 1980 requirements	1,110,000
Percent growth, 1968–80	50.6
Annual openings, 1968–80 total	69,000
Growth	31,000
Replacements	38,000
Available training data	—

Clerks (railroad)

A high school education is generally required for railroad clerk jobs. Railroads prefer workers who have training or some experience in working with figures.

Employment 1968	93,000
Projected 1980 requirements	89,000
Percent growth, 1968–80	–4.8
Annual openings, 1968–80 total	2,700
Growth	–400
Replacements	3,100
Available training data	—

Dental assistants

Although most entrants are trained on the job an increasing number of dental assistants are entering the occupation through formal post-high school dental assisting programs. Based on the known training sources, programs to train dental assistants could double and all requirements still would not be met by those receiving academic training.

Employment 1968	100,000
Projected 1980 requirements	150,000
Percent growth, 1968–80	50.0
Annual openings, 1968–80 total	9,000
Growth	4,400
Replacements	4,600
Available training data:	
Junior college graduates	1,307
Vocational education completions:	
Secondary	1,201
Post-secondary	1,952

Electronic computer operating personnel

In filling these jobs, employers usually require at least a high school education. For console operator positions, some college training may be preferred.

Employment 1968	175,000
Projected 1980 requirements	400,000
Percent growth, 1968–80	129.0
Annual openings, 1968–80 total	20,400
Growth	18,800
Replacements	1,600
Available training data:	
Junior colleges	4,633

Front office clerks (hotel)

Although education beyond high school generally is not required for these jobs, hotel employers are attaching greater importance to college training in selecting applicants who may later advance to managerial positions.

Employment 1968	50,000
Projected 1980 requirements	69,000
Percent growth, 1968–80	27.6
Annual openings, 1968–80 total	3,200
Growth	1,250
Replacements	1,950
Available training data	—

Library technicians

A high school diploma or its equivalent is the standard entrance requirement for both academic and on-the-job library technician training programs. An increasing number of new entrants will be required to have training in formal academic programs.

Employment 1968	70,000
Projected 1980 requirements	125,000
Percent growth, 1968–80	77.1
Annual openings, 1968–80 total	9,000
Growth	4,500
Replacements	4,500
Available training data:	
Junior college graduates	134

Mail carriers

Although no formal education or prior experience is required for mail carriers, applicants must pass civil service and physical examinations.

Employment 1968	246,000
Projected 1980 requirements	335,000
Percent growth, 1968–80	36.2
Annual openings, 1968–80 total	12,200
Growth	7,400
Replacements	4,800
Available training data	—

Office machine operators

Graduation from high school or business school is the minimum educational requirement for all but the most routine office machine operator jobs. The necessary amount of training dealing with business machines varies by type of machine used.

Employment 1968	325,000
Projected 1980 requirements	460,000
Percent growth, 1968–80	39.4
Annual openings, 1968–80 total	25,000
Growth	10,000
Replacements	15,000
Available training data	—

Postal clerks

Although no formal education or prior experience is required for postal clerks, applicants must pass civil service and physical examinations.

Employment 1968	290,000
Projected 1980 requirements	385,000
Percent growth, 1968–80	32.8
Annual openings, 1968–80 total	14,600
Growth	7,900
Replacements	6,700
Available training data	—

Receptionists

Formal educational requirements are rarely specified beyond a high school diploma. Nevertheless, about 1 receptionist in 5 has some college training. Business courses are valuable for applicants seeking beginning positions.

Employment 1968	240,000
Projected 1980 requirements	400,000
Percent growth, 1968–80	65.6
Annual openings, 1968–80 total	30,000
Growth	13,000
Replacements	17,000
Available training data	—

Shipping and receiving clerks

High school graduates are preferred for beginning jobs as shipping and receiving clerks. Post-high school training or courses in transportation are important for advancement to warehouse managers, industrial traffic managers, or purchasing agents.

Employment 1968	370,000
Projected 1980 requirements	465,000
Percent growth, 1968–80	25.3
Annual openings, 1968–80 total	15,400
Growth	7,800
Replacements	7,600
Available training data:	
MDTA enrollment O.J.T.	1,500

Station agents

Experienced telegraphers usually become agents in small stations or assistants in larger ones.

Employment 1968	10,900
Projected 1980 requirements	5,200
Percent growth, 1968–80	-52.1
Annual openings, 1968–80 total	-225
Growth	-475
Replacements	250
Available training data	—

Stenographers and secretaries

Graduation from high school is essential for practically all secretarial and stenographic positions. Graduates whose high school courses included shorthand, typing, and other business subjects meet the requirements of many employers. Some employers prefer persons having a background of academic high school subjects supplemented by technical training taken after graduation.

Employment 1968	2,650,000
Projected 1980 requirements	3,650,000
Percent growth, 1968–80	36.8
Annual openings, 1968–80 total	237,000
Growth	82,000
Replacements	155,000
Available training data:	
MDTA enrollment:	
Institutional	6,480
Vocational education completions:	
Secondary	126,782
Post-secondary	15,373

Telegraphers, telephoners, and towermen (railroad)

Most railroads prefer high school graduates for beginning positions and require applicants to pass examinations on train operating rules and duties related to their future assignments.

Employment 1968	13,200
Projected 1980 requirements	12,700
Percent growth, 1968–80	3.8
Annual openings, 1968–80 total	100
Growth	-50
Replacements	150
Available training data	—

Telephone operators

In hiring beginning telephone operators, employers prefer young people who have at least a high school education. Courses required or considered helpful include English, business arithmetic, and typing.

Employment 1968	400,000
Projected 1980 requirements	480,000
Percent growth, 1968–80	20.9
Annual openings, 1968–80 total	28,000
Growth	6,900
Replacements	21,100
Available training data	—

Traffic agents and clerks (civil aviation)

These jobs generally require high school graduation, and college training is considered desirable. College courses in transportation are helpful for higher level positions such as traffic representative.

Employment 1968	37,500
Projected 1980 requirements	60,000
Percent growth, 1968–80	60.1
Annual openings, 1968–80 total	2,600
Growth	1,500
Replacements	1,100
Available training data	—

Typists

Most employers require applicants for typing positions to meet certain standards of speed and accuracy. Typists should have a good understanding of spelling, vocabulary, punctuation, and grammar. Most typists learn their skills by attending day or evening classes in public or private schools. High school graduates generally are preferred by employers.

Employment 1968	700,000
Projected 1980 requirements	930,000
Percent growth, 1968–80	36.8
Annual openings, 1968–80 total	63,000
Growth	21,000
Replacements	42,000
Available training data:	
Vocational education completions:	
Secondary	80,472
Post-secondary	7,592

Sales Occupations

The minimum educational requirements for sales careers vary widely. Some sale positions require no formal education; others specify a college degree in a technical or scientific field. Even for routine sales jobs, however, a high school diploma is an asset for the beginner. Training for some sales jobs, such as those in retail stores, is usually received on the job. Some persons combine on-the-job training with home study or courses offered by manufacturers or local universities.

Employment 1968	4,647,000
Projected 1980 requirements	6,000,000
Percent growth, 1968–80	29.1

Annual openings, 1968–80 total	263,000
Growth	113,000
Replacements	150,000

Insurance agents and brokers

Although not required, a college degree is helpful to an insurance agent or broker. Courses in accounting, economics, business law, and insurance are very useful. Some insurance companies sponsor classes in sales and insurance principles; other training is available from local educational institutions or through correspondence courses. All agents and most brokers must be licensed in the State where they sell insurance. To receive a license, most States require candidates to pass a written examination in insurance fundamentals and State insurance laws.

Employment 1968	410,000
Projected 1980 requirements	480,000
Percent growth, 1968–80	16.9
Annual openings, 1968–80 total	16,200
Growth	5,800
Replacements	10,400
Available training data	—

Manufacturers' salesmen

Increasingly, employers prefer college graduates for positions as manufacturers' salesmen, although many persons succeed with little or no training beyond high school. Employer preferences for college training in a specified field vary with the nature of the product sold. Training at a college of pharmacy usually is required of drug manufacturer salesmen; industrial salesmen often need a scientific or technical background. Beginning salesmen are given specialized training before they start to work. Some companies have formal training programs which may last from 1 to 2 years; other firms offer classroom instruction followed by additional training on the job under supervision of field managers.

Employment 1968	500,000
Projected 1980 requirements	735,000
Percent growth, 1968–80	47.1
Annual openings, 1968–80 total	32,000
Growth	19,500
Replacements	12,500
Available training data	—

Real estate salesmen and brokers

A high school diploma is preferred by employers hiring real estate salesmen. Most real estate salesmen have some college training and many are college graduates. Courses in real estate, psychology, economics, finance, and business are helpful. Many firms offer their own formal training programs for beginning salesmen. Other courses are available at local educational institutions. All States and the District of Columbia require real estate salesmen to be licensed. This licensing requires the passing of a written examination; in over half the States, a specific amount of selling experience or equivalent eduation also is necessary.

Employment 1968	225,000
Projected 1980 requirements	270,000
Percent growth, 1968–80	20.1
Annual openings, 1968–80 total	14,200
Growth	3,800
Replacements	10,400
Available training data	—

Retail trade salesworkers

Although not essential, employers prefer to hire high school graduates for retail sales positions. Salesmanship, home economics, and commercial arithmetic are among the high school subjects that are useful in a sales career. Most salesworkers are trained on the job; but, part-time selling experience gained while still in school may be helpful in obtaining full-time sales employment. In larger stores, applicants may spend a few days in formal training sessions before beginning actual sales work.

Employment 1968	2,800,000
Projected 1980 requirements	3,460,000
Percent growth, 1968–80	24.0
Annual openings, 1968–80 total	150,000
Growth	55,000
Replacements	95,000
Available training data	—

Automobile parts countermen

Although not essential, employers prefer to hire high school graduates for entry jobs as parts countermen. High school or vocational school courses in auto mechanics, commercial arithmetic, salesmanship, and bookkeeping are important; experience gained through gasoline service station work also is an asset to the prospective parts counterman. Most countermen learn their skills on the job; up to 2 years' working experience may be necessary before an employee is fully qualified.

Employment 1968	65,000
Projected 1980 requirements	80,000
Percent growth, 1968–80	23.1
Annual openings, 1968–80 total	2,500
Growth	1,250
Replacements	1,250
Available training data	—

Automobile salesmen

Many employers require beginning automobile salesmen to be at least 21 years old and a high school

graduate. A growing number of salesmen have education beyond high school. Courses in public speaking, commercial arithmetic, business law, and salesmanship are useful; previous sales experience or work requiring contact with the public also is helpful. Most beginning salesmen are trained on the job, although large firms sometimes provide formal classroom training.

Employment 1968	120,000
Projected 1980 requirements	145,000
Percent growth, 1968–80	20.8
Annual openings, 1968–80 total	4,400
Growth	2,100
Replacements	2,300
Available training data	—

Automobile service advisers

For service adviser trainee jobs, employers seek high school graduates over 21 years of age who have work experience in automobile repair or related activities. A driver's license usually is required and high school or vocational school courses in automobile mechanics, commercial arithmetic, salesmanship, and English are important. Beginning service advisers are trained on the job under the guidance of more experienced service advisers and the service manager. A beginner usually becomes a qualified service adviser in 1 to 2 years.

Employment 1968	10,000
Projected 1980 requirements	12,500
Percent growth, 1968–80	25.0
Annual openings, 1968–80 total	300
Growth	200
Replacements	100
Available training data	—

Securities salesmen

A college education is increasingly necessary for beginners seeking to enter this field. A degree in business administration, economics, or liberal arts is good preparation for securities sales work. Almost all States require securities salesmen to be licensed; personal bonds or written examinations are needed to obtain this license. In addition, practically every salesman must be a registered representative of his firm according to the regulations of the firm's securities exchange, other exchanges through which it does business, or the National Association of Securities Dealers. Examinations and character investigations are required for registration. Most firms provide training for beginners, which may vary from short informal programs to combined classroom instruction and on-the-job experience that lasts 6 months or more.

Employment 1968	135,000
Projected 1980 requirements	170,000
Percent growth, 1968–80	24.0
Annual openings, 1968–80 total	7,400
Growth	2,800
Replacements	4,600
Available training data	—

Wholesale trade salesworkers

High school graduation is the usual educational requirement for a wholesale salesman, although selling scientific or technical equipment often requires training beyond high school. In some cases, engineering degrees are necessary. A beginner usually is trained on the job in several non-selling positions before being assigned as a salesman. Generally 2 years or longer are required before a trainee is ready for a territory of his own.

Employment 1968	530,000
Projected 1980 requirements	695,000
Percent growth, 1968–80	29.5
Annual openings, 1968–80 total	25,200
Growth	13,200
Replacements	12,000
Available training data	—

Service Occupations

Training requirements differ greatly among the various service occupations. Although a high school diploma is always an advantage, some service jobs usually do not require any formal education requirements. Some others require a college degree, and still others demand special training.

Employment 1968	9,381,000
Projected 1980 requirements	13,100,000
Percent growth, 1968–80	39.6
Annual openings, 1968–80 total	752,000
Growth	310,000
Replacements	442,000

Barbers

To be eligible for a license that is required in practically all States, a candidate must have completed at least the eighth grade and graduated from a State-approved barber school. All but a few States require beginners to take an examination for an apprentice license. After working 1 or 2 years, the apprentice takes a second examination for his license as a registered barber.

Employment 1968	210,000
Projected 1980 requirements	260,000

Percent growth, 1968–80	23.8
Annual openings, 1968–80 total	12,800
Growth	4,200
Replacements	8,600
Available training data:	
Vocational education completions:	
Secondary	139
Post-secondary	553

Bellmen and bell captains (hotel)

Although no specific educational requirements exist for bellmen, graduation from high school enhances opportunities for promotion to front office clerical jobs.

Employment 1968	30,000
Projected 1980 requirements	32,000
Percent growth, 1968–80	10.6
Annual openings, 1968–80 total	1,100
Growth	300
Replacements	800
Available training data	—

Building custodians

There are no formal educational requirements for most positions in custodial work, and most custodians acquire their skills on the job. However, entry workers should be able to do simple arithmetic and follow written directions. High school shop courses may help the worker perform the many handyman tasks that are required.

Employment 1968	1,100,000
Projected 1980 requirements	1,460,000
Percent growth, 1968–80	32.7
Annual openings, 1968–80 total	80,000
Growth	30,000
Replacements	50,000
Available training data	—

Cooks and chefs

Most cooks—particularly those who work in small eating places—acquire their skills on the job. Less frequently they are trained as apprentices under trade union contracts or new employee training programs conducted by large hotels and restaurants. Training offered by a number of schools and other institutions is a distinct advantage for applicants seeking jobs as cooks or chefs in some large restaurants or other establishments which provide food.

Employment 1968	670,000
Projected 1980 requirements	900,000
Percent growth, 1968–80	33.2
Annual openings, 1968–80 total	48,000
Growth	19,000
Replacements	29,000
Available training data:	
MDTA enrollment O.J.T.	1,800
Institutional	3,600
Vocational education completions:	
Secondary	1,563
Post-secondary	423

Cosmetologists

All States require that cosmetologists be licensed, and that applicants have completed at least eighth grade—in many States the tenth grade, and in a few the twelfth grade. Successful completion of a State-approved cosmetology course is recognized as adequate preparation for the State licensing examination; in some States, a period of apprenticeship may be substituted.

