



# A Holistic Understanding of Digital Skills: DRAW Detailed Findings and Discussion

With the urgent need for adult digital skill development as a backdrop, the Digital Resilience in the American Workforce (DRAW) initiative, funded by the U.S. Department of Education's Office of Career, Technical, and Adult Education (OCTAE),<sup>1</sup> conducted a wide-ranging landscape scan to identify effective approaches and existing resources supporting digital skills development. The scan also identified current efforts to advance digital access and

digital equity; useful skill definitions, frameworks, and assessments; and practitioner professional development opportunities. Learnings from the scan are summarized in the report [\*Digital Resilience in the American Workforce: Findings From a National Scan on Adult Digital Literacy Instruction\*](#). This deep dive explores two themes in more detail: lifelong and life-wide learning and digital skills for employment.



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## Introduction

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Even before the COVID-19 pandemic, adult learners found themselves having to navigate the increased use of e-commerce, a shift to online learning, and growing use of telehealth services. Meanwhile, in the workforce, increased automation and the integration of technology into many jobs mean there is an ever-growing list of platforms and processes to which workers must adapt.

In focus groups conducted for the DRAW landscape scan, adult learners noted the varied ways each of them uses technology in their daily lives and work, including navigating new and constantly evolving apps and platforms for tasks such as coordinating and supporting their children’s schooling and extracurricular activities or for finding and engaging in formal employment, entrepreneurship, and gig-economy opportunities. Learners also expressed access to better employment opportunities as a top motivating factor for improving their digital literacy. With this learner input in mind, this deep dive explores two themes in more detail: lifelong and life-wide learning and digital skills for employment.

For further exploration of the frameworks uncovered by the DRAW landscape scan, see [Putting Digital Literacy and Digital Resilience Into Frame](#) and a [crowdsourced list of frameworks](#). A related resource, [Digital Skills Frameworks and Assessments: A Foundation for Understanding Adult Learners’ Strengths and Learning Needs](#), was developed for the CREATE Adult Skills Network.

## ***Defining Digital Literacy***

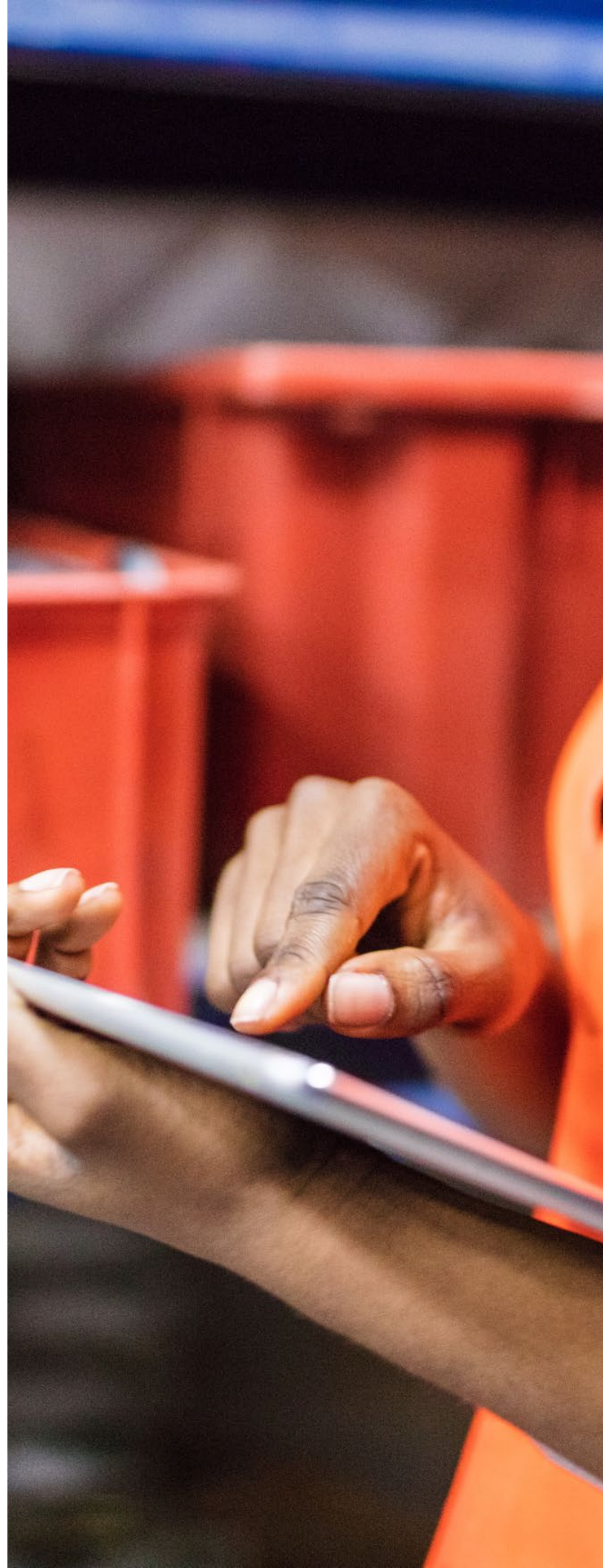
Multiple definitions of digital literacy, digital skills, and digital resilience are at play in the field today. The literature references effective use of digital tools and technologies, digital literacy, digital resilience, occupational digital literacy, problem solving in technology-rich environments or digital problem solving, and others.

