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Women Make Gains in the Workplace Amid a Rising Demand for Skilled Workers

The gender wage gap narrows as women stride into high-skill jobs and acquire more education

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How we did this

The American workplace has seen a rising need for high-skill workers in recent decades. This report examines the impact of the changing landscape for job skills on gender disparities in the U.S. labor market.

The analysis is based on job skills and preparation data from the U.S. Department of Labor's Occupational Information Network (O*NET), specifically Version 23, released August 2018, and Version 5.1, released November 2003. O*NET analysts rate the importance of 35 skills related to job performance in individual occupations. For the purposes of this analysis, we grouped these into five major families of job skills: social, fundamental, analytical, managerial and mechanical. Occupations were then assigned to one of four skill tiers based on the importance rating of each of the five major skills, ranging from least important to most important.

Examples of occupations in which each of the five skills is most important, or is in greatest need, in 2018 are as follows: social skills – sales managers; fundamental skills – lawyers; analytical skills – physicists; managerial skills – chief executives; and mechanical skills – industrial machinery mechanics. Occupational employment and wage data are from the Current Population Survey (CPS). For more information about the analysis, see the methodology section of this report.

Terminology

The importance of a skill refers to its rating on a scale from one (not important) to five (extremely important). A rating of three means the skill is considered important for work performance in an occupation. The source data on occupational information, the Occupational Information Network (O*NET), provides ratings for 35 skills in individual occupations. We grouped these skills into five major categories for the analysis in this report: social, fundamental, analytical, managerial and mechanical.

In much of the analysis, we sorted occupations into four tiers based on the importance of a skill to those occupations. Occupations are ranked by the ratings for a skill, say social skills, and those ranking in the highest quartile (the top 25%) of a skill are occupations in which social skills are "most important." A skill is "more important" in occupations in the second highest quartile, "less important" in occupations in the third highest quartile and "least important" in occupations in the lowest quartile (the bottom 25%). This process is applied separately for each of the five skill groups analyzed. Each quartile consists of the same number of occupations. It is possible that an occupation is ranked at the top (or the bottom) with respect to more than one skill. For example, psychiatrists are in the top tier, or are "most important" users, of fundamental, social and analytical skills.

The terms "occupation" and "job" are used interchangeably in the report, as are the terms "earnings" and "wages."

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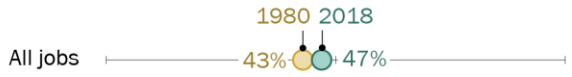
The gender wage gap narrows as women stride into high-skill jobs and acquire more education

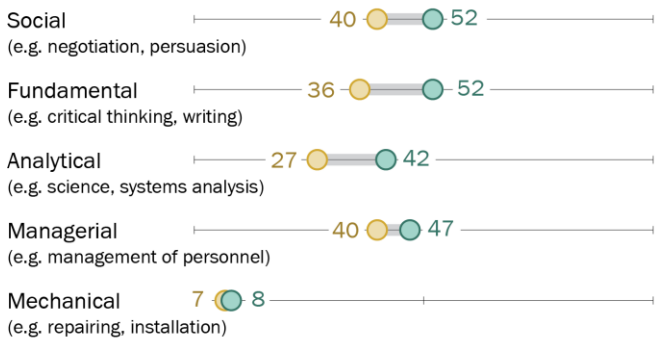
Employers in the United States are increasingly in pursuit of workers who are adept in social skills, like negotiation and persuasion, and have a strong grounding in fundamental skills, such as critical thinking and writing. In the past nearly four decades, employment in the U.S. has expanded most rapidly in jobs in which these skill sets are most valued. Jobs attaching greater importance to analytical skills, such as science, mathematics and programming, are also hiring workers at a brisk pace.[1]

Amid a growing need for skilled workers, women lead in filling jobs in which social, fundamental and analytical skills are most important ...

Women's share in employment

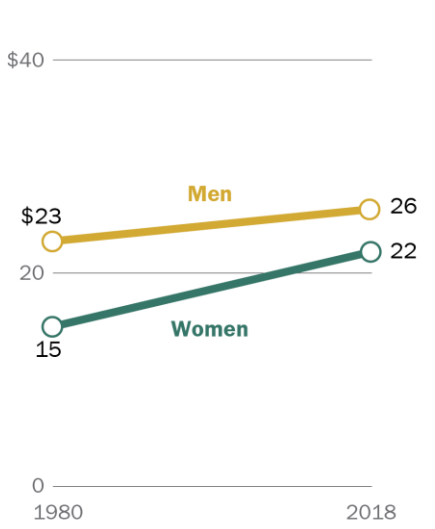


In jobs in which _____ skills are MOST important



... and it is one reason their earnings are growing faster than men's

Average hourly earnings, in 2018 dollars



Note: Occupations are ranked by the ratings for a skill, and those in the highest quartile of a skill are ones in which that skill is "most important." Full-time and part-time workers ages 16 and older.
Source: Pew Research Center analysis of O*NET (Version 23) and 1980 and 2018 Current Population Survey annual and outgoing rotation groups files (IPUMS).
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[1] See the text box for how occupations are grouped based on the importance of skills for job performance.

Women are in the vanguard of meeting these challenges. Not only have women been entering the labor force in greater numbers than men since 1980, they have made their presence felt more strongly in jobs with the greatest reliance on these types of skills.

Presently, women are in the majority in jobs that draw most heavily on either social or fundamental skills – such as legal, teaching and counseling occupations – accounting for 52% of employment in these jobs in 2018 (up from roughly 40% in 1980). The share of women has also risen greatly among those working in occupations that rely most on analytical skills – such as accounting and dentistry – from 27% in 1980 to 42% in 2018, according to a new Pew Research Center analysis of government data.

The growing presence of women in higher-skill occupations has contributed to more rapid wage growth for them in recent decades compared with men, and this helped to narrow the gender wage gap. From 1980 to 2018, the average hourly wage of women increased 45%, from $15 to $22, compared with an increase of 14% for men, from $23 to $26 (wages expressed in 2018 dollars).[2] Thus, the earnings of women as a ratio of the earnings of men increased from 0.67 to 0.85, a narrowing of the gender wage gap from 33 cents to the dollar in 1980 to 15 cents to the dollar in 2018.

The increase in wages for women has been sharper in jobs calling for greater prowess in skills. For instance, women's earnings increased by 58% from 1980 to 2018 in jobs placing the greatest emphasis on analytical skills. The gender wage gap narrowed from

Skill groups and the occupations with the greatest need for them

The 35 skills whose importance is rated in O*NET are grouped into five major families of job skills as follows:

Social skills – instructing, service orientation, monitoring, social perceptiveness, coordination, negotiation, persuasion
Fundamental skills – critical thinking, writing, speaking, reading comprehension, active listening, active learning, learning strategies, judgment and decision making
Analytical skills – science, mathematics, programming, complex problem solving, systems analysis, systems evaluation, operations analysis, technology design
Managerial skills – management of personnel resources, management of financial resources, management of material resources, time management
Mechanical skills – troubleshooting, equipment selection, equipment maintenance, repairing, installation, operation monitoring, quality control analysis, operation and control

Examples of occupations with among the greatest need for these skill groups are as follows:

Social skills – Sales managers, coaches and scouts, marriage and family therapists
Fundamental skills – Lawyers, psychiatrists, education administrators
Analytical skills – Physicists, biomedical engineers, computer and information research scientists
Managerial skills – Chief executives, construction managers, medical and health services managers
Mechanical skills – Signal and track switch repairers, industrial machinery mechanics, millwrights

[2] Percentage changes are computed before underlying estimates are rounded.

32 to 12 cents to the dollar in those jobs. This was due in part to a rapid rise in college completion among women working in high-skill jobs.

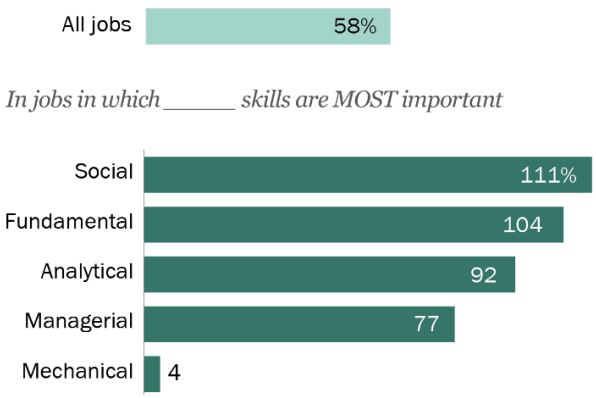
The ongoing presence of a gender wage gap, albeit narrower, is attributed to a variety of factors by scholars. Some of these factors, such as job skills, education level, work experience, union membership, hours worked, industry and occupation are measurable.[3] Others such as discrimination, differences in professional networks, and responsibilities associated with motherhood and caregiving are difficult to measure.

Women currently hold an edge over men in certain skills and in schooling: They are more likely to hold jobs in which fundamental and social skills are more important, and a greater share of women than men have graduated from college.[4] The analysis in this report estimates that women's edge in high fundamental- and social-skill jobs and college education raised their earnings by 4 cents to the dollar in 2018 when compared with men's earnings.[5] This means that if women were to lose their lead in skills and education, the gender wage gap would widen from 15 cents to the dollar to 19 cents to the dollar.

These findings are based on an analysis of the Occupational Information Network (O*NET), a database of occupational information developed under the sponsorship of the U.S. Department of Labor. The analysis in this report relies on O*NET ratings of the importance of 35 skills in individual occupations. These skills represent workers' attributes related to work performance and are grouped into five major categories for the purposes of this analysis: social, fundamental, analytical, managerial and

Employment is rising most rapidly in occupations in which social and fundamental skills are most important

% change in employment, 1980-2018



Note: Occupations are ranked by the ratings for a skill, and those in the highest quartile of a skill are ones in which that skill is "most important." Full-time and part-time workers ages 16 and older.
Source: Pew Research Center analysis of O*NET (Version 23) and 1980 and 2018 Current Population Surveys (IPUMS).
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[3] Wages may differ across occupations for reasons other than the job skills analyzed in this report, such as occupation-specific skills or the work environment, and a narrowing of occupational segregation among women and men has contributed to the decrease in the gender wage gap in recent decades.

[4] In 2018, 40% of employed women 16 and older had a bachelor's degree or higher level of education, compared with 35% of men.

[5] This estimate is based on a regression analysis like those in common use among researchers. Regression analysis is a statistical technique that estimates the relationship between earnings and the factors that are believed to determine earnings, such as skills, education, experience, occupation, industry, etc.

mechanical (see text box).[6] Employment and earnings estimates are derived from the Current Population Survey (CPS), a monthly survey conducted jointly by the U.S. Census Bureau and the Bureau of Labor Statistics. Among the report's other key findings:

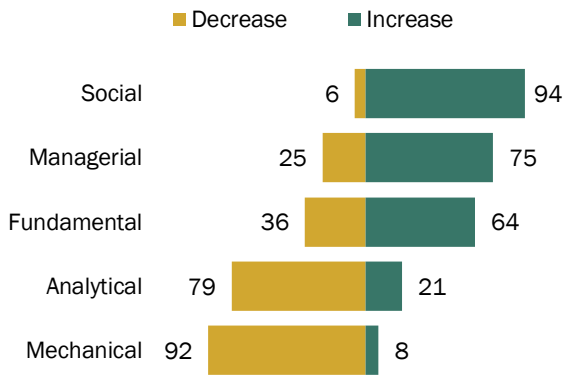
Not only are women gaining greater representation in jobs that are most demanding of social and fundamental skills, but employment in those jobs is growing rapidly. From 1980 to 2018, overall employment more than doubled in jobs where social and fundamental skills are most important, by 111% and 104%, respectively. Employment in jobs most in need of analytical skills increased nearly as sharply (92%), compared with an increase of 58% in employment overall.

In addition, the importance of social skills, *relative* to the importance of other skills within occupations, appears to have increased in more than nine-in-ten occupations since the 1980s, and the relative importance of fundamental skills has increased in more than six-in-ten occupations.[7] The relative importance of managerial skills also seems on the rise in most occupations.

Although the relative importance of analytical skills increased in only about one-in-five long-standing occupations, the profiles of newer occupations emerging in today's knowledge-based economy illustrate a growing need for specific analytical skills. Jobs such as database architects, informatics nurse specialists and video game designers represent a new class of occupations that rely more heavily on

The importance of social skills is increasing *relative* to the importance of other skills in almost all occupations

% of occupations with an increase or a decrease in the importance of a skill, relative to the importance of other skills in that occupation, circa 1990 to 2018



Note: Findings are tentative due to changes in methodology for rating occupational skills between the two versions of the source data. Sample consists of 670 occupations at the 6-digit level of classification matched between 2003 and 2018 in O*NET data. "Circa 1990" refers to O*NET data from 2003 (Version 5.1), which is based on ratings developed from the late 1970s through the early 1990s for the Dictionary of Occupational Titles.
Source: Pew Research Center analysis of O*NET (Versions 5.1 and 23).
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[6] In addition to ratings related to the attributes of workers, O*NET also provides ratings related to occupational requirements. The latter set of requirements are not included in the analysis in this report. A sizable body of literature examines how computerization and automation are affecting the tasks workers perform on the job, including the disparate effects of these changes on women and men (for example, Autor, Levy and Murnane, 2003; Autor, 2019; McKinsey Global Institute, 2018; Organization for Economic Cooperation and Development, 2018; Eurofound, 2018; and International Monetary Fund, 2018).

[7] The findings on the changing importance of skills within jobs are based on Occupational Information Network (O*NET) data from 2003 (Version 5.1) and 2018 (Version 23). The former contains ratings developed mostly in the period from the late 1970s to the early 1990s and

programming, science, systems analysis and evaluation, and technology design skills – all elements of the general class of so-called STEM skills.[8] On the other hand, demand for mechanical skills, such as repairing, troubleshooting and equipment maintenance, is on the wane.[9]

Measuring the need for skills in the workplace

The analysis of job skills in this report is based on the U.S. Department of Labor-sponsored Occupational Information Network (O*NET), a database spanning more than 950 occupations. Each occupation is rated on a variety of dimensions, including the importance of 35 skills representing workers' attributes related to work performance. More specifically, O*NET analysts assign a numerical rating to the importance of each skill, from one (not important) to five (extremely important).

In this analysis, the ratings of individual skills within each of the five broader skill groups are averaged to estimate the importance rating for the skill groups (see text box above for the detailed skills within each group). For example, the importance of social skills in an occupation is estimated as the average of the importance ratings for instructing, service orientation, monitoring, social perceptiveness, coordination, negotiation and persuasion.

Grouping occupations by the importance of a skill

The grouping of occupations by the importance of a skill is based on a comparison *across* occupations. Occupations are ranked by the ratings for a skill, and those falling in the highest quartile (top 25%) of a skill are occupations in which that skill is "most important." A skill is "more important" in occupations in the second highest quartile of that skill, "less important" in occupations in the third highest quartile and "least important" in occupations in the lowest quartile (bottom 25%). This process is applied separately for each of the five skill groups analyzed. It is possible that an occupation is ranked at the top (or the bottom) for more than one skill. Each quartile consists of the same number of occupations.

Data sources

The analysis is based principally on O*NET data from 2018 (Version 23) and 2003 (Version 5.1). The 2003 dataset contains ratings based on data collected from the late 1970s through the early 1990s for the Dictionary of Occupational Titles (DOT), the predecessor to O*NET. The ratings from the DOT are based on a different methodology than currently used in O*NET and comparisons of skill ratings over time should be treated with appropriate caution. Employment and earnings estimates are derived from the Current Population Survey (CPS), sourced from IPUMS. See Methodology for details.

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the latter contains ratings mostly developed since 2010. As detailed elsewhere in the report, these findings are tentative due to changes in methodology for rating occupational skills between the two versions of the data.