Employment 1968	475,000
Projected 1980 requirements	685,000
Percent growth, 1968–80	42.9
Annual openings, 1968–80 total	38,000
Growth	17,000
Replacements	21,000
Available training data:	
Vocational education completions:	
Secondary	7,126
Post-secondary	2,476

FBI special agents

An applicant must have graduated from a State-accredited resident law school or a 4-year resident college with a major in accounting. The law school training must have been preceded by at least 2 years of resident undergraduate college work. Accounting graduates also must have had at least 3 years of experience in accounting or auditing or a combination of both.

Employment 1968	6,600
Projected 1980 requirements	—
Percent growth, 1968–80	—
Annual openings, 1968–80 total	—
Growth	—
Replacements	—
Available training data	—

Firefighters

In most communities, qualifying examinations are open to men who have a high school education. The men who receive the highest grades on their examinations have the best chances for appointment. The examinations test the applicant mentally and physically. Some post-secondary training currently is being provided for firefighting positions.

Employment 1968	180,000
Projected 1980 requirements	245,000
Percent growth, 1968–80	34.0

Annual openings, 1968–80 total	7,700
Growth	5,200
Replacements	2,500
Available training data:	
Vocational education completions:	
Secondary	34
Post-secondary	823

Licensed practical nurses

All States and the District of Columbia license practical nurses. Usually only candidates who have completed a course in practical nursing and passed an examination are licensed. Generally, at least 2 years of high school must be completed to enroll in practical nursing courses.

Employment 1968	320,000
Projected 1980 requirements	600,000
Percent growth, 1968–80	87.5
Annual openings, 1968–80 total	48,000
Growth	23,000
Replacements	25,000
Available training data:	
Junior college graduates	5,564
Vocational education completions:	
Secondary	2,192
Post-secondary	19,586

Hospital attendants

Although some institutions hire persons with less than a high school education, high school graduates are preferred. Hospital attendants usually learn their skills on the job with some supplemented classroom work.

Employment 1968	800,000
Projected 1980 requirements	1,500,000
Percent growth, 1968–80	87.5
Annual openings, 1968–80 total	100,000
Growth	58,000
Replacements	42,000
Available training data:	
Secondary	7,270
Post-secondary	3,939

Housekeepers and assistants (hotel)

Although no specific educational requirements exist for housekeepers, most employers prefer applicants who have at least a high school diploma.

Employment 1968	25,000
Projected 1980 requirements	35,000
Percent growth, 1968–80	27.6
Annual openings, 1968–80 total	2,400
Growth	600
Replacements	1,800
Available training data	—

Police officers (municipal)

Some police departments accept recruits who have less than a high school education, particularly if they have worked in a field related to law enforcement. A few cities require some college training and some hire law enforcement students as police interns. College training is required of women because of their special assignments.

Employment 1968	280,000
Projected 1980 requirements	360,000
Percent growth, 1968–80	27.5
Annual openings, 1968–80 total	15,000
Growth	6,500
Replacements	8,500
Available training data:	
Junior college graduates	2,851
Vocational education completions:	
Secondary	168
Post-secondary	4,846

Private household workers

Although a high school diploma is an advantage, no formal education is required for most private household workers.

Employment 1968	1,700,000
Projected 1980 requirements	1,980,000
Percent growth, 1968–80	14.8
Annual openings, 1968–80 total	121,000
Growth	21,000
Replacements	100,000
Available training data	—

State police officers

Most States require that applicants have a high school education or an equivalent combination of education and experience. In all States, recruits enter a formal training program of several months.

Employment 1968	35,000
Projected 1980 requirements	52,000
Percent growth, 1968–80	47.7
Annual openings, 1968–80 total	2,800
Growth	1,700
Replacements	1,100
Available training data	—

Stewardesses (civil aviation)

Applicants must have a high school education. Those having 2 years of college, nurses' training, or experience in dealing with the public are preferred. Most large airlines train their own stewardesses; however, a few airlines that do not operate their own schools may hire graduates who have been trained at private stewardesses' schools.

Employment 1968	25,000
Projected 1980 requirements	65,000
Percent growth, 1968–80	150.7
Annual openings, 1968–80 total	—
Growth	3,300
Replacements[1]	—
Available training data	—

[1]Not available. Stewardesses generally are not affected by normal death and retirements rates because of the extremely high turnover for this occupation. Many leave the occupation before age 30.

Waiters and waitresses

Most waiters and waitresses acquire their skills on the job. Increasingly, employers prefer that beginners have at least 2 or 3 years of high school. In certain restaurants, knowledge of a foreign language may be important.

Employment 1968	960,000
Projected 1980 requirements	1,240,000
Percent growth, 1968–80	
Annual openings, 1968–80 total	67,000
Growth	23,000
Replacements	44,000
Available training data:	
Vocational education completions:	
Secondary	663
Post-secondary	110

Craftsmen

A large proportion of skilled workers learn their trades informally on-the-job; others acquire the necessary skills from apprenticeship or other formal training. Most training authorities recommend a formal apprenticeship program lasting from 2 to 6 years as the best way to learn a skilled trade. In addition, many companies provide on-the-job training and related classroom instruction. Some young persons move from one semi-skilled job to another and, over a period of years, acquire the expertise demanded of a skilled worker. Others learn a skilled trade in vocational, trade, or technical schools. In addition, many men in the Armed Forces acquire training that helps them to qualify, with additional experience, for skilled jobs in civilian life.

Employment 1968	10,015,000
Projected 1980 requirements	12,200,000
Percent growth, 1968–80	21.8
Annual openings, 1968–80 total	396,000
Growth	182,000
Replacements	214,000
Available training data	—

Construction trades

In interpreting data for the construction trades, note should be taken of the points made in the discussion on page 6, on the special problems of planning training in the construction trades because of such factors as the cyclical and seasonal nature of the construction industry. In addition it must be kept in mind that in the construction trades all annual openings do not have to be filled by newly trained workers. The economy has a trained cadre of construction workers who have obtained construction trade skills during the peak periods of construction activity of business and seasonal cycles. During periods of increasing construction activity, as implied in the projections presented in this report, many of these trained workers will be drawn into the construction crafts from the ranks of the unemployed and from other occupations to which they shifted during periods of reduced construction activity.

As indicated earlier in this report, the projections presented here are based on a series of assumptions, concerning such factors as the international political situation, the direction of Government programs, and general economic conditions, all of which are subject to wide variability over the long run. In construction and other industries where the demand for workers is particularly affected by changes in economic conditions and the economic policy of government these assumptions become even more critical. Officials concerned with planning training programs must keep these assumptions clearly in mind in using the projections and make judgments as to the effect on training needs of circumstances which indicate that the assumptions will not be borne out.[34]

In this section on construction trades occupations, data are presented on employment and manpower needs for these workers in the construction industry as well as an all-industry total. As an additional aid to individuals engaged in planning training programs, information is also presented on annual openings and apprenticeship completions over the 1960-68 period as well as the data on 1968-80 projections and current training. (See discussion on page 6 for illustrative uses of historical data).

Asbestos and insulating workers. Most asbestos workers learn their trade through a 4-year "improvership" program where they learn to use the tools of the trade and to work with insulating materials.

[34]See discussion on alternate projections for construction craftsmen in chapter I. p. 4.

	All industries	Construction industry
Employment 1968	22,000	15,000
Projected 1980 requirements	28,000	21,000
Percent growth	27.3	14.0
Annual openings, 1968–80 total	800	700
Growth	500	500
Replacements	300	200
Available training data	---	---

Bricklayers. Completion of a 3-year apprenticeship program is the desired training for bricklayers. During the 1960's apprenticeship completions numbered nearly one-half of openings resulting from growth and death and retirement. A high school education or its equivalent is important for entry to apprenticeship programs. Some skills of the trade may also be obtained through vocational school courses. Training may also be obtained informally on the job.

Employment 1968 and projected 1980 requirements[1]

	All industries	Construction industry
Employment 1968	200,000	175,000
Projected 1980 requirements	260,000	225,000
Percent growth	30.0	28.6
Annual openings, total	8,400	7,200
Growth	5,000	4,200
Replacements	3,400	3,000

Employment, 1960–68

Employment 1960	200,000	
Employment 1968	200,000	
Percent growth	—	
Annual openings, total	3,000	
Growth	—	
Replacements	3,000	
Available training data:		
Apprenticeship completions	1,651 (1969)	1,430 (annual average 1961–68)
Vocational education completions:		
Secondary	4,032	
Post-secondary	272	

[1] Includes stonemasons, marblesetters, and tile setters.

Carpenters. A 4-year apprenticeship program, including 144 hours of related classroom instruction, is recommended. During the 1960's, apprenticeship completions numbered about 14 percent of openings resulting from growth and death and retirements. A high school education or its equivalent is desirable. Training may also be acquired on the job. Some knowledge of the trade may also be obtained through vocational school courses.

Employment 1968 and projected 1980 requirements

	All industries	Construction industry
Employment 1968	869,000	670,000
Projected 1980 requirements	1,075,000	825,000
Percent growth	23.7	23.1
Annual openings, total	39,300	30,000
Growth	17,200	13,000
Replacements	22,100	17,000

Employment 1960–68

Employment 1960	832,000	
Employment 1968	869,000	
Percent growth	4.4	
Annual openings, total	23,900	
Growth	4,600	
Replacements	19,300	
Available training data:		
MDTA (OJT)	3,700	
MDTA Institutional	500	
Apprenticeship	3,698 (1969)	3,256 (annual average 1961–68)
Vocational education completions:		
Secondary	7,472	
Post-secondary	1,080	

Cement Masons. A 3-year apprenticeship program that includes related classroom instruction is recommended. During the 1960's, apprenticeship completions numbered about 12 percent of openings resulting from growth and death and retirement. Education above the grade school level is desirable. Skills may also be acquired informally on the job.

Employment 1968 and projected 1980 requirements

	All industries	Construction industry
Employment 1968	60,000	55,000
Projected 1980 requirements	90,000	85,000
Percent growth	50.0	54.5
Annual openings, total	3,600	3,600
Growth	2,500	2,500
Replacements	1,100	1,100

Employment 1960–68

Employment 1960	45,000	
Employment 1968	60,000	
Percent growth	33.3	
Annual openings, total	2,700	
Growth	1,900	
Replacements	800	
Available training data:		
Apprenticeship completions	300 (1969)	327 (annual average 1961–68)

Electricians (construction). A high school education is required for electrician jobs. An apprenticeship program lasting 4 years and including 144 hours of classroom instruction each year is recommended. During the 1960's, apprenticeship completions numbered about 55

percent of openings resulting from growth and death and retirement. Most cities require electricians to pass licensing examinations. Training may also be acquired on the job. Some skills of the trade may also be acquired through vocational school courses.

Employment 1968 and projected 1980 requirements

Employment 1968	190,000
Projected 1980 requirements	270,000
Percent growth	42.1
Annual openings, total	10,500
Growth	6,700
Replacements	3,800

Employment 1960–68

Employment 1960	155,000
Employment 1968	190,000
Percent growth	22.6
Annual openings, total	7,200
Growth	4,400
Replacements	2,800

Available training data:[1]		
Apprenticeship completions	5,091 (1969)	4,005 (annual average (1961–68)

[1] Vocational education curriculums are provided for electricians but the statistics on completions are combined with data on maintenance electricians.

Elevator constructors. Training is obtained through employment as an elevator constructor helper for a number of years. At least 2 years of continuous job experience including 6 months' on-the-job training at the factory of a major elevator firm is usually necessary. The helper-trainee generally attends evening classes in vocational schools.

Employment 1968	14,500
Projected 1980 requirements	18,000
Percent growth, 1968–80	24.1
Annual openings, 1968–80 total	500
Growth	300
Replacements	200
Available training data	—

Floor covering installers. Employers prefer that floor covering installers have a high school education. Although many workers acquire their skills through informal training, a 3-to-4 year apprenticeship program, including related classroom instruction, is recommended. Training may also be obtained through formal on-the-job training. Some skills of the trade may be acquired through vocational school courses.

	All industries	*Construction industry*
Employment 1968	37,000	26,000
Projected 1980 requirements	47,000	33,000
Percent growth	27.0	26.9
Annual openings, total	1,700	1,250
Growth	800	575
Replacements	900	675
Available training data	—	—

Glaziers (construction). Although many learn the trade informally on the job, a 3-year apprenticeship is recommended. During the 1960's, completions of apprenticeship programs numbered about 45 percent of openings resulting from growth and death and retirement of glaziers in the construction industry, but some of these apprentices work outside of construction. A high school diploma or its equivalent is required for entry to apprenticeship programs.

Employment 1968 and projected 1980 requirements

Employment 1968	9,000
Projected 1980 requirements	13,000
Percent growth	44.4
Annual openings, total	500
Growth	350
Replacements	150

Employment 1960–68

Employment 1960	5,000
Employment 1968	9,000
Percent growth	80.0
Annual openings, total	500
Growth	400
Replacements	100

Available training data:		
Apprenticeship completions	217 (1969)	225 (annual average 1961–68)

Lathers. Although many lathers acquire their skills informally on the job, a 2-year apprenticeship is recommended. During the 1960's, apprenticeship completions numbered about 40 percent of openings resulting from growth and death and retirement. A high school education is encouraged.

Employment 1968 and projected 1980 requirements

	All industries[1]
Employment 1968	30,000
Projected 1980 requirements	38,000
Percent growth	26.7
Annual openings, total	1,250
Growth	650
Replacements	600

Employment, 1960–68

Employment 1960	27,000
Employment 1968	29,000
Percent growth	7.4
Annual openings, total	750
Growth	250
Replacements	500

Available training data:		
Apprenticeship completions	145 (1969)	310 (annual average 1961–68)

[1] Nearly all are employed in the construction industry.

Operating engineers. A 3-year apprenticeship program is the recommended training. A high school education or its equivalent is required for entry to these programs. Training may be obtained informally on the job by oilers (operating engineers assistants), and helpers to heavy equipment repairmen who demonstrate the initiative and skill to be given instructions by experienced operating engineers. Some skills of the trade may also be acquired through vocational school courses.

Employment 1968 and projected 1980 requirements

	All industries	*Construction industry*
Employment 1968	285,000	220,000
Projected 1980 requirements	410,000	300,000
Percent growth	43.9	36.4
Annual openings, total	14,800	10,000
Growth	10,400	6,700
Replacements	4,400	3,300

Employment, 1960–68

Employment 960	210,000
Employment 1968	285,000
Percent growth	35.7
Annual openings, total	12,500
Growth	9,400
Replacements	3,100
Available training data:	
Apprenticeship completions	829
MDTA enrollment (OJT)	800
Vocational education completions:	
Secondary	103
Post-secondary	299

Painters and paperhangers. A high school education is preferred but not essential for painter and paperhanger employment. Although a 3-year formal apprenticeship program including related classroom instruction is recommended, training may also be obtained informally, on the job. During the 1960's, apprenticeship completions numbered only about 7 percent of openings resulting from growth and death and retirement. Some skills of the trade may be acquired through vocational school courses.