Some useful definitions include:

**Museum and Library Services Act definition:** The skills associated with a) using technology to enable users to find, evaluate, organize, create, and communicate information; and b) developing digital citizenship and the responsible use of technology.<sup>2</sup>

**Multidimensional digital problem solving:** How digital technology can be used to solve a problem or complete a task, as well as a set of cognitive abilities to investigate and analyze solutions and results.<sup>3</sup>

**Digital resilience:** Having the awareness, skills, agility, and confidence to be empowered users of new technologies and adapt to changing digital skill demands. Digital resilience improves an individual's capacity to problem solve and upskill, navigate digital transformations, and be an active participant in society and the economy.<sup>4</sup>



## Digital Skills for Lifelong and Life-Wide Learning

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Holistic or life-wide learning involves growth through engagement in real contexts, helping learners develop skills or knowledge in all areas of their lives.<sup>5</sup> Contemporary literature stresses the need for holistic digital skills training that expands beyond workforce or economic needs.<sup>6</sup> Holistic training should connect digital competencies to a range of outcomes, including:

- Increased literacy and language acquisition
- Improved social inclusion and integration
- Increased self-efficacy, agency, confidence, and well-being
- Participation in civic life
- Building of relationships
- Improved quality of life
- Promotion of critical thinking<sup>7</sup>

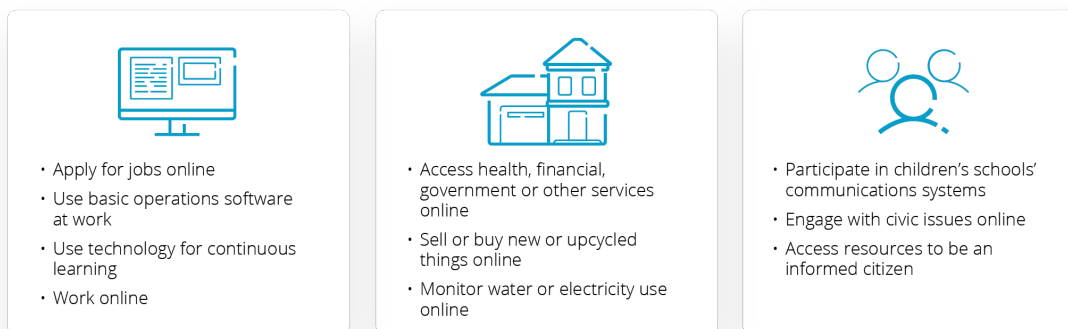
This means educators should use “community-focused approaches to learning about technology,”<sup>8</sup> support self-directed learning, and envision practice environments for technology use.<sup>9</sup> Such an approach could leverage partnerships with employers, community-based agencies, families, schools, and others.<sup>10</sup>

Holistic or life-wide learning also recognizes the importance of using motivational context levers: a parent learning through a child; work or school requirements; the influence of friends and family; or a new cell phone contract that upgrades to a smartphone.<sup>11</sup>

[Teaching the Skills That Matter](#), an OCTAE initiative to support adult educators in integrating the transferable skills that support learning in any context, advocates that foundational skills such as critical thinking and problem solving need to be included in the digital environment along with technical skills when preparing learners for work, school, and accomplishing daily tasks that occur in digital environments.

