

The New Landscape of Digital Literacy

How workers' uneven digital skills affect economic mobility and business competitiveness, and what policymakers can do about it.

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CAPSULE SUMMARY: **Exciting new findings about workers' digital literacy**

The Covid-19 pandemic has thrown a stark spotlight on need for digital skills among a wide swath of the American workforce. But even before the pandemic, the US labor market reflected a growing demand for workers across industries to have strong digital skills. This report uses data from a rigorously designed international assessment to analyze workers' current level of digital skills, providing a breakdown of how skills differ among workers in major industries and occupations as well as demographic categories. Next, it provides a short summary of recommendations for how policymakers and business leaders can invest in upskilling to ensure that all workers have the resilience needed to respond to the continuing transformation of jobs in the US labor market, and to acquire new digital skills as necessary. This report is a companion to *Digital Skills for an Equitable Recovery*, which provides more detailed policy recommendations and related background.

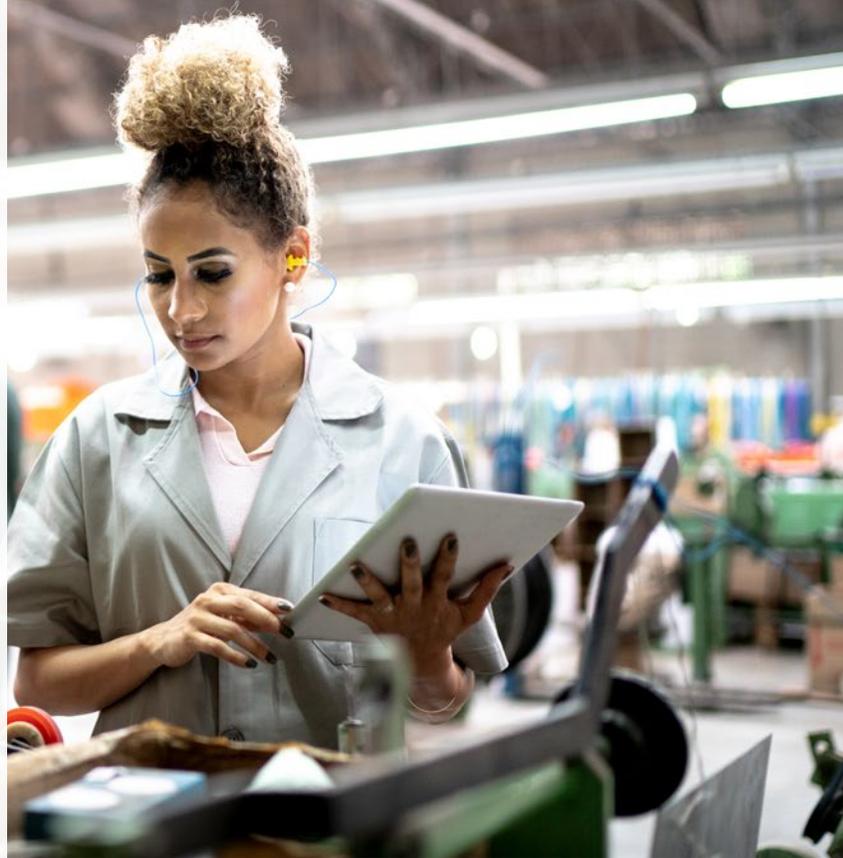
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For businesses to flourish in this rapidly transforming environment, they need reliable access to skilled workers, and strong, responsive public policies that facilitate upskilling for their incumbent workforce.



A rapidly changing economic environment is driving demand for digital skills

Jobs across the United States increasingly require digital literacy skills. This is not limited to workers in the information technology field or those with college degrees; even entry-level workers in agriculture, healthcare, and hospitality are now required to effectively use technology to do their jobs. For example, Kentucky Fried Chicken now trains workers on food safety using virtual reality goggles,¹ while agribusiness giant Taylor Farms is training human workers to collaborate with robots in packing vegetables.² Many companies have recently beefed up their remote work expectations and processes, whether in response to the Covid-19 pandemic, a natural disaster, or other business imperatives.³ Telehealth in particular has seen an enormous surge, with one major Washington State healthcare provider reporting increases of ten to fifteen times the normal number of “virtual visits” in just the first month of the pandemic.⁴

In this rapidly evolving context, research from the Urban Institute affirms the growing urgency of foundational digital skills for all workers, including those in frontline, essential roles such as home health aides and janitors.⁵

In addition, a recent report from the Brookings Institution documented the increasing digitization of American jobs across a diverse array of 545 occupations.⁶

Using US Department of Labor O*NET data, Brookings researchers drew on two variables to inform their calculations, writing that they chose these as “the most relevant measures of the overall digital tenor of occupations.”⁷ Researchers added that the first variable, “knowledge-computer and electronics,” was chosen because it captures the overall computer knowledge required by a job. The second variable, “work activity-interacting with computers” was chosen because it quantifies the degree to which computers are core to the occupation’s work activity.⁸ Even occupations that are not necessarily thought of as requiring digital skills saw large jumps in their digitization scores (calculated using the above variables) between 2002 and 2016, per the Brookings analysis.

For businesses to flourish in this rapidly transforming environment, they need reliable access to skilled workers, and strong, responsive public policies that facilitate upskilling for their incumbent workforce. For workers to thrive, they need access to timely and accessible upskilling opportunities, including those that allow them to build

foundational digital skills as well as acquiring more advanced competencies. And in the wake of the pandemic, both workers and businesses need those public policies and learning opportunities to include the flexibility to be adapted, when appropriate, to incorporate high-quality virtual or remote upskilling options.

Governors and other state policymakers have begun to recognize the technology-driven changes taking place across their labor markets. In the past several years, numerous states have launched Future of Work task forces and similar efforts to understand how best to prepare businesses and their workers for the current and future transformation of their industries, including growing demands for digital skills. Among the states leading the way are Indiana, Washington, New Jersey, and California.⁹

The need for digital skills is also gaining urgency in other arenas. To date, forty-three states have set ambitious goals for postsecondary credential attainment. This entails setting a target for the percentage of state residents who should attain such credentials by a given deadline (typically 2025).¹⁰ For many individuals—especially those who are working adults, parents, and/or living in rural communities—digital skills are a vital “threshold competency” needed in order to access the online or blended learning opportunities they will need in order to complete postsecondary credentials.

The Covid-19 pandemic has significantly magnified the degree to which workers who have not yet passed this first digital competency threshold can face negative ripple effects. For example, workers may have difficulty using remote tools newly required by their employer, assisting their children with online learning, or navigating the very public systems designed to help them access education or other assistance.

In addition, both now and over the longer term, people without foundational digital skills may struggle to advance in their careers, or have difficulty holding on to their existing jobs as their roles evolve to demand greater digital fluency.

Even before the pandemic, the importance of foundational digital skills in equipping workers to pursue further education and training opportunities was evident. Two examples highlight the particular urgency of this issue for

workers in rural communities, as well as others who may not always be able to access in-person learning opportunities. The first is Western Governors University (WGU), a fully online, accredited nonprofit higher education institution. Launched by a bipartisan alliance of Western-state governors nearly two decades ago, WGU focuses on competency based instruction rather than a “seat time” model. Today WGU serves 121,000 adult students¹¹ with an average age of 37; three-quarters of them are working.¹² The rapid growth of WGU illustrates the heavy demand for its type of learning model among a wide range of workers and students.

The second example comes from California, where the state’s newest community college, Calbright, launched in 2019 as an online-only institution meant to serve the eight million adult Golden State residents who are “stranded” in low-wage work or otherwise unable to access traditional upskilling pathways.¹³ While Calbright has only just enrolled its first round of 450 students, observers have already noted that there are potential challenges in using an online-only format to target learners who may have struggled in their previous attempts at education.¹⁴

Research from the Urban Institute suggests that technology and digital literacy training are a crucial component of support for *any* community college students taking online courses.¹⁵ However, researchers also caution that technology should not be “the tail wagging the dog,” and urge stakeholders to start with learners’ needs and goals in mind so that adoption of digital technology is a goal-driven rather than a product-driven approach.¹⁶

Gaining a big-picture perspective on building a digitally-resilient workforce

Given these fast moving developments in both workforce development and postsecondary attainment, many leaders are eager to gain a bird’s-eye view of the current landscape to inform their decisionmaking going forward. This report provides policymakers, business leaders, and advocates with the big-picture perspective and hard data they will need as they work to foster a digitally skilled and resilient workforce.¹⁷ It does so by providing a snapshot of America’s workers **current** digital skills. Knowing the

assets and barriers faced by today's workers will help leaders to identify the most urgent priorities for action—from industry-specific as well as demographic perspectives.

This report draws on data from the Organization for Economic Cooperation and Development (OECD) Survey of Adult Skills, also known as the PIAAC, to describe the digital literacy skills of workers ages 16-64 who are currently employed.¹⁸ Crucially, the focus is *not* on workers' ability to use a particular software program or navigate a proprietary system. Rather, the PIAAC measures a worker's overall ability to engage in "Problem-Solving in Technology-Rich Environments," by assessing such skills as being able to navigate a website, find and evaluate relevant content and submit or communicate necessary data.