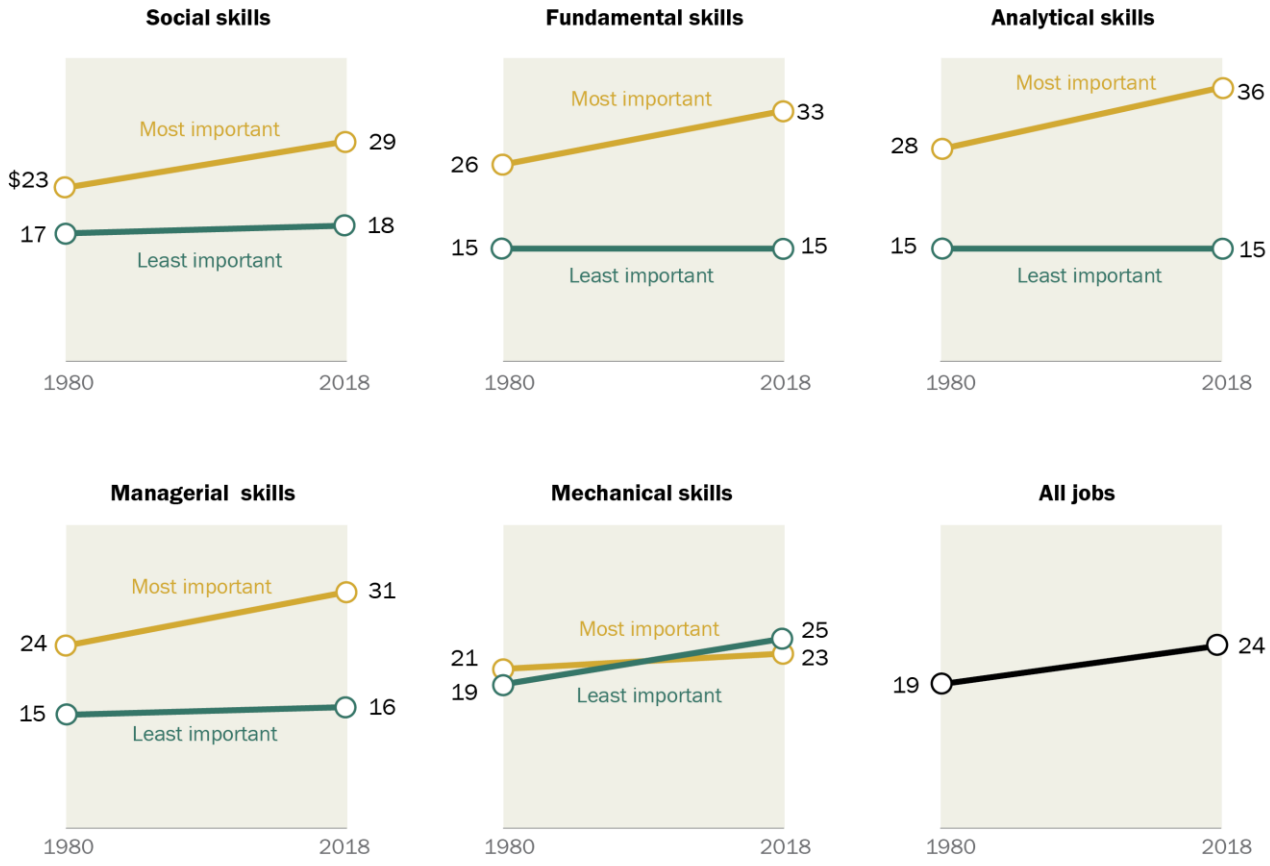
[8] STEM refers to science, technology, engineering and math. A recent Pew Research Center analysis profiled the U.S. STEM workforce from 1990 to 2016 based on an analysis of workers ages 25 and older in any of 74 occupations.

[9] In related research, economists using alternative data sources and frameworks have noted a decrease in the demand for routine skills and an increase in the demand for non-routine skills, such as social skills.

Jobs that rely heavily on social, fundamental, analytical and managerial skills also pay more. In 2018, jobs in which social skills are most important – clergy and sales managers, for example – paid a mean hourly wage of $29. In contrast, jobs relying the least on social skills – slaughterers and meat packers, for example – paid a mean hourly wage of $18, about 40% less. Likewise, jobs most in need of analytical skills – physicists and civil engineers, for example – paid $36 per hour, on average, more than double the mean hourly wage of $15 in occupations least in

Wages are increasing more rapidly in occupations that rely most heavily on analytical and managerial skills

Average hourly wage in the highest (most important) and lowest (least important) quartiles of jobs ranked by importance of a skill, in 2018 dollars



Note: Occupations are ranked by the ratings for a skill, and those in the highest quartile of a skill are ones in which that skill is "most important" and those in the lowest quartile are the ones in which that skill is "least important." Full-time and part-time workers ages 16 and older.
Source: Pew Research Center analysis of O*NET (Version 23) and 1980 and 2018 Current Population Survey outgoing rotation groups (IPUMS). "Women Make Gains in the Workplace Amid a Rising Demand for Skilled Workers"

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need of analytical skills, such as dressing room attendants and loading machine operators. A similar pattern prevailed among occupations ranked by the importance of fundamental and managerial skills.

On the other hand, wages vary little across jobs based on their reliance on mechanical skills. In 2018, jobs in which mechanical skills are most important, such as ship engineers and elevator installers and repairers, paid an average hourly wage of $23. This was slightly *less* than the average hourly wage of $25 in jobs in which mechanical skills are least important.

A reason for this pattern in wages is that social, fundamental, analytical and managerial skills reinforce and complement each other, pushing wages higher or lower in tandem. But mechanical skills and nonmechanical skills move in opposition. Thus, a job with a limited need for mechanical skills, such as human resource managers, can be a high-wage job because it calls for greater competence in other skills.

Wages are rising faster in jobs that rely more on nonmechanical skills. From 1980 to 2018, wage growth ranged from 24% in jobs in which social skills are most important to 29% in jobs in which managerial and analytical skills are most important. Meanwhile, wages in jobs least in need of these nonmechanical skills were either stagnant or barely changed from 1980 to 2018. Overall, rising employment in higher-skill jobs *and* rising wages in those jobs affirm the growing demand for workers more practiced in social, fundamental, managerial and analytical skills.

The more rapid increase in the wages of workers nimble in nonmechanical skills also sheds light on a related phenomenon – the growing gap in wages between the most and least educated. Jobs in which nonmechanical skills are most important mainly employ workers with four years of college or higher levels of education. As employment has shifted in the direction of these jobs,[10] a rising share of American workers, women especially, have benefited from this trend, at least to some extent by acquiring more schooling.[11]

The need for proficiency in social and fundamental skills is widespread across occupations. A direct examination of the skill ratings in the O*NET reveals the ubiquity of social and basic skills among jobs today. As of 2018, fundamental skills were rated "important" to "extremely important" for work performance by O*NET analysts in about seven-in-ten

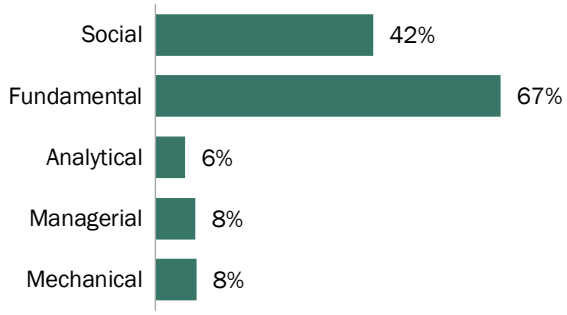
[10] For example, the share of workers with jobs in the top rungs of social skills increased from 31% in 1980 to 42% in 2018.
[11] This trend – rising shares of more skilled workers pulling away from other workers in terms of earnings – is implicit in Pew Research Center's findings on the size and economic well-being of the American middle class. That research, covering the period since 1970, shows that a growing share of American adults live in upper-income households with incomes rising faster than the incomes of lower- and middle-income households.

occupations.[12] Social skills were rated similarly important in about four-in-ten occupations. This breadth of demand across occupations was much greater than the comparable scope for analytical, managerial and mechanical skills, which are more likely to be rated "somewhat important" or "not important" by O*NET analysts.

The growing demand for high-skill workers – and the changing skills requirements within occupations – is not lost on Americans. A new Pew Research Center survey finds that 51% of adults who are in the labor force say it will be essential for them to get training and develop new skills throughout their work life in order to keep up with changes in the workplace.[13]

Fundamental skills are considered important in two-thirds of occupations

% of occupations in which a given skill is rated important to extremely important in 2018



Note: "Important" and "extremely important" refer to scores on the O*NET scale of 1 to 5. "Important" is a score of 3 and "extremely important" is a score of 5.
Source: Pew Research Center analysis of O*NET (Version 23). "Women Make Gains in the Workplace Amid a Rising Demand for Skilled Workers"

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Workers also echoed the importance of social and fundamental skills in their own jobs in a 2016 Pew Research Center survey. When asked to assess the importance of selected skills in doing their jobs, 50% of employed adults said that interpersonal skills were extremely important, 46% pointed to critical thinking, and 45% said good written and spoken communication were extremely important. Only about one-in-ten said that the ability to operate, build or repair machinery or equipment was extremely important.[14]

[12] In the O*NET, analysts rate the importance of each skill to work performance in an occupation on a scale of one to five, from not important to extremely important.
[13] In the same survey, 62% of adults who say there is too much economic inequality in the U.S. today also say that ensuring workers have the skills they need for today's jobs would do a great deal to reduce economic inequality. It is the only measure that majorities of Democrats and Republicans who think there's too much economic inequality say would do a great deal to reduce it.
[14] The survey was conducted in association with the Markle Foundation. The same Pew Research Center report also examined the changing need for skills in the workplace, but through a narrower lens.

1. Employment is rising most rapidly in jobs most in need of social, fundamental and analytical skills

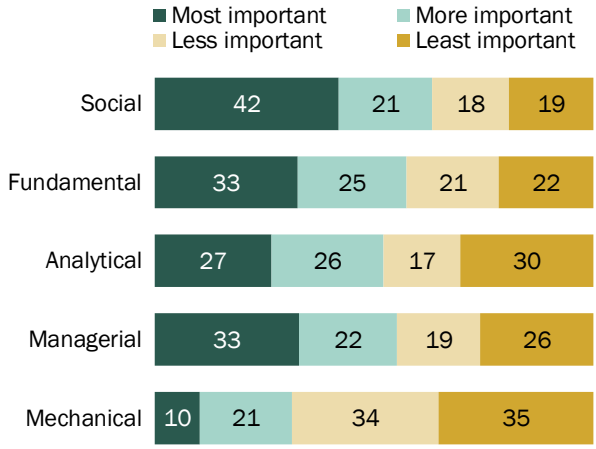
The U.S. economy employed nearly 156 million workers in 2018 in the midst of a record long spell of job creation. The jobs these workers did are different from what workers had done a few decades ago. Opportunities in the manufacturing sector have diminished, shrunken by a rising tide of automation and globalization. Meanwhile, the growing demand for a college education and the emergence of Millennials have fueled growth in the education sector. And the aging Baby Boomers have created an appetite for more health care workers.

Viewed through the lens of skills, a sizable plurality of workers are engaged in occupations in which socials skills are most important, such as nursing and retail sales. In 2018, 42% of all workers, or 65 million, held jobs in which social skills are most important. In contrast, only 19% of workers were employed in occupations in which social skills are least important.

Fundamental skills are also in relatively high demand. Some 33% of workers were employed in occupations in which fundamental skills are most important, such as accounting and teaching, compared with 22% in occupations in which fundamental skills are least important. The need for managerial skills is similar, with 33% of workers in jobs in which managerial skills are most important and 26% in jobs in which they are least important.

Four-in-ten workers are in occupations in which social skills are most important

% of employed workers, by importance of a skill, 2018



Note: Occupations are ranked by the ratings for a skill, and those in the highest quartile of a skill are ones in which that skill is "most important." A skill is "more important" in occupations in the second highest quartile, "less important" in occupations in the third highest quartile and "least important" in occupations in the lowest quartile. An occupation may rank at the top or the bottom for more than one skill. Full-time and part-time workers ages 16 and older.
Source: Pew Research Center analysis of O*NET (Version 23) and 2018 Current Population Survey (IPUMS).
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The demand for analytical skills is more diffuse, perhaps because they represent a more specialized set of science, engineering and technological skills. While about one-in-four workers are employed in occupations in which analytical skills are most important, nearly one-in-three are in occupations in which analytical skills are least important. The need for workers who possess mechanical skills is modest – only 10% are employed in occupations in which mechanical skills are most important.

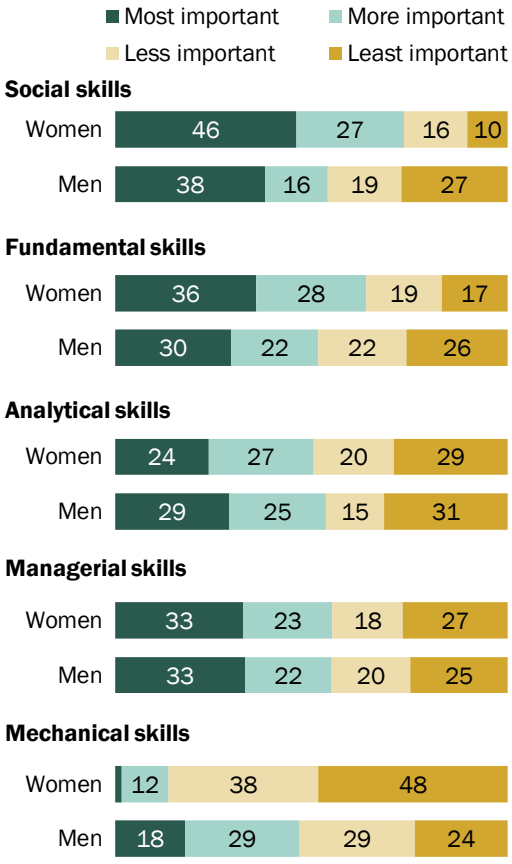
Women are more likely than men to hold jobs that require a high degree of proficiency in social skills. In 2018, nearly three-in-four women either worked in occupations in which social skills are most important (46%) or more important (27%). Among men, about half worked in jobs in which social skills are most important (38%) or more important (16%). Men were nearly three times as likely as women to hold jobs where social skills are least important, 27% vs. 10%.

On the other hand, men are much more likely than women to work in jobs requiring mechanical skills. In 2018, 47% of men were employed in occupations in which these skills are either most or more important, compared with only 14% of women. Conversely, women were twice as likely as men – 48% vs. 24% – to be found in jobs in which mechanical skills are least important.

Women also have an edge over men with respect to fundamental skills. About two-thirds of women (64%) were in jobs in which fundamental skills are either most or more important, compared with 52% of men. The gender gap in analytical skills is narrow, with women and men almost equally spread across jobs ranked by the importance of analytical skills.

Women have a greater presence in occupations needing high social and fundamental skills

% of employed workers, by importance of a skill, 2018



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Source: Pew Research Center analysis of O*NET (Version 23) and 2018 Current Population Survey (IPUMS).
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There is virtually no difference in how women and men are represented in occupations grouped by the importance of managerial skills.

The differences in the skill distributions of women and men have implications for their earnings. As shown in the next chapter, wages increase with the importance ratings of nonmechanical skills and decrease with the importance rating of mechanical skills. With women placed more favorably in the realm of nonmechanical skills and men leaning more to mechanical skills, the differences in employment patterns boost women's earnings and help narrow the gender wage gap.

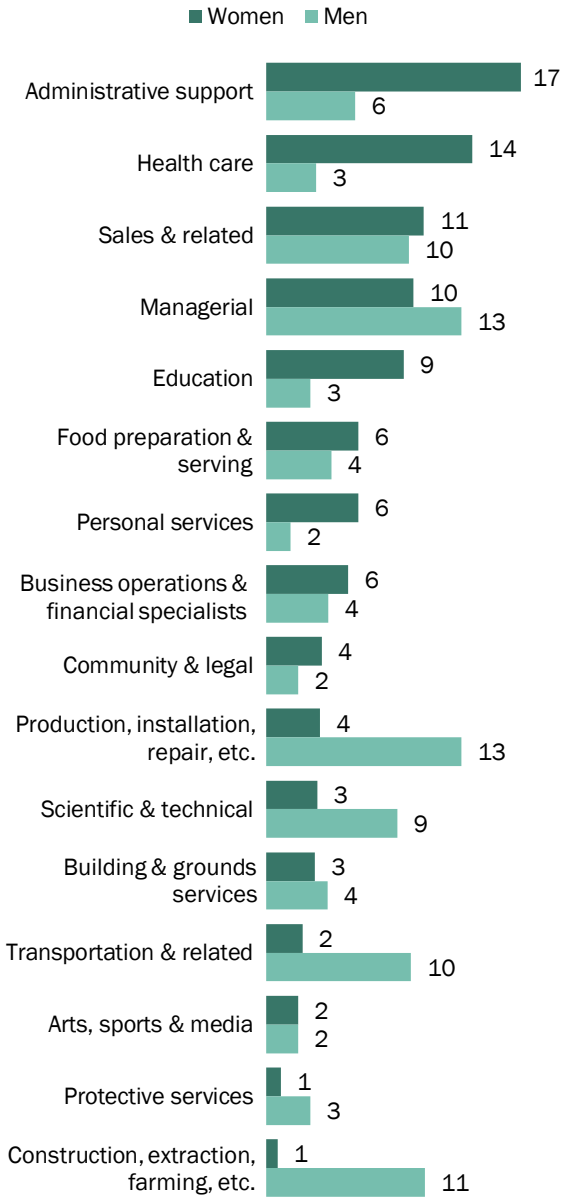
Gender differences in skills are rooted in gender differences in occupations

The skills that women and men deploy in the workplace are influenced by the specific occupations they gravitate to, whether by choice or by dint of cultural norms and other constraints.