Digital US created the following infographic to show various areas of life in which adults may need to use technology, from applying for a job or completing tasks at work to accessing health and financial services or participating in children’s school or community activities.<sup>12</sup>

## Digital Skills at Work, Home, and in the Community



Source: Digital US Coalition, *Building a Digitally Resilient Workforce*, 2020.

## Developing Digital Skills: The Need for Learner Confidence and Agency

The themes of transferable skills, adaptation to change, learner confidence, and learner agency came up throughout our interviews and in questionnaire answers.<sup>13</sup> For example, respondents noted:

“I think people focus too much on tools and not on the underlying concepts that will transfer to new technologies as they are developed.”

“There is not enough investment in the ‘humanities’ side of digital skills—that is *how* to think critically, assess digital tools, explore, develop self-efficacy and confidence, etc. There is too much focus on memorizing a particular piece of software or tool.”

“Content needs to be developed that is designed to not only teach the *how* of the skill but the *why* and *when* of the skill.”

Adult education students have a wide range of digital proficiency, so our instruction needs to be designed for ongoing, “intentional integration” of digital-age skills that includes the ability to “transfer skills from one context to another.”

In addition, respondents said that, while instruction in basic digital literacy skills is important, it is also important to provide instruction that includes “the development of learner autonomy and agency” so that learners are “able to adapt to the ever-changing landscape of technology.”<sup>14</sup>

Adult learners working to develop their digital skills and resilience can often be challenged during the process. In fact, the struggle with acquiring digital literacy skills may result in frustration that may confirm “their beliefs that they cannot and should not learn to use technology.”<sup>15</sup>

In many cases, teachers need to be taught to understand the attitudes and behaviors around digital skill development so they can develop digital resilience in their learners.<sup>16</sup> In a DRAW learner focus group and classroom interview, learners expressed that two of the primary barriers to developing their technology skills are fear and embarrassment. Responses by practitioners to our field questionnaire also pointed to fear and embarrassment as a top hindrance to their integrating technology into their instruction and further developing their digital skills, pointing to a need in learners and teachers alike to design instruction to intentionally foster confidence and digital resilience.

## Digital Skills for Employment

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Adult learners who responded to our Learner Questionnaire clearly recognize technology skills as necessary for gaining, improving, or maintaining their employment. For those learners, the most common reason motivating their interest in learning technology skills was workforce related. In a learner focus group conducted for this scan, learners similarly focused on software applications needed for the workplace, including Microsoft Office, Google Suite, and web conferencing software. At the same time, they spoke of the need to use apps for working in the gig economy or entrepreneurship such as mobile point-of-sale applications.

**With many learners coming to adult education programs with employment as a goal, programs need to understand which digital skills are required to find a job, get hired, and be successful in the workplace.**

They also need to know how to identify—and stay up to date on—the skills most relevant for their local labor market. This section of the deep dive explores what we know about the digital skills required to find a job, maintain employment, and perform required work tasks.

**Employers increasingly require employees to have basic digital skills.** Even occupations that previously required minimal digital skills are now requiring more digital skills.<sup>17</sup> COVID-19

has accelerated digital transformation in the workplace, as noted in UpSkill America's surveys and interviews.<sup>18</sup> Eighty-two percent of middle-skill jobs require digital skills, up 4 percent since 2015, with spreadsheets and word processing standard across 78 percent of all job postings.<sup>19</sup> UpSkill America's surveys and interviews<sup>20</sup> identify similar trends in what employers are seeking, including:

- Increased use of tablets, device, and equipment with digital interfaces for work tasks
- Comfort with digital communications and digital collaboration platforms
- Ability to use data management software
- Ability to monitor, test, and work alongside robots
- Flexibility and adaptability as businesses engage in digital transformation

**Transferable digital skills are critical.** Due to the rapid nature of change in industry-specific technologies, many employers are focused on finding workers who are comfortable with a broad range of digital technologies. A key implication of this phenomenon for policymakers is that investing in occupational digital literacy should focus more on opportunities for workers to build industry-specific and also transferable skills.<sup>21</sup>