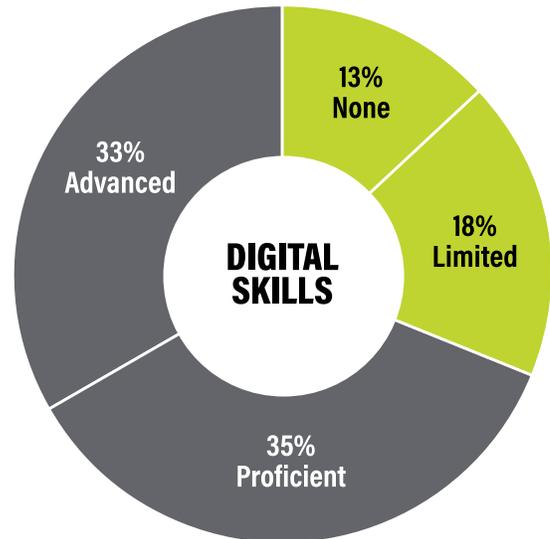
Today's reality: Nearly one-third of U.S. workers lack digital skills

Across all industries, data show that nearly one-third (31 percent) of workers lack digital skills. This number includes the 13 percent of overall workers who have *no* digital skills and another 18 percent who have *limited* skills. An additional 35 percent have achieved a baseline level of proficiency in their digital skills, and the final 33 percent of workers have advanced skills.

More context about each of these categories is provided below.

- **No digital skills:**¹⁹ People with no digital skills failed to meet one or more of the three baseline criteria to even take the full digital skills assessment: 1) prior computer use, 2) willingness to take the computer-based assessment, or 3) ability to complete four out of six very basic computer tasks, such as using a mouse or highlighting text on screen.
- **Limited digital skills:**²⁰ People with limited digital skills can complete only very simple digital tasks that have a generic interface and just a few steps. As an example, people at this level would have a difficult time sorting email responses to an event invitation into pre-existing folders to keep track of who can and cannot attend an event.

NEARLY ONE-THIRD OF AMERICA'S WORKERS LACK DIGITAL SKILLS



Currently employed US workers ages 16-64.
Source: OECD Survey of Adult Skills (PIAAC) 2012-14.

- **Proficient digital skills:**²¹ People at this level would typically struggle with tasks that require the use of both generic and specific technology applications. For example, a person might not be able to complete a task involving with the use of a new type of online form, and the need to navigate across multiple pages and applications to answer the test question. This task may have multiple steps, and may require the use of tools (such as the "sort" function) to solve the problem. The person may have to identify the goal themselves, and engage in higher-level reasoning to solve the problem.
- **Advanced digital skills:**²² At this level, a person might have to make use of an online form that they are encountering for the first time. In doing so, they might have to define for themselves the goal of the problem they are solving, and use inferential reasoning in solving the problem. They might need to navigate across different online pages and applications, carry out multiple steps of a task, and evaluate the relevance of a set of items to discard distractors.



IS THE GLASS HALF FULL OR HALF EMPTY? UNDERSTANDING FRAGMENTED KNOWLEDGE

It may seem surprising that in this day and age some workers have few or no digital skills. It is important to note that many of these workers may have **fragmented knowledge**: That is, they may be comfortable using a mobile phone to text a photo, but not be familiar with how to operate a mouse or upload a job application.

This is particularly true for individuals who do not own a desktop or laptop computer. Data from the US Census Bureau indicates that 23 percent of US households fall into this category.¹

Fragmented knowledge is also more likely to occur among people who have smartphone-only internet access—that is, they can get online using their phones, but don't have broadband internet access at home. (This group partially overlaps with but is not identical to the previous group mentioned above.) A 2019 survey from the nonpartisan Pew Research Center showed that people of color are more likely to have smartphone-only internet access, with 23 percent of Black respondents and 25 percent of Latino respondents falling into this category, compared to just 12 percent of whites.²

Workers with fragmented knowledge may be adept at navigating certain digital tasks they perform often in their daily lives, yet also held back from advancing in their careers due to lack of digital problem-solving skills like those measured by the PIAAC. Policymakers and advocates seeking to help these workers upskill should be careful not to underestimate their ingenuity and expertise.³

In particular, leaders should ensure that workers have a voice in identifying what skill-building opportunities they need, what support is necessary to ensure their success, and how their employers can most effectively be engaged in upskilling conversations. (Labor-management partnerships are one proven model for this type of collaborative program design.⁴)

Understanding the phenomenon of fragmented knowledge can help leaders avoid making assumptions about who lacks digital skills and why, and which interventions can help people make bridges between the skills they have and the skills they need.

1 "Computer and internet use in the United States: 2016," US Census Bureau, 2018, <https://www.census.gov/content/dam/Census/library/publications/2018/acs/ACS-39.pdf>

2 Source: <https://www.pewresearch.org/internet/2019/06/13/mobile-technology-and-home-broadband-2019/>. Data on Asian/Pacific Islanders and other racial/ethnic groups was not provided in the Pew study. Additionally, it should be noted that among overall adults surveyed by Pew who lack home broadband internet access, 27 percent cited cost (of either the broadband service or a computer) as the most important reason for their lack of access.

3 See, for example, "Digital Diaspora: How immigrants are capitalizing on today's technology," Welcoming Center for New Pennsylvanians, November 2012, <https://welcomingcenter.org/wp-content/uploads/2016/08/Digital-Diaspora-FINAL-report-Nov-2012-1.pdf>.

4 "The benefits of labor-management partnerships," Labor-Management Project, 2014, <https://www.labormanagementinitiatives.org/wp-content/uploads/sites/7/2014/11/Benefits-of-LM-Partnership-Cross-Industry-Lit-Review.pdf>

Digital skill gaps occur across industries and occupations

Construction, transportation, and storage industry sectors face biggest gap

Every industry in America faces significant digital skill gaps in its workforce. Nevertheless, there are variations among different industry sectors when it comes to this issue. For example, the construction, transportation, and storage sectors have the highest proportion of workers without digital skills; fully half of all workers (50 percent) in these sectors lack skills. While it might seem as though these industries simply don't have much need for digital skills, in fact that is not the case. For example, the Brookings Institution analysis mentioned above found that both construction managers and construction laborers saw dramatic increases in their "digitization scores" between 2002 and 2016.²³

The construction sector is far from the only one facing significant skills gaps. More than one-third of workers in numerous other sectors have few or no digital skills. This includes retail, wholesale, and auto repair, where 37 percent of workers have limited or no digital skills; hospitality and other services (36 percent); manufacturing (35 percent); and the combined category of administrative and support services and arts, entertainment, and recreation (35 percent).

In some cases, digital skill development can be a chicken-or-the-egg question: Did the worker develop the skills because their job requires it, or did the industry hire workers who already had the skills they needed? Regardless of the direction of that causality, the industries that have slightly fewer workers who lack digital skills include several sectors that have more thoroughly incorporated digital technologies over the past few decades. Still, even

Selected industries ²⁴	Percentage of workers with no digital skills	Percentage of workers with limited digital skills	Combined percentage of workers with limited or no skills*
Construction, transportation and storage	22%	28%	50%
Retail, wholesale, and auto repair	14%	23%	37%
Hospitality and other services	18%	18%	36%
Manufacturing	16%	19%	35%
Administrative and support services; arts, entertainment and recreation	13%	22%	35%
Health and social work	12%	21%	33%
Finance, insurance, and real estate (FIRE)	6%	14%	19%*
Education	5%	11%	15%*

*NOTE: Numbers may not sum due to rounding.

within those industries, there are startling gaps. For example, a full one-third (33 percent) of workers in America's robust health and social work sector lack digital skills—a particularly concerning finding given the widespread use of electronic health records and related computer tools across the sector, as well as the recent increase in demand for telehealth services due to the Covid-19 pandemic.

Health workers' skill gaps also have broad geographic implications, as the sector is robustly represented in nearly every US state and local economy. While the health sector in general is relatively recession proof and is expected to continue growing as more and more baby boomers reach retirement, localities that have fewer skilled workers will be less desirable choices for healthcare industry expansion and location of ancillary services. Digital skill gaps thus have significant **economic** development as well as **workforce** development repercussions.

Continuing down the list of sectors, nearly one in five workers (19 percent) in the financial, insurance, and real estate (or FIRE) sector have few or no digital skills. Again, this is especially concerning given the prevalence of required digital tools in these industries.²⁵ As described later in this report, numerous workers with limited digital skills are nevertheless called upon to **use** computers regularly on the job. The costs of their skill gaps are significant, serving as an invisible drag on productivity as workers develop sometimes elaborate and time-consuming coping mechanisms to cover for their lack of skills.²⁶

Finally, nearly one in six US workers in the education sector (15 percent) also lack digital skills. This is perhaps surprising, given the substantial growth in digital technologies for educational contexts in recent years, but it may reflect in part the decentralized and uneven access to professional development for many workers in the education field.²⁷ In particular, educators in part-time roles or working as adjunct or contract workers may lack institutional support, including for professional development in building their digital skills.²⁸

The percentage of such workers can be substantial in some sub-sectors of the education field. For example, a full 78 percent of the adult educators funded under the federal Workforce Innovation and Opportunity Act are part-time teachers.²⁹ Any gaps in teachers' skills can have



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major ripple effects; WIOA-funded educators serve approximately 1.4 million adult learners each year through adult basic education, high school equivalency, and English language classes.³⁰

Businesses are responding to digital skill development needs among their workforce

The real life effects of the industry numbers detailed above are reflected in numerous recent examples of American companies moving to tackle digital skills gaps among their workforce. For example, Nationwide Insurance is investing \$160 million in boosting digital skills for its 28,000 workers.³¹ Another insurance company, Guardian Life, is launching a new effort to provide workers with advanced digital skills.³² Meanwhile, Accenture's broad-based Inclusive Future of Work initiative aims to help workers whose jobs may be affected by automation.³³ And Eat 'n' Park Restaurants has piloted a ten-week online customer service curriculum to upskill and retain workers.³⁴

The wide ranging impact of digital skill gaps across industries has multiple implications for policymakers and business leaders. It brings home the fact that policy solutions must be multi-sectoral—this is not an issue that can be cordoned off into a single industry sector or cluster. It vividly illustrates that workers who struggle in one industry because they lack key digital skills cannot simply jump to a new industry where such skills are unnecessary.