Employment 1968 and projected 1980 requirements

	All industries	*Construction industry*
Employment 1968	430,000	300,000
Projected 1980 requirements	510,000	350,000
Percent growth	18.6	16.7
Annual openings, total	18,200	12,300
Growth	6,700	4,200
Replacements	11,500	8,100

Employment 1960–68

Employment 1960	415,000	
Employment 1968	430,000	
Percent growth	3.6	
Annual openings, total	12,500	
Growth	1,900	
Replacements	10,600	
Available training data:		
Apprenticeship completions	829 (1969)	860 (annual average 1961–68)
Vocational education completions:		
Secondary	405	
Post-secondary	33	

Plasterers. A 3 to 4 year apprenticeship including classroom instruction is recommended for work as a plasterer. Skills may also be acquired on the job by working as plasterers' helpers or laborers. Some skills of the trade may also be acquired through vocational school courses.

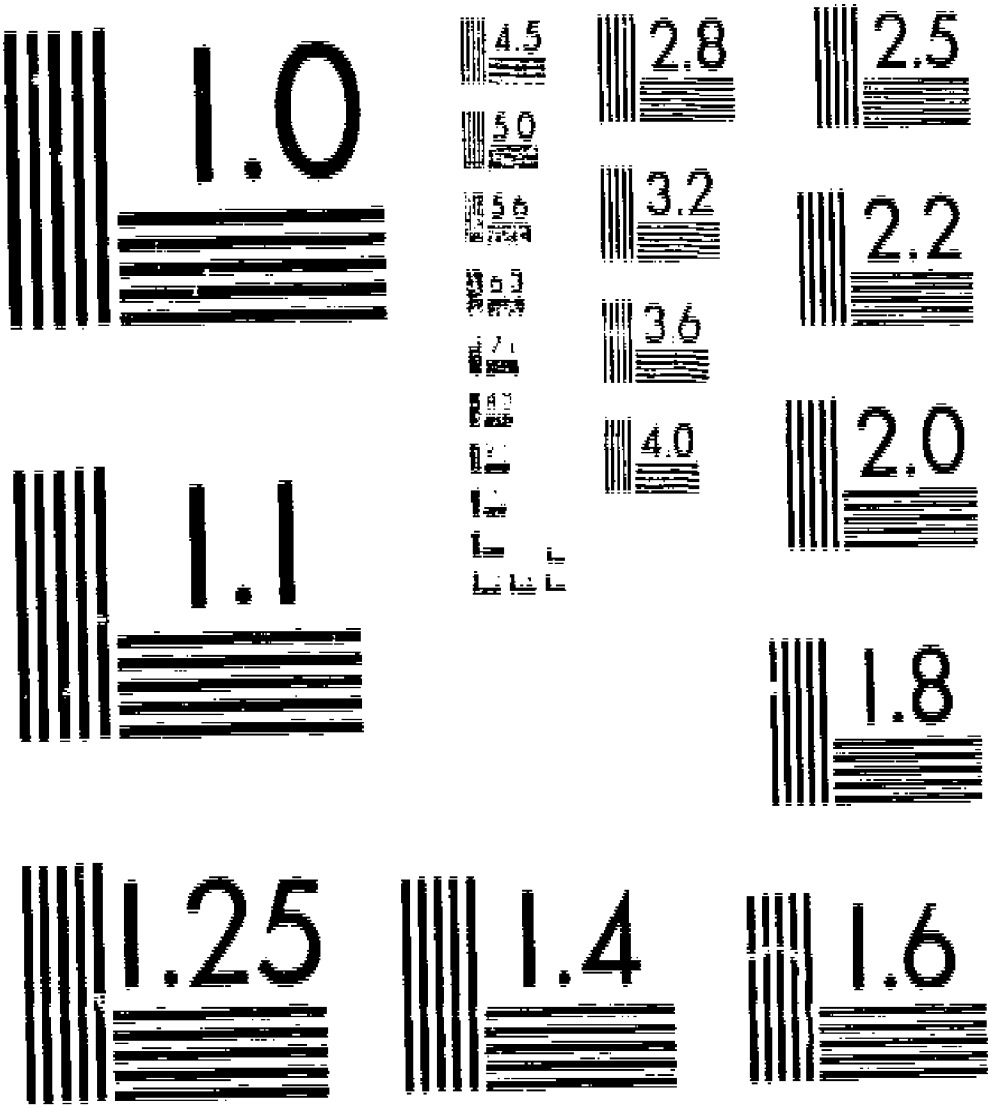
Employment 1968 and projected 1980 requirements

	All industries	*Construction industry*
Employment 1968	40,000	35,000
Projected 1980 requirements	40,000	35,000
Percent growth	0	0
Annual openings, total	700	600
Growth	0	0
Replacements	700	600

Employment 1960–68

Employment 1960	50,000	
Employment 1968	40,000	
Percent growth	-20.0	
Annual openings, total	-450	
Growth	-1,250	
Replacements	800	
Available training data:		
Apprenticeship completions	228 (1969)	248 (annual average 1961–68)
Vocational education completions:		
Secondary	26	
Post-secondary	11	

Plumbers and pipefitters. A 5-year apprenticeship including related classroom instruction is recommended for these jobs. Plumbing and pipefitting skills also may be acquired informally on the job. Some skills of the trade may be acquired through vocational school courses. Some localities require workers to pass a licensing examination.



MICROCOPY RESOLUTION TEST CHART

NATIONAL BUREAU OF STANDARDS-1963-A

Employment 1968 and projected 1980 requirements

	All industries	Construction industry
Employment 1968	330,000	210,000
Projected 1980 requirements	475,000	285,000
Percent growth	43.9	35.7
Annual openings, total	19,500	10,800
Growth	12,100	6,200
Replacements	7,400	4,600
Employment 1960–68		
Employment 1960	325,000	
Employment 1968	330,000	
Percent growth	1.5	
Annual openings, total	6,700	
Growth	600	
Replacements	6,100	
Available training data:		
Apprenticeship completions	4,888 (1969)	3,248 (annual average 1961–68)
Vocational education completions:		
Secondary	725	
Post-secondary	162	

Roofers. A 3-year apprenticeship including related classroom instruction is recommended for this work. Training also may be acquired informally on the job. A high school education or its equivalent is desirable for roofers.

Employment 1968 and projected 1980 requirements

	All industries	Construction industry
Employment 1968	55,000	50,000
Projected 1980 requirements	80,000	70,000
Percent growth	45.5	40.0
Annual openings, total	3,000	2,500
Growth	2,100	1,700
Replacements	900	800
Employment, 1960–68		
Employment 1960	50,000	
Employment 1968	55,000	
Percent growth	10.0	
Annual openings, total	1,300	
Growth	600	
Replacements	700	
Available training data:		
Apprenticeship completions	266 (annual average 1961–68)	

Sheet metal workers. A 4-year apprenticeship program including related classroom instruction is recommended for sheet metal workers. During the 1960's, the number of apprenticeship completions totaled more than openings for sheet metal workers in the construction industry, but many individuals completing the training went into other industries. A high school education or its equivalent is required for entry to apprenticeship programs. Many workers in this trade acquire their skill informally on the job. Skills of the trade may also be acquired through vocational school courses.

Employment 1968 and projected 1980 requirements

	All industries	Construction industry
Employment 1968	50,000	40,000
Projected 1980 requirements	70,000	55,000
Percent growth	40.0	37.5
Annual openings, total	2,500	2,000
Growth	1,700	1,250
Replacements	800	750
Employment, 1960–68		
Employment 1960	48,000	
Employment 1968	50,000	
Percent growth	4.2	
Annual openings, total	1,200	
Growth	500	
Replacements	700	
Available training data:		
Apprenticeship completions	2,544 (1969)	1,829 (annual average 1961–68)
Vocational education completions:		
Secondary	1,388	
Post-secondary	254	

Stonemasons, marble setters, tilesetters, and terrazzo workers. A 3-year apprenticeship program including related classroom instruction is recommended for these jobs. However, many persons acquire their skills through on-the-job training. A high school education or its equivalent is desirable for this work.

Employment 1968	30,000
Projected 1980 requirements	35,000
Percent growth, 1968–80	16.7
Annual openings, 1968–80 total	850
Growth	350
Replacements	500
Available training data	—

Structural-, ornamental-, and reinforcing-iron workers, riggers, and machine movers. A 3-year apprenticeship program including related classroom instruction is recommended for these jobs. During the 1960's, apprenticeship completions numbered about 40 percent of openings resulting from growth and death and retirement. However, many workers acquire skill on the job. A high school education or its equivalent is desirable.

Employment 1968 and projected 1980 requirements

	All industries	Construction industry
Employment 1968	75,000	45,000
Projected 1980 requirements	103,000	70,000
Percent growth	40.0	55.6
Annual openings, total	3,900	3,000
Growth	2,500	2,100
Replacements	1,400	900

Employment 1960–68

Employment 1960	65,000
Employment 1968	75,000
Percent growth	15.4
Annual openings, total	2,400
Growth	1,300
Replacements	1,100
Available training data	—

Machining occupations

All-round machinists. Although a 4-year apprenticeship is the best way of learning the machinist trade, many persons qualify through years of experience in machining jobs. A high school or vocational school education that includes courses in mathematics, physics, or machine shop is helpful. A typical apprenticeship lasts about 4 years and includes 8,000 hours of shop training and 570 hours of related classroom instruction.

Employment 1968 and projected 1980 requirements

Employment 1968	400,000
Projected 1980 requirements	450,000
Percent growth	12.5
Annual openings, total	12,600
Growth	4,200
Replacements	8,400

Employment 1960–68

Employment 1960	300,000	
Employment 1968	400,000	
Percent growth	33.3	
Annual openings, total	19,300	
Growth	12,500	
Replacements	6,800	
Available training data:		
Apprenticeship completions	3,527 (1969)	1,581 (annual average 1961–68)
MDTA enrollment		
(OJT)	1,900	
Institutional	1,800	

Layout men. From 6 to 10 years' training and experience are needed to develop the skills required for this occupation. A machinist apprenticeship or equivalent knowledge of machining operations is necessary. A layout man must be trained in mathematics; blueprint reading; and the use of precision-measuring tools.

Employment 1968	(1)
Projected 1980 requirements	(1)
Percent growth, 1968–80	(1)
Annual openings, 1968–80 total	(1)
Growth	(1)
Replacements	(1)
Available training data	—

[1] Included in all-round machinists' total.

Instrument makers—mechanical. Most instrument makers learn their trade through apprenticeships. A typical 4-year apprenticeship consists of about 8,000 hours of shop training and 570 hours of classroom instruction. Shop training includes the use of hand and machine tools and measuring instruments; classroom instruction covers subjects such as mathematics, physics, blueprint reading, chemistry, and electronics. Employers generally prefer that apprentices have a high school education, including courses in algebra, geometry, science, and machine shop work.

Employment 1968	(1)
Projected 1980 requirements	(1)
Percent growth, 1968–80	(1)
Annual openings, 1968–80 total	(1)
Growth	(1)
Replacements	(1)
Available training data	—

[1] Included in all-round machinists' total.

Setup men (machine tools). A set-up man usually must qualify as an all-round machinist or skilled machine tool operator. A set-up man must have thorough training in the operation of one or more kinds of machine tools; reading blueprints; and making computations to select speeds and feeds for machine tools.

Employment 1968	70,000
Projected 1980 requirements	85,000
Percent growth, 1968–80	26.9
Annual openings, 1968–80 total	2,600
Growth	1,500
Replacements	1,100
Available training data	—

Tool and die makers. Tool and die making can be acquired through formal 4 or 5 years formal apprenticeship or equivalent time on the job. Most employers prefer apprentices who have a high school or trade school education. Several years' experience is necessary to qualify for more difficult work. Many metal machine workers, after years of experience, take classroom training to become tool and die makers.

Employment 1968 and projected 1980 requirements

Employment 1968	150,000
Projected 1980 requirements	160,000
Percent growth	6.7
Annual openings, total	3,700
Growth	800
Replacements	2,900

Employment, 1960–68

Employment 1960	140,000
Employment 1968	150,000
Percent growth	—
Annual openings, total	3,800
Growth	1,300
Replacements	2,500

Available training data:		
Apprenticeship completions	4,125 (1969)	1,873 (annual average 1961–68)

Mechanics and repairmen

Air-conditioning, refrigeration, and heating mechanics. Most air-conditioning, refrigeration, and heating mechanics start as helpers and learn their skills on the job. Increasingly, employers prefer on-the-job trainees to be high school graduates who have had courses in mathematics, physics, and blueprint reading. Many high schools and vocational schools offer courses to prepare students for entry jobs as air-conditioning and refrigeration mechanics or oil burner mechanics.

Employment 1968	100,000
Projected 1980 requirements	140,000
Percent growth, 1968–80	40.0
Annual openings, 1968–80 total	5,000
Growth	3,300
Replacements	1,700
Available training data	—

Aircraft mechanics. Aircraft mechanics must be licensed by the FAA or the FCC. Mechanics may prepare for the trade and their licenses by working as trainees or apprentices, or as helpers to experienced mechanics. The larger airlines train apprentices in a carefully planned 3- or 4-year program of instruction and work experience. For trainee or apprentice jobs, the airlines prefer men who have a high school or trade school education including courses in mathematics, physics, chemistry, and machine shop. Other mechanics prepare for their trade by graduating from an FAA-approved mechanics school. Most of these schools have an 18 to 24-month program. Several colleges and universities also offer 2-year programs that prepare the student for the FAA mechanics examination.

Employment 1968	135,000
Projected 1980 requirements	230,000
Percent growth, 1968–80	70.4
Annual openings, 1968–80 total	9,700
Growth	7,900
Replacements	1,800
Available training data	—

Appliance servicemen. Appliance servicemen usually are hired as helpers and acquire their skills on-the-job. Trainees generally are supervised closely for 6 to 12 months. Some servicemen need up to 3 years' experience to become fully qualified. Many trainees take correspondence courses or attend technical schools to improve their skills.

Employment 1968	205,000
Projected 1980 requirements	260,000
Percent growth, 1968–80	26.8
Annual openings, 1968–80 total	8,600
Growth	4,600
Replacements	4,000

Available training data:	
Vocational education completions:	
Secondary	880
Post-secondary	1,781

Automobile body repairmen. Generally, 3 to 4 years of on-the-job training is necessary to become a fully qualified automobile body repairman. Most training authorities recommend the completion of a 3- or 4-year formal apprenticeship program as the best way to learn the trade. These programs include on-the-job and related classroom instruction. Although high school graduation usually is not required for an entry job, most employers consider this an asset.

