

Employment projections through the lens of education and training

The new BLS education and training categories provide information on the typical path to enter and how to become competent in occupations; they not only are a useful resource for career exploration but also provide insight into the expected demand for workers by education level and other types of career preparation

Dixie Sommers
and
Teresa L. Morisi

Students and career changers want to know what preparation is needed for entry into various careers or, alternatively, what types of career opportunities may be available for a given level of preparation. The counselors, teachers, parents, and others who assist the students also need this information. To better meet this need, the Bureau of Labor Statistics (BLS) has introduced a new set of education and training categories to depict the preparation that individuals need to enter and to become competent in specific occupations.

While these categories were developed specifically for users interested in career exploration and guidance, other data users are interested in this information as well. To help them make decisions on investments and human resource planning, policy makers, businesses, and others want to know what the expected demand may be for workers with various levels of education attainment and other preparation. While not directly depicting demand by education attainment, the BLS education and training categories provide insight into the expected demand.

This article examines the 2010–2020 employment projections through the lens of the new education and training categories. The results indicate, for example, that the fastest projected employment growth, 21.7 percent over the decade, is among occupations with a master's degree as the typical entry-level education needed, while the largest number of projected new jobs, 7.6 million, is among occupations with a

high school or equivalent as the typical entry-level needed.

This article begins by discussing what the new categories are, why BLS changed from the previous categories, and how BLS assigned the new categories. Next, it examines how the assignments are distributed across major occupation groups and across the intersections of the three dimensions of the new system. Then summary results are presented using the 2010–2020 employment projections, as well as wage information from the Occupational Employment Statistics program. In addition, the article discusses the projections for the entry-level education categories, exploring the results by the on-the-job training (OJT) and related work experience dimensions.

In this exercise, BLS presents its approach to a problem that labor market analysts across the globe face. All analysts need a way to generalize and summarize employment trends by education and other preparation—a way that requires developing some construct to represent the complexities of how labor markets intersect with education and other preparation for work. The article concludes with a brief review of how other analysts, including those in Canada and Europe, are addressing this problem.

What the new categories are

The path for entry and competency. Some occupations have several paths by which a prospective worker can enter, while others have a single

Dixie Sommers
is Assistant
Commissioner and
Teresa L. Morisi
is Branch Chief
in the Division
of Occupational
Outlook, Office
of Occupational
Statistics and
Employment
Projections, Bureau of
Labor Statistics. Email:
sommers.dixie@bls.
gov and morisi.teri@
bls.gov.

distinct path. An important part of the path is the education that one needs to enter the occupation. For some occupations, a certain level of education is universally required, while for others, it is not as clear-cut. Consider two legal occupations: lawyers and paralegals. Prospective lawyers need to graduate from law school after completing a bachelor's degree. Paralegals, however, can enter the occupation with one of three formal education levels—a postsecondary nondegree award, an associate's degree, or a bachelor's degree.

Another part of the path is whether prior work experience is needed for entry. Such work experience is related to the current occupation a worker is entering, rather than general work experience through which the individual may develop more general skills or work habits. Many of the occupations with a work experience requirement are first-line supervisors or managers who need to have experience in the field that they are supervising or managing. Entrants to some nonmanagerial occupations may also need related work experience.

For some occupations, education can be substituted for work experience and vice versa. An example is the occupation chefs and head cooks. A prospective chef or head cook could enter the occupation with a degree from a culinary school and no prior work experience, or in lieu of formal education, he or she could enter with years of work experience as a lower-level cook.

OJT is also an important part of the path. Such training is needed in many occupations for a person to become competent at performing the occupation. To be “competent” means that someone is qualified to perform the occupation independently. OJT is normally attained after one is employed in an occupation. It can be an apprenticeship, which is a formal relationship between a worker and a sponsor. Apprenticeships are most common in construction occupations, such as electricians, stonemasons, or carpenters. In other occupations, entrants need to complete an internship or residency. Each is found mainly in teaching and medical occupations and may be required for state licensure or certification. In addition, in some occupations, workers need less formal types of OJT to become competent.

BLS sought the best way to depict these requirements and devised the new education and training categories that are being used for the first time with the projections of employment from 2010 to 2020. The new categories include assignments in three different dimensions that make up a path: (1) typical education needed for entry, (2) work experience in a related occupation, and (3) typical OJT needed to attain competency.¹ The BLS data show the

projected demand for occupations, and the categories indicate the education and training characteristics for occupations in the base year of 2010. The data presented in this article summarize the projected employment trends from the 2010–2020 National Employment Matrix by category and by path. Thus, the data represent the trend for occupations assigned to each category or path. The data do not specifically indicate the demand for workers by education attainment, such as demand for college graduates, nor do they indicate or project the educational attainment of the workforce.

The education and training assignments represent a typical path. The assignments in the education and training system are given to each of the 749 detailed occupations for which BLS publishes employment projections. The assignments for entry-level education, work experience in a related occupation, and OJT go together, in that they represent the typical path to enter an occupation and become competent at performing it. BLS analysts decide the “typical path” after reviewing and analyzing various data sources and qualitative information, as described in the section on how the categories were assigned (page 16).

Typical entry-level education and work experience in a related occupation are “preemployment” qualifications, while typical OJT usually occurs after one is employed. Although some occupations may have more than one path for entry, only one path is assigned in the system. The “typical path” holds even for those occupations, such as the chefs and head cooks example mentioned earlier, in which formal education and work experience may be substituted for each other. If an occupation has multiple paths for entry, they are discussed in the narratives in the *Occupational Outlook Handbook*.

Preemployment requirements: education and work experience. The first category in the path is the typical education level needed for one to enter an occupation. The assignments include five postsecondary levels (doctoral or professional degree, master's degree, bachelor's degree, associate's degree, and postsecondary nondegree award). Other assignments are some college, no degree; high school diploma or equivalent; and less than high school.² Note that the education level assigned to an occupation is the typical level most workers need to enter. (BLS economists arrived at the typical level by analyzing data and other research; see the section on page 16 on how the categories were assigned for more information.) In the paralegals example mentioned earlier, several education levels are possible for entry. The education assignment for paralegals is “associ-

ate's degree," because BLS economists determined it to be the typical education needed for entry. Lawyers are assigned "doctoral or professional degree."

The second preemployment category is work experience in a related occupation. This metric captures work experience that employers commonly consider necessary or commonly accept as a substitute for more formal types of training or education. The work experience is occupation specific; that is, it is in a related occupation that provides experience related to the current occupation that a worker is entering and can be transferred to another job in the same occupation. Specific work experience is distinct from general work experience, through which the individual may develop more general skills or work habits. The assignments are a measure of time (more than 5 years, 1–5 years, less than 1 year, or none). As just noted, many occupations for which work experience in a related occupation is needed are first-line supervisors and managers, who need experience in the occupations they will supervise. For example, architectural and engineering managers typically have more than 5 years work experience in architectural or engineering occupations before becoming managers. Some nonmanagement occupations require work experience in a related occupation; real estate brokers, for example, typically need between 1 and 3 years of work experience as a licensed real estate agent.

Postemployment requirement: on-the-job training. Occupations also receive an assignment that represents the typical OJT needed for a worker to attain competency in the occupation. This training is occupation specific; it is not job specific. Occupation-specific training can be transferred to another job in the same occupation. For example, the training an electrician receives through an apprenticeship can be transferred to another electrician job. Internship-residency is another assignment for this category, although it is not strictly a postemployment requirement but tends to come before one is employed. For example, after completing their doctorate program, podiatrists must complete a residency program that lasts 3 years. In most states, the residency is required before a podiatrist can be licensed to practice.

Other assignments for this category include long-term OJT (more than 1 year), moderate-term OJT (1–12 months), short-term OJT (1 month or less), and none. For example, real estate sales agents typically enter the occupation with a high school diploma and learn their occupation through long-term OJT. Insurance underwriters are assigned "moderate-term OJT" in the system—even though they typically need a bachelor's degree for entry,

they receive OJT as a trainee supervised by a senior underwriter. A fast-food cook is an example of an occupation in which one undergoes short-term OJT.