The occupations in which women are more concentrated are often represented at the top of the ratings of social, fundamental and managerial skills. They fall into the broad categories of administrative support, health care, sales and related, managerial, and education related occupations. Collectively, these five major groups of occupations accounted for 61% of women's employment in 2018. Examples of these types of jobs include supervisors of administrative support workers,

The top employing occupations for women and men are different

% of women and men employed in an occupation, 2018



Note: Full-time and part-time workers ages 16 and older.
Source: Pew Research Center analysis of 2018 Current Population Survey (IPUMS).
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Occupations often need higher proficiency in more than one skill

A key aspect of workplace skills is that jobs often place a high degree of emphasis on more than one skill. In general, social, fundamental, analytical and managerial skills operate in harmony, a higher need for one skill accompanied by a higher need for the other skills. However, mechanical skills are weakly, and negatively, related with the other skills. Thus, there is considerable overlap in the counts of workers in jobs in which social, fundamental, analytical and managerial skills are more (or less) important, but there is little overlap among jobs in which mechanical skills and other skills are more important.

The relationship among skills is illustrated by the appearance of some occupations at the top of the ratings of more than one skill. For example, education administrators are called upon to be highly adept in social, fundamental *and* managerial skills. The 10 occupations that appear at the top of the importance ratings for each skill in 2018 are as follows:

Social skills – Coaches and scouts; educational, guidance, school and vocational counselors; clergy; lodging managers; sales managers; education administrators, elementary and secondary school; marriage and family therapists; emergency management directors; education administrators, preschool and child care center/program; and first-line supervisors of office and administrative support workers.

Fundamental skills – Neuropsychologists and clinical neuropsychologists; education administrators, elementary and secondary school; psychiatrists; judges, magistrate judges and magistrates; lawyers; physics teachers, postsecondary; agricultural sciences teachers, postsecondary; clergy; law teachers, postsecondary; and anthropology and archeology teachers, postsecondary.

Analytical skills – Biomedical engineers; physicists; chemical engineers; aerospace engineers; nuclear engineers; software developers, applications; operations research analysts; computer and information research scientists; remote sensing scientists and technologists; and mining and geological engineers, including mining safety engineers.

Managerial skills – Education administrators, elementary and secondary school; construction managers; medical and health services managers; chief executives; training and development managers; purchasing managers; education administrators, postsecondary; education administrators, preschool and child care center/program; lodging managers; and first-line supervisors of non-retail sales workers.

Mechanical skills – Signal and track switch repairers; heating and air conditioning mechanics and installers; aircraft mechanics and service technicians; elevator installers and repairers; electric motor, power tool and related repairers; industrial machinery mechanics; mobile heavy equipment mechanics, except engines; electromechanical technicians; millwrights; and electrical and electronics repairers, commercial and industrial equipment.

Simple correlations show that the strongest complementarity is among fundamental and social skills. The correlation between the ratings for these two skills in 2018 was 0.83, on a scale of zero (not related) to one (perfectly related). Other notable correlations are between fundamental and analytical skills (0.76), social and managerial skills (0.67), and fundamental and managerial skills (0.61). A principal components analysis finds that mechanical skills comprise one principal component, and the remaining skills comprise the second principal component, affirming the complementarity of nonmechanical skills and their independence from mechanical skills.

psychiatrists, supervisors of sales workers, medical and health services managers, and education administrators (see text box).

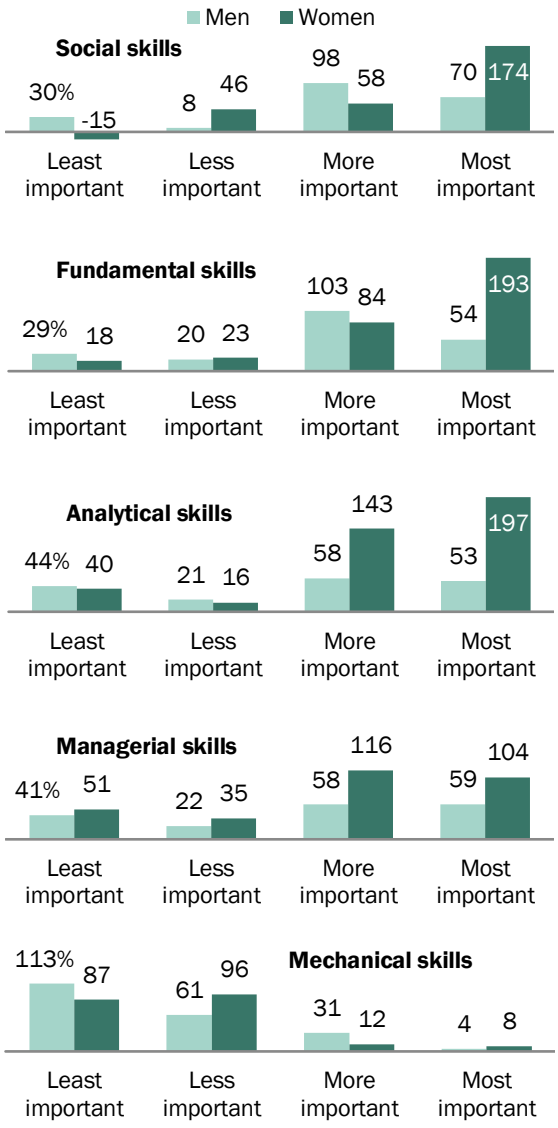
In contrast, men are more concentrated in jobs with a stronger need for mechanical skills. Specifically, production, installation and repair occupations, construction, extraction and farming, and transportation and related occupations are among the top five occupations for men, accounting for 34% of their employment in 2018. Examples of jobs within these broad groups include signal and track switch repairers, elevator installers and repairs, and industrial machinery mechanics.

Employment is rising rapidly in jobs in which social and fundamental skills are most important

The value placed on social and fundamental skills in the modern workplace reflects the rapid growth in employment in jobs in which these skills are most important, by 111% and 104% from 1980 to 2018, respectively. Jobs in which analytical skills are most important expanded nearly as much, rising in employment by 92%. The pace of hiring in these jobs was well in excess of the gain in employment overall (58%).

Women's employment is rising faster than men's in high-skill occupations

% change in employment, by importance of a skill, 1980 to 2018



Note: Occupations in the highest or lowest quartiles of a skill are ones in which that skill is "most important" or "least important." Full-time and part-time workers ages 16 and older.
Source: Pew Research Center analysis of O*NET (Version 23) and 1980 and 2018 Current Population Surveys (IPUMS).
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Women have done more than men to capitalize on the increased demand for social, fundamental and analytical skills.[15] The employment of women in jobs in which social skills are most important increased 174% from 1980 to 2018, compared with 70% for men. An even greater gender divide appeared during this time in hiring into jobs in which fundamental skills are most important – 193% to 54% in favor of women. Women's gains in employment (197%) also outdistanced men's (53%) in occupations relying most on analytical skills. Overall, women's employment increased by 74% from 1980 to 2018, compared with 45% for men.

In contrast, men were more inclined than women to move into jobs in which social, fundamental and analytical skills are least important. For example, among jobs in which social skills are least important, men's employment increased 30% from 1980 to 2018, compared with a *decrease* of 15% in women's employment.

As social, fundamental and analytical skills have become more prominent in the workplace, the importance of mechanical skills has diminished sharply. Occupations in which mechanical skills are most important barely registered an increase in employment from 1980 to 2018 – only 8% for women and 4% for men, compared with the 58% increase in employment overall.

The rapidly growing presence of women in higher-skill nonmechanical activities is partly a result of their transition into new lines of work since 1980. Most notably, women's share in employment in community and legal services occupations increased from 35% in 1980 to 60% in 2018. Women also moved into the majority in business operations and financial specialist occupations, with their share in employment increasing from 36% to 54% over the period. Other notable changes include the rising presence of women in managerial as well as scientific and technical occupations, with their shares in these two job categories increasing by 15 and 10 percentage points, respectively.

On the other side of the ledger, women pivoted away from food preparation and serving, administrative support, and installation, maintenance and repair occupations from 1980 to 2018. The most significant change was the exit from food preparation and serving occupations, with women's share in employment in these jobs decreasing from 67% to 56% over the period. Meanwhile, women's share in employment in administrative support occupations fell from 79% to 72%, and their share in installation, maintenance and repair occupations decreased from 26% to 20%.

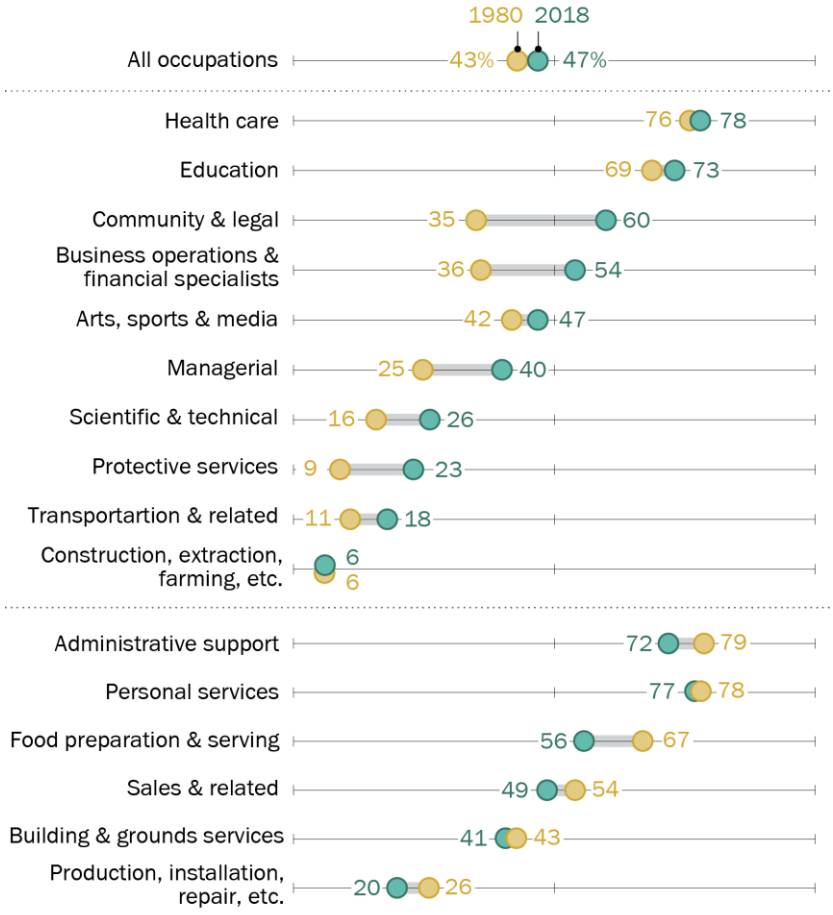
[15] This trend has also been observed by other researchers with reference to different classifications of skills, earlier time periods and data from the Dictionary of Occupational Titles and other sources (Autor and Price, 2013; Cortes, Jaimovich and Siu, 2018).

The occupations that women progressed into from 1980 to 2018 require higher degrees of proficiency in nonmechanical skills than the occupations women retreated from. For example, the average rating for fundamental skills in community and legal services occupations was 3.7 in 2018 (on the O*NET scale from one to five, or from "not important" to "extremely important"). The average rating for fundamental skills in food preparation and serving occupations was 2.7.

Overall, the occupational transitions made by women from 1980 to 2018 are one reason why their employment in higher-skill nonmechanical occupations has grown more rapidly than the employment of men in similar occupations. Nonetheless, as noted above, these shifts fell short of closing the gender gap in the occupational distributions of men and women. While women accounted for 47% of employment overall in 2018, their shares were markedly higher than this in health care, education, administrative support and personal services occupations and distinctly lower in some higher-skilled occupations, such as scientific and technical occupations.

Women accounted for a greater share of employment in many higher-skill, white-collar occupations in 2018

Women's share in total employment in an occupation (%), 1980 and 2018



Note: Full-time and part-time workers ages 16 and older.
Source: Pew Research Center analysis of 1980 and 2018 Current Population Surveys (IPUMS).
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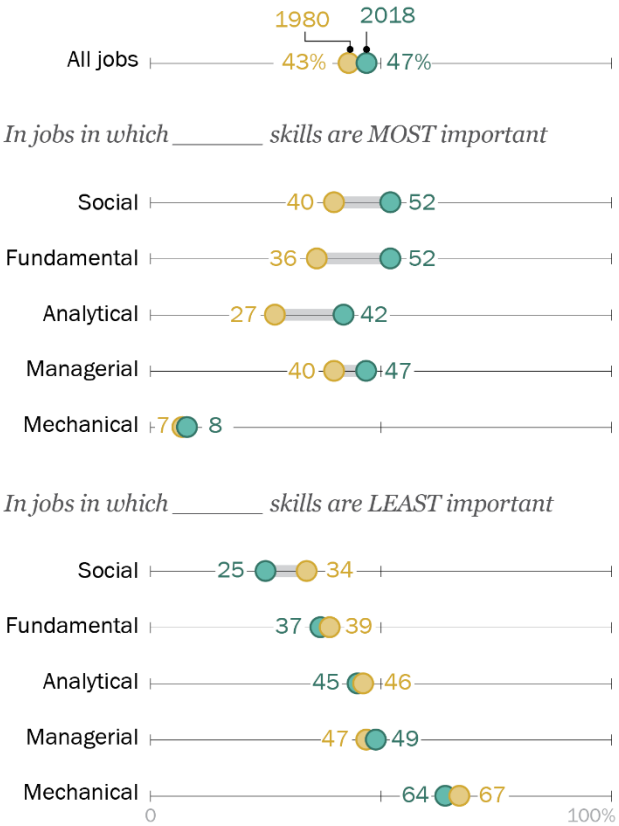
The occupational gender gap notwithstanding, the profile of women in high-skill jobs has come into sharper relief since 1980. As noted, women's share of employment in jobs in which social, fundamental and analytical skills are most important increased rapidly from 1980 to 2018. Meanwhile, women's role in occupations placing the least importance on social skills has diminished markedly, from 34% in 1980 to 25% in 2018. Their presence in occupations least in need of fundamental, analytical, managerial or mechanical skills is largely unchanged.

At the top of the skills ladder, nursing is a leading activity for women and management is a leading activity for men

Occupations ranked at the top of the social skills ladder employed nearly 34 million women and 32 million men in 2018. In terms of employment, the leading high-social-skills job for women was nursing, with 3 million women working as registered nurses in 2018. Employment as elementary and middle school teachers was nearly as important for women in the group of occupations requiring high social skills, followed by supervising sales workers, managing in assorted jobs and providing customer service. Notably, vast majorities of registered nurses (88%) and elementary and middle school teachers (80%) are women.

Women's presence in high-skill occupations is rising and is unchanged or falling in low-skill occupations

Women's share in employment (%)



Note: Occupations are ranked by the ratings for a skill, and those in the highest or lowest quartiles of a skill are ones in which that skill is "most important" or "least important." Full-time and part-time workers ages 16 and older.
Source: Pew Research Center analysis of O*NET (Version 23) and 1980 and 2018 Current Population Surveys (IPUMS).
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For men, a variety of managerial jobs provided the top high-social-skills opportunities, engaging more than 3 million men in 2018. Perhaps not surprisingly, most such managers (64%) are men. Retail sector jobs were also significant as a leading social skills activity, with more than 4 million men managing sales workers or working as retail salespersons.