Employment 1968 and projected 1980 requirements

Employment 1968	100,000
Projected 1980 requirements	125,000
Percent growth	25.0
Annual openings, total	3,500
Growth	2,100
Replacements	1,400

Employment, 1960–68

Employment 1960	86,000
Employment 1968	100,000
Percent growth	—
Annual openings, total	3,000
Growth	1,800
Replacements	1,200

Available training data:		
MDTA enrollment (OJT)	2,000	
Institutional	3,900	
Apprenticeship completions	211 (1969)	163 (annual average 1961–68)
Vocational education completions:		
Secondary	4,164	
Post-secondary	1,586	

Automobile mechanics. Most automobile mechanics learn the trade through 3 to 4 years of on-the-job experience. An additional year or two usually is needed to learn a specialty, such as automatic transmission repair. Most training authorities recommend completion of a 3- or 4-year formal apprenticeship program as the best way to learn this trade. Work experience as a gasoline service station attendant, training in the Armed Forces, and courses offered at high schools, vocational schools, or private trade schools are helpful.

Employment 1968 and projected 1980 requirements

Employment 1968	615,000
Projected 1980 requirements	745,000

Percent growth	21.1	
Annual openings, total	20,050	
Growth	11,300	
Replacements	8,750	
Employment, 1960–68		
Employment 1960	535,000	
Employment 1968	615,000	
Percent growth		
Annual openings, total	17,300	
Growth	10,000	
Replacements	7,300	
Available training data:		
MDTA enrollment (OJT)	2,200	
Institutional	9,700	
Apprenticeship completions	1,017 (1969)	524 (average annual 1961–68)

Bowling-pin machine mechanics. Pinsetting machine mechanics learn their skills at schools maintained by bowling-machine manufacturers. To become a trainee at a factory school, candidates usually must be 16 years old, and take written tests of mechanical ability and personality traits. After attending factory schools, trainees need several months of on-the-job experience. Employers prefer to hire persons who are high school graduates.

Employment 1968	6,500
Projected 1980 requirements	6,000
Percent growth, 1968–80	-7.7
Annual openings, 1968–80 total	50
Growth	-50
Replacements	100
Available training data	—

Business machine servicemen. Most business machine servicemen acquire their skills through on-the-job training and work experience following instruction in manufacturer's or dealer's training schools. Employers prefer trainee applicants who are high school graduates and under 30 years of age, although candidates having unusual mechanical aptitude or related work experience may be accepted without meeting these requirements. A serviceman usually needs 1 to 3 years of practical experience and on-the-job training following a formal training program before he is considered fully qualified.

Employment 1968	115,000
Projected 1980 requirements	200,000
Percent growth, 1968–80	73.9
Annual openings, 1968–80 total	8,500
Growth	7,100
Replacements	1,400
Available training data:	
Vocational education completions:	
Secondary	379
Post-secondary	119

Electric sign servicemen. Most electric sign servicemen are trained on the job; generally, 3 years of on-the-job training are required to become fully qualified. Some qualify through apprenticeship programs that combine on-the-job training and classroom instruction and last 3 to 5 years. Employers prefer to hire high school graduates. Many cities require servicemen to have licenses. An applicant can obtain a license by passing a comprehensive examination in electrical theory.

Employment 1968	6,100
Projected 1980 requirements	8,200
Percent growth, 1968–80	34.4
Annual openings, 1968–80 total	300
Growth	200
Replacements	100
Available training data	—

Farm equipment mechanics. Most farm equipment mechanics begin as helpers and learn their skills on the job. Generally, at least 3 years of on-the-job training is necessary before a person can become a qualified mechanic. Some mechanics have completed a 3 to 4 year apprenticeship program that includes on-the-job training and related classroom instruction.

Employment 1968	40,000
Projected 1980 requirements	45,000
Percent growth, 1968–80	12.5
Annual openings, 1968–80 total	1,100
Growth	400
Replacements	700
Available training data	—

Industrial machinery repairmen. Most workers who become industrial machinery repairmen begin as helpers and acquire their skills through several years' experience on the job. Others learn their trade through 4-year formal apprenticeship programs consisting of on-the-job training and related classroom instruction.

Employment 1968	175,000
Projected 1980 requirements	220,000
Percent growth, 1968–80	25.7
Annual openings, 1968–80 total	7,500
Growth	3,750
Replacements	3,800
Available training data	—

Instrument repairmen. Instrument repairmen may learn their trade on-the-job or through formal apprenticeship programs. Apprenticeships generally last 4 years and combine courses with actual work experience. Some train for instrument repair work in technical institutes or junior colleges. These schools offer programs that usually last 2 years and emphasize basic engineering courses, science, and mathematics. Men hired as trainees or apprentices generally must be high school graduates.

Employment 1968	85,000
Projected 1980 requirements	120,000
Percent growth, 1968–80	41.2
Annual openings, 1968–80 total	4,600
Growth	2,900
Replacements	1,700
Available training data:	
Vocational education completions:	
Secondary	232
Post-secondary	211

Maintenance electricians. Maintenance electricians learn the skills of their trade on the job or through formal apprenticeship programs. Apprenticeships usually last 4 years and combine on-the-job training with classroom instruction in related technical subjects. More than 4 years generally are required to become a maintenance electrician informally, on the job. A growing number of cities and counties require electricians to pass a comprehensive examination and get a license.

Employment 1968	240,000
Projected 1980 requirements	305,000
Percent growth, 1968–80	27.1
Annual openings, 1968–80 total	9,900
Growth	5,400
Replacements	4,500
Available training data	—

Millwrights. Millwrights acquire their skills on the job or through apprenticeship programs. Apprenticeships generally last 4 years and combine shop training with related classroom instruction. Many companies require that apprentice applicants be high school graduates between the ages of 18 and 26. High school courses in science, mathematics, mechanical drawing, and machine shop are important for the prospective millwright.

Employment 1968	75,000
Projected 1980 requirements	85,000
Percent growth, 1968–80	13.3
Annual openings, 1968–80 total	2,400
Growth	900
Replacements	1,500
Available training data	—

Television and radio service technicians. Workers may qualify as television and radio service technicians through technical, vocational, or high school training in electronics subjects, mathematics, and physics. Two or 3 days' combined training and on-the-job experience are needed to become a qualified technician. Home study courses also are helpful. Young men often gain experience in servicing electronic equipment through military service.

Employment 1968	125,000
Projected 1980 requirements	145,000
Percent growth, 1968–80	16.0
Annual openings, 1968–80 total	3,000
Growth	1,700
Replacements	1,300
Available training data	—

Truck mechanics and bus mechanics. Most truck or bus mechanics learn their skills on the job. Generally, 3 to 4 years' experience is necessary to qualify as an all-round mechanic. A formal 4-year apprenticeship is the recommended way to learn these trades. Typical apprenticeships consist of about 8,000 hours of shop training and 576 hours of related classroom instruction. For entry jobs, employers usually seek high school graduates who are at least 18 years of age. High school or vocational school courses in automobile repair, and mathematics are useful. For some jobs that require driving, the mechanic must have a State chauffeur's license or meet qualifications for drivers established by the U.S. Department of Transportation.

Employment 1968	110,000
Projected 1980 requirements	130,000
Percent growth, 1968–80	18.2
Annual openings, 1968–80 total	2,900
Growth	1,400
Replacements	1,500
Available training data	—

Vending machine mechanics. Although not required, many beginning vending machine mechanics are high school graduates. High school or vocational school courses in electricity and machine repair are helpful. Mechanic trainees acquire their skills by working 6 months to 2 years on the job or by attending manufacturer-sponsored training sessions. A commercial driver's license and a good driving record usually are required for vending machine repair jobs.

Employment 1968	16,000
Projected 1980 requirements	20,000
Percent growth, 1968–80	25.0
Annual openings, 1968–80 total	650
Growth	350
Replacements	300
Available training data	—

Watch repairmen. Many persons prepare for this trade through courses given in private watch repair schools or public vocational high schools. Some are trained informally on the job or through formal apprenticeship. Although not required, students in most watch repair schools are high school graduates. A few States require watch repairmen to pass a qualifying examination and obtain a license.

Employment 1968	20,000
Projected 1980 requirements	21,000
Percent growth, 1968–80	5.0

Annual openings, 1968–80 total	1,400
Growth	800
Replacements	600
Available training data	—

Printing (graphic arts) occupations

Bookbinders and related workers. A 4- or 5-year apprenticeship that combines on-the-job training with related classroom instruction generally is required to qualify as a skilled bookbinder. Apprenticeship applicants usually must have a high school education and be at least 18 years of age. For the less skilled bindery occupations, the training period may last from several months to 2 years.

Employment 1968 and projected 1980 requirements

Employment 1968	30,000
Projected 1980 requirements	25,000
Percent growth	–16.7
Annual openings, total	400
Growth	–400
Replacements	800

Employment 1960–68

Employment 1960	28,000
Employment 1968	30,000
Percent growth	7.1
Annual openings, total	1,200
Growth	300
Replacements	900

Available training data:		
Apprenticeship completions	315 (1969)	228 (average annual 1961–68)

Composing room occupations. Most compositors learn their trade through apprenticeships that generally require 6 years of progressively advanced training supplemented by classroom instruction or correspondence courses. Some work as helpers for several years or combine trade school and helper experience. A typical apprenticeship program for compositors includes instruction in elementary hand composition; page makeup; proofreading; and intensive training in one or more specialized fields. Applicants for apprenticeships usually must be high school graduates.

Employment 1968 and projected 1980 requirements

Employment 1968	190,000
Projected 1980 requirements	180,000
Percent growth	–5.3
Annual openings, total	3,200
Growth	–800
Replacements	4,000

Employment 1960–68

Employment 1960	180,000
Employment 1968	190,000
Percent growth	5.6
Annual openings, total	5,300
Growth	1,300
Replacements	4,000

Available training data:		
Apprenticeship completions	837 (1969)	767 (average annual 1961–68)

Electrotypers and stereotypers. Electrotypers and stereotypers usually learn their trades through apprenticeships which last 5 or 6 years and includes training on the job and classes in related technical subjects. Apprenticeship applicants usually must be at least 18 years of age and have a high school education or its equivalent.

Employment 1968 and projected 1980 requirements

Employment 1968	8,000
Projected 1980 requirements	6,000
Percent growth	–25.0
Annual openings, total	–25
Growth	–175
Replacements	150

Employment 1960–68

Employment 1960	9,000
Employment 1968	8,000
Percent growth	–11.1
Annual openings, total	500
Growth	–1,200
Replacements	1,700

Available training data:		
Apprenticeship completions	27 (1969)	80 (average annual 1961–68)

Lithographic occupations. A 4- or 5-year apprenticeship usually is required to become a well-rounded lithographic craftsman. In this program, an apprentice becomes familiar with all lithographic operations, although the specific occupation in which he seeks journeyman status is emphasized. Apprenticeship applicants generally must be at least 18 years of age, high school graduates, and in good physical condition.

Employment 1968	73,000
Projected 1980 requirements	80,000
Percent growth, 1968–80	9.6
Annual openings, 1968–80 total	1,800
Growth	600
Replacements	1,200
Available training data:	
Apprenticeship completions	785

Photoengravers. Most photoengravers learn their skills through a 5-year apprenticeship which includes at least 800 hours of related classroom instruction. Applicants must be at least 18 years of age, have a high school education or its equivalent, and know chemistry, physics, and art. Credit for previous experience acquired

in photoengraving work may shorten the required apprenticeship time.

Employment 1968	18,000
Projected 1980 requirements	18,000
Percent growth, 1968–80	0.0
Annual openings, 1968–80 total	300
Growth	0
Replacements	300
Available training data:	
Apprenticeship completions	54

Printing pressmen and assistants. The most common way of learning the pressman's trade is through a 2- to 5-year apprenticeship that combines on-the-job training and related classroom or correspondence school work. Some workers learn the skills as helpers or press assistants or through a combination of work experience and training in vocational or technical schools. A high school education or its equivalent generally is required; courses in physics and chemistry are recommended.

Employment 1968 and projected 1980 requirements

Employment 1968	90,000
Projected 1980 requirements	105,000
Percent growth	16.7
Annual openings, total	2,850
Growth	1,250
Replacements	1,600

Employment 1960–68

Employment 1960	76,000	
Employment 1968	90,000	
Percent growth	18.4	
Annual openings, total	3,100	
Growth	1,800	
Replacements	1,300	
Available training data:		
Apprenticeship completions	826 (1969)	538 (average annual 1961–68)

Telephone industry occupations

Central office craftsmen. The telephone companies usually hire inexperienced men to train for skilled jobs in central offices. Applicants for these jobs must have at least a high school or vocational school education. Telephone training and experience in the Armed Forces or technical training beyond high school may be helpful.

Employment 1968	80,000
Projected 1980 requirements	92,000
Percent growth, 1968–80	15.8
Annual openings, 1968–80 total	2,700
Growth	1,000
Replacements	1,700
Available training data	—

Central office equipment installers. Applicants must have a high school or vocational school education. Men with some college education, especially those with engineering training, often are hired for these jobs.

Employment 1968	22,000
Projected 1980 requirements	22,000
Percent growth, 1968–80	0.0
Annual openings, 1968–80 total	400
Growth	0
Replacements	400
Available training data	—

Linemen and cable splicers. Telephone companies train high school or vocational school graduates as linemen and cable splicers. Men who have received telephone training and experience in the Armed Forces frequently are given preference for job openings.

Employment 1968	40,000
Projected 1980 requirements	39,000
Percent growth, 1968–80	6.8
Annual openings, 1968–80 total	600
Growth	200
Replacements	400
Available training data	—

Telephone and PBX installers and repairmen. The minimum educational requirement for telephone PBX installers and repairmen is a high school or vocational school education. Telephone companies give classroom and on-the-job training to inexperienced men. These workers continue training to qualify for more difficult assignments.

Employment 1968	86,000
Projected 1980 requirements	100,000
Percent growth, 1968–80	16.9
Annual openings, 1968–80 total	3,000
Growth	1,200
Replacements	1,800
Available training data	—

Other crafts occupations

Automobile trimmers and installers (automobile upholsterers). A high school education is desirable but not essential. High school and vocational school courses in furniture upholstery provide valuable training; courses in mathematics also are helpful. Although a small number of workers learn through 3- or 4-year apprenticeships, most automobile upholsterers learn their skills on the job.

Employment 1968	8,000
Projected 1980 requirements	10,000
Percent growth, 1968–80	25.0
Annual openings, 1968–80 total	350
Growth	175
Replacements	175
Available training data	—

Blacksmiths. Most workers enter this occupation by obtaining jobs as helpers in blacksmith shops; others enter through 3 or 4 years of formal apprenticeship training.

Employment 1968	15,000
Projected 1980 requirements	14,000
Percent growth, 1968–80	-6.7
Annual openings, 1968–80 total	500
Growth	-100
Replacements	600
Available training data	—

Boilermaking occupations. Although many men work as helpers to experienced boilermakers, and many layout men and fit up men acquire skills on the job, training authorities agree that a 4-year apprenticeship is the best way to learn this trade. Most employers prefer to hire beginning workers having a high school education.

Employment 1968 and projected 1980 requirements

Employment 1968	25,000
Projected 1980 requirements	30,000
Percent growth	20.0
Annual openings, total	1,000
Growth	400
Replacements	600

Employment 1960–68

Employment 1960	24,000
Employment 1968	25,000
Percent growth	4.2
Annual openings, total	600
Growth	100
Replacements	500

Available training data:		
Apprenticeship completions	180 (1969)	100 (average annual 1961–68)

Dispensing opticians and optical mechanics. Although most optical mechanics and dispensing opticians learn skills on the job, training authorities agree that an apprenticeship offers more job opportunities, security, and advancement than learning on the job.