Why BLS developed the new categories

BLS used an earlier education and training category system from 1995 (with the publication of 1994–2005 projections) through the 2009 publication of the 2008–2018 projections.³ The earlier system assigned 1 of 11 categories to each occupation that represented the "most significant source" of education or training. The 11 categories combined education, work experience, and OJT, and BLS analysts could choose only one category to assign to an occupation. The previous categories included postsecondary education levels ranging from first professional degree to postsecondary vocational award; two categories with work experience—bachelor's or higher degree, plus work experience and work experience in a related occupation; and three OJT categories denoting long-term, moderate-term, and short-term OJT.

The previous system was replaced for a number of reasons. One is that since each occupation received just a single assignment to cover education, work experience, and training, it did not provide enough information on the path that a person typically needs to follow to enter an occupation and become competent at performing it. Except for the "bachelor's or higher degree plus work experience" item, the system did not show whether an occupation needed combinations of education, work experience, and training (for example, postsecondary education and some period of OJT), since only one assignment could be made. Only postsecondary education levels were included; no assignments could be made for the high school level and below. In addition, the former categories could be misinterpreted. For example, some users assumed that all occupations assigned an OJT category were high school or less than high school occupations, although this was not the case. Another drawback of the system was that the term *most significant source* was not defined.

How the new categories were developed

The new education and training system is the result of work by BLS economists, with input from data users. BLS staff reviewed the drawbacks of the prior system and developed ways to better represent the typical path of entry and competency. Two rounds of public comment occurred, in November 2008 and September 2010. The latter round included an experimental dataset of about 100

occupations. The BLS received many helpful comments from the public and considered these when devising the final system.

BLS originally proposed adding a licensing category. However, further testing and refinement of the licensing definition revealed some problems, such as how to capture occupations in which a subset requires licensure either in all states or some states. An additional issue is that states also regulate occupations through less-restrictive forms, known as registration and statutory certification, in which a state grants “title” protection to an individual with a certification. These forms of regulation are sometimes referred to as “licenses.” BLS found this information proved too complex to represent accurately, without extensive additional research.

BLS also studied certification as a possible category to include in the classification system. Certification does not fit into the overall concept of the system, however, which is to provide information on what is needed to enter and to attain competency in an occupation. Certification is normally voluntary and is a recognition that a nongovernmental body provides. It can demonstrate competence in occupation-specific skills, job-specific skills, or advanced practice skills. Therefore, certification is generally obtained for a person to advance within an occupation, either to a higher level or to move to a specialized area. In addition, the term *certification* is often confused with academic certificates received from postsecondary institutions. For these reasons, certification is not included in the education and training classification system. Certification, however, is discussed in the narratives of occupational profiles in the *Occupational Outlook Handbook* if it is important for the occupation.

BLS published the final categories on the BLS website in fall 2011, followed by the occupational assignments in December 2011. The 2010–2020 employment projections released on February 1, 2012, were the first to incorporate the new system.

Users should not compare results from the new education and training categories with the previous system. The major difference is that the concepts are not the same. The previous system assigned a single category that represented the “most significant source” of education or training. The concepts for the new system are more clearly defined. The education assignment represents the typical entry-level education, and the assignment in the current system could be different from what was assigned in the past. In addition, occupations could not receive education assignments below the postsecondary level in the previous system. The 2010–2020 projections also are the first to in-

corporate the 2010 Standard Occupational Classification (SOC) system, and some occupations are new and will not have prior assignments.

How the categories were assigned

BLS economists assigned occupations to categories on the basis of analyses of qualitative and quantitative information. Sources of quantitative data included educational attainment data from the American Community Survey (ACS) and the Occupational Information Network (O*NET).

American Community Survey data. The Census Bureau’s ACS collects data on educational attainment, as well as employment by occupation. The BLS published educational attainment data on its website that are based on the ACS microdata files for 2005 through 2009.⁴ These data show the percent distribution of workers 25 years and older employed in an occupation by their highest level of education attained.⁵ The data are particularly useful in analyzing occupations with multiple entry-level education possibilities.

Like any sample survey, the ACS is a household sample survey and is subject to response and coding error, as well as sampling error. The ACS data therefore must be carefully evaluated. In addition, although the Census Bureau’s occupational classification system also is based on the SOC, it does not provide the same level of detail as the BLS shows in the National Employment Matrix. As a result, some detailed SOC occupations shown in the BLS data have the same educational attainment data because they are combined in the Census Bureau’s occupational classification system.

These data show the highest level of educational attainment of individuals working in the occupation. Thus, the data may show higher or lower educational attainment than the assignment given in the classification system for typical entry education. For example, the ACS data show that a majority of advertising sales agents have a bachelor’s degree, but the education category assignment for the occupation is “high school diploma or equivalent,” because workers typically enter the occupation with the lower level of education. In other cases, the category assignment reflects a higher level of education than the attainment data show. For example, occupational therapists are assigned to the master’s degree category, but more than half have only a bachelor’s degree according to the ACS data. The entry requirements for occupational therapists have changed over time, and current entrants typically need a master’s degree.

In some cases, the ACS data may show workers with educational attainment much higher than is needed for their occupation. In fact, the ACS data show that every occupation has some share of workers with a bachelor's degree. For example, according to the ACS data for 2005 through 2009, among workers 25 years and older, 12.5 percent of waiters and waitresses and 13.0 percent of bank tellers had bachelor's degrees as their highest level of education attainment, although these occupations have education assignments of less than high school and high school diploma in the BLS category system, respectively.⁶ Some of these results may be response or coding error, or college-educated workers may in fact be in every occupation, even those in which most workers have less than a high school diploma. Some workers choose occupations that do not necessarily mesh with their educational attainment. For example, they may have family responsibilities that cause them to choose an occupation for which they are over qualified because it has flexible hours. In addition, college-educated workers may not be able to find a job that uses the education they possess, sometimes referred to as "mal-employment," which can be more likely during recessions.⁷ Even if workers have the right level of degree, they may also experience mismatches between the field of their degree and the fields of degrees required in the jobs available. In other cases, workers simply choose occupations below their education level because they prefer them or they may be working in them while pursuing other options.

When assigning education categories, BLS economists reviewed ACS 2005–2009 educational attainment distributions for occupations by two age breakouts: ages 18 to 29 and 30 and older. For most occupations, the younger age group was considered to better represent the education level needed by workers who are entering the occupation; for occupations requiring a doctoral or professional degree, the older cohort was more appropriate given the time required to attain advanced degrees.

Other resources used to assign categories. BLS economists also analyzed data from the O*NET, a product of the Employment and Training Administration of the U.S. Department of Labor. O*NET's data on education, work experience, and training requirements for occupations come from a survey of workers in the occupation and of occupational experts and analysts. A limitation of the O*NET data was the small sample sizes for some of the occupations surveyed.

Economists at BLS also used qualitative information to assign categories. They interviewed persons who were knowledgeable about education and training requirements

for the occupations. They obtained information from employers, workers in the occupation, training experts, and representatives of professional and trade associations and unions, among others. BLS economists also reviewed information from regulatory authorities (if they existed for an occupation) and actual job postings for the occupations.

A summary look at the assignments

Education categories by major occupation group. How are the education and training categories distributed across major occupation groups? The SOC system groups occupations according to the type of work performed and not according to education or skill level. Thus, finding a range of typical entry-level education categories within any of the 22 SOC major occupation groups is not surprising. These distributions indicate that analysis of occupations by the education categories is best done at the detailed occupation level, rather than at the major group level.

Four major groups had six education categories represented: education, training, and library occupations; health-care practitioners and technical occupations; personal care and service occupations; and transportation and material moving occupations. Two major groups with the least dispersion across education categories had only two categories represented: building and grounds cleaning and maintenance occupations and construction and extraction occupations, in which only the high school diploma and less than high school education categories occurred. (See table 1.)

Conversely, each education category is found across multiple major occupation groups, with the high school diploma or equivalent assignment found in 20 of the 22 major groups (all but computer and mathematical occupations and life, physical, and social science occupations). The bachelor's degree assignment appears in 15 major groups and the associate's degree in 13 major groups. The least dispersion across major groups is for the doctoral or professional degree (5 groups), master's degree (6 groups), and some college, no degree (6 groups). (See table 1.)