At the very top of the skills ladder, women are primarily engaged in nursing and men in assorted managerial pursuits

Top 5 occupations for women and men in terms of employment among jobs ranked as most important users of a skill, 2018 (employment in thousands)

WOMEN		MEN	
SOCIAL SKILLS			
All jobs ranked as "most important" users of skill	*33,637*	*All jobs ranked as "most important" users of skill*	*31,525*
Registered nurses	3,060	Managers, other	3,149
Elementary & middle school teachers	2,742	First-line supervisors of sales workers	2,769
First-line supervisors of sales workers	1,869	Retail salespersons	1,621
Managers, other	1,738	Chief executives	1,153
Customer service representatives	1,643	Construction managers	944
FUNDAMENTAL SKILLS			
All jobs ranked as "most important" users of skill	*26,200*	*All jobs ranked as "most important" users of skill*	*24,320*
Registered nurses	3,060	Managers, other	3,149
Elementary & middle school teachers	2,742	Computer & information research scientists	1,310
Managers, other	1,738	Chief executives	1,153
Accountants	1,174	Construction managers	944
First-line supervisors, office & admin. support	1,046	Lawyers	815
ANALYTICAL SKILLS			
All jobs ranked as "most important" users of skill	*17,348*	*All jobs ranked as "most important" users of skill*	*23,944*
Registered nurses	3,060	Managers, other	3,149
Managers, other	1,738	Software developers, applications & systems	1,359
Accountants	1,174	Computer & information research scientists	1,310
Financial managers	682	Chief executives	1,153
Counselors	648	Construction managers	944
MANAGERIAL SKILLS			
All jobs ranked as "most important" users of skill	*23,813*	*All jobs ranked as "most important" users of skill*	*27,268*
Registered nurses	3,060	Managers, other	3,149
Secretaries & administrative assistants	2,428	First-line supervisors of sales workers	2,769
First-line supervisors of sales workers	1,869	Chief executives	1,153
Managers, other	1,738	Construction managers	944
Accountants	1,174	Electricians	866
MECHANICAL SKILLS			
All jobs ranked as "most important" users of skill	*1,220*	*All jobs ranked as "most important" users of skill*	*14,636*
Driver/sales workers & truck drivers	238	Driver/sales workers & truck drivers	3,321
Computer support specialists	160	Automotive service technicians & mechanics	900
Engineering technicians, except drafters	80	Electricians	866
Metal workers & plastic workers, other	72	Pipelayers	621
Network and computer systems administrators	44	Maintenance & repair workers, general	490

Note: Full-time and part-time workers ages 16 and older. Occupations are ranked by the ratings for a skill, and those in the highest quartile of a skill are ones in which that skill is "most important." Sample consists of 431 4-digit occupations.
Source: Pew Research Center analysis of O*NET (Version 23) and 2018 Current Population Survey (IPUMS).
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Across other nonmechanical skills, nursing also emerges as a key occupation for women serving in top-rung fundamental, analytical and managerial skills jobs. So too are miscellaneous managerial jobs, even though women account for only about one-third of employment in these jobs. Retail jobs in supervisory capacities and accounting are other key high-skill occupations for women.

Men in jobs calling for prowess in fundamental, analytical and managerial skills are principally employed as managers, from serving as chief executives to construction managers to an assortment of other managerial jobs. Most construction managers (92%) and chief executives (73%) are male. So too are computer research and software developers, other major sources of high-skill work for men.

Estimating employment in occupations grouped by the importance of skills and tracking change over time

This chapter of the report focuses on how employment trends are shaping the demand for skills in the U.S. workplace. For 2018, the demand for a skill is measured by the employment of workers in groups of occupations ranked by the importance of individual skills in 2018. For example, social skills are in greater demand than mechanical skills because more workers are employed in occupations for which social skills are most important. Changes in the demand for a skill are measured by the change in employment from 1980 to 2018 in occupations grouped by the importance of that skill in 2018. The question of whether skills have changed *within* occupations is addressed in a later chapter.

The O*NET database, which is the source of ratings for occupational skills, does not contain employment information for occupations. In this analysis, the employment estimates are obtained from the Current Population Survey, or CPS (IPUMS versions). Although both O*NET and the CPS use the same occupational classification, there is one key difference: O*NET lists more than 950 occupations coded at the eight-digit level, the finest detail possible, whereas the CPS lists fewer than 500 occupations coded at the four-digit level. Thus, occupational data in O*NET must be aggregated to match up to the CPS data. This process, described in detail in Methodology, culminated in a dataset for 2018 containing skills ratings and estimates of the employment of women and men in 431 occupations. Total employment in these 431 occupations is estimated to be 155.3 million, just shy of the official government estimate of total U.S. employment of 155.8 million for 2018.

Tracking changes in employment since 1980 required one additional step. Because occupational classifications are frequently revised, it was necessary to use a harmonized scheme that matches occupation codes over time. This was done using the OCC2010 variable in the IPUMS-CPS data, which provides a consistent, long-term classification of occupations based on the 2010 standard occupational classification. This process resulted in a dataset containing skills and employment data for up to 266 occupations in 1980. Total employment in these 266 occupations is estimated to be 98.5 million, similar to the official government estimate of total U.S. employment of 99.3 million for 1980.

2. Women's lead in skills and education is helping narrow the gender wage gap

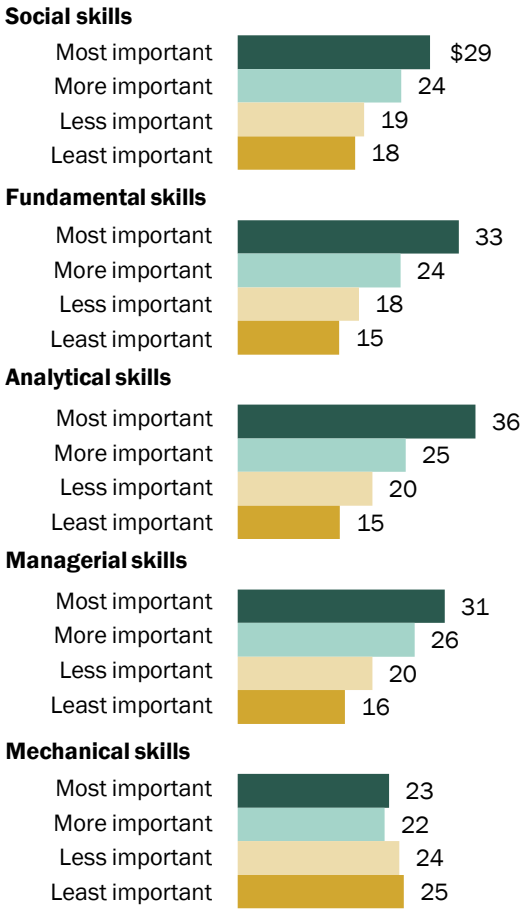
Jobs in which social, fundamental, analytical or managerial skills are more important pay better than jobs requiring higher levels of mechanical skills. Wages in these jobs have also increased at a higher rate than in other jobs since 1980, as has the pace of hiring. Workers have raised their education level in response: The share of American workers with a four-year college degree increased steadily from 1980 to 2018, especially among women.[16] But while women's earnings increased faster than men's earnings over the period, a substantial gender wage gap remains.

In 2018, wages in occupations in which nonmechanical skills are most important were about twice as high as wages in occupations in which these skills are least important. For example, jobs with the greatest need for fundamental skills paid an average hourly wage of $33, compared with $15 in jobs with the least need for fundamental skills. (Wages are expressed in 2018 dollars.)

A somewhat greater rise in wages is seen when occupations are ranked by analytical skills, with the average wage rising from $15 in the least analytically skilled jobs to $36 in the most analytically skilled jobs. Moving from jobs in

Wages increase with the importance of social, fundamental, analytical and managerial skills

Average hourly wage, by importance of a skill, 2018



Note: Occupations are ranked by the ratings for a skill, and those in the highest or lowest quartiles of a skill are ones in which that skill is "most important" or "least important." Full-time and part-time workers ages 16 and older.
Source: Pew Research Center analysis of O*NET (Version 23) and 2018 Current Population Survey outgoing rotation group (IPUMS). "Women Make Gains in the Workplace Amid a Rising Demand for Skilled Workers"

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[16] A 2013 Pew Research Center survey found broad satisfaction among the public with higher education. Some 91% of adults with a bachelor's degree or higher level of education said that considering what they and their family paid for their undergraduate education, it has either paid off for them or they expect it will pay off in the future.

which social skills are least important to jobs in which they are most important boosts wages from $18 to $29, on average.

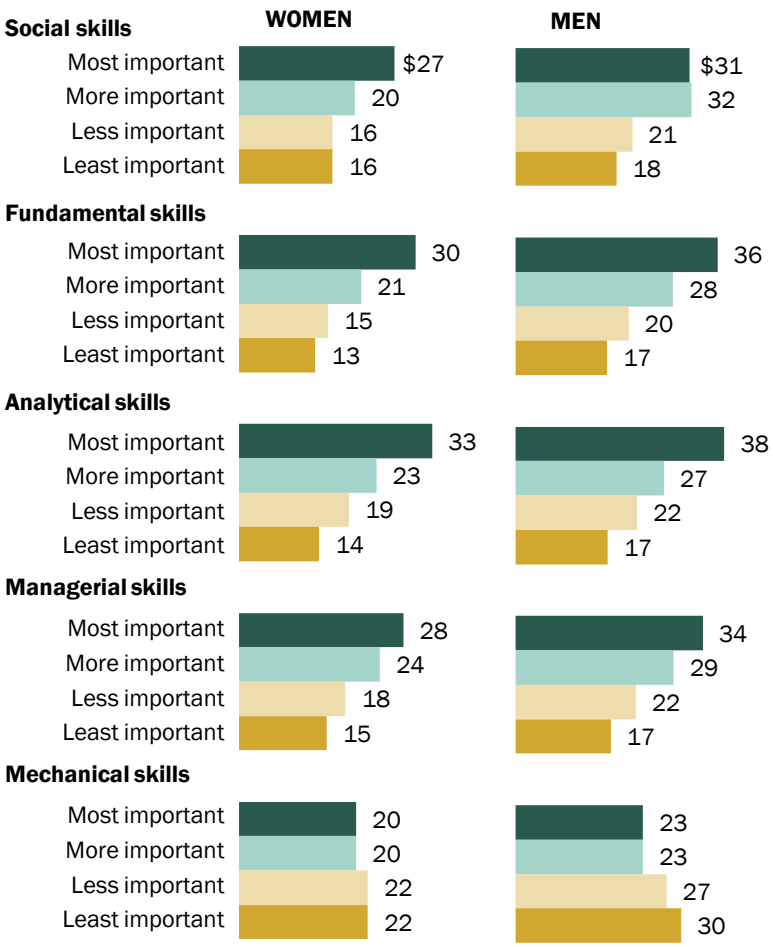
It is important to note that the observed increase in earnings with the importance of a skill is not necessarily the result of the rising importance of only that skill. As noted, social, fundamental, analytical and managerial skills tend to rise and fall in importance in concert. Thus, if wages are seen to rise with the importance of analytical skills, part of the reason is that the importance of social, fundamental and managerial skills has also increased to some extent. Determining the precise contribution of a single skill to raising wages is a difficult proposition.

Unlike with nonmechanical skills, wages barely change with the importance of mechanical skills. Occupations in which mechanical skills are most important paid an average hourly wage of $23 in 2018, compared with $25 in occupations in which mechanical skills are least important.

The reason why wages do not increase with the need for mechanical skills is that the demand for nonmechanical

The earnings of women and men vary similarly with the change in importance of skills

Average hourly wage, by importance of a skill, 2018



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Source: Pew Research Center analysis of O*NET (Version 23) and 2018 Current Population Survey outgoing rotation group (IPUMS).
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skills moves in opposition to the demand for mechanical skills. In other words, jobs most in need of mechanical skills often are less in need of other skills, blunting the potential for wages to rise with the importance of mechanical skills. Conversely, as the need for mechanical skills wanes, the need for other skills grows stronger, serving to buffer wages.

The earnings of women and men vary similarly across the different types of skills and their importance. For both women and men, the highest paying jobs in 2018 were those in the topmost ranking of analytical skills, $33 per hour for women and $38 per hour for men. And both women and men would more than double their earnings moving from low-analytical-skill jobs to high-analytical-skill jobs. A similar pattern prevails across occupations grouped by importance of social, fundamental and managerial skills.

Neither women nor men experience an increase in earnings with a rise in the importance of mechanical skills.

The evidence on women's and men's wages underscores the ubiquity of the gender wage gap. Regardless of the classification of occupations – by skill type or the importance of a skill – women's earnings fell short of men's earnings in 2018. For example, women in occupations with the greatest need for fundamental skills earned $30 per hour, 83% as much as what men earned per hour in similar jobs ($36). A gap of similar magnitude is observed in most groupings of jobs by skill type and importance, an issue taken up in more detail later in this chapter.

Women's earnings are rising faster than men's, especially in high-skill jobs

The growing demand for workers more proficient in social, fundamental, managerial and analytical skills has translated into more rapidly growing wages in high-skill jobs. In other words, the returns on nonmechanical skills, as measured by the gain in wages with the increase in importance of a skill, rose from 1980 to 2018. This was true for both women and men.

Overall, the average hourly wage at the workplace increased 24% from 1980 to 2018, from $19 to $24.[17] Women's earnings rose at a greater rate over the period, by 45%, from $15 in 1980 to $22 in 2018. In contrast, men's wages increased 14%, from $23 to $26.

[17] Percentage changes are computed before underlying estimates are rounded.

Amid relatively lackluster wage growth for men overall, men's earnings increased by more than 20% in jobs in which fundamental and analytical skills are most important or in which managerial skills are more (but not most) important. At the same time, men's wages were about unchanged in jobs in which nonmechanical skills are either less or least important. Thus, only men working in higher—nonmechanical-skill jobs experienced notable wage growth from 1980 to 2018.

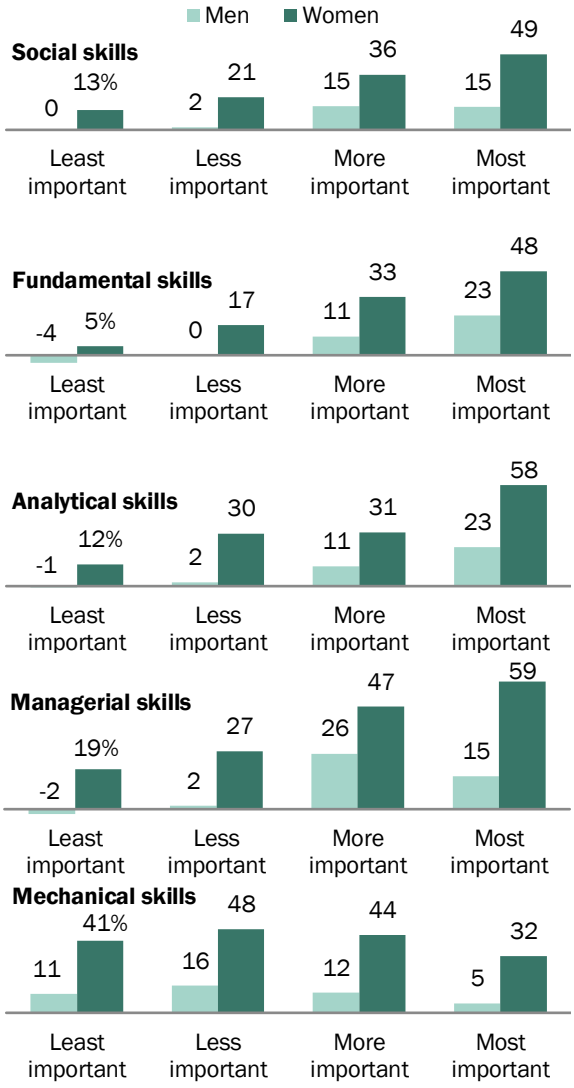
Women experienced more rapid wage growth than men across the board. Their average hourly wage increased by nearly 50% in jobs in which social and fundamental skills are most important and by close to 60% in jobs in which analytical and managerial skills are most important. In the second tier of skills – jobs in which these skills are more important – women's earnings increased by 47% in the realm of managerial skills and by upwards of 30% in the realms of social, fundamental and analytical skills. As with men, the growth in wages for women was much higher at the top of the skills ladder than at the bottom.

The gender wage gap narrowed from 1980 to 2018, more so in high-skill jobs

The more rapid increase in women's earnings from 1980 to 2018 resulted in a narrowing of the gender wage gap. In 1980, the average hourly wage of women was 67% of the average hourly wage of men, $15 vs. $23. By 2018, women earned 85% as much as men, $22

Women's earnings increased by more than men's, especially in high-skill jobs

% change in average hourly wage, by importance of a skill, 1980-2018



Note: Occupations in the highest or lowest quartiles of a skill are ones in which that skill is "most important" or "least important." Full-time and part-time workers ages 16 and older.
Source: Pew Research Center analysis of O*NET (Version 23) and 1980 and 2018 Current Population Survey outgoing rotation groups (IPUMS).
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vs. $26, on average. Put another way, the gender wage gap narrowed from 33 cents to the dollar in 1980 to 15 cents to the dollar in 2018.

The gender wage gap in 1980 tended to be wider in high-skill occupations. For example, in occupations placing the highest importance on managerial skills, women earned only 60% as much as men on average. On the other hand, in occupations placing the least importance on managerial skills, women earned 72% as much as men. This pattern also prevailed with respect to social, fundamental and analytical skills in 1980.