At the same time, the variations between sectors—both numerically, in terms of percentage of workers affected; and substantively, in terms of the specific causes and consequences of their skill gaps—point to the need for solutions that are responsive to individual sectors’ specific contexts. The digital skills needed by grocery store workers using a customized app to select items for a customer order and respond to that customer are different from those needed by a greenhouse worker using data from sensors to make adjustments as part of precision agriculture.³⁵

To this end, policymakers should prioritize digital skill building strategies that incorporate employer input in their design, and use contextualized learning models that help workers see the real life implications of their new digital skills and apply them during the learning process.

There is wide variation in digital skills across occupations

In addition to looking at workers’ skills in particular industries, we can also look across industries at workers in similar *occupations*. Viewed in this light, there are enormous variations in digital skill levels. The occupational category with the greatest portion of low-skilled workers is plant and machine operators and assemblers. Nearly two-thirds (63 percent) of workers in this category have limited or no digital skills. Workers in these occupations include people who operate industrial and agricultural machinery and equipment; drive and operate trains and other motor vehicles; or assemble parts.

Other occupational categories that have significant numbers of workers with digital skill gaps include the combined grouping of skilled agricultural and fishery workers

Selected occupations ³⁶	Percentage of workers with <i>no</i> digital skills	Percentage of workers with <i>limited</i> digital skills	Combined percentage of workers with limited or no skills*
Plant and machine operators and assemblers	33%	29%	63%
Skilled agricultural and fishery workers; elementary occupations	32%	21%	53%
Craft and related trades workers	21%	27%	48%
Service workers and shop and market sales workers	16%	24%	40%
Clerks	6%	19%	24%
Technicians and associate professionals	8%	15%	24%
Professionals	4%	9%	13%

*NOTE: Numbers may not sum due to rounding.



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and elementary occupations. More than half (53 percent) of workers in these occupations have limited or no digital skills. Workers in these occupations are responsible for growing and harvesting crops; producing animal products; forestry, fishery; cleaning and janitorial work; delivery services; freight handling; and entry-level jobs in mining, construction, and manufacturing.

It is important to note that while many of these workers may need digital skills to carry out their job duties, even more are required to use online scheduling tools, mobile-accessible HR and payroll systems, or customized corporate apps in order to maintain their employment. For example, at one major casino, 50,000 of the company's 58,000 employees do **not** have a company-issued e-mail address.³⁷ Instead, they rely on a customized app for key work-related information—an especially important connection for frontline staff in janitorial or other roles that are traditionally “back of house.”³⁸ Similarly, a supply-chain and logistics company also relies on a customized mobile app to reach delivery drivers and the rest of their 11,000 employees in the field—a tool that proved especially useful for rapid response during a recent hurricane.³⁹

Craft and related trades workers are next on the list, with nearly half (48 percent) of workers in those occupations having limited or no digital skills. This occupational category

encompasses a very wide variety of jobs, including welding; maintaining and repairing industrial machinery; making precision instruments and jewelry; and many more.

The next occupational category is service workers and sales workers. A full 40 percent of these workers have limited or no digital skills. This is notable given the exceptionally rapid pace of technological change among industries that employ many of these workers. For example, cosmetics giant L’Oreal has recently provided digital upskilling opportunities for 14,000 employees,⁴⁰ while Walmart has rolled out a suite of digital apps that frontline workers are expected to use for activities such as processing inventory.⁴¹ Similarly, the previously mentioned Brookings Institution analysis shows that the retail industry as a whole saw a sizeable jump from 2002 to 2016 in the amount of digital skills and knowledge demanded of its workforce.⁴²

There are somewhat lower but still troubling levels of digital skill gaps among workers in the remaining occupational categories.⁴³ Nearly a quarter (24 percent) of clerks, an equal number (24 percent) of technicians and associate professionals, and 13 percent of professionals nevertheless have limited or no digital skills. While these numbers are lower than other occupations, they are particularly concerning because of the near-universal requirements for

using digital tools in these fields. Workers in professional or quasi-professional occupations must not only use general digital tools such as e-mail and spreadsheets, but also specific tools such as advanced software customized for their work. Because of the collaboration-intensive nature of knowledge work, workers in these occupations who have limited digital skills can serve as an accidental productivity bottleneck, hampering their colleagues and their companies from achieving full capacity.

Digital skill gaps have consequences for businesses' and workers' economic competitiveness

Digital skills and earnings: Good news and bad news

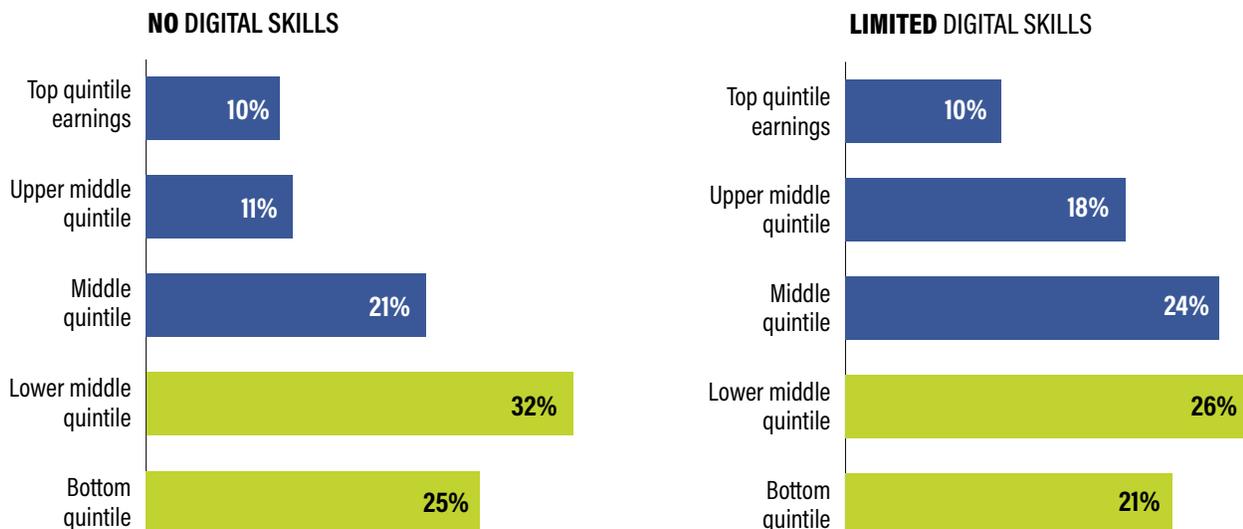
The economic impact felt by workers with limited or no digital skills is vividly clear in the data on earnings: The lower a person's digital skills, the lower their earnings tend to be.

The PIAAC data divides workers into five levels of earnings, known as quintiles. The majority of workers with **no** digital skills are clustered into the bottom two quintiles. Specifically, 25 percent of workers with no digital skills are in the lowest earnings quintile, and another 32 percent are in the second-lowest quintile. At the other end of the spectrum, just 10 percent of workers with no digital skills made it into the top earnings quintile.

Numbers are similar among workers with **limited** digital skills. In particular, 21 percent of workers with limited skills are in the lowest earning quintile, and another 26 percent are in the second-lowest quintile. In contrast, just 10 percent of workers with limited skills are earning in the top quintile.

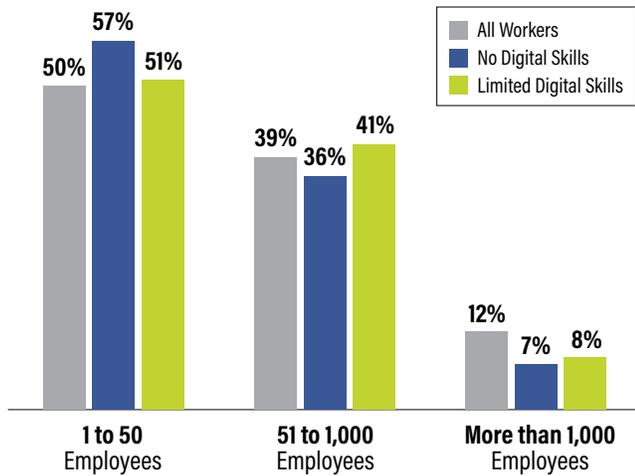
There is a bad news/good news component to this finding, because the US has traditionally had a closer connection between basic skills (such as literacy) and earnings than other industrialized countries.⁴⁴ The bad news is that so many workers' skills are low. The good news is that as people's skills improve, they can expect to command higher wages in the US labor market.

ROUGHLY HALF OF WORKERS WITH LIMITED OR NO DIGITAL SKILLS HAVE LOW EARNINGS



Numbers may not sum to 100 due to rounding. Currently employed US workers ages 16-64. Source: *OECD Survey of Adult Skills (PIAAC) 2012-14*.

WORKERS WITH LIMITED OR NO DIGITAL SKILLS ARE SLIGHTLY MORE LIKELY TO WORK FOR SMALL BUSINESSES



Among currently employed workers ages 16-64. Size of employer refers to location at which person works. Source: *OECD Survey of Adult Skills (PIAAC) 2012-14*.