Multiple dimensions of occupational preparation. An advantage of the new BLS education and training categories is that it helps data users examine paths to entry and competence, that is, the intersection of education, related work experience, and OJT. Educational attainment is an important preparation for entry into many occupations but often does not tell the whole story. Individuals making career decisions, counselors and others who assist these individuals, and those planning and funding workforce development activities need to understand the training

Table 1. Number of occupations assigned to education categories, by major occupation group

SOC	Major occupation group	Typical education needed for entry									Number of education categories represented
		Total, all occupations	Doctoral or professional degree	Master's degree	Bachelor's degree	Associate's degree	Postsecondary non-degree award	Some college, no degree	High school diploma or equivalent	Less than high school	
00	Total, all occupations	749	25	29	154	47	42	6	350	96	8
11	Management	33	—	2	20	2	—	1	8	—	—
13	Business and financial operations	30	—	—	20	—	1	—	8	1	4
15	Computer and mathematical	16	1	2	12	—	—	1	—	—	4
17	Architecture and engineering	35	—	—	22	12	—	—	1	—	3
19	Life, physical, and social science	43	7	9	19	8	—	—	—	—	4
21	Community and social service	17	—	6	9	—	—	—	2	—	3
23	Legal	9	3	—	2	1	1	—	2	—	5
25	Education, training, and library	24	1	4	15	1	1	—	2	—	6
27	Arts, design, entertainment, sports, and media	41	—	—	19	1	2	1	18	—	5
29	Healthcare practitioners and technical	46	13	6	6	11	6	—	4	—	6
31	Healthcare support	15	—	—	—	2	4	—	8	1	4
33	Protective service	22	—	—	—	—	2	1	19	—	3
35	Food preparation and serving related	18	—	—	—	—	1	—	2	15	3
37	Building and grounds cleaning and maintenance	10	—	—	—	—	—	—	6	4	2
39	Personal care and service	33	—	—	1	1	6	1	18	6	6
41	Sales and related	22	—	—	3	—	—	—	13	6	3
43	Office and administrative support	55	—	—	2	2	—	—	50	1	4
45	Farming, fishing, and forestry	11	—	—	1	—	—	—	7	3	3
47	Construction and extraction	59	—	—	—	—	—	—	39	20	2
49	Installation, maintenance, and repair	51	—	—	—	4	15	—	31	1	4
51	Production	107	—	—	—	1	2	—	90	14	4
53	Transportation and material moving	52	—	—	3	1	1	1	22	24	6
Number of major occupation groups represented		22	5	6	15	13	12	6	20	12	(¹)

¹ Data not applicable. SOURCE: U.S. Bureau of Labor Statistics.

and related work experience dimensions in addition to educational attainment. The following discussion examines how detailed occupations are distributed across these multiple dimensions.

While high school completion is the typical entry-level education in 350 occupations, a high school diploma alone is not sufficient. Individuals preparing for these occupations can expect to face additional training requirements, often of significant length. Among the 350 high

school occupations, only 28 do not typically require OJT to attain competency. Of the occupations with an OJT assignment, the largest numbers are in the moderate-term OJT category (159 occupations) and in the short-term OJT category (100 occupations). Another 49 are in the long-term OJT category, and 14 are assigned to the apprenticeship category. Only one high school occupation has no OJT or related work experience required.⁸ (See table 2.)

Concerning work experience in a related occupation,

651 of the 749 occupations typically have no such requirement for entry. Of the 98 occupations with a work experience assignment other than “none,” 58 are manager or supervisor occupations in which experience in the type of work managed or supervised is typically needed for entry or may be substituted for other entry requirements.⁹ The largest numbers of occupations with a related work experience assignment other than “none” have an entry-level education assignment of bachelor’s degree (38 occupations) and high school diploma or equivalent (42 occupations). (See table 2.)

Most occupations with a related work experience assignment do not also have an OJT assignment. Of the 98 occupations with a related work experience assignment other than “none,” only 31 have an OJT assignment other than “none.” (See table 2.) These 31 occupations are a diverse list, representing 12 of the 22 major occupation groups and 5 of the 8 education categories.

Results for the 2010–2020 projections

Summary results. In their analysis of the 2010–2020 occupational projections, Lockard and Wolf presented summary data for each of the three dimensions of education, training, and related work experience.¹⁰ (See table 3.) These data are totals for all occupations assigned to each category. For example, employment in 2010 for the bachelor’s degree education category was 22.2 million and is projected to grow by 16.5 percent to 25.8 million by 2020. These numbers represent the sum of employment in all 154 occupations assigned bachelor’s degree as the typical entry-level education. Note that these data do *not* represent the number of workers with bachelor’s degrees in 2010 or projected to have such degrees in 2020.

The summary information in Lockard and Wolf shows what the BLS projections indicate about the changing demand for entry-level workers with various types of educational preparation. The fastest projected growth is among occupations with master’s degree and doctoral or professional degree as the typically entry-level education needed, while the slowest growth is among occupations with high school diploma or equivalent. These data are useful because demand for workers with particular levels of education attainment is largely driven by growth or decline in employment in the occupations in which such attainment is typically required for entry. The BLS projections depict the demand by occupation. Actual labor market activity may be somewhat different. Given the complexity of entry paths in certain occupations, some employers may require or prefer different education entry levels

than the “typical” levels identified by BLS, and employers may adjust entry requirements in times of high or low unemployment. Also, within an education attainment level, demand may vary by the field of study related to the occupation. Indeed, the BLS projections indicate, for example, that bachelor’s degree occupations in the computer and mathematical occupations group are projected to grow by 22.9 percent between 2010 and 2020, much faster than the 13.7 percent growth projected for bachelor’s degree occupations in the education, training, and library group.

For the OJT dimension, Lockard and Wolf show that the fastest growth is projected for occupations assigned to the apprenticeship category, at 22.5 percent compared with 14.3 percent for all occupations. This category includes mainly construction occupations, which are projected to grow at above average rates but are not expected to regain all the jobs lost during the 2007–2009 recession. For the work experience in a related-occupation dimension, the fastest projected growth is among occupations in which no such experience is typically required. Among occupations with a work experience assignment other than “none,” the most rapid projected growth is a below-average 13.0 percent change over the decade for the less than 1-year group. (See table 3.)

Education and training requirements and wages. How do wages vary across the education and training categories? Table 3 and chart 1 show the May 2010 median annual wages for the occupations assigned to the various education, work experience, and OJT categories. These summary-level data from the BLS Occupational Employment Statistics program indicate the wage variation. The OES data are medians for all workers, including both entry-level and experienced workers, while the education and training assignments are for entry-level preparation. How wages vary when education, work experience, and OJT are combined to show paths of entry and preparation is discussed in the following paragraphs.

Across the education categories, the wage patterns approximate what would be expected from other information: wages are generally higher as the typical entry-level education rises.¹¹ The results differ somewhat from this expectation, however, because other characteristics affect wages, including related work experience, OJT, and the field of study related to the occupation.

The highest median annual wages, at \$87,500, are for occupations in the doctoral or professional degree category—more than twice the \$33,840 median for all occupations. Median annual wages are similar for the three next-highest education categories: master’s degree at \$60,240,

Table 2. Number of occupations assigned to education, on-the-job training, and previous work experience categories