Employment 1968	22,000
Projected 1980 requirements	23,000
Percent growth, 1968–80	4.5
Annual openings, 1968–80 total	500
Growth	100
Replacements	400
Available training data:	
Vocational education completions:	
Secondary	44
Post-secondary	77

Foremen. Most workers who are promoted to foremen are high school graduates who have learned their skills on the job. Although fewer than one-tenth of all foremen are college graduates, a growing number of employers are hiring foremen trainees with college backgrounds.

Employment 1968	1,444,000
Projected 1980 requirements	1,730,000
Percent growth, 1968–80	19.8
Annual openings, 1968–80 total	56,200
Growth	24,000
Replacements	32,000
Available training data	—

Furniture upholsterers. The most common way to learn this trade is to complete on-the-job training in an upholstery shop. Other ways of acquiring training are by working for furniture manufacturers in jobs closely related to upholstering and through vocational or high school courses. A few people acquire the necessary skills through formal apprenticeship programs.

Employment 1968	32,000
Projected 1980 requirements	33,000
Percent growth, 1968–80	3.1
Annual openings, 1968–80 total	800
Growth	100
Replacements	700
Available training data:	
Vocational education completions:	
Secondary	1,330
Post-secondary	332

Jewelers and jewelry repairmen. Young persons generally learn the jewelry trade either by serving a 3- to 4-year formal apprenticeship or through informal on-the-job training while working for an experienced jeweler.

Employment 1968	25,000
Projected 1980 requirements	25,000
Percent growth, 1968–80	0.0
Annual openings, 1968–80 total	200
Growth	0
Replacements	200
Available training data	—

Locomotive engineers. Firemen (helpers) who have qualified for promotion are selected on a seniority basis to fill engineer positions. To qualify, the applicant must pass a comprehensive examination.

Employment 1968	35,000
Projected 1980 requirements	33,000
Percent growth, 1968–80	-5.7
Annual openings, 1968–80 total	1,350
Growth	-150
Replacements	1,500
Available training data	—

Locomotive firemen. Employers prefer applicants who have a high school education or equivalent. Firemen who have sufficient experience and seniority and who pass qualifying examinations can be promoted to

engineer. Newly hired firemen who have demonstrated ability on trial trips and passed qualifying examinations are subject to call for temporary work assignments.

Employment 1968	19,000
Projected 1980 requirements	14,100
Percent growth, 1968–80	–25.8
Annual openings, 1968–80 total	–200
Growth	–400
Replacements	200
Available training data	—

Motion picture projectionists. Most motion picture theaters in urban areas are unionized, and young people who aspire to work as motion picture projectionists in these theaters must complete a period of apprenticeship. A high school education is preferred by employers. In a non-union theater, a young man may start as an usher or helper and learn the trade by working with an experienced projectionist.

Employment 1968	16,000
Projected 1980 requirements	18,000
Percent growth, 1968–80	12.5
Annual openings, 1968–80 total	750
Growth	150
Replacements	600
Available training data	—

Shoe repairmen. Most shoe repairmen are hired as helpers and receive on-the-job training in large shoe repair shops. Some shoe repairmen learn this trade in vocational schools. Others enter the occupation through apprenticeship training programs.

Employment 1968	30,000
Projected 1980 requirements	30,000
Percent growth, 1968–80	0.0
Annual openings, 1968–80 total	1,500
Growth	0
Replacements	1,500
Available training data:	
Vocational education completions:	
Secondary	248
Post-secondary	26

Shop trades (railroad). Apprenticeship training is a common way of entering the railroad shop trades, although many workers are upgraded from helpers and laborers. Others enter the railroad industry as shop craftsmen.

Employment 1968	87,000
Projected 1980 requirements	85,000
Percent change, 1968–80	–2.3
Annual openings, 1968–80 total	2,250
Growth	–150
Replacements	2,400
Available training data	—

Stationary engineers. Many stationary engineers start as helpers or craftsmen in other trades and acquire their skills informally on the job. Most training authorities, however, recommend formal apprenticeship training as the best way to learn this trade. In selecting apprentices, most joint labor-management apprenticeship committees prefer high school or trade school graduates.

Employment 1968	260,000
Projected 1980 requirements	275,000
Percent growth, 1968–80	5.8
Annual openings, 1968–80 total	7,000
Growth	1,250
Replacements	5,800
Available training data	—

Operatives

These workers ordinarily receive only brief on-the-job training. The simplest repetitive and routine semiskilled jobs can be learned in a day and mastered in a week. Even those jobs that require a higher degree of skill can be learned in a few months. The ability to learn new jobs quickly, however, is an important qualification for semiskilled workers.

Employment 1968	13,955,000
Projected 1980 requirements	15,400,000
Percent growth, 1968–80	10.4
Annual openings, 1968–80 total	426,000
Growth	120,000
Replacements	306,000
Available training data	—

Driving occupations

Busdrivers, intercity. Most companies prefer applicants having a high school education or its equivalent. Some States require the applicant to have a chauffer's license. All drivers must be 21 years old and meet minimum health and experience qualifications established by the U.S. Department of Transportation. Applicants must have a good record and 1 year's driving experience. On-the-job training usually lasts for 2 to 6 weeks but can extend to 3 months.

Employment 1968	24,000
Projected 1980 requirements	28,000
Percent growth, 1968–80	17.5

Annual openings, 1968–80 total	900
Growth	350
Replacements	550
Available training data	—

Busdriver–local transit. Many employers prefer applicants having a high school education or its equivalent. Generally, a motor vehicle operator's permit and 1 or 2 years of driving experience on some type of motor vehicle are basic requirements. Most States require a chauffer's license. Most companies train new workers on the job.

Employment 1968	65,000
Projected 1980 requirements	56,000
Percent growth, 1968–80	–13.9
Annual openings, 1968–80 total	500
Growth	–800
Replacements	1,300
Available training data	—

Routemen. In most States, a routeman is required to have a chauffer's license. Most employers require high school graduation. Sales experience or a job as routeman's helper or work in a bakery, dairy, laundry, or dry cleaning establishment are valuable qualifications. Most companies train new workers on the job.

Employment 1968	235,000
Projected 1980 requirements	250,000
Percent growth, 1968–80	5.1
Annual openings, 1968–80 total	3,800
Growth	1,000
Replacements	2,800
Available training data	—

Truck drivers, over-the-road. Many employers require at least a grade school education; others require 2 years of high school. Driver training courses in high school, driving schools, or technical vocational schools are recommended. A course in automotive mechanics is helpful. Some companies have formal testing and training programs. At least 1 year of driving experience is required and most States require a chauffer's license. Previous experience in local trucking is a valuable qualification.

Employment 1968	640,000
Projected 1980 requirements	800,000
Percent growth, 1968–80	24.7
Annual openings, 1968–80 total	21,600
Growth	13,200
Replacements	8,400
Available training data	—

Other operative occupations

Assemblers. Assemblers are usually trained on the job in a few days or weeks. High school graduates or workers who have taken vocational school courses, such as blueprint-reading, are preferred by many employers although a high school diploma is not usually required.

Employment 1968	785,000
Projected 1980 requirements	850,000
Percent growth, 1968–80	8.4
Annual openings, 1968–80 total	26,000
Growth	5,500
Replacements	20,500
Available training data	—

Taxi drivers. In addition to a State-issued chauffer's license, a taxi driver must have a special operator's license issued by the local police, safety department, or Public Utilities Commission. Some companies teach the applicant taxicab regulations and the location of streets. Formal education seldom is required. However, many companies prefer applicants who have at least an eighth grade education.

Employment 1968	85,000
Projected 1980 requirements	75,000
Percent growth, 1968–80	–10.7
Annual openings, 1968–80 total	1,200
Growth	–700
Replacements	1,900
Available training data	—

Truck drivers, local. Some employers prefer applicants who have completed 2 to 4 years of high school. Training is often informal. Applicants sometimes ride with and observe an experienced driver. Some companies give a 1- or 2-day indoctrination course which covers general duties, the efficient operation and loading of a truck, company policies, and the preparation of delivery forms and company records. A few receive training sponsored by Federal Government programs.

Employment 1968	1,200,000
Projected 1980 requirements	1,450,000
Percent growth, 1968–80	21.9
Annual openings, 1968–80 total	37,000
Growth	21,500
Replacements	15,500
Available training data	—

Automobile painters. Most automobile painters start as helpers and acquire their skills informally by working for 3 to 4 years with experienced painters. A small number learn through a 3-year apprenticeship. Applicants having a high school education are preferred.

Employment 1968	30,000
Projected 1980 requirements	35,000
Percent growth, 1968–80	25.0
Annual openings, 1968–80 total	1,200
Growth	600
Replacements	600
Available training data	—

Brakemen railroad. A high school education or its equivalent is preferred. No previous training is required. The usual training is on the job and lasts about a year.

Employment 1968	74,000
Projected 1980 requirements	70,000
Percent growth, 1968–80	–5.2
Annual openings, 1968–80 total	1,000
Growth	–300
Replacements	1,300
Available training data	—

Electroplaters. Most electroplaters learn their skills on the job. Others train through a 3- or 4-year apprenticeship. High school, vocational school, college, and technical institute courses in electroplating are useful.

Employment 1968	13,000
Projected 1980 requirements	15,700
Percent growth, 1968–80	20.8
Annual openings, 1968–80 total	600
Growth	200
Replacements	400
Available training data	—

Gasoline and service station attendants. A high school education is preferred for these jobs. Most gasoline and service station attendants acquire their skills on the job. These workers must have a driver's license, a general understanding of how an automobile works, and a knowledge of simple arithmetic. It usually takes from several months to a year for a gasoline service station attendant to become fully qualified. Formal training for this occupation is available in some high schools. Most oil companies conduct 2 to 8 weeks of formal training programs for service station managers.

Employment 1968	400,000
Projected 1980 requirements	475,000
Percent growth, 1968–80	15.9
Annual openings, 1968–80 total	10,900
Growth	6,200
Replacements	4,700
Available training data	—

Inspectors (manufacturing). Inspectors are usually trained on the job for a brief period—from a few hours or days to several months. Workers having a high school education are preferred.

Employment 1968	585,000
Projected 1980 requirements	635,000
Percent growth, 1968–80	8.5
Annual openings, 1968–80 total	19,200
Growth	4,200
Replacements	15,000
Available training data	—

Machine tool operators. Usually 1½ to 2 years of on-the-job training is needed for this work. Courses in mathematics and blueprint reading are useful.

Employment 1968	500,000
Projected 1980 requirements	520,000
Percent growth, 1968–80	4.0
Annual openings, 1968–80 total	10,500
Growth	1,700
Replacements	8,800
Available training data	—

Meat cutters. Most meat cutters acquire their skills either through a 2- to 3-year apprenticeship program or on the job. Workers having a high school education are preferred. Training in mathematics, English, and the use of power tools is helpful.

Employment 1968	200,000
Projected 1980 requirements	200,000
Percent growth, 1968–80	2.6
Annual openings, 1968–80 total	4,500
Growth	400
Replacements	4,100
Available training data:	
MDTA enrollment completions	
Institutional	630
Vocational education completions:	
Secondary	630
Post-secondary	107

Photographic laboratory workers. Although generally is not required for semiskilled jobs in photographic laboratory work, completion of high school frequently is needed for advancement to supervisory jobs. Generally, the training time required to become a specialist in a particular activity is less than that needed to become an all-round darkroom technician. Training on the job to become a fully qualified darkroom technician usually takes 3 or 4 years. Completion of college level courses in this field is important for people aspiring to supervisory jobs in photographic laboratories. On-the-job training for workers in semiskilled photo lab occupations range from a few weeks to several months.

Employment 1968	30,000
Projected 1980 requirements	39,000
Percent growth, 1968–80	29.9
Annual openings, 1968–80 total	1,600
Growth	750
Replacements	850
Available training data:	
Vocational education completions:	
Secondary	711
Post-secondary	666

Power truck operators. Most workers can learn to operate a power truck in a few days. It may take several weeks, however, to learn the physical layout and operation of a plant or other establishment and the most efficient way of handling the materials to be moved.

Employment 1968	163,000
Projected 1980 requirements	183,000
Percent growth, 1968–80	12.2

Annual openings, 1968–80 total	4,100
Growth	1,500
Replacements	2,600
Available training data	—

Production painters. High school graduation is not generally required for a production painter. Most workers in this field receive on-the-job training that lasts from 2 weeks to several months.

Employment 1968	160,000
Projected 1980 requirements	170,000
Percent growth, 1968–80	8.5
Annual openings, 1968–80 total	4,000
Growth	1,100
Replacements	2,900
Available training data	—

Signal department workers (railroad). Railroads prefer that these workers have a high school education or its equivalent. Knowledge of electricity and mechanical skill are assets to young men seeking these jobs. New employees are hired as helpers and after about 1 year of training on the job they usually advance to assistant. Openings for signalmen and signal maintainers are filled by promoting qualified assistants according to seniority rules.

Employment 1968	12,100
Projected 1980 requirements	11,600
Percent growth, 1968–80	-4.5
Annual openings, 1968–80 total	-450
Growth	-550
Replacements	100
Available training data	—

Stationary firemen (boiler). Some large cities and a few States require stationary firemen to be licensed. Although requirements differ from State to State, the applicant usually must have the necessary experience and pass an examination to qualify. Firemen sometimes supplement on-the-job training by taking courses in subjects such as practical chemistry; elementary physics; blueprint reading; applied electricity; and the theory of refrigeration, air-conditioning, ventilation, and heating.

Employment 1968	73,000
Projected 1980 requirements	58,000
Percent growth, 1968–80	-20.6
Annual openings, 1968–80 total	-600
Growth	-1,300
Replacements	700
Available training data	—

Waste water treatment plant operators. Entry jobs generally do not require specific training, and most operators learn their skills on the job. Most municipalities accept men with less than a high school education; however, in a number of large municipalities applicants must have a high school education or its equivalent. Most States have certification programs that issue qualification standards for operators. Sixteen States have adopted mandatory certification, while voluntary certification programs are in effect in 29 States.

Employment 1968	23,500
Projected 1980 requirements	40,000
Percent growth, 1968–80	68.9
Annual openings, 1968–80 total	2,500
Growth	1,400
Replacements	1,100
Available training data	—

Bridge and building workers (railroad). New employees usually receive their training on the job as helpers.

Employment 1968	11,200
Projected 1980 requirements	10,900
Percent growth, 1968–80	-2.7
Annual openings, 1968–80 total	275
Growth	-25
Replacements	300
Available training data	—

Track workers (railroad). Track workers generally are trained on the job. Up to 2 years are required to learn the skills of an all-round trackman. Most railroads seek men between the ages of 21 and 45 who are able to read, write, and perform heavy work. Applicants often are required to take physical examinations.