The gender wage gap narrowed from 1980 to 2018

Average hourly wage of women as % of the average hourly wage of men

Note: Full-time and part-time workers ages 16 and older.
Source: Pew Research Center analysis of 1980 and 2018 Current Population Survey outgoing rotation groups (IPUMS).
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Despite the initial lag in high-skill occupations, women succeeded in closing the gender wage gap by more in those occupations. For instance, in occupations placing the most importance on social skills, women's earnings increased from 65% of the level of men's earnings in 1980 to 84% of the level in 2018. This gain of 19 cents to the dollar was nearly twice the gain women made in low-social-skill jobs. In those jobs, the wage gap narrowed by 11 cents, from women earning 75% as much as men to 86% as much.[18]

The greatest wage closure achieved by women was in high-managerial-skill jobs. From earning 60% as much as men in these jobs in 1980, women progressed to earning 83% as much as men in 2018, a narrowing of 23 percentage points. The closure of the wage gap in high-analytical-skill jobs was almost as notable, with women advancing from earning 68% to 88% as much as men. By 2018, then, the gender wage gap was about the same across both high- and low-skill jobs when grouped by the importance of social, fundamental, analytical or managerial skills.

A rising level of education among women is one reason why the gender wage gap closed from 1980 to 2018. In 1980, 16% of employed women ages 16 and older had completed four years of college education or more, compared with 20% of men. By 2018, 40% of women had completed at least a four-year college program, compared with 35% of men. Thus, whereas women once lagged men in college completion by 4 percentage points, they are now ahead of men by 5 points overall and are better equipped for higher-skill jobs.

[18] The relationship between the emergence of social skills and its role in narrowing the gender wage gap has been noted in the case of former West Germany.

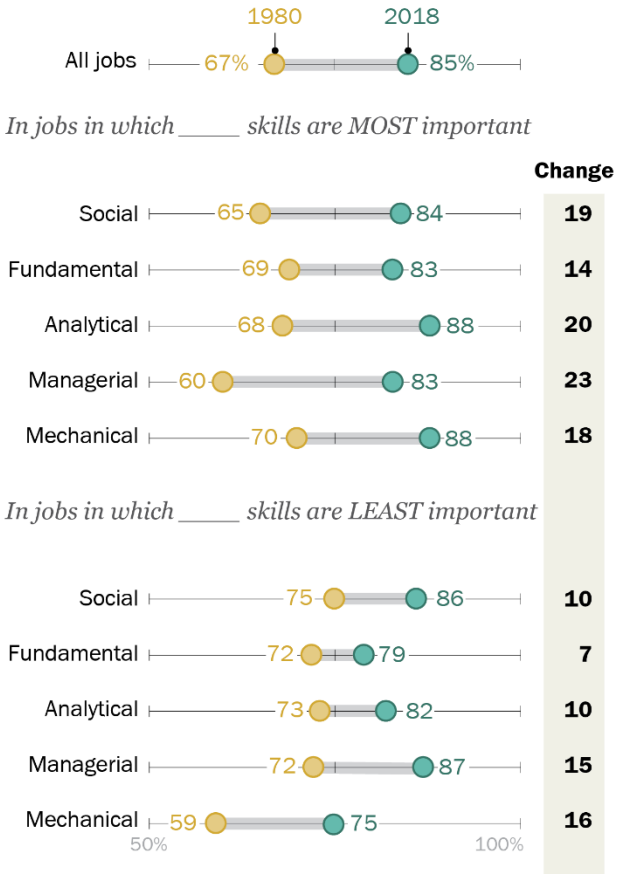
Not coincidentally, the turnabout in education was among the sharpest within jobs in which managerial and analytical skills are most important. In 1980, only 19% of women in high-managerial-skill jobs had completed at least four years of college, compared with 42% of men in those jobs. By 2018, there was no discernable difference – 55% of women and 56% of men in high-managerial-skill jobs held a bachelor's degree or higher level of education.

Over the same period, women in high-analytical-skill jobs went from lagging men in college completion in 1980, by 36% to 48%, to taking the lead by 2018, at 74% to 68%. The more pronounced transformation in education within high-skill jobs, compared with a muted shift within low-skill jobs, helps explain why the gender wage gap narrowed more in high-skill jobs than in low-skill jobs.

The narrowing of the gender wage gap also received an assist from a narrowing of the differences in the occupations and industries in which women and men work. As noted in the previous chapter, women made significant strides in moving out of lower-paying occupations and into higher-paying occupations from 1980 to 2018. An example of a lower-paying occupation women exited from is food preparation and serving, in which they earned $11 per hour in 2018, on average. An example of a higher-paying occupation women stepped into is financial specialists, in which they earned $31 per hour in 2018.

The gender wage gap narrowed more in high-skill jobs from 1980 to 2018

Women's wages as % of men's wages



Note: Occupations are ranked by the ratings for a skill, and those in the highest or lowest quartiles of a skill are ones in which that skill is "most important" or "least important." Full-time and part-time workers ages 16 and older. Changes are computed before underlying estimates are rounded.
Source: Pew Research Center analysis of O*NET (Version 23) and 1980 and 2018 Current Population Survey outgoing rotation groups (IPUMS).
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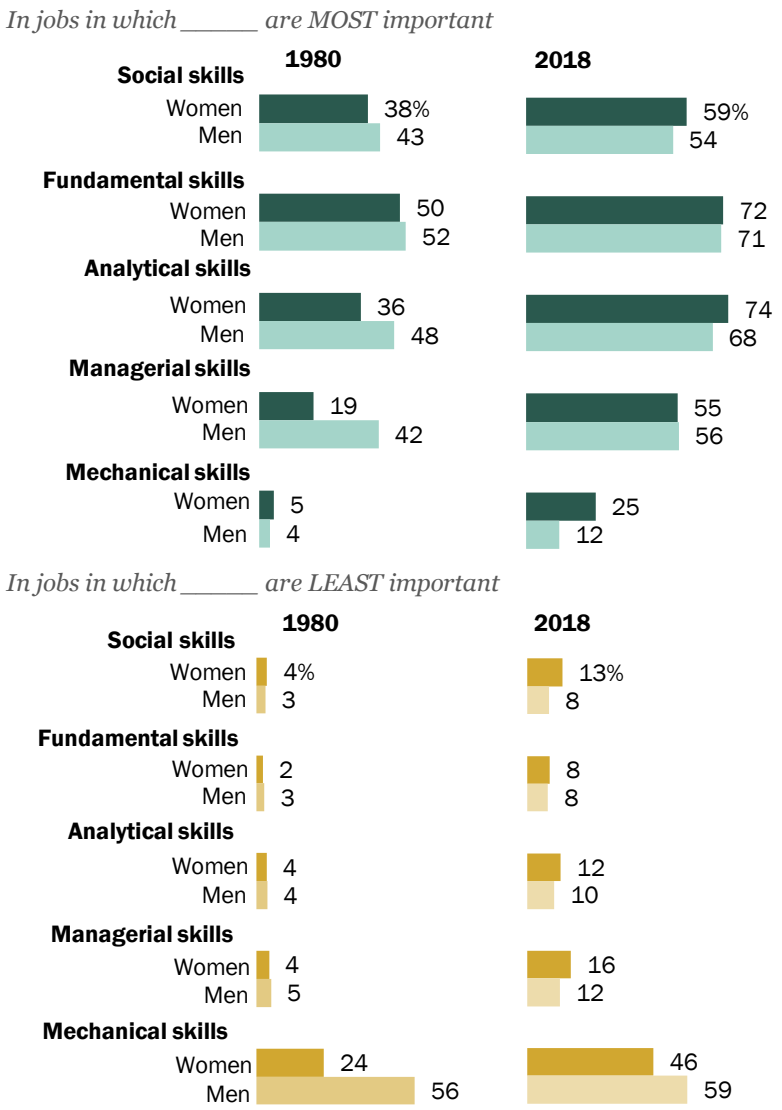
Higher levels of educational attainment among women and the shifts they made across occupations are intertwined with their rising profile in high-skill jobs. They are among the reasons

why women are now in the majority in high social and fundamental skill jobs, are no longer underrepresented in high managerial skill jobs, and have greatly raised their share in high-analytical-skill jobs. To the extent that earnings increase with the importance of skills, independent of their relationship with schooling and occupation, these trends also helped to narrow the gender wage gap from 1980 to 2018.

A decline in the union membership rate from 1980 to 2018 also contributed to the observed decline in the gender wage gap. Specifically, in a change more detrimental to men's wages, the union membership rate among men fell from 28% in 1983 to 12% in 2018, compared with a decrease from 18% to 11% among women.[19]

College completion has increased faster among women than men, especially in high-skill occupations

% of workers who have a bachelor's degree or more education



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[19] Pew Research Center estimates from the Current Population Survey outgoing rotation group files for education level and union membership and CPS annual files for occupation estimates. Data on union membership were collected in the CPS starting in 1983. According to the

Job skills and higher levels of education are pulling women's earnings closer to men's, but other factors are driving a wedge

The persistence of a gap in the earnings of women and men is not entirely understood by scholars. Some of the factors that determine the earnings of workers are quantifiable, such as job skills, education level, work experience, union membership, hours worked, industry and occupation. But data on other factors, such as occupation-specific skills or the work environment, is often lacking. In addition, some factors that may result in a wage gap between women and men are difficult to measure. These include the responsibilities of motherhood and family and the effect they have on women's engagement with the workplace when compared with men; gender stereotypes and discrimination; and differences in professional networking and in the inclination to negotiate for raises and promotions.

Like other research in the field, this analysis uses a statistical technique called regression analysis to determine the influence of factors such as skills and education on the size of the gender wage gap in 2018. As noted, women earned 85% as much as men in 2018, prior to accounting for any observed differences between women and men. The regression analysis is used to estimate the extent to which the 15-cent gap is related to the difference between women and men in skills and education level, part-time work, occupations, industries, and age, among other things.[20] (See Methodology.)

Among the factors analyzed, two are found to work to the benefit of women: their presence in high-skill jobs and their education level. Overall, women's representation in higher-skill jobs is estimated to raise their earnings by 2 cents to the dollar in 2018 compared with men's earnings. Women's higher level of education also confers a benefit over men to the extent of 2 cents to the dollar. This means that if women were to lose their lead over men in skills and education their earnings would fall relative to the earnings of men, from 85% to 81%.

Bureau of Labor Statistics (BLS), union members had median usual weekly earnings of $1,051 in 2018, while those who were not union members had median weekly earnings of $860, among full-time wage and salary workers. Some of the gap may be due to factors such as differences in industry and occupation.

[20] Cultural norms, differences in opportunities and discrimination may also contribute to observed disparities in hours worked, occupation and industry. The estimates in this report do not purport to statistically quantify the effects of discrimination on the gender wage gap.

The factors that work to the detriment of women's earnings include relatively more part-time work and disparities in occupations and industries of employment.[21] The combined effect of these differences was to lower women's wages by about 7 cents to the dollar in 2018 compared with men's wages. Thus, if these disparities were to vanish, along with the gaps in skills and education, women's earnings as a percent of men's earnings would increase from 81% to 88%.

The gender wage gap would widen if women and men had the same job skills and education levels

Women's wages as % of men's wages, 2018

No controls for observable differences between women and men	85%
With controls for skills and education	81
With controls for skills, education, part-time work, industry, occupation, union membership, age and other factors	88

Note: Full-time and part-time workers ages 16 and older. See Methodology for details.
Source: Pew Research Center analysis of O*NET (Version 23) and 2018 Current Population Survey outgoing rotation groups files (IPUMS).
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In summary, the overall effect of differences in skills, education, part-time work, industry, occupation and other observed factors is modest.[22] Skills and education yield women a relative benefit of 4 cents for each dollar, but part-time work, industry, occupation and other factors give men an advantage of about 7 cents. The net effect is 3 cents in favor of men. This means that after accounting for observable differences in labor market attributes between women and men the gender wage gap is about 12 cents to the dollar, slightly narrower than 15 cents of the dollar, but shy of equality.

[21] In 2018, 22% of women and 11% of men worked part-time. Differences in how women and men are distributed across occupations are presented in Chapter 1 of the report. With respect to industries, women are much more likely than men to work in personal services and health and education services. Men are more likely to be employed in the construction, utilities and manufacturing sectors.
[22] As the differences between men and women have narrowed with respect to education, occupation and other factors, the role of these factors in accounting for the gender wage gap has diminished over time.

3. In a technology-driven era, social and fundamental skills still reign supreme within occupations

Even as automation, smart speakers and other technology-driven applications reshape daily lives, personal engagement and a mastery of fundamentals remain valued in the workplace. In 2018, social and fundamental skills were rated more important than analytical, managerial or mechanical skills in a larger number of jobs. Evidence also suggests that the importance of social skills *within* occupations has increased more than the importance of other skills in recent decades, a trend that would drive a growing need for social skills regardless of any changes in employment across occupations. Newer jobs, some brought into existence by new technologies, may also fuel a growing need for analytical skills.

The need for social and fundamental skills appears to be on the rise within jobs

In the labor market, the change in demand for a skill is the result of two forces: a rise in employment in jobs more in need of that skill and an increased need for that skill to perform a given job. Shifts in employment have played an important role in raising the demand for social and fundamental skills since 1980 (see Chapter 1). It also appears likely that the need for social and fundamental skills, as well as for managerial skills, has intensified within most occupations in recent decades.

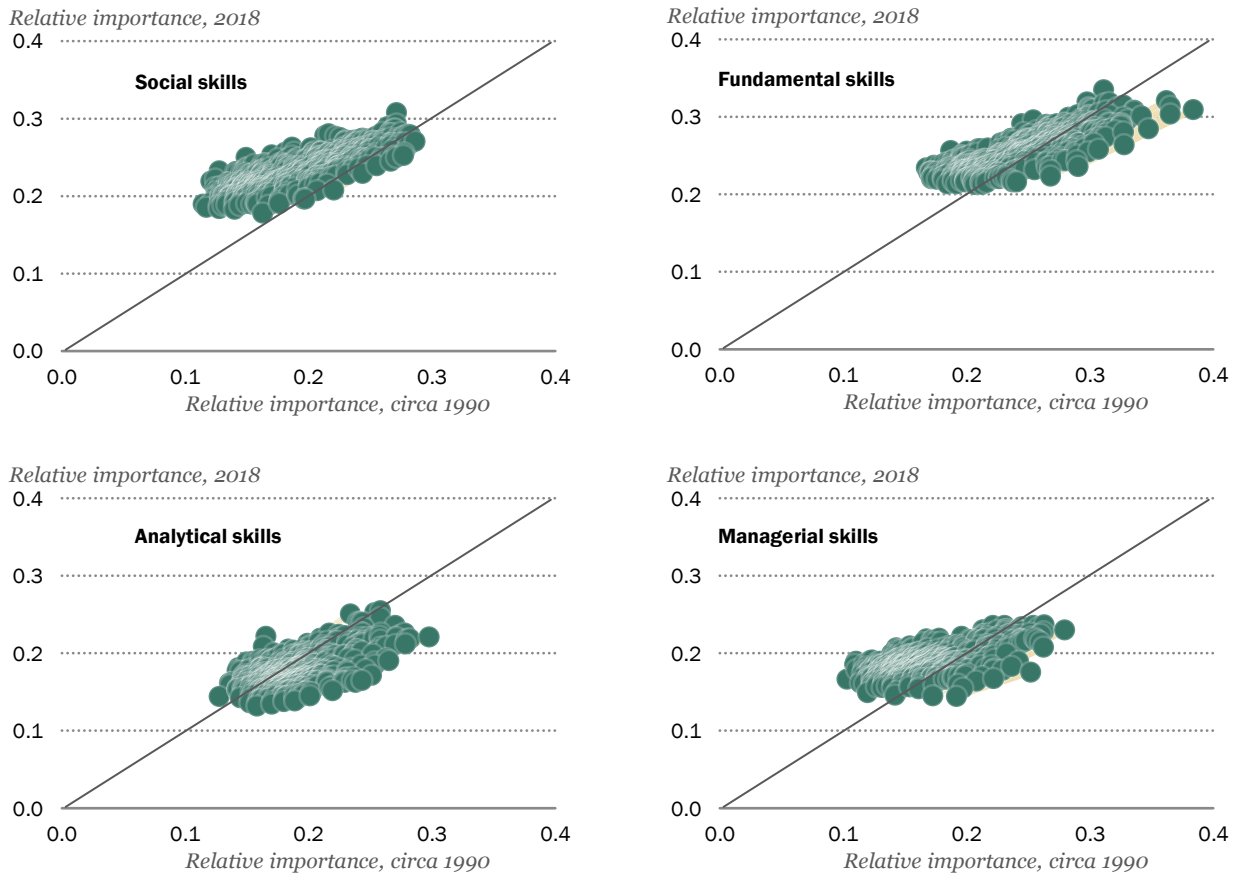
The changing mix of skills within a job is assessed by looking at the importance of each skill within the job *relative* to the importance of other skills. If the importance rating of, say, social skills increases by more than the ratings of other skills in an occupation, then the relative importance of social skills will increase, and the job will be judged to have become a more intensive user of social skills.[23]

The charts below show how the relative importance of a skill in 2018 compares with the relative importance of the skill circa 1990. A point lying above the gradient line indicates that the relative importance of the skill in 2018 is greater than its relative importance circa 1990. Such an upward drift appears in most occupations with respect to the relative importance of social, fundamental and managerial skills. Indeed, the need for social skills, in relative terms, increased in 94% of occupations since circa 1990. Over the same period, the relative importance of managerial skills

[23] The relative importance of a skill is its rating divided by the sum of the ratings for all five skills. Suppose that all five skills received an importance rating of three in a job. Each skill would then have a relative importance of 0.2, or 3/15. Further suppose that the rating for social skills increases to five while the rating for all other skills increases to four. The relative importance of social skills increases to 0.24 (or 5/21) and the relative importance of other skills *decreases* to 0.19 (or 4/21).