Typical entry-level education and work experience in a related occupation	Typical on-the-job training						
	Total, all occupations	Internship-residency	Apprenticeship	Long-term on-the-job training	Moderate-term on-the-job training	Short-term on-the-job training	None
Total, all occupations	749	25	15	70	221	177	241
More than 5 years	18	—	—	1	3	1	13
1 to 5 years	70	2	—	2	10	3	53
Less than 1 year	10	—	—	1	3	5	1
None	651	23	15	66	205	168	174
Doctoral or professional degree	25	8	—	—	—	1	16
More than 5 years	1	—	—	—	—	1	—
1 to 5 years	—	—	—	—	—	—	—
Less than 1 year	—	—	—	—	—	—	—
None	24	8	—	—	—	—	16
Master's degree	29	4	—	—	—	—	25
More than 5 years	1	—	—	—	—	—	1
1 to 5 years	2	—	—	—	—	—	2
Less than 1 year	—	—	—	—	—	—	—
None	26	4	—	—	—	—	22
Bachelor's degree	154	13	—	4	20	2	115
More than 5 years	6	—	—	—	—	—	6
1 to 5 years	31	2	—	1	3	1	24
Less than 1 year	1	—	—	—	—	—	1
None	116	11	—	3	17	1	84
Associate's degree	47	—	1	3	10	2	31
More than 5 years	1	—	—	—	—	—	1
1 to 5 years	1	—	—	—	—	—	1
Less than 1 year	—	—	—	—	—	—	—
None	45	—	1	3	10	2	29
Postsecondary nondegree award	42	—	—	7	6	6	23
More than 5 years	—	—	—	—	—	—	—
1 to 5 years	3	—	—	—	—	—	3
Less than 1 year	—	—	—	—	—	—	—
None	39	—	—	7	6	6	20
Some college, no degree	6	—	—	1	2	2	1
More than 5 years	1	—	—	—	—	—	1
1 to 5 years	1	—	—	—	1	—	—
Less than 1 year	1	—	—	—	—	1	—
None	3	—	—	1	1	1	—
High school diploma or equivalent	350	—	14	49	159	100	28
More than 5 years	8	—	—	1	3	—	4
1 to 5 years	30	—	—	—	5	2	23
Less than 1 year	4	—	—	1	1	2	—
None	308	—	14	47	150	96	1
Less than high school	96	—	—	6	24	64	2
More than 5 years	—	—	—	—	—	—	—
1 to 5 years	2	—	—	1	1	—	—
Less than 1 year	4	—	—	—	2	2	—
None	90	—	—	5	21	62	2

SOURCE: U.S. Bureau of Labor Statistics.

bachelor's degree at \$63,430, and associate's degree at \$61,590. (See table 3 and chart 1.)

The somewhat lower median wage for master's degree occupations compared with bachelor's and associate's degree occupations conflicts with the expectation that investment in additional education generally results in a return of higher wages. Wages are affected by factors besides the level of

degree, however, including the field of study relevant to the occupation. Returns are generally higher in some types of occupations—notably those in management and in technical fields—than others with the same or higher education requirements, such as counseling or social work.

Chart 2 shows the distribution of employment by ranges of median wages for the master's, bachelor's, and associ-

Table 3. Employment, total job openings, and median annual wages by education, work experience, and on-the-job training category, 2010–2020

[In thousands]

Education, work experience, and on-the-job training	Employment				Change, 2010–2020		Total job openings due to growth and replacement needs, 2010–2020		Median annual wage, May 2010
	Number		Percent distribution		Number	Percent	Number	Percent	
	2010	2020	2010	2020					
Typical education needed for entry									
Total, all occupations	143,068.2	163,537.1	100.0	100.0	20,468.9	14.3	54,787.4	100.0	\$33,840
Doctoral or professional degree	4,409.7	5,286.3	3.1	3.2	876.6	19.9	1,701.8	3.1	87,500
Master's degree	1,986.0	2,417.2	1.4	1.5	431.2	21.7	903.9	1.6	60,240
Bachelor's degree	22,171.1	25,827.2	15.5	15.8	3,656.1	16.5	8,562.4	15.6	63,430
Associate's degree	7,994.6	9,434.6	5.6	5.8	1,440.0	18.0	2,941.0	5.4	61,590
Postsecondary nondegree award	6,524.0	7,624.9	4.6	4.7	1,100.9	16.9	2,389.6	4.4	34,220
Some college, no degree	811.6	953.8	.6	.6	142.2	17.5	362.0	.7	44,350
High school diploma or equivalent	62,089.6	69,665.7	43.4	42.6	7,576.1	12.2	21,745.9	39.7	34,180
Less than high school	37,081.7	42,327.4	25.9	25.9	5,245.7	14.1	16,180.8	29.5	20,070
Work experience in a related occupation									
Total, all occupations	143,068.2	163,537.1	100.0	100.0	20,468.9	14.3	54,787.4	100.0	33,840
More than 5 years	4,612.4	4,956.0	3.2	3.0	343.6	7.4	1,368.5	2.5	87,410
1 to 5 years	17,103.0	19,078.2	12.0	11.7	1,975.2	11.5	5,638.7	10.3	52,000
Less than 1 year	3,129.6	3,535.2	2.2	2.2	405.6	13.0	1,125.2	2.1	32,320
None	118,223.3	135,967.7	82.6	83.1	17,744.5	15.0	46,654.9	85.2	31,260
Typical on-the-job training									
Total, all occupations	143,068.2	163,537.1	100.0	100.0	20,468.9	14.3	54,787.4	100.0	33,840
Internship-residency	5,374.2	6,271.5	3.8	3.8	897.3	16.7	2,193.6	4.0	55,580
Apprenticeship	2,539.0	3,109.2	1.8	1.9	570.2	22.5	1,183.0	2.2	44,550
Long-term	7,039.0	7,920.5	4.9	4.8	881.5	12.5	2,545.5	4.6	45,370
Moderate-term	25,007.0	28,244.5	17.5	17.3	3,237.5	12.9	8,682.0	15.8	35,650
Short-term	58,171.0	66,040.0	40.7	40.4	7,869.0	13.5	23,767.8	43.4	22,810
None	44,937.9	51,951.3	31.4	31.8	7,013.4	15.6	16,415.5	30.0	56,680

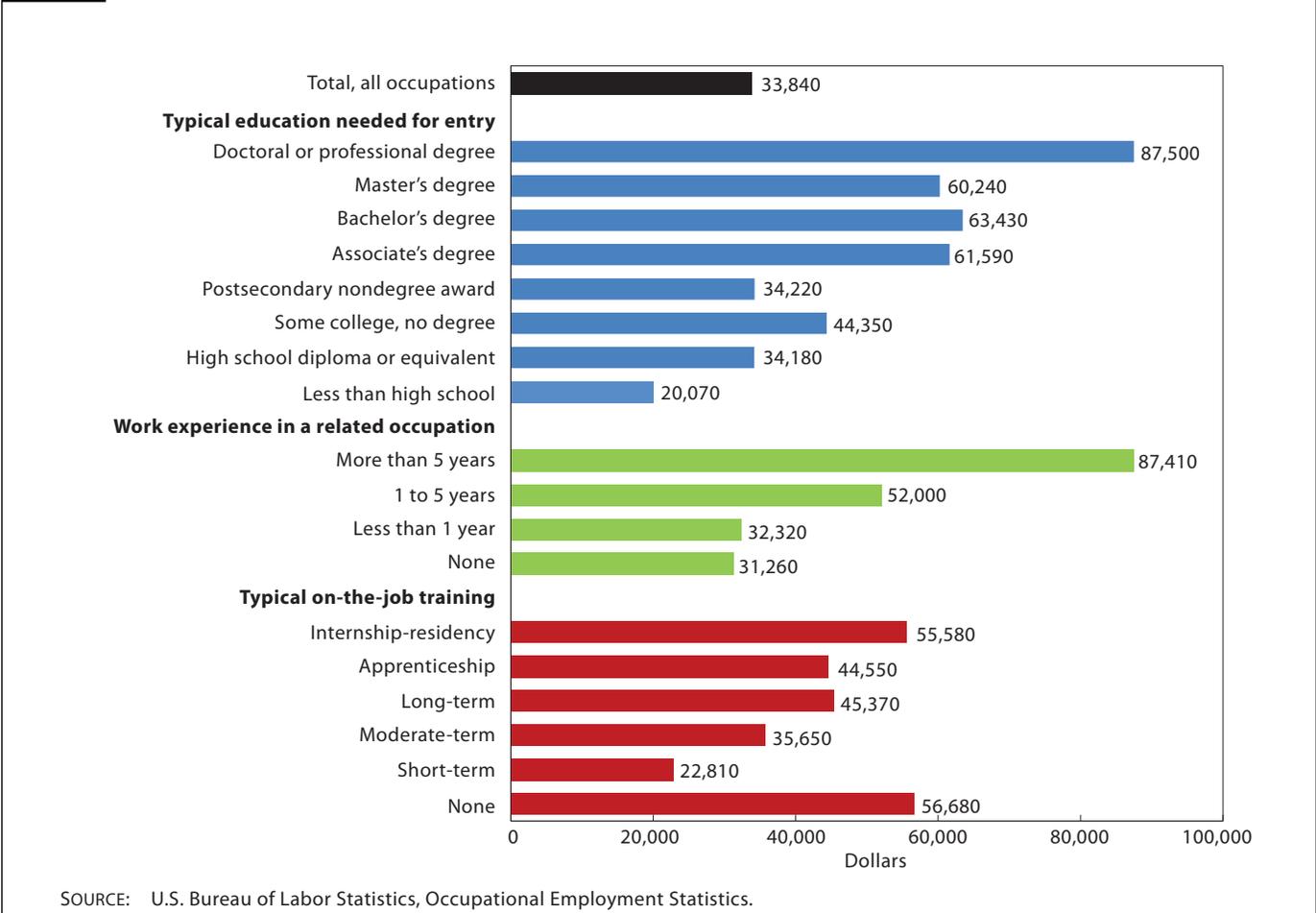
SOURCE: U.S. Bureau of Labor Statistics.