Employment 1968	57,000
Projected 1980 requirements	55,000
Percent growth, 1968–80	-3.7
Annual openings, 1968–80 total	1,300
Growth	-200
Replacements	1,500
Available training data	—

Welders and oxygen and arc cutters. Generally, it takes several years of training to become a skilled manual arc or gas welder, and somewhat longer to become a combination welder. Some skilled jobs may require a knowledge of blueprint reading, welding symbols, metal properties, and electricity. Some of the less skilled jobs, however, can be learned after a few months of on-the-job training. For entry in manual welding jobs, most employers prefer to hire young men who have high school or vocational school training in welding methods. Before being assigned to work where the strength of the weld is a highly critical factor, welders may be required to pass a qualifying examination. Where critical safety factors are involved, certification may be necessary. Some localities require welders to obtain a license before they can do certain types of outside construction work.

Employment 1968	480,000
Projected 1980 requirements	675,000
Percent growth, 1968–80	40.6
Annual openings, 1968–80	23,000
Growth	16,600
Replacements	7,000

Available training data:

MDTA enrollment completions:	
OJT	1,700
Institutional	8,800
Vocational education completions:	
Secondary	6,596
Post-secondary	4,254

Laborers (Nonfarm)

Much of the work that nonfarm laborers perform involves simple tasks that require little special training. Brief instruction and a few hours of on-the-job training usually are sufficient preparation for a job as a nonfarm laborer.

Employment 1968	3,555,000
Projected 1980 requirements	3,500,000
Percent growth, 1968–80	-1.5
Annual openings, 1968–80 total	60,000
Growth	-4,000
Replacements	64,000
Available training data	—

Construction laborers and hod carriers. Little formal training is required for work as a building or construction laborer. Employers generally seek young men who are at least 18 years of age and in good physical condition.

Employment 1968	750,000
Projected 1980 requirements	925,000
Percent growth, 1968–80	23.3
Annual openings, 1968–80 total	29,000
Growth	15,000
Replacements	14,000
Available training data	—

Appendix A. Methodology and Assumptions of Requirements Projections

The methods used to develop the projected 1980 requirements presented in this report are the same as those used in other Bureau of Labor Statistics studies of future occupational needs. The BLS has developed projections that encompass a number of interrelated components and permit a comprehensive view of tomorrow's economy and its manpower needs. The projections prepared by BLS cover labor force, hours of employment, output per manhour, potential demand, gross national product or GNP, the composition of demand, output and productivity by 82 detailed industry groups, and employment in over 250 industries and in detailed occupations.[1]

Projection methods

The first step in making industry and occupational projections is to use statistics made by the Bureau of Census of total population to the target year and its composition by age, sex, and color. As a second step, the Bureau of Labor Statistics develops projections of the labor force by age, sex, and color on the basis of population and changing labor force participation rates for each group in the population. These changes reflect a variety of factors, including changing educational standards, retirement practices, and participation of women in the labor force. Labor force projections are then translated into the level of gross national product (GNP) that can be produced by a fully employed labor force. GNP is derived by subtracting unemployment from the labor force and multiplying that figure by an estimate of output per worker in the target year of the projection. Calculations are not so simple as it may seem. Allowance must be made for average growth in productivity and expected changes in hours of work.

The next step is to distribute this potential growth in real GNP among the major components of GNP: consumer expenditures, business investment, government expenditures—Federal, State, and local—and net foreign demand. In distributing GNP among its components, alternatives are considered.

After calculating and distributing potential GNP growth among its major categories, projections are developed for each of the major demand categories, such as the amount spent by consumers for food, clothing, rent, automobiles, drugs, cosmetics, trips abroad, medical expenses, and other goods and services. For each of the major GNP demand categories, a different procedure is followed in allocating demand to the producing industry.

Once estimates are developed for the products or service to be purchased, the production load is allocated not only to the various industries which make the final product but also to the intermediate and basic industries which provide raw materials, components, transportation, electric power, and other goods or services required in making final products. For this purpose, the Department of Commerce has developed an input-output table for the economy of the United States. This table shows transactions among industries; effects of such transactions can be traced among industries.

Estimates of production in each industry are then translated into employment requirements by projecting changes in output per man-hour in each industry and dividing this figure into output. Changes in output per man-hour are developed through studies of productivity and technological trends in all industries. These studies provide inputs to assess such things as potential competition among products, potential employment and economic effects of new technologies and inventions, and the effect of technological changes on the occupational structure of industries.

As an independent check and to develop more detailed industry employment projections than allowed for by input-output tables, a regression analysis is conducted relating production and employment in various industries against the levels of final demand and other key variables. Also, detailed in-depth studies are conducted on several industries which encompass the development of projections of requirements through the analysis of a variety of economic variables. Results of the regression analysis and input-output model are evaluated along with detailed industry analyses to develop final industry projections.

Projections of industry manpower requirements are

[1] A summary report of all 1980 projections with a more detailed statement on methodology has been published by the Bureau entitled, *The U.S. Economy in 1980* (BLS Bulletin 1673).

then translated into occupational requirements. This calculation is made through the use of occupational composition patterns for all industries in the United States, which are summarized in the BLS Industry-Occupational Matrix. This matrix, which is divided into 120 industry sectors, shows the percentage composition of employment according to 160 occupations.[2] These patterns are applied to current employment and to projected requirements by industry to estimate current employment and future requirements by occupation. In making these projections, allowance is made for changing occupational structures based on studies of the way each industry has changed in the past and is likely to change in the future. To arrive at a total for the economy, future employment requirements for each occupation are aggregated across all industries.

For many occupations, requirements are projected on the relationship of certain independent variables rather than on proportional representation in each industry. For example, employment requirements for automobile mechanics are projected on the expected stock of motor vehicles and their maintenance requirements, and elementary school teachers on trends in pupil-teacher ratios applied to projected school attendance. Projections developed independently are meshed with other occupational data in the matrix.

After estimating the requirements of each occupation, projections are prepared of the number of workers who will be needed as replacements. These separations from the labor force resulting from all causes including occupational transfers constitute a very significant portion of total annual training needs.

Tables of working life have been developed based on actuarial experience for deaths and general patterns of labor force participation of each age.[3] Withdrawals from the labor force can be projected for men and women separately in each occupation for which age and sex are known. The net effects of inter-occupational transfers, however, are not known in any systematic fashion and can only be estimated in projecting manpower training needs.

Assumptions

The BLS projections to 1980 presented in this report are based on these specific assumptions:

The *international climate* will improve. The United States will no longer be fighting a war, but a still guarded relationship between the major powers will permit no major reductions in armaments. This assumption would still permit some reduction from the peak levels of defense expenditures during the Vietnam conflict.

Armed Forces strength will drop back to about the same level that prevailed in the pre-Vietnam escalation period.

The *institutional framework of the American economy* will not change radically.

Economic, social, technological, and scientific trends including values placed on work, education, income, and leisure will continue.

Fiscal and monetary policies will achieve a satisfactory balance between low unemployment rates and relative price stability without reducing the long-term economic growth rate.

All levels of government will join efforts to meet a wide variety of domestic requirements, but Congress will channel more funds to State and local government.

Fertility rates will be lower than they have been in the recent past.

[2] See the "Industry-Occupational Matrix," in *Occupational Employment Patterns*, 1960 and 1975 (BLS Bulletin 1599).

[3] See *Tomorrow's Manpower Needs* (BLS Bulletin 1606, Vol. I) for detailed information.

Appendix B. Detailed Occupational Projections

Appendix B presents employment estimates, projected requirements, and annual job openings in tabular form for 232 occupations in more detail than any other which the Bureau has published. They are presented only for individuals who need statistics on projections for their specific purposes. Chapter IV presents the same data along with ways workers are trained in specific occupations; statistics on completions of training programs; appendix C summarizes the training statistics in tabular form. In the table, occupations are classified in the traditional way; professional and technical workers followed by managerial, clerical, sales, craftsmen, operatives, nonfarm laborers, service, and farm workers. Within each of these major groups, however, individual occupations are classified into related fields, e.g., health, counseling, building trades, etc.

When applicable, the table includes the program code for the related instructional program used by the Office of Education in *Vocational Education* and Occupations.[1] Projections cover the following proportion of workers in the five program areas:

Program area	*Percent*
Technical	96
Health	93
Trade and industrial	82
Office	73
Distributive	22

In the table, absolute figures are rounded and percentages shown to one decimal place. Hence, totals and percentages calculated on the basis of unrounded figures do not always correspond exactly with rounded data in the table.

[1]Office of Education Bulletin OE-80061, 1969.

Table B–1. Estimated 1968 employment, projected 1980 requirements, and average annual openings, 1968–80, by occupation

Occupation	Vocational education code[1]	Estimated employment, 1968	Projected requirements, 1980	Percent change 1968-80	Average annual openings, 1968–80		
					Total	Employment change	Replacement needs
Professional and technical occupations		10,325,000	15,500,000	50.1	777,000	431,000	346,000
Business administration and related professions:							
Accountants		500,000	720,000	43.4	33,000	19,000	14,000
Advertising workers	04.01	140,000	155,000	8.1	5,700	950	4,750
Marketing research workers	04.01	20,000	42,000	105.8	2,700	1,800	900
Personnel workers	14.06	110,000	155,000	42.9	6,900	3,900	3,000
Public relations workers		100,000	165,000	64.0	8,800	5,300	3,500
Clergymen:							
Protestant clergymen		244,000	295,000	20.1	11,000	4,100	6,900
Rabbis		6,000	7,100	20.1	300	100	200
Roman Catholic priests		62,000	75,000	20.1	2,800	1,000	1,800
Conservation occupations:							
Foresters		25,000	32,000	28.0	1,000	600	400
Forestry aides	16.0603	13,000	20,000	57.3	900	600	300
Range managers		4,000	5,200	30.0	200	100	100
Counseling occupations:							
Employment counselors		5,300	10,800	102.3	700	450	250
Rehabilitation counselors		12,000	21,000	72.6	1,050	700	350
School counselors		54,000	75,000	41.8	3,800	1,900	1,900

See footnotes at end of table.

Table B–1. Continued–Estimated 1968 employment, projected 1980 requirements, and average annual openings, 1968–80, by occupation

Occupation	Vocational education codes[1]	Estimated employment, 1968	Projected requirements, 1980	Percent change 1968-80	Average annual openings, 1968–80		
					Total	Employment change	Replacement needs
Professional and technical occupations–Continued							
Engineers		1,100,000	1,500,000	40.2	73,400	36,000	[2]37,400
Aerospace		65,000	75,000	16.3	1,400	900	500
Agricultural		12,000	14,500	20.0	400	200	200
Ceramic		10,000	12,000	20.0	400	200	200
Chemical		50,000	67,000	25.8	1,600	1,100	500
Civil		180,000	270,000	48.9	11,500	7,400	4,100
Electrical		230,000	345,000	49.0	12,500	9,500	3,000
Industrial		120,000	185,000	56.5	7,200	5,500	1,700
Mechanical		215,000	275,000	27.6	8,600	5,200	3,400
Metallurgical		6,000	8,500	42.4	300	200	100
Mining		5,000	5,300	6.0	100	25	75
Health service occupations	07.000	295,000	450,000	53.1	20,000	13,000	7,000
Physicians		12,000	18,500	54.2	800	500	300
Osteopathic physicians		100,000	130,000	31.7	4,900	2,600	2,300
Dentists							
Dental hygienists	07.0102 16.0301	16,000	33,500	109.4	2,400	1,500	900
Dental laboratory technicians	07.0103	27,000	37,500	38.9	2,100	900	1,200
Registered nurses	07.0301 16.0305	660,000	1,000,000	51.5	65,000	28,000	37,000
Optometrists		17,000	21,000	23.5	800	300	500
Pharmacists		121,000	130,000	7.0	4,400	700	3,700
Podiatrists		8,500	9,500	11.8	200	100	100
Chiropractors		16,000	19,000	18.8	900	250	650
Occupational therapists		7,000	19,000	171.4	1,500	1,000	500
Physical therapists		14,000	36,000	157.1	2,800	1,800	1,000
Speech pathologists and audiologists		18,000	33,000	83.3	2,300	1,300	1,000
Medical laboratory workers	07.02 16.0303	100,000	190,000	90.0	12,800	7,500	5,300
Radiological technologists	07.0501, 02, 03 16.0304	75,000	120,000	60.0	7,300	3,800	3,500
Medical record librarians		12,000	20,000	66.7	1,400	700	700
Dieticians		30,000	42,100	40.3	2,700	1,000	1,700
Hospital administrators		15,000	22,000	46.7	900	600	300
Sanitarians		10,000	14,000	41.0	600	300	300
Veterinarians		24,000	34,000	41.7	1,400	800	600
Mathematics and related occupations:							
Mathematicians		65,000	110,000	60.4	8,400	3,500	[3]4,900
Statisticians		23,000	33,000	45.9	1,600	900	700
Actuaries		4,000	6,700	59.5	300	200	100
Natural science occupations:							
Environmental scientists:							
Geologists		22,800	27,100	18.9	800	400	400
Geophysicists		6,800	8,600	26.5	300	150	150
Meteorologists		4,000	5,500	34.1	200	100	100
Oceanographers		5,200	9,700	85.4	500	400	100
Life science occupations:							
Life scientists		170,000	240,000	41.1	15,200	5,800	[4]9,400
Biochemists		11,000	17,000	55.5	700	500	200

See footnotes at end of table.

Table B–1. Continued—Estimated 1968 employment, projected 1980 requirements, and average annual openings, 1968–80, by occupation

Occupation	Vocational education codes[1]	Estimated employment, 1968	Projected requirements, 1980	Percent change 1968-80	Average annual openings, 1968–80		
					Total	Employment change	Replacement needs
Professional and technical occupations—Continued							
Physical scientists:							
Chemists		130,000	200,000	55.7	12,800	6,000	[5] 6,800
Physicists		45,000	75,000	63.9	4,600	2,400	[6] 2,200
Astronomers		1,400	1,900	35.7	100	50	50
Performing artists:							
Actors and actresses		14,000	18,500	32.4	900	400	500
Dancers		23,000	27,500	18.3	1,400	400	1,000
Musicians and music teachers		166,000	190,000	13.8	8,600	1,900	6,700
Singers and singing teachers		60,000	70,000	14.2	3,100	700	2,400
Social scientists:							
Anthropologists		3,000	4,100	36.4	200	100	100
Economists		31,000	48,000	54.6	2,200	1,400	800
Geographers		3,900	5,200	32.0	200	100	100
Historians		14,000	19,000	35.7	800	400	400
Political scientists		11,400	17,000	49.1	800	450	350
Sociologists		10,000	14,000	37.8	600	300	300
Teachers:							
College and university teachers		286,000	395,000	37.8	17,000	9,000	8,000
Kindergarten and elementary school teachers		1,230,000	1,270,000	3.3	99,000	3,300	[7] 95,700
Secondary school teachers		940,000	1,065,000	13.6	101,000	11,000	[8] 90,000
Technicians:							
Draftsmen	17.13	295,000	435,000	48.1	15,300	11,800	3,500
Engineering and science	16.01	620,000	890,000	43.2	31,000	22,000	9,000
Writing occupations:							
Newspaper reporters		37,000	45,000	21.6	1,800	650	1,150
Technical writers		30,000	35,000	29.2	1,300	700	600
Other professional and related occupations:							
Airline dispatchers		1,200	1,600	33.3	50	25	25
Air traffic controllers	17.0403	14,600	18,000	23.5	425	225	200
Architects		34,000	50,000	47.1	2,300	1,300	1,000
Broadcast technicians	16.0108	20,000	23,000	14.9	400	250	150
College placement officers		2,500	4,000	60.0	200	125	75
Commercial artists	17.07 17.19	50,000	57,000	13.0	1,900	500	1,400
Flight engineers	17.0402	7,500	12,000	59.3	225	125	100
Ground radio operators and teletypists		8,200	10,000	21.6	225	125	100
Home economists		100,000	130,000	30.0	7,800	2,500	5,300
Industrial designers	17.0703	10,000	11,500	15.0	300	100	200
Interior designers and decorators	17.0701 .0702	15,000	17,300	15.0	700	200	500
Landscape architects		8,500	11,500	35.3	500	250	250
Lawyers		270,000	335,000	22.7	14,500	5,500	9,000
Librarians		106,000	135,000	28.6	8,200	2,500	5,700
Models		50,000	64,000	15.9	1,700	700	1,000
Photographers		60,000	72,000	18.0	2,200	900	1,300

See footnotes at end of table.