The relative importance of social, fundamental and managerial skills increased in most occupations from circa 1990 to 2018

The relative importance of a skill circa 1990 versus the relative importance the skill in 2018



Note: Each point on a chart shows a skill's relative importance circa 1990 and in 2018 in an occupation. A point lying above the gradient line indicates that the relative importance of a skill in 2018 is greater than its relative importance circa 1990, within the occupation. For example, the relative importance of social skills is shown to increase from circa 1990 to 2018 in most occupations, but the relative importance of mechanical skills is shown to decrease in most occupations. Findings are tentative due to changes in methodology for rating occupational skills between the two versions of the source data. "Circa 1990" refers to O*NET data from 2003 (Version 5.1), which is based on ratings developed from the late-1970s to the early-1990s for the Dictionary of Occupational Titles.
Source: Pew Research Center analysis of data from the O*NET (Versions 23 and 5.1).
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increased in 75% of occupations, and that of fundamental skills rose in 64% of occupations. (For this analysis, "circa 1990" refers to O*NET data from 2003 (Version 5.1), which is based on ratings developed from the late 1970s through the early 1990s for the Dictionary of Occupational Titles.)

The other side of the coin of these trends is that analytical and mechanical skills became relatively less important within occupations over recent decades. The relative importance of analytical skills dropped in 79% of occupations, and that of mechanical skills fell in 92% of occupations.[24] Overall, the indications are that the need for social, fundamental and managerial skills has risen faster than the need for other skills within occupations since the 1980s.

These findings should be treated with caution, however. A definitive conclusion is made difficult by the lack of data that is fully comparable over time. O*NET data using the current schematic for job skills was first released in 2003. The ratings in the 2003 dataset are based on evaluations conducted under the predecessor to the O*NET, the Dictionary of Occupational Titles (DOT). The implicit advantage is that DOT evaluations were conducted from the late 1970s through the early 1990s and yield a longer frame of reference for changes in ratings over time. However, changes in methodology between the DOT and the O*NET confound the comparisons to some degree: The ratings for any given skill for an occupation may have drifted upward or downward with the change in methodology. Focusing on the *relative* importance of skills corrects for any drift in the ratings that is shared among the five skill groups.[25]

Emerging occupations call for greater proficiency in analytical skills

The skills profiles of newer occupations listed in the O*NET point to a rising need for analytical skills in the near future. Starting in 2010, O*NET data listed 147 occupations as "new and emerging," reflecting the changes driven by modern-day technologies.[26] These jobs, such as database architects, informatics nurse specialists and video game designers, often call for greater proficiency in analytical skills, ranging from programming to science to systems analysis and evaluation.

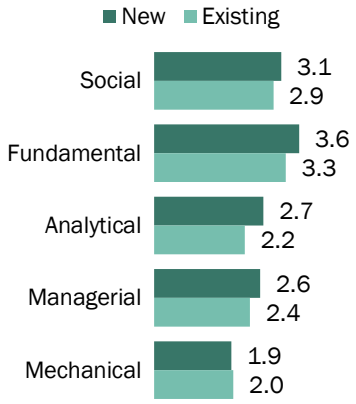
[24] The ratings for analytical skills considered in the absolute, not relative to other skills, increased in more than 50% of occupations.
[25] If absolute ratings for social, fundamental, analytical, managerial and mechanical skills each increased or decreased by, say, 10% due to a change in methodology, the relative importance of any skill would not change. If those absolute skill ratings changed differently due to changes in methodology, the estimated changes in the relative importance of skills may partly be due to changes in methodology. The increased importance of nonmechanical skills as noted in this analysis is consistent with other research conducted either within the confines of DOT data or with alternative data sources, such as newspaper advertisements for job openings (Borghans, ter Weel and Weinberg, 2006; Deming, 2015; and Atalay, Phongthiengtham, Sotelo and Tannenbaum, 2018).
[26] These are not necessarily entirely new occupations. But they became significant by 2010 as a result of rising employment and were assigned their own eight-digit occupation code.

This impression is confirmed by a comparison of the importance ratings for skills in new jobs with the ratings in older jobs in 2018, this time without the worry of changing methodology.[27] The biggest difference between new and existing jobs is in their average rating for analytical skills, 2.7 vs. 2.2, or a difference of 21% in favor of new jobs, pointing to a sharper rise in the need for analytical skills in the future compared with the change in past decades.

Other differences in skills between new and older jobs in 2018 are consistent with the trends noted above with respect to changes in skill ratings from the 1980s to 2018. The average rating of social skills in new jobs is 3.1, 7% greater than the rating for social skills in existing jobs. The ratings for fundamental and managerial skills are both 10% higher in new jobs, while the difference in mechanical skills points to potentially a downward drift in the future.[28]

Newer occupations are more intensive users of skills

Average importance ratings of skills in new and existing jobs, 2018



Note: Average ratings computed across 996 8-digit occupations in the 2018 O*NET.
Source: Pew Research Center analysis of O*NET (Version 23).
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Social and fundamental skills retain their place at the top

The new occupations do share one trait with existing occupations: Both place the greatest emphasis on social and fundamental skills. Across all jobs combined, fundamental skills received an average importance rating of 3.2 in 2018. That was somewhat higher than the average rating of 2.9 for social skills, and notably higher than the rating for managerial (2.4), analytical (2.2) and mechanical skills (2.0). A rating of three – close to the average for social and fundamental skills across all occupations – means the skill is considered important for the job in O*NET nomenclature.

The five skill groups analyzed in this report are comprised of 35 detailed skills. As listed in the overview, fundamental skills encompass eight finer skills, and four of these skills – active listening, speaking, critical thinking and reading comprehension – appeared at the top of the importance ratings in 2018, with an average rating of 3.4 or higher. Rounding out the list of the top 10 finer skills are two more fundamental skills (judgment and decision making and writing),

[27] The 2018 O*NET contains ratings for 819 older occupations at the eight-digit level.
[28] In the O*NET, each skill is assigned a rating for each occupation on a scale of one to five as follows: 1 – not important, 2 – somewhat important, 3 – important, 4 – very important, and 5 – extremely important.

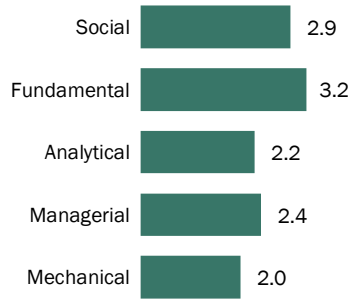
three social skills (monitoring, social perceptiveness and coordination) and one analytical skill (complex problem solving).[29]

Looking just below the top 10, one fundamental skill (active learning), three social skills (service orientation, instructing and persuasion) and one managerial skill (time management) complete the list of the top 15 most highly rated skills in 2018. Mechanical skills, such as equipment maintenance, equipment selection, repairing, and installation, are among the lowest rated of the 35 skills in 2018. So too are some analytical skills, such as technology design and programming.

The average importance of a skill also reflects whether it is in widespread use across occupations. Programming, which refers to "writing computer programs for various purpose," is a higher-order computer skill that is in limited use across occupations.[30] Indeed, there are only four occupations, including computer programmers, in which programming is listed as being "very important" to "extremely important" in 2018. On the other hand, programming is rated "not important" in 157 occupations, and its average rating across all 772 occupations examined was 1.5.[31]

Social and fundamental skills had the highest average importance rating in 2018

Average importance rating of a skill across all jobs, 2018



Note: Average ratings computed across 772 6-digit occupations in the 2018 O*NET.
Source: Pew Research Center analysis of O*NET (Version 23).
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At the other end of the scale is active listening, one of the finer fundamental skills and estimated to have the highest average importance rating (3.6) in 2018. Active listening was rated "very important" to "extremely important" in 196 occupations and at least "somewhat important" in all occupations. There is no occupation in 2018 in which active listening is "not important"; it is a ubiquitous skill.

[29] See the appendix for a listing of all 35 skills and their importance rating in 2018.
[30] Programming is distinct from O*NET task measures such as interacting with computers. A report from Brookings Institution finds an increasing role for knowledge of computer and electronics and interacting with computers since 2002.
[31] The count of occupations represents the six-digit occupations for which data are available for 2018.

Among occupations that are top-rung users of skills, the need for social and fundamental skills typically exceeds the need for other skills

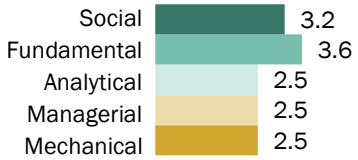
The analysis in this report divides occupations into four skill tiers based on the importance rating of each of five skills. Occupations are ranked by their importance rating on, say, fundamental skills, and the top 25% of occupations (the highest quartile) are listed as "most important" users of fundamental skills. Conversely, the bottom 25% of occupations (the lowest quartile) are listed as "least important" users of fundamental skills. This process is repeated for each of the five major skill groups.

However, the degree to which fundamental skills are needed in the top echelon is not necessarily the same as the degree to which another skill is needed in the top echelon. In 2018, an occupation was a most important user of fundamental skills (in the highest quartile) only if the importance rating for fundamental skills in that occupation was 3.6 or greater. By contrast, the highest ranked users of analytical skills were occupations in which the importance rating for analytical skills was 2.5 or greater. Because fundamental skills, along with social skills, are in greater need across occupations, they represent a higher intensity of use in the uppermost tiers of occupations.

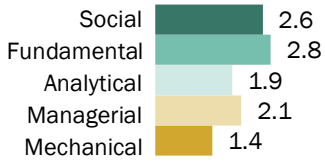
The same pattern prevails with respect to the lowest tier of skills. Occupations are considered "least important" users of fundamental skills if the importance rating of fundamental skills in those occupations is 2.8 or less. But "least important" users of analytical skills are occupations in which the importance rating for this skill is 1.9 or less.

Ratings thresholds for top- and low-end users of skills vary by skill type

Rating above which a job is defined as a 'most important' user of a skill, 2018



Rating below which a job is defined as a 'least important' user of a skill



Note: Ratings thresholds are computed for 431 4-digit occupations for which employment and wage data were available.
Source: Pew Research Center analysis of data from the O*NET (Version 23).
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Because the importance of social, fundamental, managerial and analytical skills tends to rise and fall in concert, it is not unusual for an occupation to place in the same tier with respect to more than one skill. "Physics teachers, postsecondary" represent an occupation that is among the top tier users of social, fundamental and analytical skills. But this does not mean that each of these skills is equally important for physics teachers. More specifically, the ratings for the three skills for physics teachers in 2018 are as follows: fundamental – 4.1, social – 3.3, and analytical – 2.8. Thus, a mastery of fundamentals and people skills outrank the need for analytical skills among physics teachers.

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Methodology

Data sources

The analysis in this report is based on the combination of job skills and preparation data from the U.S. Department of Labor's Occupational Information Network (O*NET) and occupational employment and wage data from the Current Population Survey (CPS).

Occupational Information Network (O*NET): The O*NET database provides a variety of information related to the requirements of more than 950 occupations. The occupations are classified according to a coding scheme that is consistent with the 2010 Standard Occupational Classification. Among other things, O*NET includes information on 35 specific skills representing attributes of workers related to work performance (critical thinking or service orientation, for example). Each skill is rated on a scale of one to five measuring its importance to job performance, from not important to extremely important. This report focuses on the analysis of the importance ratings of the 35 job skills in the O*NET data.[32] The ratings are based on information generated by trained job analysts.

Much of the analysis in this report used the most recent version of the O*NET database available at the time (Version 23, released August 2018). This file contains importance ratings of skills for 967 occupations (at the eight-digit level of classification). One occupation – mathematical technicians – was dropped because it was last evaluated prior to 2002. The importance ratings for the remaining 966 occupations were developed by analysts on a rolling basis from 2010 to 2018, with about 10% or slightly more of occupations rated in any given year.

Some of the analysis in this report used one of the first releases of O*NET (Version 5.1, released November 2003) with the goal of evaluating changes in skill ratings within occupations. This file contained importance ratings for 901 occupations, after the omission of mathematical technicians. The importance ratings in the 2003 O*NET data were developed by analysts using data collected mostly from the late 1970s through the early 1990s for the Dictionary of Occupational Titles (DOT). For that reason, changes in skills ratings from 2003 to 2018 are referred to as changes from circa 1990 to 2018. However, because of revisions to the methodology between the DOT and the O*NET the estimated changes in skill ratings within occupations should be treated with caution.

[32] O*NET data also contain a measure of the level of the skill needed to perform a job on a scale of one to seven. The ratings for importance and level are highly correlated. The correlation coefficients between the importance and level ratings range from 0.81 for monitoring skills to 0.99 for equipment maintenance skills and repairing skills.

Current Population Survey (CPS): Conducted jointly by the U.S. Census Bureau and the Bureau of Labor Statistics, the CPS is a monthly survey of approximately 55,000 households and is the source of the nation's official statistics on unemployment. The CPS sample covers the civilian, non-institutionalized population. In this report, 12 monthly CPS files in each year were combined to generate annual estimates of occupational employment in 1980 and 2018. Wages are estimated from the annual outgoing rotation group (ORG) files which consist of the sample of workers from whom wage information was collected. Some of the CPS microdata files used in this report are the Integrated Public Use Microdata Series (IPUMS-CPS) provided by the University of Minnesota.[33]

Determining job skills

For the analysis in this report, we group the 35 skills rated in the O*NET into five major families of job skills – social, fundamental, analytical, managerial and mechanical (see table below). The grouping is similar to the O*NET classification of skill categories. In general terms, social skills refer to interpersonal skills, fundamental skills lay the foundation for acquiring other skills, analytical skills capture scientific and technological prowess, managerial skills pertain to the management of people, things and finances, and mechanical skills describe the ability to work with and to control machinery or equipment.

As noted, the importance of each detailed skill element to an occupation is given a numerical rating on a scale of one (not important) to five (extremely important) in the O*NET data. The midpoint, a rating of three, indicates the skill is important for the occupation. A simple average of the ratings of detailed skills is used to represent the importance of a skill group to an occupation. For example, the 2018 O*NET importance rating for each of the seven social skills for chief executives (occupation code 11-1011.00) is as follows: 4.12 for monitoring (element ID 2.A.2.d), 4.25 for social perceptiveness (element ID 2.B.1.a), 4.25 for coordination (element ID 2.b.1.b), 4.12 for persuasion (element ID 2.B.1.c), 4.12 for negotiation (element ID 2.B.1.d), 3.12 for instructing (element ID 2.B.1.e) and 3.12 for service orientation (element ID 2.B.1.f). The average of these seven scores – 3.87 – is taken as the measure of the importance of social skills for chief executives. A similar process of averaging the importance ratings of detailed skill elements is used to determine the importance ratings of fundamental (4.08), analytical (3.03), managerial (4.06) and mechanical skills (1.31) for chief executives. The end result of this method is an average numerical rating for the importance of social, fundamental, analytical, managerial and mechanical skills in each of the 966 occupations retained from the 2018 O*NET and the 901 occupations retained from the 2003 O*NET.

[33] Flood, Sarah, Miriam King, Renae Rodgers, Steven Ruggles and J. Robert Warren. Integrated Public Use Microdata Series, Current Population Survey: Version 6.0 [dataset]. IPUMS, 2018.