ate's degree occupations. The occupations in these three education categories have about the same shares of employment in the median wage ranges more than \$75,000 to \$100,000, more than \$50,000 to \$75,000, and less than median for all occupations (\$33,840). In the highest-paying median wage range (more than \$100,000), however, only one master's degree occupation appears—political scientists, at \$107,420—and one associate's degree occupation—air traffic controllers, at \$108,040. Each of these occupations accounts for 0.3 percent of employment among all occupations in its education category. Eight bachelor's degree occupations have median wages above \$100,000, however, and they account for 7.7 percent of the jobs in bachelor's degree occupations: chief executives; architectural and engineering managers; natural sciences managers; computer and information systems manag-

ers; petroleum engineers; marketing managers; financial managers; and airline pilots, copilots, and flight engineers. All the bachelor's degree occupations in the highest wage range require education in business, science or engineering, or another technical field, and all but petroleum engineers require related work experience or, in the case of airline pilots, copilots, and flight engineers, moderate-term OJT.

In wage range from \$33,840, the median wage for all occupations, to \$50,000, the master's degree occupations have nearly twice the share of employment (20.1 percent) than do bachelor's degree occupations (11.4 percent), and associate's degree occupations fall in between (16.5 percent). (See chart 2.) The seven master's degree occupations in this wage range include four community and social service occupations (marriage and family therapists, mental health

Chart 1. Median annual wages for occupations by education and training category, May 2010



counselors, all other counselors, and healthcare social workers); two education, training, and library occupations (curators and farm and home management advisors); and one healthcare technical occupation (all other therapists). The mental health counselors occupation pulls the overall wage for this group down, because it is a relatively large occupation, with low median wages of \$38,150.

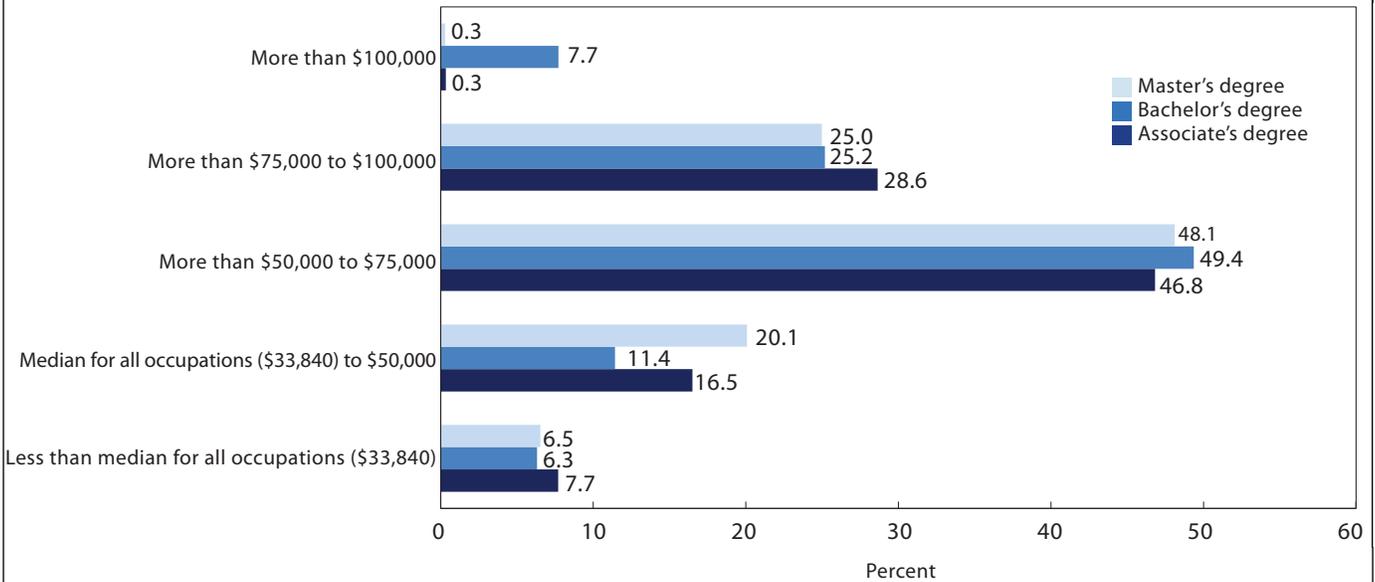
In chart 1, for the two categories between high school diploma and associate's degree, the wages differ substantially, with \$34,220 for occupations in the postsecondary nondegree award category and \$44,350 for those in the some college, no degree, category. The latter category contains only six occupations, all of which require either related work experience or OJT, or both. For the high school diploma category, median annual wages of \$34,180 are similar to the postsecondary nondegree award category, perhaps reflecting the fact that nearly all occupations in the high school category also require related work experience or OJT, or both. As expected, wages for occupations in the high school category are much higher than the \$20,070 for occupations

in the less than high school category.

When wages are considered by the related work experience categories, occupations typically requiring more than 5 years of related work experience have much higher wages, at \$87,410, than for any other work experience category. Most of these occupations are managers or supervisors. Occupations in the 1 to 5 years of related work experience category had median wages of \$52,000, much more than the median for all occupations. Wages differed little between the less than 1 year and no work experience categories, at \$32,320 and \$31,260, respectively. (See chart 1.)

For the OJT categories shown in chart 1, occupations with an OJT assignment of "none" had the highest median wage, at \$56,680. The 241 occupations in this group ranged widely across all the education categories, as seen in table 2. Among occupations with OJT assignments other than "none," wages were generally higher with more training. Median wages were similar between the apprenticeship occupations (\$44,550) and long-term OJT occupations (\$45,370). Wages for these two groups were significantly

Chart 2. Percent of employment by range of May 2010 median wages, master's, bachelor's, and associate's degree occupations



SOURCE: U.S. Bureau of Labor Statistics.

below the \$55,580 for the internship-residency group. The internship-residency group includes a mix of highly paid medical practitioners as well as teaching and counseling occupations that pay above average but much less than the medical practitioners. Occupations with moderate-term OJT are typically paid much more (\$35,650) than those with short-term OJT (\$22,810). (See chart 1.)

Value of work experience and training. Work experience and OJT can be important parts of the path for entry and competency in an occupation. Looking across the three dimensions of the system—the path—provides additional insight into the value of work experience and OJT regarding pay and job opportunities. Out of the 192 possible combinations of education, work experience, and OJT, 59 paths include one or more occupations. Some of the paths, with one occupation, have very large employment. For this analysis, the 59 paths were further narrowed to the 22 that had 10 or more occupations and/or 2010 employment of 1 million or greater. These paths are shown in table 4, which displays the paths sorted by education assignment and then by work experience and OJT. All typical entry-level education categories are represented, except for some college, no degree. Two of the paths each have one large occupation with employment of greater than 1 million.

An analysis of these paths reveals the following three observations. First, for occupations assigned the same

entry-level education, those that require work experience generally pay more than those without it. Second, the fastest growing paths include many healthcare occupations. Last, most job openings (new jobs and replacement positions) are projected in paths with lower pay, little formal education, no work experience, and little or no OJT.