Table B–1. Continued—Estimated 1968 employment, projected 1980 requirements, and average annual openings, 1968–80, by occupation

Occupation	Vocational education codes[1]	Estimated employment, 1968	Projected requirements, 1980	Percent change 1968-80	Average annual openings, 1968–80		
					Total	Employment change	Replacement needs
Professional and technical occupations—Continued							
Other professional and technical occupations—Continued							
Pilots and copilots	16.0601	52,000	114,000	116.9	1,800	1,100	700
Programmers	16.0401	175,000	400,000	129.0	23,000	19,000	4,000
Psychologists	14.0203	32,000	58,000	81.3	3,100	2,200	900
Radio and television announcers		14,000	16,000	14.9	600	200	400
Recreation workers		40,000	70,000	75.0	4,100	2,500	1,600
Social workers		160,000	270,000	66.7	16,700	9,000	7,700
Surveyors		45,000	68,000	50.2	2,600	1,900	700
Systems analysts	14.0204	150,000	425,000	183.0	27,000	23,000	4,000
Urban planners		7,000	13,500	93.0	800	600	200
Managerial occupations		7,776,000	9,500,000	22.2	380,000	144,000	236,000
Bank officers		125,000	193,000	53.8	9,900	5,600	4,300
Conductors (railroad)		38,000	39,000	2.7	2,500	1,000	1,500
Industrial traffic managers		15,000	17,000	10.4	500	150	350
Managers and assistants (hotels)	04.10	150,000	198,000	27.6	9,500	3,600	5,900
Purchasing agents	04.99	140,000	185,000	27.2	6,700	3,300	3,400
Clerical and related occupations		12,803,000	17,300,000	35.1	912,000	375,000	537,000
Bank clerks		400,000	512,000	28.8	29,500	9,500	20,000
Bank tellers	04.04, 14.0105	230,000	337,000	46.2	20,000	8,000	12,000
Bookkeeping workers	14.0102, 14.0104	1,200,000	1,500,000	18.9	78,000	20,000	58,000
Cashiers	04.08, 14.0103	730,000	1,110,000	50.6	69,000	31,000	38,000
Clerks (railroad)		93,000	89,000	–4.8	2,700	–400	3,100
Dental assistants	07.0101	100,000	150,000	50.0	9,000	4,400	4,600
Electronic computer operating personnel	14.0201, .0202, 02.0201	175,000	400,000	129.0	20,400	18,800	1,600
Front office clerks (hotels)	04.10	50,000	69,000	27.6	3,200	1,250	1,950
Library technicians		70,000	125,000	77.1	9,000	4,500	4,500
Mail carriers	14.0403	246,000	335,000	36.2	12,200	7,400	4,800
Office machine operators	0301.0404	325,000	460,000	39.4	25,000	10,000	15,000
Postal clerks	14.0403	290,000	385,000	32.8	14,600	7,900	6,700
Receptionists	14.0405	240,000	400,000	65.6	30,000	13,000	17,000
Shipping and receiving clerks	14.0503	370,000	437,000	18.1	12,400	5,400	7,000
Station agents (railroad)		10,900	5,200	–52.1	–225	–475	250
Stenographers and secretaries	14.07	2,650,000	3,650,000	36.8	237,000	82,000	155,000
Telegraphers, telephoners, and towermen (railroad)		13,200	12,700	–3.8	100	–50	150
Telephone operators	14.0401	400,000	480,000	20.9	28,000	6,900	21,100
Traffic agents and clerks (civil aviation)		37,500	60,000	60.1	2,600	1,500	1,100
Typists	14.09	700,000	930,000	36.8	63,000	21,000	42,000
Sales occupations		4,647,000	6,000,000	29.1	263,000	113,000	150,000
Insurance agents and brokers	04.13	410,000	480,000	16.9	16,200	5,800	10,400
Manufacturers' salesmen		500,000	735,000	47.1	32,000	19,500	12,500

[1] See footnotes at end of table.

Table B—1. Continued—Estimated 1968 employment, projected 1980 requirements, and average annual openings, 1968—80, by occupation

Occupation	Vocational education codes[1]	Estimated employment, 1968	Projected requirements, 1980	Percent change 1968-80	Average annual openings, 1968—80		
					Total	Employment change	Replacement needs
Sales occupations—Continued							
Real estate salesmen and brokers	04.17	225,000	270,000	20.1	14,200	3,800	10,400
Retail trade salesworkers		2,800,000	3,460,000	24.0	150,000	55,000	95,000
Automobile parts countermen	04.03	65,000	80,000	23.1	2,500	1,250	1,250
Automobile salesmen	04.03	120,000	145,000	20.8	4,400	2,100	2,300
Automobile service advisors	04.03	10,000	12,500	25.0	300	200	100
Securities salesmen	04.04	135,000	170,000	24.0	7,400	2,800	4,600
Wholesale trade salesworkers		530,000	695,000	29.5	25,200	13,200	12,000
Craftsmen		10,015,000	12,200,000	21.8	396,000	182,000	214,000
Building trades:							
Asbestos and insulating workers		22,000	28,000	27.3	800	500	300
Bricklayers	17.1004	200,000	260,000	30.0	8,400	5,000	3,400
Carpenters	17.1001	869,000	1,075,000	23.7	39,300	17,200	22,100
Cement masons (cement and concrete finishers)	17.1099	60,000	90,000	50.0	3,600	2,500	1,100
Electricians (construction)	17.1002	190,000	270,000	42.1	10,500	6,700	3,800
Elevator constructors	17.1099	14,500	18,000	24.1	500	300	200
Floor covering installers	17.1099	37,000	47,000	27.0	1,700	800	900
Glaziers	17.1009	9,000	13,000	44.4	500	350	150
Lathers	17.1006	30,000	38,000	26.7	1,250	650	600
Operating engineers (construction machinery operators)	17.100302	285,000	410,000	43.9	14,800	10,400	4,400
Painters and paperhangers	17.1005	430,000	510,000	18.6	18,200	6,700	11,500
Plasterers	17.1006	40,000	40,000	0.0	700		700
Plumbers and pipefitters	17.1007	330,000	475,000	43.9	19,500	12,100	7,400
Roofers	17.1010	55,000	80,000	45.5	3,000	2,100	900
Sheet-metal workers	17.2205	50,000	70,000	40.0	2,500	1,700	800
Stonemasons, marble setters, tile setters, and terrazzo workers	17.1004	30,000	35,000	16.7	850	350	500
Structural-, ornamental-, and reinforcing-iron workers; riggers; and machine movers	17.1099	75,000	105,000	40.0	3,900	2,500	1,400
Machine occupations:							
All-round machinists (includes layout men, instrument makers—mechanical)	17.2302, .2303	400,000	450,000	12.5	12,600	4,200	8,400
Setup men (machine tools)	17.2302, .2303	70,000	85,000	26.9	2,600	1,500	1,100
Tool and die makers	17.2307	150,000	160,000	6.7	3,700	800	2,900
Mechanics and repairmen:							
Air-conditioning, refrigeration, and heating mechanics	17.01	100,000	140,000	40.0	5,000	3,300	1,700
Aircraft mechanics	17.0401	135,000	230,000	70.4	9,700	7,900	1,800
Appliance servicemen	17.02	205,000	260,000	26.8	8,600	4,600	4,000
Automobile body repairmen	17.0301	100,000	125,000	25.0	3,500	2,100	1,400
Automobile mechanics	17.0302, .0303, 17.12	615,000	745,000	21.1	20,000	11,300	8,750
Bowling-pin machine mechanics		6,500	6,000	−7.7	50	−50	100
Business machine servicemen	17.06	115,000	200,000	73.9	8,500	7,100	1,400

See footnotes at end of table.

Table B–1. Continued—Estimated 1968 employment, projected 1980 requirements, and average annual openings, 1968–80, by occupation

Occupation	Vocational education codes[1]	Estimated employment, 1968	Projected requirements, 1980	Percent change 1968-80	Average annual openings, 1968–80		
					Total	Employment change	Replacement needs
Craftsmen—Continued							
Electric sign servicemen		6,100	8,200	34.4	300	200	100
Farm equipment mechanics		40,000	45,000	12.5	1,100	400	700
Industrial machinery repairmen		175,000	220,000	25.7	7,550	3,750	3,800
Instrument repairmen	17.21, .2101	85,000	120,000	41.2	4,600	2,900	1,700
Maintenance electricians	17.1002, 17.14	240,000	315,000	31.3	10,800	6,300	4,500
Millwrights	17.1099	75,000	85,000	13.3	2,400	900	1,500
Television and radio service technicians		125,000	145,000	16.0	3,000	1,700	1,300
Truck mechanics and bus mechanics		110,000	130,000	18.2	2,900	1,400	1,500
Vending machine mechanics		16,000	20,000	25.0	650	350	300
Watch repairmen	17.2102	20,000	21,000	5.0	1,400	800	600
Printing (graphic arts) occupations:							
Bookbinders and related workers		30,000	25,000	–16.7	400	–400	800
Composing room occupations		170,000	180,000	–5.3	3,200	–800	4,000
Electrotypers and stereotypers		8,000	6,000	–25.0	–25	–175	150
Lithographic occupations		73,000	80,000	9.6	1,800	600	1,200
Photoengravers		18,000	18,000	0.0	300	0	300
Printing pressmen and assistants		90,000	105,000	16.7	2,850	1,250	1,600
Telephone industry occupations:							
Central office craftsmen	17.1501	80,000	92,000	15.8	2,700	1,000	1,700
Central office equipment installers	17.1501	22,000	22,000	0.0	400	0	400
Linemen and cable splicers	17.1402	40,000	39,000	6.8	600	200	400
Telephone and PBX installers and repairmen		86,000	100,000	16.9	3,000	1,200	1,800
Other crafts occupations:							
Automobile trimmers and installation men (automobile upholsterers)	17.35	8,000	10,000	25.0	350	175	175
Blacksmiths	17.2399	15,000	14,000	–6.7	500	–100	600
Boilermaking occupations	17.1099	25,000	30,000	20.0	1,000	400	600
Dispensing opticians and optical mechanics	7.0601	22,000	23,000	4.5	500	100	400
Foremen		1,444,000	1,730,000	19.8	56,200	24,000	32,200
Furniture upholsterers	17.35	32,000	33,000	3.1	800	100	700
Jewelers and jewelry repairmen		25,000	25,000	0.0	200	0	200
Locomotive engineers		35,000	33,000	–5.7	1,350	–150	1,500
Locomotive firemen (helpers)		19,000	14,100	–25.8	–200	–400	200
Motion picture projectionists		16,000	18,000	12.5	750	150	600
Shoe repairmen	17.3402	30,000	30,000	0.0	1,500	0	1,500
Shop trades (railroad)		87,000	85,000	–2.3	2,250	–150	2,400
Stationary engineers	17.32	260,000	275,000	5.8	7,050	1,250	5,800
Operatives		13,955,000	15,400,000	10.4	426,000	120,000	306,000
Driving occupations							
Busdrivers, intercity	04.19	24,000	28,000	17.5	900	350	550

See footnotes at end of table.

Table B–1. Continued—Estimated 1968 employment, projected 1980 requirements, and average annual openings, 1968–80, by occupation

Occupation	Vocational education codes[1]	Estimated employment, 1968	Projected requirements, 1980	Percent change 1968-80	Average annual openings, 1968–80		
					Total	Employment change	Replacement needs
Operatives—Continued							
Busdrivers, local transit	04.19	65,000	56,000	–13.9	500	–800	1,300
Routemen	04.06	235,000	250,000	5.1	3,800	1,000	2,800
Taxidrivers	04.19	85,000	75,000	–10.7	1,200	–700	1,900
Truckdrivers, local		1,200,000	1,450,000	21.9	37,000	21,500	15,500
Truckdrivers, over-the-road		640,000	800,000	24.7	21,600	13,200	8,400
Other operative occupations		785,000	850,000	8.4	26,000	5,500	20,500
Assemblers		30,000	35,000	25.0	1,200	600	600
Automobile painters		74,000	70,000	–5.2	1,000	–300	1,300
Brakemen (railroad)		13,000	15,700	20.8	600	200	400
Electroplaters							
Gasoline service station attendants	04.16	400,000	475,000	15.9	10,900	6,200	4,700
Inspectors (manufacturing)		585,000	635,000	8.5	19,200	4,200	15,000
Machine tool operators	17.2302 .2303	500,000	520,000	4.0	10,500	1,700	8,800
Meat cutters		200,000	200,000	2.6	4,500	400	4,100
Photographic laboratory occupations	17.0901	30,000	39,000	29.9	1,600	750	850
Power truck operators		163,000	183,000	12.2	4,100	1,500	2,600
Production painters		160,000	170,000	8.5	4,000	1,100	2,900
Signal department workers (railroad)		12,100	11,600	–4.5	–450	–550	100
Stationary firemen (boiler)		73,000	58,000	–20.6	–600	–1,300	700
Waste water treatment plant operators	17.3203	23,500	40,000	68.9	2,500	1,400	1,100
Welders and oxygen and arc cutters	17.2306	480,000	675,000	40.6	23,000	16,000	7,000
Laborers nonfarm		3,555,000	3,500,000	–1.5	60,000	–4,000	64,000
Bridge and building workers (railroad)		11,200	10,900	–2.7	275	–25	300
Track workers (railroad)		57,000	55,000	–3.7	1,300	–200	1,500
Construction laborers and hod carriers		750,000	925,000	23.3	29,000	15,000	14,000
Service occupations		9,381,000	13,100,000	39.6	752,000	310,000	442,000
Barbers	17.2601	210,000	260,000	23.8	12,800	4,200	8,600
Bellmen and bell captains (hotels)	04.10	30,000	32,000	10.6	1,100	300	800
Building custodians	17.11	1,100,000	1,460,000	32.7	80,000	30,000	50,000
Cooks and chefs		670,000	900,000	33.2	48,000	19,000	29,000
Cosmetologists	17.2602	475,000	685,000	42.9	38,000	17,000	21,000
FBI special agents		6,600	---	---	---	---	---
Firefighters	17.2801	180,000	245,000	34.0	7,700	5,200	2,500
Licensed practical nurses	7.0302	320,000	600,000	87.5	48,000	23,000	25,000
Hospital attendants	7.0303, 04	800,000	1,500,000	87.5	100,000	58,000	42,000
Housekeepers and assistants (hotels)	04.10	25,000	35,000	27.6	2,400	600	1,800
Police officers (municipal)	16.0605	285,000	360,000	27.5	15,000	6,500	8,500

See footnotes at end of table.