O*NET skill elements that represent social, fundamental, analytical, managerial and mechanical skills

Social skills	Element ID	Analytical skills	Element ID
Monitoring	2.A.2.d	Mathematics	2.A.1.e
Social perceptiveness	2.B.1.a	Science	2.A.1.f
Coordination	2.B.1.b	Complex problem solving	2.B.2.i
Persuasion	2.B.1.c	Operations analysis	2.B.3.a
Negotiation	2.B.1.d	Technology design	2.B.3.b
Instructing	2.B.1.e	Systems analysis	2.B.4.g
Service orientation	2.B.1.f	Systems evaluation	2.B.4.h
		Programming	2.B.3.e

Fundamental skills	Element ID	Mechanical skills	Element ID
Reading comprehension	2.A.1.a	Equipment selection	2.B.3.c
Active listening	2.A.1.b	Installation	2.B.3.d
Writing	2.A.1.c	Operation monitoring	2.B.3.g
Speaking	2.A.1.d	Operation and control	2.B.3.h
Critical thinking	2.A.2.a	Equipment maintenance	2.B.3.j
Active learning	2.A.2.b	Troubleshooting	2.B.3.k
Learning strategies	2.A.2.c	Repairing	2.B.3.l
Judgment and decision making	2.B.4.e	Quality control analysis	2.B.3.m

Managerial skills	Element ID
Time management	2.B.5.a
Management of financial resources	2.B.5.b
Management of material resources	2.B.5.c
Management of personnel resources	2.B.5.d

Note: The element ID is the identifier for a job skill as listed in the O*NET data.
Source: O*NET (Versions 5.1 and 23).
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Linking the 2003 and 2018 O*NET data files

To determine changes in skill ratings within occupations it was necessary to match the occupations present in the 2003 O*NET data with the occupations present in the 2018 data. Other than the difference in the numbers of occupations – 901 in 2003 and 966 in 2018 – the occupation codes and definitions also vary somewhat due to revisions in occupational classifications. These differences were resolved partly by use of crosswalks provided by O*NET and partly by manual inspection of occupation codes and definitions. An example of a match is that "pressure vessel

inspectors," a 2003 occupation with code 13-1041.05, was linked to "construction and building inspectors," a 2018 occupation with code 47-4011.00.

Additionally, some occupations from 2003 were combined to match to a single occupation in 2018, and vice versa. For example, three occupations from 2003, "employment, recruitment and placement specialists" (code 13-1071.00), "employment interviewers, private and public employment service" (code 13-1071.01) and "personnel recruiters" (code 13-1071.02) were matched to one occupation in 2018, "human resource specialists" (code 13-1071.00).

The final step in the process of matching the 2003 and 2018 O*NET files was to aggregate occupations from the eight-digit level of detail, e.g. code 13-1071.01, to the six-digit level of detail, e.g. code 13-1071. The result was a dataset consisting of 670 occupations at the six-digit level matched from 2003 to 2018. In addition to facilitating the matching of occupations over time, as in the example above, the aggregation was also done for consistency with the analysis based on the matching of O*NET data to CPS data (see below).

Matching O*NET and CPS data

Because O*NET does not contain employment or wage information for occupations it is necessary to match the skills data to CPS data. Although both the 2018 O*NET and the CPS use the 2010 standard occupational classification there is one key difference: O*NET lists more than 950 occupations coded at the eight-digit level, the finest detail possible, whereas the CPS lists fewer than 500 occupations coded at the four-digit level. In other words, an occupation listed in the CPS typically encompasses more than one occupation listed in O*NET. Thus, occupational data in O*NET must be aggregated to match up to the CPS data. This was done in three steps, as detailed below:

Step 1: The job skills and preparation ratings for eight-digit occupations in O*NET were aggregated to the six-digit level. For example, "financial managers," a six-digit occupation, are broken apart into two eight-digit occupations in O*NET: "treasurers and controllers" and "financial managers, branch or department." The job skills and preparation ratings for these two eight-digit occupations in O*NET were averaged to estimate the ratings for financial managers. This process was repeated as necessary, and the end result was a set of numerical ratings on job skills and preparation for 772 six-digit occupations in 2018.

Step 2: The ratings for six-digit occupations were further aggregated to the four-digit level using an occupational crosswalk from the Bureau of Labor Statistics. For example, "marketing and sales managers," a four-digit occupation, consists of the following two six-digit occupations: "marketing

managers" and "sales managers." In this step of the aggregation process, the job skills and preparation ratings for marketing managers and sales managers are averaged using the employment in each occupation as the weight. If employment data were not available, as was the case for a few occupations, simple averages of the ratings for six-digit occupations were used to estimate ratings for the broader four-digit occupations. The result of this process was average jobs skills and preparation ratings for some 480 four-digit occupations that could be matched to the CPS in 2018.

Step 3: Because occupational classifications are frequently revised, an additional step was necessary to match the job skills and preparation ratings to a harmonized occupation coding scheme that could be used to trace employment and wage trends going back in time. The scheme in the IPUMS-CPS data (OCC2010) provides a consistent, long-term classification of occupations based on the 2010 standard occupational classification. Because of some inconsistencies between the latest CPS occupational codes and the harmonized occupation coding in OCC2010, additional aggregation and recoding was needed to maximize the number of occupations with valid skill ratings. For example, job skills and preparation ratings for "advertising and promotions managers," "marketing and sales managers," and "public relations managers" – three distinct four-digit occupations in the current CPS – were averaged using employment weights to estimate the ratings for "managers in marketing, advertising, and public relations" – a single occupation in the time-consistent OCC2010 classification.

The final datasets with job skills, employment and wage data from O*NET and the CPS includes 431 occupations for 2018 and 266 occupations for 1980. These datasets provide virtually complete coverage of U.S. employment. The 431 occupations within the 2018 dataset employed 155.3 million workers, close to the official government estimate of total U.S. employment of 155.8 million. The 266 occupations in the 1980 dataset employed 98.5 million workers, compared with the official estimate of total employment of 99.3 million.

Grouping occupations by the importance of a skill

The analysis in this report divides occupations into four skill tiers based on the importance rating of each of the five skill groups. Occupations are ranked by their importance rating on, say, social skills, and the top 25% of occupations (the highest quartile) are listed as "most important" users of social skills. The second and third quartile of occupations are defined to be "more important" and "less important" users of social skills, respectively. Finally, the bottom 25% of occupations (the lowest quartile) are listed as "least important" users of social skills. This process is repeated for each of the five major skill groups. The importance ratings that define the boundaries for each of the four tiers for the various skill types are shown in the table below.

Importance ratings that determine whether an occupation is a 'least,' 'less,' 'more' or 'most' important user of a skill, by type of skill

Skill quartile	Social	Fundamental	Analytical	Managerial	Mechanical
Least important	< 2.6	< 2.8	< 1.9	< 2.1	< 1.4
Less important	2.6 – 2.9	2.8 – 3.2	1.9 – 2.1	2.1 – 2.3	1.4 – 1.8
More important	2.9 – 3.2	3.2 – 3.6	2.1 – 2.5	2.3 – 2.5	1.8 – 2.5
Most important	> 3.2	> 3.6	> 2.5	> 2.5	> 2.5

Note: Occupations are ranked by the ratings for a skill, and those in the highest quartile of a skill are ones in which that skill is "most important" and those in the lowest quartile are the ones in which that skill is "least important." The quartiles consist of the same number of occupations. Ratings thresholds are computed for 431 4-digit occupations for which employment and wage data were available.
Source: Pew Research Center analysis of O*NET (Version 23).
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The relative importance of a skill

In this report, the changing mix of skills within a job is assessed by looking at the relative importance of each skill within the job. The relative importance of a skill is its rating divided by the sum of the ratings for all five skills. Suppose that the importance ratings for the major skill groups within a job are as follows: social – 3.1; fundamental – 3.2; analytical – 2.5; managerial – 2.4; and mechanical – 1.8. The sum of the ratings for the five skills is 13 and the relative importance of social skills in this job 0.24 (or 3.1/13), the relative importance of analytical skills is 0.19 (or 2.5/13), and so on. If all skills have the same importance rating, say, 3.0, then the relative importance of each skill is 0.2.

If the importance rating of, say, social skills increases by more than the ratings of other skills in an occupation, then the relative importance of social skills will increase, and the job will be judged to have become a more intensive user of social skills. For example, suppose that the importance ratings for the five skills in the same job at a later point in time are as follows: social – 3.5; fundamental – 3.6; analytical – 2.6; managerial – 2.7; and mechanical – 1.8. Then the relative importance of social skills is estimated to have increased to 0.25 and the relative importance of analytical skills to have decreased to 0.18, even though the ratings of both skills have increased over time.

Hourly wages

Wage estimates pertain to a worker's main job. Workers paid by the hour report hourly wages. For workers who are not paid by the hour, the hourly wage is calculated as weekly earnings divided by the usual numbers of hours worked in a week. The CPS collects data on wages from outgoing rotation groups only, which represent one-quarter of the monthly sample. Self-employed workers are excluded from this subsample. Wages are adjusted for inflation with the Consumer Price Index Research Series (CPI-U-RS).

Using regression analysis to determine how skills, education and other factors affect the gender wage gap

How much a worker earns on her job is related to her skills, education, experience and other qualifications, and to the nature of the job, such as occupation and industry. In this report, a regression analysis is used to determine the relationship between the hourly wages of women and men and the following characteristics for which data were available: job skills, education level, occupation, industry, union membership, part-time work, age, race and ethnicity, geographic region, and metropolitan area status. Regressions are estimated separately for women and men following an approach in common use (see table below for the results).

The results from the regressions are used to estimate the earnings of women, relative to men's earnings, assuming women and men had the same characteristics on average – that is, if they worked in jobs with the same skill requirements, had the same education levels, were equally likely to be union members, and so on. (This widely used technique is known as the Blinder-Oaxaca decomposition.) The regression analysis can also be used to assess how a difference between women and men with respect to any given characteristic, say the average rating on nonmechanical skills, may contribute to the gender wage gap.

Among the key findings, the regression analysis shows that wages are estimated to increase by about 22% for women and 24% for men with a one-point increase in the importance of nonmechanical skills in 2018 on average (the importance ratings for social, fundamental, analytical and managerial skills are combined to represent nonmechanical skills). On the other hand, wages decreased by about 4% for women and 2% for men with a one-point increase in the importance of mechanical skills. The gender differences in the returns to nonmechanical and mechanical skills are among the "unexplained" differences in the earnings of women and men.

Women held a slight edge over men on nonmechanical skills in 2018: The average rating on nonmechanical skills for women was 2.75 compared with 2.69 for men, with the difference arising from how women and men were distributed across occupations. Women also benefited from a

lower rating on mechanical skills compared with men, an average of 1.51 versus 1.94. Gender differences in skill endowment are among the “explained” differences in the earnings of women and men. Examples of other differences include the greater share of women (40%) than men (35%) who have a bachelor’s degree or higher level of education and the greater share of women (18%) than men (7%) who work in administrative support occupations.

Regression analysis of the relationship of women's and men's wages to the characteristics of workers and their jobs, 2018

	Women			Men		
	Variable mean	Coefficient	Std. error	Variable mean	Coefficient	Std. error
Dependent variable: Ln hourly wage	2.894			3.059		
Independent variables:						
Constant	1.000	1.367	0.040	1.000	1.245	0.031
Non-mechanical skills	2.752	0.199	0.008	2.690	0.216	0.008
Mechanical skills	1.508	-0.038	0.008	1.944	-0.017	0.006
High school	0.228	0.065	0.008	0.290	0.123	0.007
Some college	0.300	0.098	0.008	0.268	0.155	0.007
Bachelor's degree or more	0.402	0.363	0.008	0.348	0.397	0.008
Age	41.474	0.028	0.001	41.253	0.036	0.001
Age squared	1927.797	0.000	0.000	1903.692	0.000	0.000
Union representation	0.112	0.083	0.006	0.123	0.115	0.006
Part-time worker	0.225	-0.130	0.005	0.113	-0.223	0.006
Hispanic	0.162	-0.053	0.005	0.191	-0.085	0.005
Non-Hispanic black	0.135	-0.073	0.005	0.107	-0.160	0.006
Non-Hispanic other	0.089	-0.014	0.006	0.086	-0.018	0.006
Occupation						
Managerial	0.092	0.251	0.033	0.110	0.320	0.022
Business operations	0.030	0.266	0.034	0.023	0.279	0.024
Financial specialists	0.027	0.276	0.034	0.019	0.318	0.025
Scientific & technical	0.036	0.344	0.033	0.099	0.394	0.021
Community & legal	0.039	0.173	0.033	0.021	0.197	0.025
Education	0.100	0.056	0.033	0.033	0.180	0.024
Arts, sports & media	0.016	0.191	0.035	0.017	0.253	0.024
Healthcare	0.102	0.333	0.032	0.028	0.340	0.023
Healthcare support	0.046	-0.054	0.032	0.006	-0.057	0.030
Protective services	0.010	-0.045	0.036	0.034	0.032	0.023
Food preparation & serving	0.067	-0.189	0.032	0.050	-0.070	0.022
Building & grounds services	0.031	-0.055	0.033	0.040	0.035	0.020
Personal services	0.050	-0.134	0.032	0.015	-0.027	0.025
Sales & related	0.102	0.034	0.032	0.091	0.129	0.022
Administrative support	0.181	0.060	0.032	0.068	0.046	0.021
Construction & extraction	0.003	0.216	0.045	0.091	0.222	0.021

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Continued

Regression analysis of the relationship of women's and men's wages to the characteristics of workers and their jobs, 2018

	Women			Men		
	Variable mean	Coefficient	Std. error	Variable mean	Coefficient	Std. error
Occupation (cont.)						
Installation, maintenance & repair	0.002	0.163	0.048	0.061	0.229	0.022
Production	0.035	0.002	0.033	0.082	0.133	0.021
Transportation & material moving	0.025	0.033	0.033	0.102	0.086	0.020
Industry						
Construction	0.013	0.069	0.023	0.106	0.011	0.013
Manufacturing, durable goods	0.035	0.142	0.020	0.101	0.030	0.013
Manufacturing, nondurable goods	0.029	0.098	0.020	0.049	0.020	0.014
Wholesale and retail trade	0.200	-0.035	0.018	0.202	-0.090	0.012
Transportation and warehousing	0.027	0.090	0.020	0.066	0.023	0.014
Utilities	0.005	0.188	0.029	0.020	0.073	0.017
Communications	0.007	0.180	0.027	0.015	0.031	0.018
Finance, insurance & real estate	0.074	0.097	0.018	0.056	0.046	0.014
Business & repair services	0.054	0.066	0.019	0.088	0.013	0.013
Personal services	0.041	0.025	0.019	0.015	-0.102	0.018
Entertainment & recreation services	0.018	0.014	0.021	0.021	-0.079	0.017
Health, education & other prof.	0.433	0.038	0.017	0.172	-0.043	0.012
Public administration	0.050	0.093	0.019	0.056	0.011	0.014
Northeast	0.184	0.052	0.006	0.175	0.034	0.006
South	0.370	-0.027	0.005	0.369	-0.006	0.005
West	0.226	0.079	0.005	0.242	0.059	0.005
Metropolitan area	0.879	0.079	0.005	0.880	0.069	0.005
R-squared	0.407			0.414		

Note: Full-time and part-time workers ages 16 and older, including 76,527 women and 78,920 men. CPS sample weights for the outgoing rotation groups are used to estimate weighted least squares regressions. The farming industry and occupations in farming are omitted variables.
Source: Pew Research Center analysis of O*NET (Version 23) and 2018 Current Population Survey outgoing rotation group.
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Appendix

Occupational skills and their importance rating, 2018

	Skill rank	Skill rating mean	Rating percentiles		
			25th	50th (median)	75th
Social skills		**2.9**	**2.6**	**2.9**	**3.2**
Monitoring	5	3.3	3.0	3.2	3.5
Social perceptiveness	7	3.2	2.9	3.0	3.4
Coordination	9	3.1	2.9	3.0	3.3
Service orientation	13	2.9	2.5	2.9	3.3
Instructing	14	2.8	2.4	2.8	3.1
Persuasion	15	2.7	2.4	2.8	3.0
Negotiation	19	2.6	2.3	2.6	2.9
Fundamental skills		**3.2**	**2.9**	**3.3**	**3.6**
Active listening	1	3.6	3.1	3.6	4.0
Speaking	2	3.5	3.0	3.5	3.9
Critical thinking	3	3.5	3.1	3.5	3.9
Reading comprehension	4	3.4	3.0	3.4	3.9
Judgement and decision making	6	3.2	2.9	3.1	3.5
Writing	10	3.1	2.6	3.1	3.6
Active learning	12	3.0	2.8	3.0	3.4
Learning strategies	16	2.7	2.3	2.8	3.0
Analytical skills		**2.2**	**1.9**	**2.2**	**2.5**
Complex problem solving	8	3.1	2.9	3.1	3.5
Systems analysis	17	2.6	2.1	2.6	3.0
Systems evaluation	21	2.5	2.1	2.5	3.0
Mathematics	22	2.5	2.1	2.4	2.9
Operations analysis	26	2.0	1.6	1.9	2.5
Science	28	1.9	1.3	1.6	2.3
Technology design	33	1.7	1.5	1.7	1.9
Programming	34	1.5	1.1	1.5	1.8

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Continued

Occupational skills and their importance rating, 2018

	Skill rank	Skill rating mean	Rating percentiles		
			25th	50th (median)	75th
Managerial skills		**2.4**	**2.1**	**2.3**	**2.5**
Time management	11	3.1	2.9	3.0	3.3
Management of personnel resources	18	2.6	2.3	2.6	2.9
Management of material resources	27	1.9	1.8	1.9	2.1
Management of financial resources	29	1.8	1.5	1.8	2.0
Mechanical skills		**2.0**	**1.4**	**1.8**	**2.5**
Operation monitoring	20	2.6	1.9	2.5	3.1
Quality control analysis	23	2.4	2.0	2.4	3.0
Operation and control	24	2.2	1.4	2.1	3.0
Troubleshooting	25	2.1	1.4	2.0	2.7
Equipment maintenance	30	1.7	1.0	1.3	2.4
Equipment selection	31	1.7	1.0	1.5	2.3
Repairing	32	1.7	1.0	1.1	2.3
Installation	35	1.2	1.0	1.0	1.3

Note: The importance of each detailed skill element to an occupation is given a numerical rating on a scale of one (not important) to five (extremely important) in the O*NET data. The O*NET data provides ratings for 967 8-digit occupations. The ratings shown are averages across 772 6-digit occupations, where the rating for a 6-digit occupation often reflects the simple average of ratings for 8-digit occupations that comprise the 6-digit occupation. The ratings for skill groups, e.g. social skills, are simple averages of the ratings for the detailed skill elements that constitute that group.