Small and mid-sized businesses face greater skill gaps

A majority of workers with **no** digital skills are employed in small and mid-sized enterprises, often abbreviated SMEs. Workers with **limited** digital skills are also slightly over represented in SMEs. Given that small businesses employ tens of millions of Americans and represent an



Many workers who have digital skill gaps are nonetheless working in jobs that regularly call upon them to use such skills.

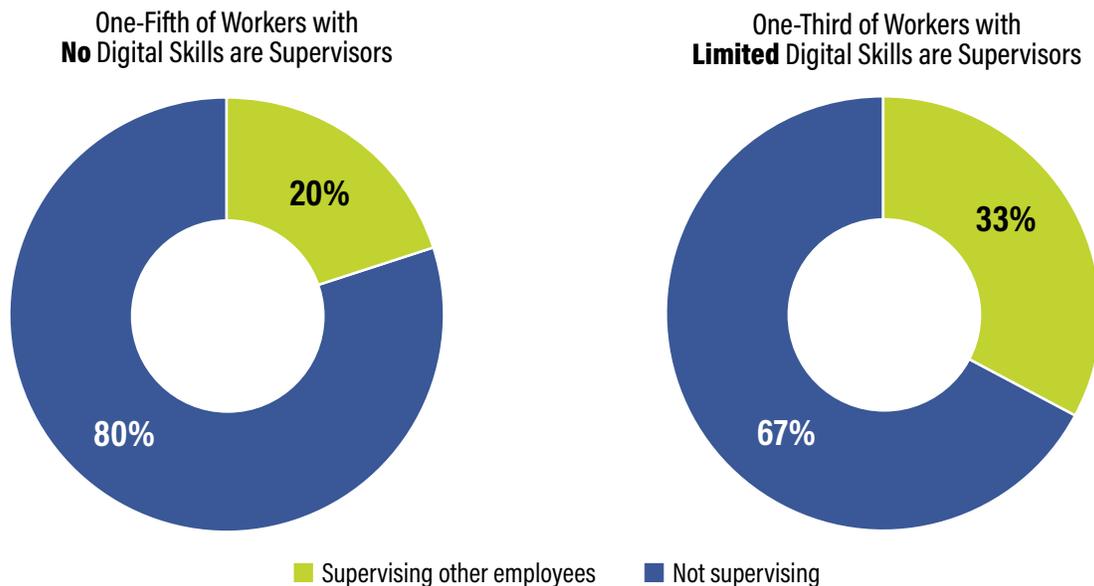
important engine for new job creation,⁴⁵ these skill gaps are especially concerning.

Notably, SMEs are more likely to depend on strong public policies to help them upskill their current workforce. Where very large employers may be able to launch an in-house upskilling initiative entirely on their own, SMEs often look to industry associations and chambers of commerce, industry sector partnerships, or other qualified intermediary organizations to assist them in developing their talent pipeline.⁴⁶

Many workers with digital skill gaps are supervisors

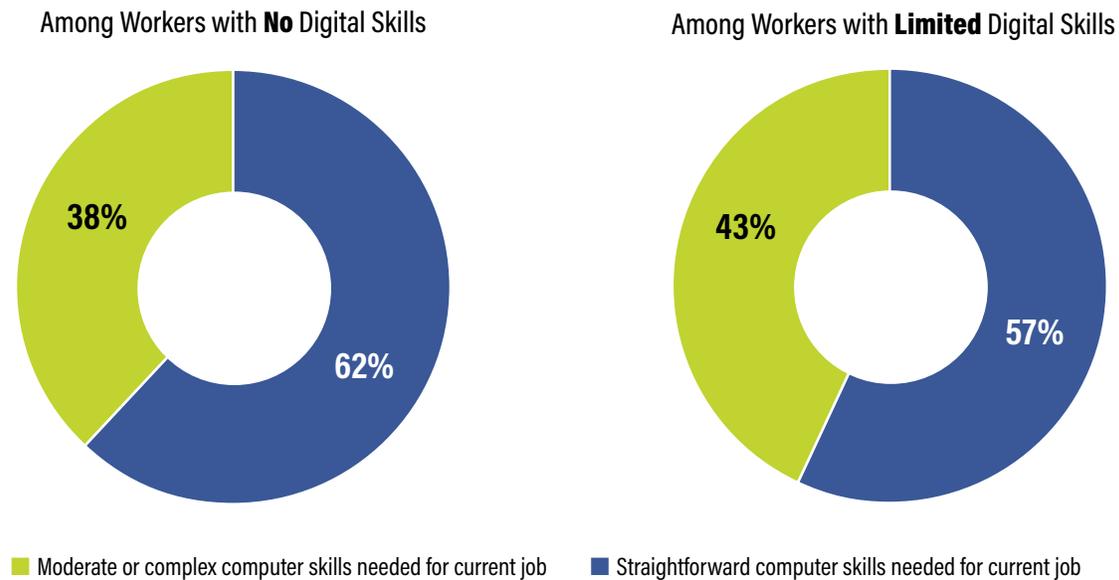
Skill gaps have impacts that stretch beyond individual employees. Data show that a surprising number of workers with digital skill gaps are actually **supervising** other employees. A full one-third (33 percent) of workers with limited digital skills are supervising others, as are one-fifth (20 percent) of workers with no digital skills. These

LOW DIGITAL SKILLS AREN'T JUST A PROBLEM FOR WORKERS THEMSELVES; MANY ARE ALSO SUPERVISING OTHERS



Currently employed US workers ages 16-64. Source: *OECD Survey of Adult Skills (PIAAC) 2012-14*.

MANY WORKERS WHO LACK DIGITAL LITERACY HAVE JOBS THAT REQUIRE SUBSTANTIVE COMPUTER SKILLS



Currently employed US workers ages 16-64. Source: *OECD Survey of Adult Skills (PIAAC) 2012-14*.

workers' skill gaps thus have ripple effects that can dampen productivity and delay adoption of more efficient work practices across their companies.⁴⁷

Depending on how many people a worker is supervising, these ripple effects can reach numerous fellow employees. Notably, among workers with limited or no digital skills who are supervisors, approximately one in six are supervising eleven or more employees.

Workers who lack digital skills nevertheless need to use them on the job

Many workers who have digital skill gaps are nonetheless working in jobs that regularly call upon them to use such skills. More than one in three workers with **no** digital skills (38 percent) say that their current job requires either "moderate" or "complex" computer skills, as do 43 percent of individuals with **limited** computer skills.

Without upskilling support, these workers may flounder. Previous qualitative research has shown that workers in these situations can spend significant time and energy trying to hide or compensate for their skill gaps.⁴⁸ This includes repeatedly depending on colleagues or

family members to help them complete tasks, continuing to use older, more cumbersome paper-based systems for work tasks when digital tools are available, and delaying or avoiding tasks that require digital skills.

Many workers want to upskill

Data from the PIAAC and other sources make clear that many workers with skill gaps are aware of their gaps and eager to remedy them. While there is no PIAAC data that specifically shows workers' enrollment in **digital** skill building classes, there is a close correlation between a worker's digital skill gaps and their skill gaps in traditional literacy and numeracy.⁴⁹ For that reason, analyzing the steps workers are taking to pursue general upskilling (and the barriers they face in doing so) may be helpful in understanding the factors that are at play in digital skill building.⁵⁰

PIAAC data show that workers' general upskilling efforts include enrolling in formal degree or certificate programs, participating in open or distance education classes, attending seminars or workshops, taking other courses or private lessons, and enrolling in basic skills or high school equivalency classes.



While a significant chunk of workers with limited or no digital skills are pursuing upskilling, their peers with higher-level digital skills are even more likely to do so.



Specific findings include:

- Ten percent (10 percent) of workers with no digital skills and 18 percent of those with limited skills reported that they had **studied for a formal degree or certificate** (on any topic) within the past 12 months.⁵¹ Their peers who have higher-level digital skills were somewhat more likely to report doing so: 25 percent of those with proficient skills and 28 percent of those with advanced skills said they had studied for a formal degree or certificate.
- Looking at participation in **open or distance education** classes over the past 12 months, eight percent of workers with no digital skills reported participating. The number rises to 14 percent of those with limited skills, 21 percent of those with proficient skills, and 26 percent of those with advanced skills.
- When it comes to participating in lighter-touch learning activities such as **seminars or workshops**, nearly one-fifth (18 percent) of workers with no digital skills reported participating within the past year. In contrast, 26 percent of workers with limited skills, 38 percent of those with proficient skills, and 47 percent of those with advanced skills had participated in such activities.
- In the less common category of **other classes or private lessons**, smaller percentages of workers reported

participation within the past year. Six percent of workers with no digital skills said they had done so, as did five percent of those with limited digital skills, nine percent of those with proficient skills, and 13 percent of those with advanced skills.