**Digital literacy in the workplace goes beyond spreadsheets, word processing, and other computer-based skills.** For example, in retail and hospitality, workers use mobile apps and tablets for inventory management and merchandising and virtual reality for food safety training.<sup>22</sup> Anson Green, a member of the DRAW Technical Working Group, noted that “in reality, many adult learners engage with a wide variety of digital tools that are not computer based but have digital interfaces, such as modern cash registers, inventory search databases, digital heat systems, digital medical devices, measuring devices, industrial machines, etc. We can't talk about 'digital skills for employment' and then talk just about office jobs.”<sup>23</sup>

*This bias toward computer use in digital literacy frameworks could result in programs and assessment methods not recognizing the digital competencies learners may already have with other devices or interfaces. It could also result in a failure to teach skills learners may need most immediately.*

Common themes related to the workplace across the digital skills and literacy framework are:

**Digital problem solving**, which Castek et al.<sup>24</sup> define as the nimble use of skills, strategies, and mindsets required to navigate online in everyday contexts, including the library, and use novel resources, tools, and interfaces in efficient and flexible ways to accomplish personal and professional goals. In the context of work, many of the frameworks consulted discuss digital problem solving as using the internet and relevant workplace tools and resources to solve work-related problems.

**Communication**, which includes appropriate email communication and use of digital collaboration tools. The SkillRise [Profile of a Lifelong Learner](#) also calls out working collaboratively with colleagues in a digital environment.<sup>25</sup> The European Union's [Digital Competence Framework](#) includes managing one's online reputation.<sup>26</sup>

**Privacy, security, and ethics**, including complying with IT policies, safeguarding sensitive information, and protecting one's personal data. Some frameworks also include environmental impact and understanding how to handle suspicious emails.<sup>27</sup>

**Information seeking**, including locating information online and assessing relevance and validity, which is sometimes integrated with problem solving.

**Content creation**, including planning, designing, and disseminating information or entertainment through digital media.

**Learning and upskilling**, including self-assessment of digital skills<sup>28</sup> and lifelong learning.<sup>29</sup>

From [Digital Digest: Putting Digital Literacy and Digital Resilience Into Frame](#)

**Adults need digital skills to find a job, even in cases where the job itself requires minimal digital skills.** The job search process increasingly relies on technology, with more and more companies relying on online job postings, automated resume screening, use of online tests to screen potential employees, and virtual interviews.<sup>30</sup>



Often, online job search and application platforms and processes are at a literacy level above that of the jobs learners are applying for and have algorithmic logic that needs unpacking.<sup>31</sup> Job seekers who struggle with navigating online job searches need support and practice with online job searches and the application process.

Within the gig economy, defined by Merriam-Webster as “economic activity that involves the use of temporary or freelance workers to perform jobs typically in the service sector” (e.g., Uber, TaskRabbit, and DoorDash), adults are using technology to generate income. In some cases, these adults are using their primary language to navigate interfaces. According to the [Beyond Disruption](#) report,<sup>32</sup> because responsiveness is a ranked metric on marketplace platforms, it disadvantages workers who do not have access to high-speed internet. By requiring digital literacy, marketplace platforms make digital skills a determining factor in securing work, often above the actual skills required for the job.

**Learners also need digital skills to maintain employment.** For example, they will need to use HR tools, access their schedule, and participate in employer-sponsored training.<sup>33</sup>

- Through its employer surveys and interviews, UpSkill America notes an increased use of tablets, mobile devices, and augmented or virtual reality for on-the-job training.<sup>34</sup>
- A scan by the Global Trade and Innovation Policy Alliance predicts high use of AR and VR in corporate learning, citing stats such as nearly one-third of Global 2000 manufacturers plan to be using immersive tools by 2022.<sup>35</sup>
- JFFLabs’ 2021 [Market Scan](#) on workforce training providers showcases some of the common products and companies that employers are turning to for internal skill development.