The 2010 median annual wages for the 22 selected paths are shown in table 4. Of these paths, five are bachelor's degree paths. The two bachelor's degree paths with work experience (Bachelor's/More than 5 years/None and Bachelor's/1 to 5 years/None)¹² have higher median wages than the three bachelor's degree paths that do not need work experience. Occupations that typically need a bachelor's degree and work experience are, for the most part, managers, directors, administrators, and others with managerial-type responsibilities. The median wage, \$116,290, for the Bachelor's/More than 5 years/None path is the highest for the bachelor's degree groups shown. This group consists entirely of management occupations.

For the three associate's degree paths shown, the path with work experience also pays more than those without. The occupation in the Associate's/1 to 5 years/None path is general and operations managers, a large occupation that had employment of 1.8 million in 2010 and a median wage of \$94,400. The two associate's degree paths with no work experience paid much less. Associate's/None/Moderate-term OJT had a median wage of \$41,470 and

Employment Projections

Table 4. Employment by path, 2010–2020, for selected paths with 2010 employment greater than 1 million or 10 or more occupations

[In thousands]

Path			Employment				Total job openings due to growth and replacement needs	Median annual wage, 2010	Number of occupations
			Number		Change, 2010–2020				
Typical entry-level education	Work experience in a related occupation	Typical on-the-job training needed to attain competency	2010	2020	Number	Percent			
Total, all occupations¹			143,068.2	163,537.1	20,468.9	14.3	54,787.4	\$33,840	749
Doctoral or professional degree	None	Internship-residency	1,013.9	1,250.7	236.8	23.4	471.0	164,930	8
Doctoral or professional degree	None	None	3,361.8	3,998.4	636.6	18.9	1,221.2	77,800	16
Master's degree	None	None	1,288.0	1,578.6	290.5	22.6	584.9	56,480	22
Bachelor's degree	More than 5 years	None	1,498.9	1,640.3	141.4	9.4	465.8	116,290	6
Bachelor's degree	1 to 5 years	None	3,050.1	3,556.5	506.4	16.6	1,175.9	77,410	24
Bachelor's degree	None	Internship-residency	4,081.3	4,677.1	595.8	14.6	1,590.9	52,430	11
Bachelor's degree	None	Moderate-term on-the-job training	2,085.8	2,390.0	304.2	14.6	797.1	61,390	17
Bachelor's degree	None	None	10,800.1	12,801.7	2,001.7	18.5	4,253.6	63,650	84
Associate's degree	1 to 5 years	None	1,767.1	1,848.6	81.6	4.6	410.1	94,400	1
Associate's degree	None	Moderate-term on-the-job training	382.5	419.5	37.0	9.7	148.3	41,470	10
Associate's degree	None	None	5,188.2	6,416.9	1,228.7	23.7	2,216.5	57,180	29
Postsecondary non-degree award	None	None	4,650.2	5,540.8	890.6	19.2	1,808.8	29,850	20
High school diploma or equivalent	More than 5 years	None	2,282.6	2,344.5	61.9	2.7	651.4	63,730	4
High school diploma or equivalent	1 to 5 years	Short-term on-the-job training	1,616.3	1,945.6	329.3	20.4	652.9	37,700	2
High school diploma or equivalent	1 to 5 years	None	8,904.4	9,849.7	945.3	10.6	2,862.0	43,570	23
High school diploma or equivalent	Less than 1 year	Long-term on-the-job training	1,064.2	1,187.3	123.1	11.6	327.2	62,450	1
High school diploma or equivalent	None	Apprenticeship	2,509.7	3,074.6	564.9	22.5	1,172.2	44,430	14
High school diploma or equivalent	None	Long-term on-the-job training	4,498.0	5,048.6	550.5	12.2	1,630.6	43,350	47
High school diploma or equivalent	None	Moderate-term on-the-job training	18,311.4	20,601.3	2,289.9	12.5	6,080.5	34,350	150
High school diploma or equivalent	None	Short-term on-the-job training	21,930.8	24,561.2	2,630.4	12.0	8,008.3	27,840	96
Less than high school	None	Moderate-term on-the-job training	1,429.2	1,673.5	244.3	17.1	595.6	32,000	21
Less than high school	None	Short-term on-the-job training	33,402.0	38,159.4	4,757.4	14.2	14,633.3	19,600	62

¹ The paths do not add up to the total.

SOURCE: U.S. Bureau of Labor Statistics.

Associate's/None/None occupations paid \$57,180.

For high school occupations, four paths with work experience are shown in table 4. Two of these work experience paths are paid much more than any of the other high school paths. High school/More than 5 years/None had a median wage of \$63,730 in 2010. This path includes managerial and first-line supervisor occupations. High school/Less than 1 year/Long-term OJT has one large occupation (business operations specialists, all other) that paid a median wage of \$62,450 in 2010.

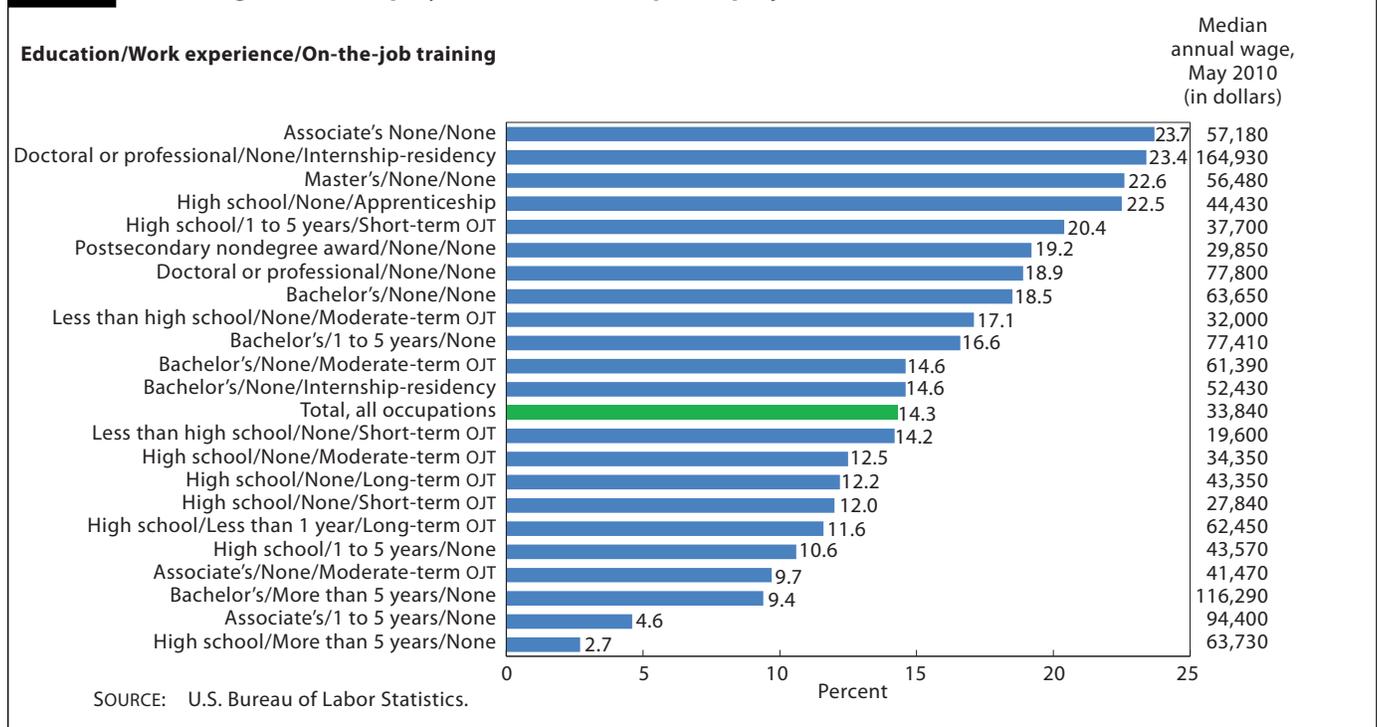
The High school/None/Apprenticeship path, which mainly includes construction occupations, had a median wage of \$44,430 in 2010. This group paid somewhat more than two paths with work experience: High school/1 to 5 years/Short-term OJT, at \$37,700, and High school/1 to 5 years/None, at \$43,570. Close to the apprenticeship path in terms of pay was High school/None/Long-term OJT, at \$43,350. Most occupations in this path are in production; installation, maintenance, and repair; and arts, design, entertainment, sports, and media.