- A subset of workers in the PIAAC survey were also asked an additional question: whether they had participated in a **basic skills or high school equivalency class** within the past year. This question was only asked of workers who had less than a high school diploma, or had finished a high school diploma within the past year, or who had foreign education below the level of an associate degree. Within this subset, roughly one in ten workers reported participating in such a class.⁵²

Overall, the trend is clear: While a significant chunk of workers with limited or no digital skills are pursuing upskilling, their peers with higher-level digital skills are even more likely to do so. There are multiple factors that could be driving this trend. As described elsewhere in this report, workers with low digital skills are also more likely to have low earnings, which makes it more difficult to pay for tuition or fees for classes. They are also more likely to work for small businesses, which may be less likely to offer tuition assistance or other paid training for their employees.⁵³

Because workers' ability to participate in upskilling is highly dependent on whether they have the time and money to do so,⁵⁴ employer support can be vital in facilitating workers' participation. For example, businesses can provide paid release time and/or tuition assistance for workers who are pursuing education; offer classes on site; and tie skill gains to wage increases and promotion opportunities. In addition, employers that participate in industry sector partnerships or labor-management partnerships can create economies of scale with fellow businesses to support upskilling for workers in similar roles across companies, within a given industry.⁵⁵

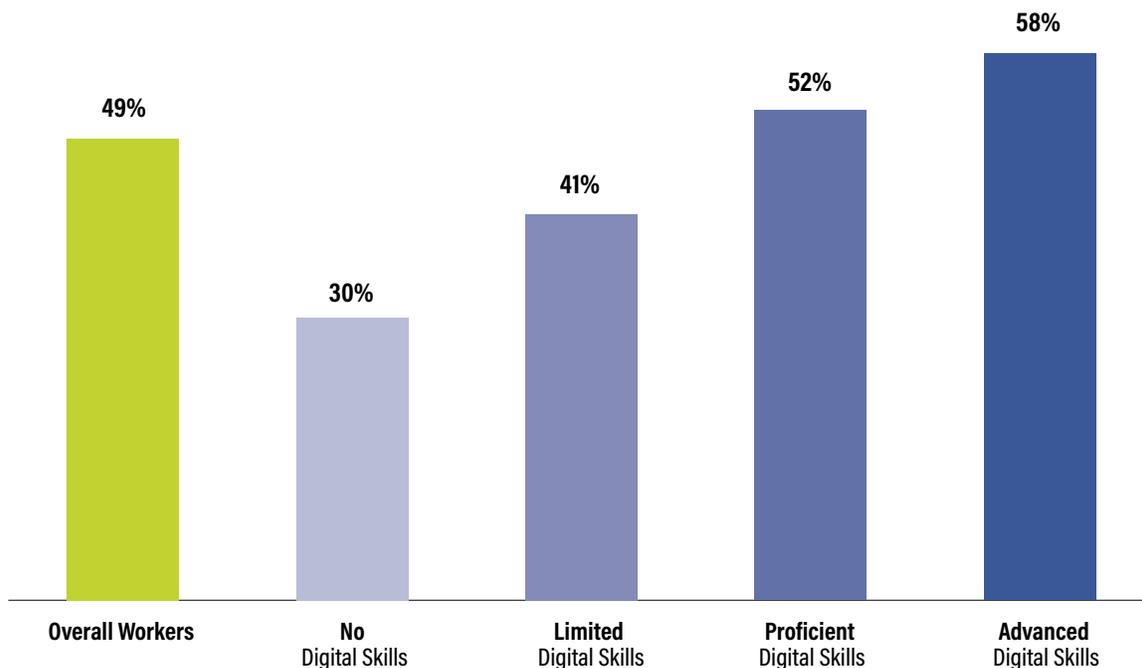
Finally, it should be noted that because workers' *digital* skill levels are strongly correlated with their *general* literacy and numeracy skills, those who struggle with technology may also struggle with the academic skills needed to gain entry to a degree or other educational program. In the case of distance learning, workers who lack digital skills may not be able to use the digital tools necessary to access those learning opportunities, thus dampening their participation in online classes and similar activities.

Workers with low skills get less on-the-job training

While it might seem that workers with limited skills would be more likely to need—and to receive—on-the-job training, in fact the data show that they are **less** likely to receive such training compared to their peers. Specifically, the PIAAC survey asked workers whether they had participated in on-the-job training within the past 12 months. Nearly one in three (30 percent) workers with no digital skills had done so, as had 41 percent of workers with limited digital skills.

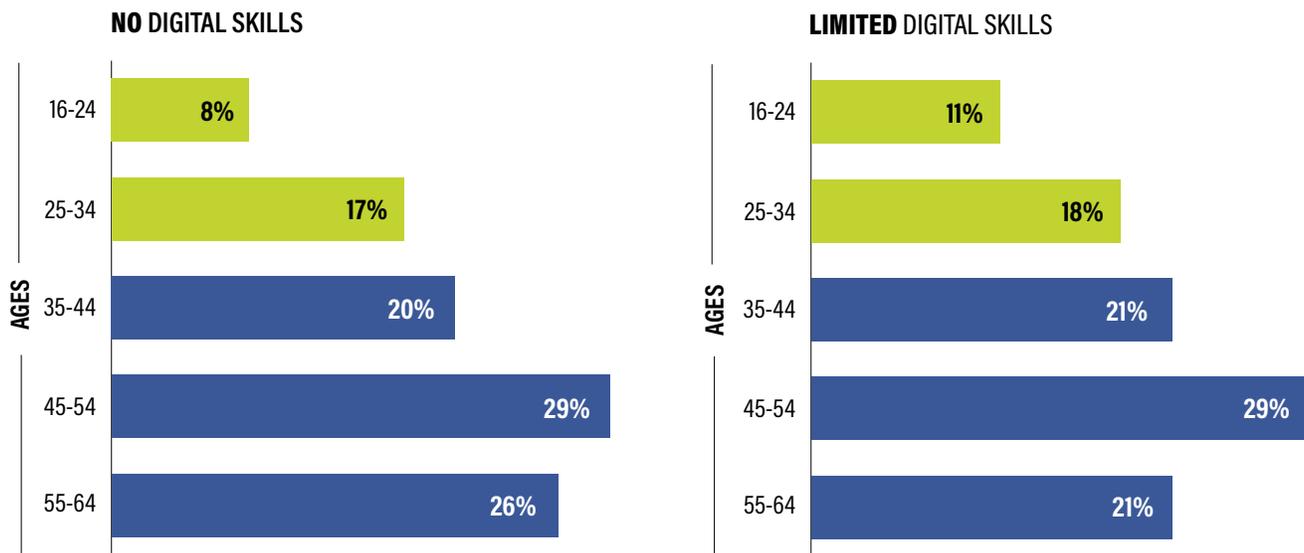
However, these numbers rose substantially to half (52 percent) of workers with proficient skills, and a full 58 percent of workers with advanced skills. This data reflects the reality that employer-provided training is often geared toward workers who have greater skill levels to begin with. Notably, research suggests that supporting skill gains among adults with lower skill levels (in this case, literacy) has a **more** powerful effect on per-capita Gross Domestic Product and labor productivity, compared to skill gains among adults who were already at a higher level to begin with.⁵⁶

WORKERS WITH FEWER DIGITAL SKILLS ARE LESS LIKELY TO HAVE HAD RECENT ON-THE-JOB TRAINING (IN ANY JOB)



Currently employed US workers ages 16-64. Source: OECD Survey of Adult Skills (PIAAC) 2012-14.

YOUNGER WORKERS ARE NOT IMMUNE TO DIGITAL SKILL GAPS



Currently employed US workers ages 16-64. Source: *OECD Survey of Adult Skills (PIAAC) 2012-14*.

Digital skill gaps occur among all demographic groups

Younger workers are not immune to digital skill gaps

While it might seem that younger workers would be uniformly digitally literate, the data in fact show that a significant portion of workers with limited or no digital skills are in their late teens through early 30s. Specifically, fully a quarter (24 percent) of all US workers with **no** digital skills are between the ages of 16-34, and 29 percent of those with **limited** skills are between 16-34.

Perhaps more worryingly, younger Americans are also behind their international peers. Looking at a broader set of PIAAC data that includes all adults (not just workers) ages 16-34, the US scored lower in digital skills than 17 out of 18 peer countries. Top countries included Finland, Japan, and Norway, with only Poland falling below the US.⁵⁷

These stark gaps in younger workers' skills likely reflect several distinct issues: First, the challenge of fragmented knowledge. (See *earlier textbox*.) Younger workers are not immune to the reality faced by their older peers, in which they **develop** only those skills that they regularly **use**. Thus, a young person might be confident in making a

quick TikTok video, but stymied when it comes to using a spreadsheet.

Second, younger workers are more likely to be people of color. As discussed elsewhere in this brief and in the accompanying *Applying a Racial Equity Lens to Digital Literacy* fact sheet, workers of color face a variety of additional barriers to digital skill building. Finally, younger workers may face uneven access to upskilling opportunities, especially if they are employed in occupations or industries that tend to provide fewer employer-based training opportunities and less support for workers wishing to pursue additional education.

More men are falling behind

Men are disproportionately likely to have no digital literacy skills: 61 percent of workers who score at the lowest skill level are men, significantly outstripping the average percentage of males in this dataset (52 percent). Interestingly, men are also slightly more concentrated at the other end of the scale, comprising 54 percent of those with **advanced** digital literacy skills.

These gender differences may reflect a variety of factors, including the reality that men who work in entry-level

jobs are more likely to be doing physical labor that does not require technology skills, while women are in frontline roles are disproportionately likely to be in service-sector jobs that require at least modest digital literacy.

Perhaps more notable from an upskilling perspective is the fact that other federal data shows us that women are far likelier to enroll in the kinds of adult education programs that currently represent the primary federal investment in foundational digital skills.⁵⁸ This suggests that digital upskilling efforts may need to use a gender lens when designing programming in order to ensure that workers of all backgrounds are able to access and succeed in upskilling opportunities.

A plurality of workers with digital skill gaps are white

Workers with digital skill gaps exist in every racial and ethnic category. White workers represent a plurality of individuals who lack such skills: 44 percent of workers with **no** digital skills are white, as are 50 percent of those with **limited** skills.