Table B–1. Continued—Estimated 1968 employment, projected 1980 requirements, and average annual openings, 1968–80, by occupation

Occupation	Vocational education codes[1]	Estimated employment, 1968	Projected requirements, 1980	Percent change 1968-80	Average annual openings, 1968–80		
					Total	Employment change	Replacement needs
Service occupations—Continued							
Private household workers		1,700,000	1,980,000	14.8	121,000	21,000	100,000
State police officers	16.0605	35,000	52,000	47.7	2,800	1,700	1,100
Stewardesses (civil aviation)	04.19	25,000	65,000	150.7	---	---	---
Waiters and waitresses	04.07 17.2904	960,000	1,240,000	28.3	67,000	23,000	44,000
Farm workers		3,464,000	2,600,000	−33.0	25,000	---	25,000

[1] Vocational Education Codes are from *Vocational Education and Occupations,* U.S. Department of Health, Education, and Welfare, Offices of Education and U.S. Department of Labor Manpower Administration, U.S. Government Printing Office, 1968.

[2] Includes an estimated 20,400 replacements for those who transfer to other occupations. Replacements for the selected branches of engineering do not include transfer losses.

[3] Includes an estimated 3,800 replacements for those who transfer to other occupations.

[4] Includes an estimated 5,300 replacements for those who transfer to other occupations.

[5] Includes an estimated 3,700 replacements for those who transfer to other occupations.

[6] Includes an estimated 1,400 replacements for those who transfer to other occupations.

[7] Includes annual replacements of 53,000 who die and retire, 38,000 who shift to another profession, and 4,700 who take the place of sub-standard teachers.

[8] Includes annual replacements of 29,000 who die and retire, 58,000 who shift to another profession, and 2,800 who take the place of sub-standard teachers.

NOTE: Percents may not agree with totals because of rounding.

Appendix C. Detailed training Statistics

This appendix presents two tables containing all available statistics on the numbers of persons completing training for occupations for which appendix B presents projections. Table C-1 presents statistics for occupations that require fewer than 4 years of college; Table C-2 presents data on occupations for which a college degree and graduate degrees are required. Data are presented in tabular form for use of individuals only needing statistics on training for their specific purpose. These same data are presented in chapter IV along with the discussion of the ways workers get their training in specific occupations and the statistics on projections that are summarized in tabular form in appendix B.

Data in table C-1 are not comparable because different programs cover different time periods (fiscal years, academic years, calendar years). Some refer to enrollments which are used as a proxy for completions although all individuals enrolled in a specific program do not complete the required training. Nevertheless, the information is valuable if used as recommended in the body of this bulletin. The table emphasizes the fragmentary and inconsistent nature of the data on this subject and the need for its improvement. Footnotes are used extensively to indicate data limitations. (See discussion on p. 2).

Table C—1. Known training in occupations which generally require less than a college degree and for which projections of manpower requirements have been prepared

Occupation	Junior college graduates academic year 1968–69	MDTA enrollments, fiscal year 1969		Vocational education completions, fiscal year 1969		Apprenticeship completions 1969
		On-the-job	Institutional	Secondary	Post-secondary	
Professional and related occupations						
Health service occupations:						
Dental hygienists	1,956			4	929	
Dental laboratory technicians	364			96	246	
Registered nurses[1]	8,960			29	6,228	
Medical laboratory workers	772			600	1,058	
Radiological technologists	570			93	442	
Medical record libararians						
Other health service occupations	1,996	2,600	18,600	3,023	3,618	
Forestry aides:						
Technicians:						
Draftsmen				12,853	3,099	
Engineering and science technicians	30,018			12,332	30,149	
Surveyors						
Other professional and related occupations:						
Broadcast technicians						
Commercial artists						
Pilots and copilots					791	

See footnotes at end of table.

Table C–1. Continued– Known training in occupations which generally require less than a college degree and for which projections of manpower requirements have been prepared

Occupation	Junior college graduates academic year 1968–69	MDTA enrollments, fiscal year 1969		Vocational education completions, fiscal year 1969		Apprenticeship completions, 1969
		On-the-job	Institutional	Secondary	Post-secondary	
Clerical and related occupations	17,092	[2] 26,700	[2] 10,200	[2] 218,149	39,492	
Bank clerks						
Bank tellers						
Bookkeeping workers						
Cashiers						
Clerks (railroad)						
Dental assistants	1,307			1,201	1,952	
Electronic computer operating personnel	4,633					
Front office clerks (hotels)						
Library technicians	134					
Mail carriers						
Office machine operators						
Postal clerks						
Receptionists						
Shipping and receiving clerks		1,500				
Station agents (railroads)						
Stenographers and secretaries		170	6,480	126,782	15,373	
Telegraphers, telephoners, and towermen (railroad)						
Telephone operators						
Traffic agents and clerks (civil aviation)						
Typists				80,472	7,592	
Sales occupations	3,685			[3] 96,928	[3] 20,595	
Manufacturers' salesmen						
Real estate salesmen and brokers						
Retail trade salesworkers						
Automobile parts countermen						
Automobile salesmen						
Automobile service advisors						
Wholesale trade salesworkers						
Service occupations		[4] 11,400	[4] 14,000	[4] 4,991	248	
Barbers				139	553	
Bellmen and bell captains						
Building custodians				800	74	
Cooks and chefs		1,800	3,606	1,563	423	
Cosmetologists				7,126	2,476	
Firefighters				34	823	
Licensed practical nurses	5,564			2,192	19,586	
Hospital attendants				7,270	3,939	
Housekeepers and assistants (hotels)						
Police officers	[5] 2,851			[5] 168	[5] 4,846	
Private household workers						
State police officers						
Waiters and waitresses				[6] 663	[6] 110	

See footnotes at end of table.

Table C–1. Continued- Known training in occupations which generally require less than a college degree and for which projections of manpower requirements have been prepared

Occupation	Junior college graduates academic year 1968–69	MDTA enrollments, fiscal year 1969		Vocational education completions, fiscal year 1969		Apprenticeship completions, 1969
		On-the-job	Institutional	Secondary	Post-secondary	
Craftsmen						
Building trades:						
Asbestos and insulating workers						[7] 1,651
Bricklayers				4,032	272	3,698
Carpenters		3,700	500	7,472	1,080	300
Cement masons						5,091
Electricians (construction)						
Elevator constructors						217
Floor covering installers						145
Glaziers						
Lathers				103	299	
Operating engineers				405	33	829
Painters and paperhangers				43	25	228
Plasterers				725	162	4,888
Plumbers and pipefitters						290
Roofers				1,385	254	2,544
Sheet-metal workers						
Stonemasons						2,006
Structural iron workers						
Riggers and machine movers						
Other construction occupations		[8] 1,295		[9] 11,455	1,064	1,063
Machine occupations				[10] 16,547	[10] 3,454	
All-round machinists		1,900	1,800			3,527
Setup man						4,125
Tool- and die-makers						
Mechanics and repairmen				[11] 24,465	[11] 13,666	
Air-conditioning, refrigeration, and heating mechanics					4,043	
Aircraft mechanics				880	1,781	
Appliance servicemen				1,098	267	
Automobile body repairmen		2,000	3,900	4,164	1,586	
Automobile mechanics		2,200	9,700			1,017
Bowling-pin machine repairmen						
Business machine servicemen				349	119	
Electric sign servicemen						
Farm equipment mechanics						
Industrial machinery repairmen						
Instrument repairmen				232	211	
Maintenance electricians						
Millwrights						
TV and radio service technicians						

See footnotes at end of table.

Table C—1. Continued—Known training in occupations which generally require less than a college degree and for which projections of manpower requirements have been prepared

Occupation	Junior college graduates academic year 1968—69	MDTA enrollments, fiscal year 1969		Vocational education completions, fiscal year 1969		Apprenticeship completions, 1969
		On-the-job	Institutional	Secondary	Post-secondary	
Craftsmen—Continued						
Truck and bus mechanics						
Vending machine mechanics						
Watch repairmen						
Printing (graphic arts) occupations				[12]10,281	[12]1,739	
Bookbinders and related workers						315
Composing room occupations						837
Electrotypers and stereotypers						27
Lithographic occupations						785
Photoengravers						54
Printing pressmen and assistants						826
Other printing occupations						99
Telephone industry occupations				[13]6	[13]96	
Central office craftsmen						
Central office equipment installers						
Linemen and cable splicers						
Telephone and PBX installers and repairmen						
Other craft occupations						
Automobile trimmers and installation men						
Blacksmiths						
Boilermaking occupations						180
Dispensing opticians and optical mechanics				44	77	
Foremen				[14]1,330	[14]332	
Furniture upholsterers						
Jewelers and jewelry repairmen						
Locomotive engineers						
Locomotive firemen (helpers)						
Motion picture projectionists				[15]248	[15]26	
Shoe repairmen						
Shop trades (railroad)						
Stationary engineers						
Operatives		[16]2,400	[16]1,600	[16]24,465	[16]4,043	
Driving occupations						
Busdrivers, intercity						

See footnotes at end of table.

Table C—1. Continued—Known training in occupations which generally require less than a college degree and for which projections of manpower requirements have been prepared

Occupation	Junior college graduates academic year 1968–69	MDTA enrollments, fiscal year 1969		Vocational education completions, fiscal year 1969		Apprenticeship completions, 1969
		On-the-job	Institutional	Secondary	Post-secondary	
Operatives—Continued						
Busdrivers, local transit						
Routemen						
Taxi drivers						
Truckdrivers, local						
Truckdrivers, over-the-road						
Other operative occupations:						
Assemblers						
Automobile painters						
Brakemen (railroad)						
Electroplaters						
Gasoline service station attendants						
Inspectors (manufacturing)						
Machine tool operators				1,026	156	
Meat cutters			630	630	107	
Photographic laboratory occupations				711	666	
Power truck operators						
Production painters						
Stationary firemen (boiler)						
Waste water treatment plant operators						
Welders and oxygen and arc cutters		1,700	8,800	6,596	4,254	
Construction laborers						

[1] The total number of registered nurses trained was 33,800 in academic year 1968–69. In addition to the training sources shown, many were trained in hospital programs and some in 4-year college programs.

[2] Includes training in occupations such as typists, bank tellers, office machine operators, bookkeeping workers, electronic computer operating personnel, and railway clerks. The number being trained in each occupation cannot be ascertained from the available data.

[3] Includes all persons who completed distributive education programs.

[4] Includes kitchen workers, maids and housemen (hotels and restaurants), porters and cleaners, and attendants. The number being trained in each occupation cannot be ascertained from the available data.

[5] May include some State police officer training.

[6] Also includes some steward department occupations in the Merchant Marine.

[7] Includes brick, stone, and tile workers.

[8] Includes riveters, construction occupations not classified, and miscellaneous structural workers. The number in each occupation cannot be ascertained from the available data.

[9] The number in each occupation cannot be ascertained from the available data.

[10] Includes structural iron workers, machinists, machine tool operators, instrument makers, set up men, inspection occupations, boilermakers, welders, and others. The number in each occupation cannot be ascertained from available data.

[11] Includes many repairmen such as auto, truck, and bus mechanics; appliance servicemen; and industrial machine repairmen. The number in each occupation cannot be ascertained from available data.

[12] Includes composing room occupations, printing pressmen, electrotypers, and stereotypers. The number in each occupation is not ascertainable from the available data.

[13] Includes linemen, testboardmen, telephone repairmen, and other occupations. The number in each occupation cannot be ascertained from the available data.

[14] Includes some upholsterers other than furniture.

[15] Also includes shoe manufacturing occupations.

[16] Includes trainees in many different industries and occupations such as punching and shearing occupations, spinning occupations, wood machining occupations; and occupations in plastics, rubber, machinery (assembly), electronics, and transportation equipment.

Table C–2. Degrees from institutions of higher education by field of study and level, United States, 1968–69

Major field of study	Bachelor's degrees	First professional degrees	Master's degrees	Doctoral degrees
Agriculture	8,044		1,696	605
Architecture	3,331		579	7
Biological sciences	35,308		5,743	3,051
Biology, general	23,305		2,503	363
Botany, general	576		412	249
Zoology, general	5,488		812	310
Bacteriology, virology, micology, parasitology, microbiology	1,357		430	331
Biochemistry	347		268	471
Biological sciences, all other	4,235		1,318	1,327
Business and commerce	93,561		19,325	533
Accounting	20,032		1,333	40
Business and commerce, all other	73,529		17,992	493
Education	152,257		71,076	4,829
Counseling and guidance	15		9,325	401
Elementary education	80,610		12,753	177
Secondary education	2,285		4,584	143
Education, all other	69,347		44,414	4,108
Engineering	41,248		15,240	23,377
English and literature	54,279		8,524	1,151
Fine and allied arts	31,588		7,413	684
Foreign languages and literature	21,685		5,034	749
Forestry	1,921		374	94
Geography	3,333		563	124
Health professions	19,825	13,673	4,067	283
Dentistry (D.D.S. and D.M.D.)		3,408		
Medical technology	2,811		28	
Medicine (M.D.)		8,025		
Nursing and/or public health nursing	10,328		1,385	3
Pharmacy	4,073		232	74
Veterinary medicine (D.V.M.)		1,146		
Health professions, all other	2,613	1,094	2,422	177
Home economics	8,979		1,149	102
Journalism	5,197		785	22
Law (L.L.B., J.D., or Higher degrees)	415	17,053	830	18
Library science	1,000		5,932	17
Mathematical subjects	27,209		5,713	1,097
Mathematics	26,905		5,217	956
Statistics (including actuarial science)	304		496	141
Military science	1,895			
Philosophy	6,100		694	286
Physical sciences	21,480		5,895	3,859
Chemistry	11,702		2,023	1,895
Geology	1,973		620	288
Physics	5,578		2,252	1,296
Physical sciences, all other	2,287		1,000	380
Psychology	29,332		4,011	1,551
Religion	5,276	4,338	2,884	346
Social sciences	140,960		22,649	3,150
Economics	16,867		2,108	634
History	40,939		5,271	826
Political science or government	23,789		2,107	467
Sociology	26,219		1,656	430
Social work, administration, welfare	3,367		5,037	90
Social sciences, all other	29,779		6,470	703

See footnotes at end of table.

Table C–2. Continued—Degrees from institutions of higher education by field of study and level, United States, 1968–69

Major field of study	Bachelor's degrees	First professional degrees	Master's degrees	Doctoral degrees
Trade and industrial training	4,269		129	14
Other broad general curriculums and miscellaneous fields	9,420	276	2,439	175

Source: NCES, *Digest of Educational Statistics,* 1970, p. 89, table 117.

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