Comparing the median wage for all paths shown in the table 4, one will find that four paths pay less than the total median wage of \$33,840—both Less than high school paths and the High school/None/Short-term OJT and Postsecondary nondegree award/None/None paths. This postsecondary nondegree award path includes some low-

er-level healthcare occupations, such as nursing aides and orderlies; a few service occupations, such as hairstylists; and some technician and repairer occupations. The three highest-paid paths shown are Doctoral or professional/None/Internship-residency, at \$164,930; Bachelor's/More than 5 years/None, at \$116,290; and Associate's/1 to 5 years/None, at \$94,400. The Master's/None/None path paid less, at \$56,480, than several occupational paths with less education. The Master's/None/None path contains some lower-paying social work occupations, including rehabilitation counselors; education, guidance, school, and vocational counselors; and healthcare social workers.

The projected percent growth in employment for the selected paths is shown in chart 3. The fastest growing paths are heavily represented by healthcare-related occupations. Other occupations represented in the fastest growing paths are in science and engineering, social sciences, and construction. The Associate's/None/None path has the fastest projected growth, 23.7 percent, and includes rapidly growing occupations in healthcare, such as physical therapy and occupational therapy assistants, diagnostic medical sonographers, dental hygienists, respiratory therapists, registered nurses, and several technologists and technicians. The Associate's/None/None path also includes occupations that are various types of science technicians, engineering technicians, and drafters. The

Chart 3. Percent growth in employment for selected paths, projected 2010–2020



Doctoral or professional/None/Internship-residency path is projected to grow by 23.4 percent and largely consists of physicians and surgeons and various dentist occupations. The Master's/None/None path is projected to grow by 22.6 percent. This path mainly includes healthcare occupations, such as occupational therapists and physician assistants; counseling and social work occupations, including rehabilitation counselors and healthcare social workers; and social science occupations, such as historians and sociologists. The construction occupations make up all but one of the occupations assigned to the High school/None/Apprenticeship path, which is projected to grow by 22.5 percent. Rapid growth is projected for many construction occupations as the construction industry recovers from the 2007–2009 recession; however, this growth represents only a partial recovery of jobs lost.¹³ Of the 12 paths that are projected to grow faster than the overall average of 14.3 percent, 9 typically need some level of postsecondary education.

The paths projected to grow the slowest are High school/More than 5 years/None; Associate's/1 to 5 years/None; and Bachelor's/More than 5 years/None. The High school/More than 5 years/None path contains an occupation projected to decline: farmers, ranchers, and other agricultural managers. The lone occupation in Associate's/1 to 5 years/None is the large and well-paying general and operations managers, which is projected to grow by 4.6 percent. The Bachelor's/More than 5 years/None path contains six management occupations.

For the most part, occupations in paths projected to have the most job openings from 2010 to 2020 are those with large employment numbers in 2010 and that require little formal education, no work experience, little or no OJT, and have low pay. (See chart 4.) Job openings come from both economic growth (new jobs) and the need to replace workers who permanently leave occupations, and the number of openings due to replacing workers is generally larger than the number of new jobs. The path projected to have the most job openings is also the lowest-paid path on the chart: Less than high school/None/Short-term OJT, with 14.6 million job openings and 4.8 million of those being new jobs. Next are two high school occupations: High school/None/Short-term OJT, with 8.0 million job openings (2.6 million from growth), and High school/None/Moderate-term OJT, with 6.1 million job openings (2.3 million from growth).

Although the top three paths with the largest number of job openings do not need postsecondary education, the path with the fourth largest number of job openings does. The Bachelor's/None/None path is projected to have 4.3

million job openings from 2010 to 2020, and 2.0 million of those are to be new jobs due to growth. This path is the fourth largest in occupational employment in 2010, at 10.8 million, and has an assortment of occupational groups.

Labor market analysis and required education

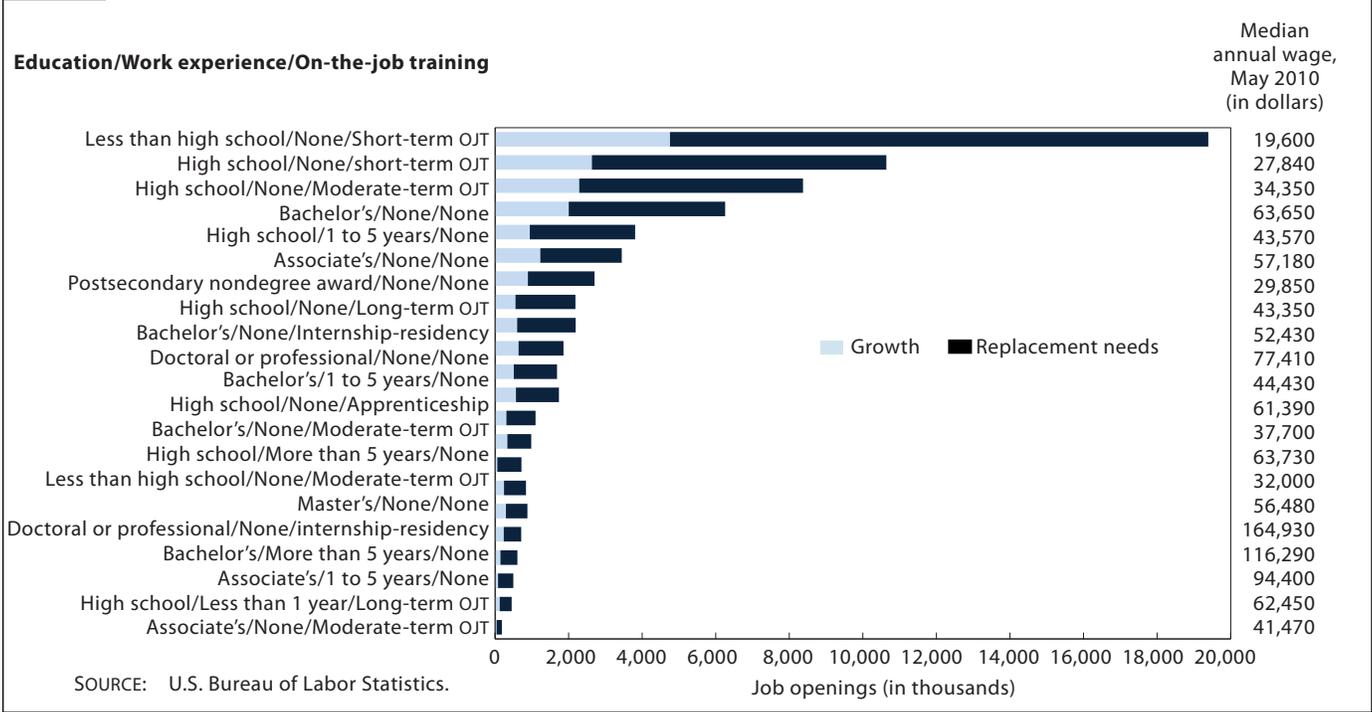
As noted at the beginning, BLS is presenting its approach to a problem that labor market analysts face across the globe. These analysts need a way to generalize and summarize employment trends by education and other preparation, which requires developing some construct to represent the complexities of how labor markets intersect with education and other preparation for work.

A review of several other studies finds two approaches to generalizing and summarizing employment trends. The first is a classification approach in which occupations are categorized according to education and training. A second approach is computational, in which the base year and projected employment are distributed by educational attainment and then employment is reaggregated by the educational attainment categories, resulting in projected labor demand by education level. In both approaches, some analysts (but not BLS) also develop projections of the labor force by education or skill level and compare these projections to the labor demand by education level to depict projected supply-demand conditions by education level.

The BLS approach is an example of the first approach, since each SOC occupation for which projections are produced receives the education and training assignments. The SOC itself does not consider education or training level in the design of the classification. Other occupational classification systems, however, build education level into the occupational classification itself using a skills hierarchy. The International Standard Classification of Occupations (ISCO)¹⁴ and Canada's National Occupational Classification (NOC)¹⁵ are examples of such classifications.