While digital equity issues do disproportionately burden workers of color (see below), the sheer scale of America’s

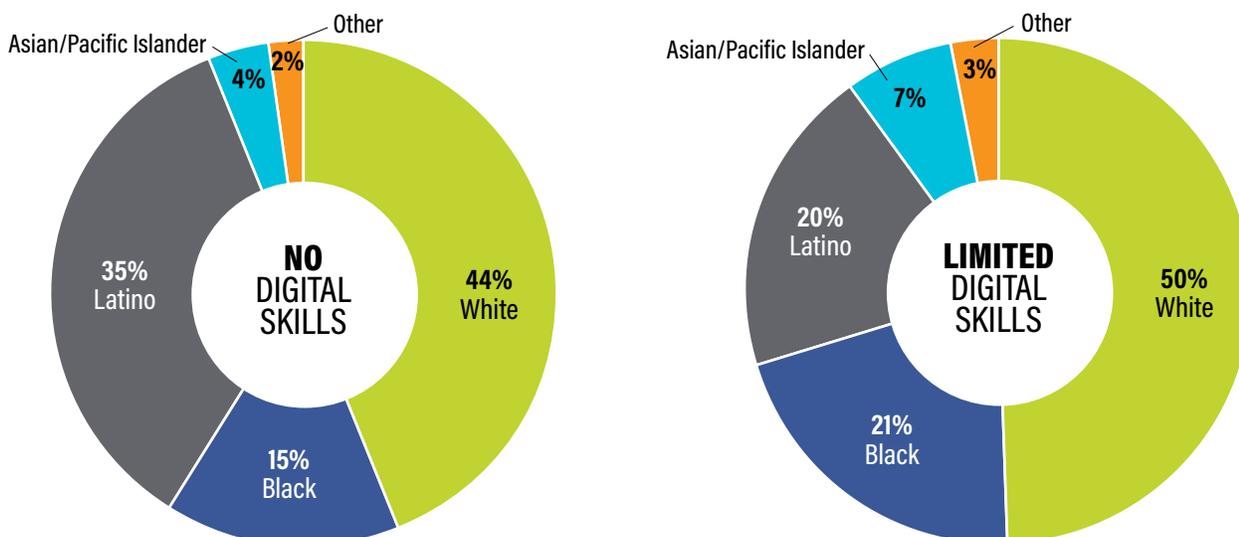
workers digital literacy skill gaps across all races illustrates the need for wide-ranging solutions that are responsive to the full range of workers’ demographic and personal characteristics. Understanding the role that race and ethnicity play in people’s opportunities for upskilling can help to ensure that workers of any background have an equitable chance to build their skills and advance in their careers.

Racial equity gaps persist in digital skills too

A wealth of prior research has illustrated the wide-ranging effects of structural racism in hampering racially equitable outcomes, including in education and workforce development.⁵⁹ Not surprisingly, these effects also spill over into the areas of access to digital technology and opportunities for digital skill building. As noted earlier, people of color are more likely to lack broadband internet access at home, more likely to lack a desktop or laptop computer at home, and otherwise face greater difficulties obtaining the technology often used to build digital literacy skills.⁶⁰

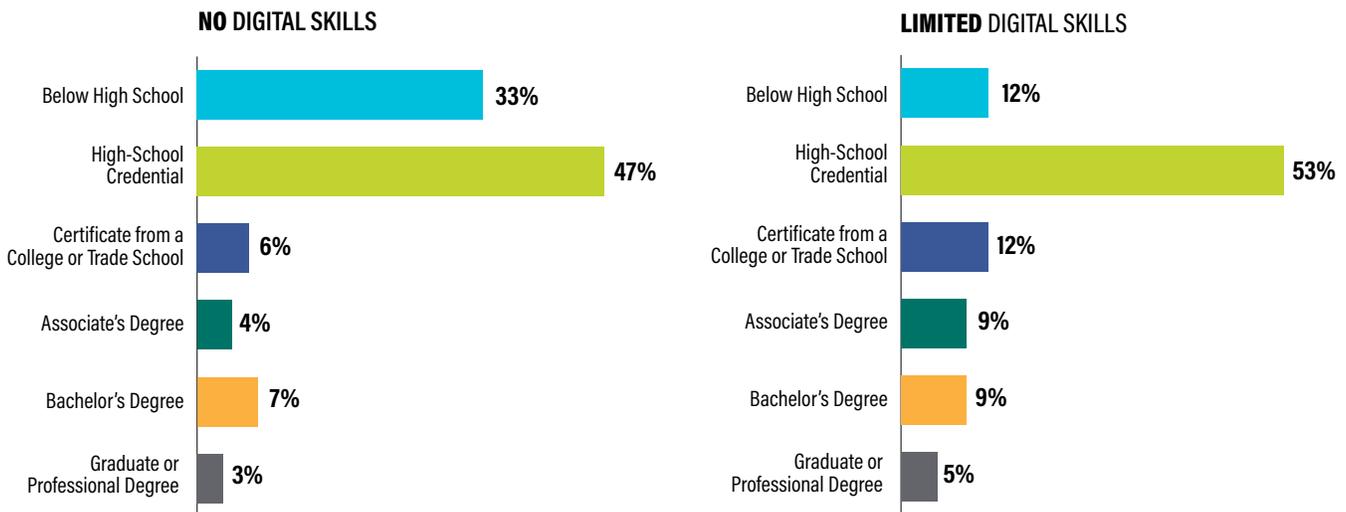
Given these realities, it is perhaps not surprising that workers of color are over represented among workers with limited digital skills. In particular, Black workers are

A PLURALITY OF WORKERS WITH DIGITAL SKILL GAPS ARE WHITE



Currently employed US workers ages 16-64. Source: OECD Survey of Adult Skills (PIAAC) 2012-14.

MOST WORKERS WITH DIGITAL SKILL GAPS HAVE A HIGH SCHOOL EDUCATION OR LESS



Currently employed US workers ages 16-64. Source: *OECD Survey of Adult Skills (PIAAC) 2012-14*.

12 percent of all workers, but 15 percent of those with no digital skills and 21 percent of those with limited skills. Latino workers (who may be of any race) are 14 percent of all workers, but a full 35 percent of those with no digital skills, and 20 percent of those with limited skills.

The picture for Asian American/Pacific Islander workers is more mixed. These workers represent five percent of all workers, four percent of those with no digital skills, and seven percent of those with limited skills.⁶¹ (Unfortunately, detailed data on other workers of color—such as Native Americans or multi-racial individuals—is not available due to low sample size.)

Workers with limited digital skills also tend to lack formal education

Overall, workers' educational attainment is highly correlated with their digital skills attainment. In particular, workers who have a high school diploma or less make up sizeable majorities of those who have few or no digital skills. There are several factors that likely influence this phenomenon. First, workers with less education are more likely to also struggle with basic literacy, making it harder for them to understand and accurately complete the digital skills assessment, which requires test takers to read instructions in order to carry out tasks.

Second, workers with less education may also be more likely to have attended K-12 schools that were under resourced, and/or to live in low-income households. Both of these circumstances can cause people to have less exposure to digital tools and skill-building opportunities.

Finally, because the digital skills assessment is conducted in English, workers who have limited English skills are more likely to struggle with the test. Because of US immigration patterns, individuals with limited English are also more likely to have limited formal education. (This issue is further discussed in the below section on immigrant workers and those with limited English.)

As the chart illustrates, workers with less than a high school education comprise just 10 percent of all workers in this dataset, but are 33 percent of those with **no** digital skills and 12 percent of those with **limited** skills.

Workers whose highest level of attainment is a high school credential (whether diploma or equivalent) make up 40 percent of all workers in the dataset, 47 percent of those with no digital skills, and 53 percent of those with limited skills.

Workers who have attained a postsecondary certificate of some kind (whether from a college or a trade school) are

nine percent of total workers in this dataset, six percent of those with no digital skills, and 12 percent of those with limited skills.

Workers whose highest level of attainment is an associate degree are 10 percent of total workers, just 4 percent of those with no skills, and nine percent of those with limited skills.

Finally, it should be noted that while workers with bachelor or graduate degrees tend to have better digital skills, they still comprise roughly one in ten workers with **no** digital skills, and a similar proportion of those with **limited** skills. (Overall, workers with bachelor or graduate degrees are 32 percent of workers in the PIAAC dataset.)

A complex picture for immigrants and English learners

Nationwide, one in six US workers is an immigrant.⁶² Roughly 75 percent of immigrant adults in the US have authorized legal status, while the remainder are undocumented.⁶³ Previous research has demonstrated

that immigrants are often creative and entrepreneurial users of digital technology.⁶⁴ However, like their US-born colleagues, they face digital skill gaps, and may possess fragmented knowledge.

In addition, because of the legal and social factors that shape who has the chance to migrate to the US, immigrants are disproportionately likely to lack formal education,⁶⁵ which as described above is associated with fewer digital skills.

While immigrants represent 15 percent of all workers in this dataset, they are 38 percent of those with no digital skills and 23 percent of those with limited digital skills.

Similarly, workers who have limited English proficiency, many but not all of whom are immigrants,⁶⁶ also have digital skill gaps. These individuals represent 14 percent of all workers in this dataset, but 43 percent of those with no digital skills and 21 percent of those with limited skills.⁶⁷ **It is important to note that because the digital skills assessment took place in English, these numbers may**

DISABILITY: A LACK OF DATA HINDERS UNDERSTANDING OF DIGITAL SKILL GAPS

The PIAAC dataset collects very limited information about individuals' disability status, including general questions about whether the person has difficulty seeing or hearing as well as whether they have ever been formally diagnosed with a learning disability. This analysis looked at the final question on learning disabilities; 7 percent of overall workers in the dataset answered yes to this question. Given the prevalence of disability among workers,¹ the lack of more robust data collection on disability as part of the PIAAC is a significant disappointment.