Source: Pew Research Center analysis of O*NET (Version 23).

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The 25 occupations receiving the highest importance rating on social skills in 2018

Occupation	Social skill rating
Coaches and scouts	4.04
Educational, guidance, school, and vocational counselors	3.93
Clergy	3.88
Lodging managers	3.88
Sales managers	3.86
Education administrators, elementary and secondary school	3.86
Marriage and family therapists	3.86
Emergency management directors	3.86
Education administrators, preschool and childcare center/program	3.81
First-line supervisors of office and administrative support workers	3.80
Psychiatrists	3.79
Special education teachers, kindergarten and elementary school	3.78
Training and development managers	3.77
Child, family, and school social workers	3.77
School psychologists	3.76
First-line supervisors of police and detectives	3.75
Gaming managers	3.73
Mental health counselors	3.73
Education administrators, postsecondary	3.73
Kindergarten teachers, except special education	3.73
Special education teachers, secondary school	3.72
Medical and health services managers	3.71
Dietitians and nutritionists	3.70
Social and community service managers	3.68
Mental health and substance abuse social workers	3.68

Note: The importance of 35 detailed skill elements to an occupation are given a numerical rating on a scale of one (not important) to five (extremely important) in the O*NET data. The O*NET data provides ratings for 967 8-digit occupations. The ratings shown are averages across 772 6-digit occupations, where the rating for a 6-digit occupation often reflects the simple average of ratings for 8-digit occupations that comprise the 6-digit occupation. The rating for social skills is the simple average of the ratings for the seven detailed skill elements that represent social skills.
Source: Pew Research Center analysis of O*NET (Version 23).
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The 25 occupations receiving the highest importance rating on fundamental skills in 2018

Occupation	Fundamental skill rating
Neuropsychologists and clinical neuropsychologists	4.31
Education administrators, elementary and secondary school	4.20
Psychiatrists	4.15
Judges, magistrate judges, and magistrates	4.14
Lawyers	4.11
Physics teachers, postsecondary	4.09
Agricultural sciences teachers, postsecondary	4.08
Clergy	4.08
Law teachers, postsecondary	4.08
Anthropology and archeology teachers, postsecondary	4.06
Criminal justice and law enforcement teachers, postsecondary	4.06
English language and literature teachers, postsecondary	4.05
Atmospheric, earth, marine, and space sciences teachers,	4.05
Social work teachers, postsecondary	4.05
Epidemiologists	4.05
Educational, guidance, school, and vocational counselors	4.03
Sociology teachers, postsecondary	4.03
Health specialties teachers, postsecondary	4.03
Education teachers, postsecondary	4.03
School psychologists	4.03
Obstetricians and gynecologists	4.02
Nursing instructors and teachers, postsecondary	4.00
Family and general practitioners	4.00
Training and development managers	3.99
Farm and home management advisors	3.99

Note: The importance of 35 detailed skill elements to an occupation are given a numerical rating on a scale of one (not important) to five (extremely important) in the O*NET data. The O*NET data provides ratings for 967 8-digit occupations. The ratings shown are averages across 772 6-digit occupations, where the rating for a 6-digit occupation often reflects the simple average of ratings for 8-digit occupations that comprise the 6-digit occupation. The rating for fundamental skills is the simple average of the ratings for the eight detailed skill elements that represent fundamental skills.
Source: Pew Research Center analysis of O*NET (Version 23).
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The 25 occupations receiving the highest importance rating on analytical skills in 2018

Occupation	Analytical skill rating
Biomedical engineers	3.66
Physicists	3.59
Chemical engineers	3.58
Aerospace engineers	3.49
Nuclear engineers	3.49
Software developers, applications	3.46
Operations research analysts	3.45
Computer and information research scientists	3.41
Remote sensing scientists and technologists	3.39
Mining and geological engineers, including mining safety engineers	3.39
Agricultural engineers	3.36
Mechanical engineers	3.36
Industrial-organizational psychologists	3.36
Biochemists and biophysicists	3.34
Computer programmers	3.34
Network and computer systems administrators	3.27
Civil engineers	3.26
Epidemiologists	3.25
Actuaries	3.22
Marine engineers	3.20
Statisticians	3.19
Biochemical engineers	3.18
Soil and plant scientists	3.16
Mathematicians	3.16
Animal scientists	3.14

Note: The importance of 35 detailed skill elements to an occupation are given a numerical rating on a scale of one (not important) to five (extremely important) in the O*NET data. The O*NET data provides ratings for 967 8-digit occupations. The ratings shown are averages across 772 6-digit occupations, where the rating for a 6-digit occupation often reflects the simple average of ratings for 8-digit occupations that comprise the 6-digit occupation. The rating for analytical skills is the simple average of the ratings for the eight detailed skill elements that represent analytical skills.
Source: Pew Research Center analysis of O*NET (Version 23).
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The 25 occupations receiving the highest importance rating on managerial skills in 2018

Occupation	Managerial skill rating
Education administrators, elementary and secondary school	3.60
Construction managers	3.53
Medical and health services managers	3.53
Chief executives	3.50
Training and development managers	3.50
Purchasing managers	3.47
Education administrators, postsecondary	3.44
Education administrators, preschool and childcare center/program	3.44
Lodging managers	3.41
First-line supervisors of non-retail sales workers	3.41
General and operations managers	3.41
First-line supervisors of mechanics, installers, and repairers	3.41
Industrial production managers	3.36
Postmasters and mail superintendents	3.35
Dentists, general	3.35
Chefs and head cooks	3.34
Food service managers	3.31
Gaming managers	3.31
Transportation managers	3.29
Administrative services managers	3.29
Sales managers	3.28
Purchasing agents, except wholesale, retail, and farm products	3.28
Fashion designers	3.28
First-line supervisors of police and detectives	3.28
Coaches and scouts	3.28

Note: The importance of 35 detailed skill elements to an occupation are given a numerical rating on a scale of one (not important) to five (extremely important) in the O*NET data. The O*NET data provides ratings for 967 8-digit occupations. The ratings shown are averages across 772 6-digit occupations, where the rating for a 6-digit occupation often reflects the simple average of ratings for 8-digit occupations that comprise the 6-digit occupation. The rating for managerial skills is the simple average of the ratings for the four detailed skill elements that represent managerial skills.
Source: Pew Research Center analysis of O*NET (Version 23).
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The 25 occupations receiving the highest importance rating on mechanical skills in 2018

Occupation	Mechanical skill rating
Signal and track switch repairers	3.81
Heating and air conditioning mechanics and installers	3.77
Aircraft mechanics and service technicians	3.70
Elevator installers and repairers	3.69
Electric motor, power tool, and related repairers	3.64
Industrial machinery mechanics	3.64
Mobile heavy equipment mechanics, except engines	3.59
Electro-mechanical technicians	3.56
Millwrights	3.55
Electrical and electronics repairers, commercial and industrial	3.52
Telecommunications equipment installers and repairers, except line	3.52
Automotive master mechanics	3.50
Farm equipment mechanics and service technicians	3.49
Ship engineers	3.44
Avionics technicians	3.42
Home appliance repairers	3.38
Maintenance and repair workers, general	3.37
Medical equipment repairers	3.35
Maintenance workers, machinery	3.33
Motorboat mechanics and service technicians	3.33
Outdoor power equipment and other small engine mechanics	3.28
Electronic equipment installers and repairers, motor vehicles	3.27
Commercial divers	3.24
Bus and truck mechanics and diesel engine specialists	3.23
Boilermakers	3.23

Note: The importance of 35 detailed skill elements to an occupation are given a numerical rating on a scale of one (not important) to five (extremely important) in the O*NET data. The O*NET data provides ratings for 967 8-digit occupations. The ratings shown are averages across 772 6-digit occupations, where the rating for a 6-digit occupation often reflects the simple average of ratings for 8-digit occupations that comprise the 6-digit occupation. The rating for mechanical skills is the simple average of the ratings for the eight detailed skill elements that represent mechanical skills.
Source: Pew Research Center analysis of O*NET (Version 23).
"Women Make Gains in the Workplace Amid a Rising Demand for Skilled Workers"

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The top 25 occupations in terms of employment among jobs ranked as most important users of social skills in 2018

Employment in 2018 (in thousands)

Occupation	Employment
All jobs ranked as "most important" users of social skills	65,162
Managers, other	4,887
First-line supervisors of retail sales workers	4,638
Registered nurses	3,467
Elementary and middle school teachers	3,436
Retail salespersons	3,166
Customer service representatives	2,577
Chief executives and legislators	1,579
First-line supervisors of office and administrative support workers	1,455
Food service managers	1,432
Post-secondary teachers	1,422
Lawyers, and judges, magistrates, and other judicial workers	1,296
Sales representatives, wholesale and manufacturing	1,276
Financial managers	1,234
Childcare workers	1,203
Marketing, advertising, and public relations managers	1,199
Social workers	1,151
Physicians and surgeons	1,097
Real estate brokers and sales agents	1,079
Secondary school teachers	1,066
General and operations managers	1,041
Construction managers	1,023
Farmers, ranchers, and other agricultural managers	996
Education administrators	960
Management analysts	947
Other teachers and instructors	911

Note: Occupations are ranked by the ratings for a skill, and those in the highest quartile of a skill are ones in which that skill is "most important." Sample consists of 431 4-digit occupations. Full-time and part-time workers ages 16 and older.
Source: Pew Research Center analysis of O*NET (Version 23) and 2018 Current Population Survey (IPUMS).
"Women Make Gains in the Workplace Amid a Rising Demand for Skilled Workers"

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The top 25 occupations in terms of employment among jobs ranked as most important users of fundamental skills in 2018

Employment in 2018 (in thousands)

Occupation	Employment
All jobs ranked as "most important" users of fundamental skills	50,520
Managers, other	4,887
Registered nurses	3,467
Elementary and middle school teachers	3,436
Accountants and auditors	1,935
Computer scientists, systems analysts, and web developers	1,826
Chief executives and legislators	1,579
First-line supervisors of office and administrative support workers	1,455
Post-secondary teachers	1,422
Lawyers, and judges, magistrates, and other judicial workers	1,296
Financial managers	1,234
Marketing, advertising, and public relations managers	1,199
Social workers	1,151
Physicians and surgeons	1,097
Secondary school teachers	1,066
General and operations managers	1,041
Construction managers	1,023
Education administrators	960
Management analysts	947
Counselors	899
Police officers and detectives	895
Human resources, training, and labor relations specialists	835
First-line supervisors of production and operating workers	834
Preschool and kindergarten teachers	720
Licensed practical and licensed vocational nurses	661
Medical and health services managers	642

Note: Occupations are ranked by the ratings for a skill, and those in the highest quartile of a skill are ones in which that skill is "most important." Sample consists of 431 4-digit occupations. Full-time and part-time workers ages 16 and older.
Source: Pew Research Center analysis of O*NET (Version 23) and 2018 Current Population Survey (IPUMS).
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The top 25 occupations in terms of employment among jobs ranked as most important users of analytical skills in 2018

Employment in 2018 (in thousands)

Occupation	Employment
All jobs ranked as "most important" users of analytical skills	41,292
Managers, other	4,887
Registered nurses	3,467
Accountants and auditors	1,935
Computer scientists, systems analysts, and web developers	1,826
Software developers, applications and systems software	1,684
Chief executives and legislators	1,579
Lawyers, and judges, magistrates, and other judicial workers	1,296
Financial managers	1,234
Marketing, advertising, and public relations managers	1,199
Physicians and surgeons	1,097
Construction managers	1,023
Farmers, ranchers, and other agricultural managers	996
Education administrators	960
Management analysts	947
Counselors	899
Electricians	888
Medical and health services managers	642
Computer and information systems managers	623
Miscellaneous engineers, including nuclear engineers	607
Other business operations and management specialists	592
Computer support specialists	568
Personal financial advisors	538
Computer programmers	479
Civil engineers	458
Social and community service managers	449

Note: Occupations are ranked by the ratings for a skill, and those in the highest quartile of a skill are ones in which that skill is "most important." Sample consists of 431 4-digit occupations. Full-time and part-time workers ages 16 and older.
Source: Pew Research Center analysis of O*NET (Version 23) and 2018 Current Population Survey (IPUMS).
"Women Make Gains in the Workplace Amid a Rising Demand for Skilled Workers"

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The top 25 occupations in terms of employment among jobs ranked as most important users of managerial skills in 2018

Employment in 2018 (in thousands)

Occupation	Employment
All jobs ranked as "most important" users of managerial skills	51,081
Managers, other	4,887
First-line supervisors of retail sales workers	4,638
Registered nurses	3,467
Secretaries and administrative assistants	2,582
Accountants and auditors	1,935
Chief executives and legislators	1,579
First-line supervisors of office and administrative support workers	1,455
Food service managers	1,432
Lawyers, and judges, magistrates, and other judicial workers	1,296
Financial managers	1,234
Marketing, advertising, and public relations managers	1,199
Physicians and surgeons	1,097
General and operations managers	1,041
Construction managers	1,023
Farmers, ranchers, and other agricultural managers	996
Education administrators	960
Electricians	888
First-line supervisors of production and operating workers	834
Property, real estate, and community association managers	719
Licensed practical and licensed vocational nurses	661
Medical and health services managers	642
First-line supervisors of construction trades and extraction workers	636
Computer and information systems managers	623
Miscellaneous engineers, including nuclear engineers	607
Other business operations and management specialists	592

Note: Occupations are ranked by the ratings for a skill, and those in the highest quartile of a skill are ones in which that skill is "most important." Sample consists of 431 4-digit occupations. Full-time and part-time workers ages 16 and older.
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The top 25 occupations in terms of employment among jobs ranked as most important users of mechanical skills in 2018

Employment in 2018 (in thousands)

Occupation	Employment
All jobs ranked as "most important" users of mechanical skills	15,855
Driver/sales workers and truck drivers	3,559
Automotive service technicians and mechanics	918
Electricians	888
Pipelayers, plumbers, pipefitters, and steamfitters	643
Computer support specialists	568
Maintenance and repair workers, general	508
Heating, air conditioning, and refrigeration mechanics and installers	473
Industrial and refractory machinery mechanics	442
Engineering technicians, except drafters	440
Miscellaneous metal workers and plastic workers, including multiple	409
Bus and truck mechanics and diesel engine specialists	390
Machinists	345
Construction equipment operators except paving, surfacing, and	344
Firefighters	307
First-line supervisors of mechanics, installers, and repairers	280
Heavy vehicle and mobile equipment service technicians and	211
Telecommunications line installers and repairers	211
Computer programmers	205
Miscellaneous installation, maintenance, and repair workers,	186
Computer, automated teller, and office machine repairers	185
Bookbinders, printing machine operators, and job printers	179
Painting workers	166
Aircraft mechanics and service technicians	164
Automotive body and related repairers	153
Sheet metal workers	148

Note: Occupations are ranked by the ratings for a skill, and those in the highest quartile of a skill are ones in which that skill is "most important." Sample consists of 431 4-digit occupations. Full-time and part-time workers ages 16 and older.
Source: Pew Research Center analysis of O*NET (Version 23) and 2018 Current Population Survey (IPUMS).
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