The Canadian Occupational Projections System produces demand projections by broad skill level, using the NOC's hierarchy of education level or training usually required for a person to work in a given occupation. This process is straightforward. The projections for individual occupations are summed according to the NOC hierarchy, resulting in employment by five skill levels: management occupations and occupations usually requiring university education, college education or apprenticeship training, high school diploma, and only OJT.¹⁶ The Canadian analysts also produce labor force projections by level of education attainment and then convert these labor force projections to broad skill level using the distributions of the

Chart 4. Job openings due to growth and replacement needs for selected paths, projected 2010–2020



nonstudent labor force by education and skill level. They also discuss in detail the reasons why a worker's education and the requirements of his or her eventual occupation may be quite different, noting that, for example, in occupations typically requiring only OJT, about 30 percent of the workers have a postsecondary education.¹⁷ This finding is similar to the comparison of the BLS education categories and the ACS educational attainment data noted earlier.

A broadly applied example of the second approach is found in Europe. The European Center for the Development of Vocational Training, referred to by its French acronym CEDEFOP (Centre Européen pour le Développement de la Formation Professionnelle), has produced analyses of skills supply and demand in Europe. The models used include production of demand by occupation and translation of this information into demand by qualification. Qualifications are broadly defined based on education attainment as three groups: high, medium, and low. Employment demand projections are translated to qualifications based on continuation of past patterns of employment by broad qualification level within both occupations and industries.¹⁸ As in Canada, the CEDEFOP model also includes components for projecting the labor force by education attainment and for allocating the labor force to occupations, assuming historical patterns of unemployment by qualification categories will continue.

The CEDEFOP authors note that “there is no simple one-

to-one relationship between occupation and qualification”¹⁹ but explore how these are changing over time. Like the Canadian analysis, CEDEFOP examines the nature of the differences between the characterization of occupational requirements and the actual distribution of workers in occupations by their level of education attainment, identifying a variety of types of mismatches.²⁰

In the United States, an example of the second approach, but also including the first approach, is found in a recent working paper by Neumark, Johnson, and Mejia.²¹ The study examines the question of whether the pending retirement of the baby boom generation will result in a skills gap in the U.S. labor market. The authors use the previous 11 BLS education and training categories to depict demand by education attainment, encountering the weaknesses of these categories described earlier. The authors also project education requirements by assuming a steady rate of growth between 2008 and 2018 in the education distributions within occupations.

Also in the United States, a Georgetown University report depicts the projected education requirements of jobs by occupation using the distribution of 2008 employment by occupation and education attainment and projecting the change in this distribution to 2018.²² The Georgetown authors assume that “the present distribution of education among the employed prime-age population is the best single indicator of present demand for education.”²³

These studies, in the United States and elsewhere, demonstrate the complexity of relating education to employment requirements. All rely on employment demand by occupation as the source of demand for workers with various educational qualifications. The studies differ in their consideration of the nature of mismatches between the education that workers have and the education and training that occupations require. The new BLS education and training categories and the 2010–2020 employment projections provide a new data set for future research on this important topic.

IN SUM, the new BLS education and training categories provide information on the typical path that one needs to enter an occupation and to become competent at perform-

ing it. They provide useful information not only for career seekers and persons who advise them but also for policy makers, businesses, and others with interest in education and training needs. When the categories are applied to the 2010–2020 employment projections, they show that faster growth is projected in occupations in which postsecondary education is typically needed for entry, and in terms of OJT, the fastest growth is projected in occupations that typically require an apprenticeship. The system also allows analysis across its three dimensions, and the three dimensions make up a “typical” path. The fastest growing paths from 2010 to 2020 are heavily represented by healthcare occupations. Individuals in occupations with the same entry-level education requirement and who need work experience earn more than those who do not need work experience. □

NOTES

¹ The education and training assignments for all occupations in the 2010 National Employment Matrix are shown in Employment Projections Table 1.12, http://www.bls.gov/emp/ep_table_112.htm.

² Definitions for the individual categories and assignments are presented at http://www.bls.gov/emp/ep_definitions_edtrain.pdf.

³ The prior system was introduced in *Employment Outlook: 1994–2005. Job Quality and Other Aspects of Projected Job Growth*. Chapter III. The Educational Requirements of Jobs. BLS Bulletin 2742, December 1995. It was further described in “A New Way to Classify Occupations by Education and Training,” *Occupational Outlook Quarterly* (Winter 1995–1996).

⁴ These data are available in Employment Projections Table 1.11 at http://www.bls.gov/emp/ep_table_111.htm.

⁵ BLS produces employment projections for 749 occupations; these occupations match the structure that the Occupational Employment Statistics (OES) program used to publish 2010 data. OES occupations are classified on the basis of the Standard Occupational Classification (SOC) system. However, OES data do not exactly match the updates made to the SOC in 2010. OES is transitioning to the 2010 SOC, but the change will not be fully implemented until the 2012 reference year.

⁶ Employment Projections Table 1.11, http://www.bls.gov/emp/ep_table_111.htm.

⁷ See, for example, Neeta P. Fogg and Paul E. Harrington, “The Growing Disconnection Between Recent College Graduates and the College Labor Market,” *CONTINUING HIGHER EDUCATION REVIEW*, Vol. 75, 2011, http://www.drexel.edu/provost/clmp/docs/CLMP_RisingMal-EmploymentandtheGreatRecession.pdf.

⁸ SOC 27–2099, Entertainers and Performers, Sports and Related Workers, All Other.

⁹ The count of 58 manager and supervisor occupations with a work experience assignment includes all occupations in SOC Major Group 11, Management Occupations, all first-line supervisor occupations, and additional occupations with “manager” or “director” in the SOC title and/or “planning and directing” activities in the occupational definition (SOC codes 13–1011, 21–2021, 27–1011, and 27–2012).

¹⁰ C. Brett Lockard and Michael Wolf, “Occupational Employment Projections to 2020,” *Monthly Labor Review*, January 2012, pp. 84–108, <http://www.bls.gov/opus/mlr/2012/01/art5full.pdf>.

¹¹ For example, see “Education Pays” at <http://www.bls.gov/emp/>

[ep_chart_001.htm](#). This chart shows 2011 median weekly earnings for persons age 25 and over by educational attainment, using data from the Current Population Survey.

¹² The paths are presented in the order of “education/work experience/on-the-job training”; see chart 3.

¹³ See Dixie Sommers and James C. Franklin, “Overview of Employment Projections to 2020,” *Monthly Labor Review*, January 2012, pp. 3–20, <http://www.bls.gov/opus/mlr/2012/01/art1full.pdf>.

¹⁴ International Labor Organization, International Standard Classification of Occupations, <http://www.ilo.org/public/english/bureau/stat/isco/?wparam=1330965836>.

¹⁵ Statistics Canada, “National Occupational Classification—Statistics (NOC-S),” <http://www.statcan.gc.ca/subjects-sujets/standard-norme/soc-cnp/2006/noc2006-cnp2006-menu-eng.htm>.

¹⁶ Human Resources and Skills Development Canada, “Looking-Ahead: A 10-Year Outlook for the Canadian Labour Market (2008–2017),” November 2008, pp. 35–38, <http://www23.hrsdc.gc.ca/1.3bd.2t.1ils@-eng.jsp>. In a footnote on page 19, “college” in the Canadian system is described as including completion of a “certificate or diploma from a postsecondary institution (community college, CEGEP, nursing school, etc.)” and “a certificate below the Bachelor’s level at a university.”

¹⁷ *Ibid.*, pp. 21–23.

¹⁸ CEDEFOP, “Skills Supply and Demand in Europe: Medium-Term Forecast Up to 2020,” 2010, pp. 56–63 and Annex III, <http://www.cedefop.europa.eu/EN/publications/15540.aspx>.

¹⁹ *Ibid.*, p. 58.

²⁰ CEDEFOP, “The Skill Matching Challenge: Analysing Skill Mismatch and Policy Implications,” 2010, <http://www.cedefop.europa.eu/EN/publications/15275.aspx>.

²¹ David Neumark, Hans P. Johnson, and Marisol Cuellar Mejia, NBER Working Paper no. 17213, “Future Skills Shortages in the U.S. Economy?” July 2011, <http://www.nber.org/papers/w17213>.

²² Georgetown University, Center on Education and the Workforce, “Help Wanted: Projections of Jobs and Education Requirements Through 2018,” 2010, <http://cew.georgetown.edu/jobs2018/>.

²³ *Ibid.*, p. 130.