Without better data, it is impossible to know how disability intersects with digital skills. For example, some people living with disabilities may be **more** experienced with digital tools because they use them to navigate the world on a regular basis. Alternatively, some people with disabilities might have fewer digital skills because of barriers they face in accessing educational and other skill-building opportunities, low income, or other factors.

Lack of data on workers with disabilities also prevents an analysis of how various demographic factors intersect—such as how the experiences of people of color who have disabilities may differ from those of white people with disabilities.

The limited data that exists in the PIAAC survey suggests a very small correlation between workers with diagnosed learning disabilities and lack of digital skills. However, the statistical differences are within the margin of error. Again, much more information is needed.

¹ See: <https://www.bls.gov/news.release/pdf/disabl.pdf>



underestimate workers' technological proficiency if they were instead working in their home language. However, because English usage is so dominant in US workplaces, it is important to know how workers fare when they are functioning in that language.

Parents are more likely to have digital skill gaps

A somewhat surprising finding of the study is that workers who have children are more likely to lack digital skills. In particular, parents represent 66 percent of total workers in this data, but 75 percent of those with **no** skills and 78 percent of those with **limited** skills.

In contrast, parents are 66 percent of those with proficient skills and only 55 percent of those with advanced skills. The analysis completed for this report did not examine the age of workers' children, and the PIAAC dataset did not specifically collect information on if children were living at home. Without more information, it is impossible to know exactly what is driving this correlation—for example, whether workers with children may spend increased time on parenting and caregiving responsibilities, leaving less time available for digital skill building.



If workers with low skills are disproportionately likely to have minor children living at home, upskilling these workers has the potential to benefit the next generation as well as workers themselves.

This finding suggests that further research on these issues would be valuable. In particular, if workers with low skills are disproportionately likely to have minor children living at home, upskilling these workers has the potential to benefit the next generation as well as workers themselves. Recent efforts to expand two-generation initiatives that target parents and children together illustrate the value of considering workers' lives more holistically when making upskilling investments.⁶⁸

Conclusion: Using this data for advocacy

Policymakers, business leaders, educators, and workforce advocates can use the information provided in this brief to inform their efforts to upskill America's workers and equip employers with the skilled workforce they need. In particular, because existing education models may not equip workers with all of the skills they need to succeed in the digital economy, policymakers should support public-private training partnerships, invest dedicated funds in digital upskilling efforts, and identify incentives to advance short-term and nontraditional training and education programs that respond to jobseeker and employer needs for rapid upskilling in the wake of the pandemic and beyond. Community colleges, technical schools, apprenticeships, and other training programs offer the education and skills necessary to thrive in 21st century careers. Scaling up these types of programs could prompt employers to shift to a nimbler skills or competency-based hiring system and increase learner access to digital and technology skills training. This approach would also help employers fill open positions more efficiently, benefiting the entire U.S. economy.

Key steps that policymakers should take include:

- Embedding digital literacy and problem-solving skills as allowable or required activities under existing workforce development, adult education, and higher education policies

- Investing in new Digital Literacy Upskilling grants to expand access to high-quality digital skills instruction that meets industry and worker needs. These dedicated investments are necessary to ensure sufficient attention is paid to digital skill building in the face of numerous competing priorities. Grants should support states in developing and implementing programs that embed digital literacy skills as part of broader occupational skills training, integrated education and training, and other accelerated learning strategies.
 - At the state level, policymakers can introduce state-level legislation or an administrative policy mirroring the federal-facing Digital Literacy Upskilling grants, but should also provide resources and technical assistance for adult education programs that serve workers and learners. These programs are an important existing avenue for digital skill building.
- Incentivizing private investment in digital skills training, instruction and upskilling opportunities for incumbent workers by expanding the scope of existing tax policies like the Work Opportunity Tax Credit (WOTC) to [allow employers to provide essential upskilling opportunities](#), both in response to the Covid-19 pandemic and over the longer term.

More detailed recommendations on how state and federal policy can support digital upskilling are available in *Digital Skills for an Equitable Recovery*.

Endnotes

- 1 Learn more: <https://www.qsmagazine.com/technology/virtual-reality-your-restaurants-next-favorite-tool>
- 2 Learn more: <https://www.pri.org/stories/2019-10-17/how-immigrant-workers-are-preparing-automation-agriculture>
- 3 For more on the shift to remote work, see: <https://www.theatlantic.com/ideas/archive/2020/03/coronavirus-creating-huge-stressful-experiment-working-home/607945/> and <https://www.gallup.com/workplace/292334/covid-strategies-policies-world-largest-companies.aspx>.
- 4 Learn more: <https://www.cio.com/article/3534499/how-the-covid-19-pandemic-is-reshaping-healthcare-with-technology.html>
- 5 Learn more: https://www.urban.org/sites/default/files/publication/100843/foundational_digital_skills_for_career_progress_2.pdf
- 6 Learn more: https://www.brookings.edu/wp-content/uploads/2017/11/mpp_2017nov15_digitalization_full_report.pdf
- 7 Ibid.
- 8 Ibid.
- 9 Learn more about these efforts: <https://www.aspeninstitute.org/blog-posts/creating-a-future-of-work-commission/>
- 10 Learn more about state postsecondary credential attainment goals and view state-by-state data using the Lumina Foundation's online tool: <http://strongernation.luminafoundation.org/report/2020/#nation>
- 11 Learn more about WGU's student base: <https://www.wgu.edu/about/students-graduates.html#close>
- 12 Additional background on WGU: <https://www.chronicle.com/article/Here-s-How-Western-Governors/243492>
- 13 Learn more about Calbright: <https://edsources.org/2019/california-s-new-online-community-college-opens-after-months-of-planning/618006>
- 14 These challenges are not limited to a lack of digital skills. Researcher Sandy Baum of the Urban Institute noted, "We know that students who do not have strong study skills, who do not have strong personal support networks are particularly vulnerable, in the sense that they tend not to do as well in purely online coursework as they would if they were in a classroom," as quoted in "Students worry as California's online community college confronts offline woes," *Cal Matters*, January 29, 2020, <https://calmatters.org/education/higher-education/2020/01/students-worry-as-californias-online-community-college-confronts-offline-woes/>
- 15 Amanda Briggs, Semhar Gebrekristos, and Shayne Spaulding, "Supporting Community College Learners Online," Urban Institute, March 2020. Viewable at: <https://www.urban.org/research/publication/supporting-community-college-learners-online>
- 16 Ibid.
- 17 As defined by the DigitalUS coalition, of which National Skills Coalition is a member, digital resilience "encompasses the awareness, skills, agility, and confidence that enable individuals to adapt to changing digital skill demands and become empowered users and learners of new technologies. Digital resilience improves our capacity to problem-solve and upskill using technology and navigate digital transformations, and it is vital for individuals, our economy, and society." Learn more: <https://digitalus.org/our-work/>
- 18 This data is collected under the auspices of the OECD across numerous industrialized countries. Only U.S. data was used in this analysis. Learn more in the "Where this data comes from" text box elsewhere in this report.
- 19 In the PIAAC data, this group represents those with no PS-TRE score.
- 20 In the PIAAC data, this group represents those who scored below Level 1 in PS-TRE.
- 21 In the PIAAC data, this group represents those who scored at Level 1 in PS-TRE.
- 22 In the PIAAC data, this group represents those who scored at Level 2 or Level 3 in PS-TRE.
- 23 See Table 3 of the Brookings report: https://www.brookings.edu/wp-content/uploads/2017/11/mpp_2017nov15_digitalization_full_report.pdf. In another example, one 2017 survey of Maryland construction contractors found that 80 percent were using mobile technology in their businesses. See: <https://www.gma-cpa.com/technology-blog/why-one-fifth-of-maryland-construction-contractors-are-not-using-mobile-technology>.
- 24 Industries not shown due to low sample size include agriculture; mining; utilities and waste management; professional, scientific and technical activities; information and communications; public administration and defense.
- 25 The rapid increase in digital skill demands for the finance and insurance fields are illustrated in Digitalization and the American Workforce, Brookings Institution, 2017: https://www.brookings.edu/wp-content/uploads/2017/11/mpp_2017nov15_digitalization_full_report.pdf
- 26 Earlier qualitative interviews conducted by National Skills Coalition for another project shed light on what these coping mechanisms include. Workers must repeatedly rely on colleagues to assist them, bring work home to request help from family members, and spend substantial extra time compensating for or attempting to hide their skill gaps.
- 27 Lack of access to professional development opportunities among contingent and adjunct faculty is discussed by Gordon Edenfield, "A Utilization-Focused Evaluation of a Community College Adjunct Faculty Professional Development Program," (Old Dominion University, 2010), viewable at https://digitalcommons.odu.edu/cgi/viewcontent.cgi?article=1107&context=efl_etds
- 28 Existing challenges on this front have been magnified by the Covid-19 pandemic, as described by Emma Dill, Karin Fischer, Beth McMurtrie, and Beckie Supiano, "As Coronavirus Spreads, the Decision to Move Classes Online Is the First Step. What Comes Next?" (*Chronicle of Higher Education*, March 6, 2020), viewable at: <https://www.chronicle.com/article/As-Coronavirus-Spreads-the/248200>
- 29 Source: US Department of Education, WIOA Title II National Reporting System, Program Year 2018-19.
- 30 Ibid.
- 31 Learn more: <https://www.hrdive.com/news/nationwide-announces-160m-employee-digital-literacy-training/570786/>
- 32 Learn more: <http://iireporter.com/inside-guardian-lifes-talent-transformation-with-svp-bob-thompson/>
- 33 Learn more: <https://www.constructforstl.org/wp-content/uploads/pdfs/futurework.PDF>
- 34 Learn more: https://assets.aspeninstitute.org/content/uploads/2019/08/Harnessing-Digital-Technology-for-Frontline-Worker-Mobility.pdf?_ga=2.40890144.382505603.1580658178-526887200.1572292248

- 35 Learn more about the skills demanded by precision agriculture: <https://www.growingproduce.com/vegetables/where-will-we-find-tech-savvy-farm-workers/>
- 36 Occupations not shown due to low sample size include legislators, senior officials and managers; armed forces.
- 37 Learn more: <https://www.theemployeeapp.com/case-studies/caesars-entertainment-corporation/>
- 38 Ibid.
- 39 Learn more: <https://3h0vk03mo4xr3fastt1k9b5z-wpengine.netdna-ssl.com/wp-content/uploads/2019/10/EmployeeApp-NFI.pdf>
- 40 Learn more: <https://www.loreal-finance.com/en/annual-report-2016/digital-culture>
- 41 Learn more: <https://corporate.walmart.com/newsroom/innovation/20180919/walmarts-custom-apps-are-enabling-a-workplace-refresh>
- 42 See Table 4: https://www.brookings.edu/wp-content/uploads/2017/11/mpp_2017nov15_digitalization_full_report.pdf
- 43 As previously noted, a handful of occupational categories are not included due to low sample size: Legislators, senior officials and managers; and members of the armed forces.
- 44 Eric A. Hanushek, Guido Schwerdt, Simon Wiederhold, and Ludger Woessmann, "Returns to Skills Around the World: Evidence From PIAAC," (Stanford, CA: Hoover Institution, 2013), viewable at: https://www.hoover.org/sites/default/files/13114_-_hanushek_schwerdt_wiederhold_and_woessmann_-_returns_to_skills_around_the_world_-_evidence_from_piaac.pdf
- 45 See specific statistics on this question in this US Small Business Administration fact sheet: <https://www.sba.gov/sites/default/files/advocacy/2018-Small-Business-Profiles-US.pdf>. SBA statistics refer to businesses with fewer than 500 employees.
- 46 More information on how policies can support industry sector partnerships is available on the NSC website under Federal Policy: <https://www.nationalskillscoalition.org/federal-policy/sector-partnerships> and State Policy: <https://www.nationalskillscoalition.org/state-policy/sector-partnerships>
- 47 For example, one key informant interviewed as part of NSC's earlier research described this example: A supervisor in an upskill retail store was unable to access the instructions and policies posted on the corporate intranet site hosted on an in-store tablet computer. Her lack of skills meant that she did not use the intranet's many resources to train her employees on company policies for merchandise display and other tasks, nor did she direct workers to access the intranet themselves. As a result, an entire crew of workers spent time re-doing tasks after other supervisors noticed their lack of alignment with corporate policy.
- 48 Foundational Skills in the Service Sector, National Skills Coalition, 2017.
- 49 Ibid.
- 50 Key informants interviewed by NSC suggest that there may also be additional digital-specific considerations that can help or hinder upskilling, such as a worker's self-perception of their technological proficiency or the degree of intimidation they feel when presented with digital tools. This is an important area for further research and exploration.
- 51 For this question and other variables reported in this section, the percentages consist of those workers who had participated in a given learning activity at any time in the past 12 months, including those currently participating.
- 52 Unfortunately, small sample size makes it impossible to report numbers broken out by level of digital literacy.
- 53 In addition, depending on the type of upskilling made available to them, workers with limited digital skills may be less able to participate. For example, if their employer is offering only optional online training that is to be completed in their off-time using personal electronic devices, workers who lack home broadband internet or personal computers may find it difficult to participate.
- 54 Foundational Skills in the Service Sector, National Skills Coalition, 2017.
- 55 See local examples of industry partnerships from the National Fund for Workforce Solutions: <https://nationalfund.org/regional-collaboratives/>. Learn more about how state policymakers can support industry sector partnerships in NSC's Sector Partnership Policy Toolkit: <https://www.nationalskillscoalition.org/resources/publications/file/Final-Sector-Partnership-Policy-Toolkit-1.pdf>
- 56 "Literacy and growth: Policy implications of new evidence from PIAAC," Guido Schwerdt, Simon Wiederhold, and T. Scott Murray (2018) <https://static1.squarespace.com/static/51bb-74b8e4b0139570ddf020/t/5c1928fecd-8366551dc39797/1545152766907/Final+1-page+summaries.pdf>
- 57 "America's Skills Challenge: Millennials and the Future," Madeline J. Goodman, Anita M. Sands, Richard J. Coley, Educational Testing Service, 2015, <https://www.ets.org/s/research/30079/asc-millennials-and-the-future.pdf>. Specific PIAAC PS-TRE international comparison chart viewable at: <https://www.ets.org/s/research/30079/millennials.html>.
- 58 Source: US Department of Education, WIOA Title II National Reporting System, Program Year 2017-18.
- 59 The Roadmap for Racial Equity: An Imperative for Workforce Development Advocates (National Skills Coalition, 2019.) Viewable at: <https://www.nationalskillscoalition.org/news/blog/nscs-new-report-explores-the-imperative-of-racial-equity-in-workforce-development>
- 60 Learn more: <https://www.pewresearch.org/internet/2019/06/13/mobile-technology-and-home-broadband-2019/>. Also see Sam Gustin, "Systemic Racial Discrimination Worsens the US Digital Divide, Study Says," Vice, December 14, 2016, https://motherboard.vice.com/en_us/article/aek85p/systemic-racial-discrimination-worsens-the-us-digital-divide-study-says.
- 61 These numbers are primarily an artifact of US immigration policy. Compared to Americans overall, Asian Americans and Pacific Islanders (AAPIs) are more likely to be immigrants, and many have arrived in the US under visa categories that select for wealthier and more highly educated individuals. Importantly, these factors are not equal across all Asian American and Pacific Islander groups; for example, individuals who arrived from Southeast Asian countries via the refugee resettlement process may have had fewer opportunities for formal education in their home countries. Unfortunately, low sample size does not allow the data in this report to be disaggregated by AAPI sub-group.
- 62 Jynnah Radford and Luis Noe-Bustamante, "Facts on U.S. Immigrants: Statistical portrait of the foreign-born population in the United States," Pew Research Center Hispanic Trends, June 3, 2019, <http://www.pewhispanic.org/2018/09/14/facts-on-u-s-immigrants/#fb-key-charts-origin>.
- 63 PIAAC data does not include specifics about immigration status. In general, other data show that approximately three-quarters of immigrants in the US have legally authorized status and the remaining 25 percent are undocumented. See: Jeanne Batalova,

Brittany Blizzard, and Jessica Bolter "Frequently Requested Statistics on Immigrants and Immigration in the United States," Migration Policy Institute, February 14, 2020, <https://www.migrationpolicy.org/article/frequently-requested-statistics-immigrants-and-immigration-united-states#Unauthorized%20Immigrants>

- 64 "Digital Diaspora: How immigrants are capitalizing on today's technology," Welcoming Center for New Pennsylvanians, November 2012, <https://welcomingcenter.org/wp-content/uploads/2016/08/Digital-Diaspora-FINAL-report-Nov-2012-1.pdf>.
- 65 Migration Policy Institute analysis of US Census Bureau 2017 data shows that among immigrants aged 25 and older, 28 percent have less than a high school education and another 23 percent have a high school diploma or equivalent. Comparable numbers for US-born

individuals are 9 percent and 28 percent, respectively. See: <https://www.migrationpolicy.org/data/state-profiles/state/demographics/US>. However, the educational attainment of new immigrants to the US is generally increasing; see also: <https://www.pewresearch.org/fact-tank/2018/09/14/education-levels-of-u-s-immigrants-are-on-the-rise/>

- 66 English learners also include some Puerto Ricans. Puerto Rico is a US territory, and individuals born on the island, many of whom speak English as a second language, are US citizens by birth.
- 67 Data in this section reflects workers who speak English less than "very well," a standard US Census measure for English skills.
- 68 Learn more about the 2-generation approach here: <https://ascend.aspeninstitute.org/two-generation/what-is-2gen/>

WHERE THIS DATA COMES FROM

Data in this publication comes from the Survey of Adult Skills, conducted under the auspices of the Organization for Economic Cooperation and Development. The survey, also known as the Program for the International Assessment of Adult Competencies, or PIAAC, is administered by National Center for Education Statistics of the Institute for Education Sciences at the U.S. Department of Education.

The survey gathered data from a representative sample of U.S. adults in 2012 and 2014. (Data used in this analysis combine information from both years for greater statistical precision.) The survey includes a background demographic questionnaire that is administered in English or Spanish, followed by a cognitive assessment in English measuring the three domains of literacy, numeracy, and “problem-solving in technology-rich environments,” or PS-TRE.

The data included here come from the PS-TRE section of the study. Individuals described in this fact sheet as having “no” digital skills are those without PS-TRE scores; “limited” skills refers to workers with scores below PS-TRE Level 1; “proficient” refers to those who scored at Level 1, and “advanced” combines data from workers who scored at Level 2 or Level 3.

Note: An additional round of U.S. PIAAC data collection was completed in 2017. While 2017 data is not reflected here due to the timing of its release to the public, it is largely consistent with earlier years. Learn more about the 2017 data here: https://nces.ed.gov/surveys/piaac/current_results.asp

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