**Adult education programs can create on-ramps to jobs requiring advanced digital skills.**

Given the demand for digital skills across sectors—for example, managing data, software development, and analyzing data,<sup>36</sup> as well as specialized knowledge and expertise in programming, data analytics and visualization, cybersecurity, software development, and technical support,<sup>37</sup> adult education providers can create on-ramps such as integrated education and training (IET) programs and other more formal job training that integrates these skills.

For example, in Rhode Island, the Providence Public Library created the [Rhode Coders Clubs](#) to introduce adult learners to coding in a non-intimidating and supportive way. The clubs are free, open to any adult with an interest or curiosity about software coding, and have no prerequisites—not even for language level. The library also offers a [Data Pathway](#) focused on data analytics and visualization. Some organizations do this by creating their own curriculum;

others use learning resources from platforms such as LinkedIn Learning, Udemy, Certiport, and Coursera, as well as enterprise training from IBM and Microsoft.

**Badging and validation of skills or competencies** based on a shared framework would help learners document their skills in ways that employers and educational providers would recognize.

- Examples of this approach to essential digital skills representation include a digital generalist credential offered by the [Greater Washington Partnership](#) and the [Northstar Digital Literacy Assessment](#) certification of foundational digital skills.

## Identifying Locally Relevant Digital Skills

High-demand industries and the specific skills required for employment in them vary by region. Research on national trends can be helpful for programs seeking to align curriculum with employer demand, but it is even better to have local or regional input on specific skill requirements.

**Real-time labor market information**, which uses job-posting data to understand employer demand, can provide critical insights into the specific skills employers are seeking.

- For example, job-posting data can indicate which productivity tools (e.g., Word or Excel) and communications tools applicants should be able to use. Tools such as Burning Glass and Emsi are increasingly being used by community colleges and workforce boards to inform programming decisions; adult education programs can work in partnership with these institutions to learn more about local trends.

**Employer engagement and partnership** can provide the best and most accurate understanding of specific skill requirements.

- For example, as part of its IET program, [Tyson Foods](#) is working with instructors to map specific literacy and numeracy skills, including digital skills, to specific work tasks.

Adult education programs can consult a variety of [resources](#) for **guidance on developing employer partnerships**:

- Aspen Institute's [Digital Skills Discussion Guide](#) helps program leaders guide discussions with employers about their digital skill needs.
- Goodwill of Central Illinois developed a digital skills survey for 300 local employers and agencies to capture changes to the employer landscape and digital skills, which will

inform the instruction of clients. Goodwill's leadership shared that an initial challenge was keeping the survey brief enough for employers to complete, requiring Goodwill to edit the survey down from four pages into six strategic questions.

In addition to surveys and research, there needs to be **ongoing dialogue** between educators and employers on skills needs. Current examples of this include:

- The [Digital US Employer Network](#), which convenes leading employers
- Learning platforms such as CrowdED Learning's [SkillBlox](#)
- Data-sharing platforms related to skill competencies, such as the U.S. Chamber of Commerce's [Job Data Exchange](#) and [T3 Innovation Network](#), as well as the [Open Skills Network](#).

## Conclusion

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The DRAW landscape scan found widespread agreement among a wide variety of stakeholders on the need for commonly adopted, updated frameworks that provide definitions for in-demand digital skills for work and holistic participation in society. While this common framework does not yet exist, there are resources that educators can use to inform instruction and assessment. The DRAW initiative's next step will be to create professional development resources and training to help educators make sense of and use existing frameworks effectively. Please follow the [DRAW project page](#) for further updates, information, professional development support, and opportunities to join discussions on advancing digital resilience and equity.



## Endnotes

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<sup>1</sup> DRAW is funded by the U.S. Department of Education’s Office of Career, Technical, and Adult Education under contract GS10FO094X.

<sup>2</sup> Museum and Library Services Act of 2018, Text: S.3530—115th Congress (2017-2018), [www.congress.gov/bill/115th-congress/senate-bill/3530/text](https://www.congress.gov/bill/115th-congress/senate-bill/3530/text).

<sup>3</sup> Tatiana Iñiguez-Berrozpe and Ellen Boeren, “Twenty-First Century Skills for All: Adults and Problem Solving in Technology Rich Environments,” *Technology, Knowledge and Learning* 25, no. 4 (March 27, 2019): 929-951, <https://link.springer.com/article/10.1007/s10758-019-09403-y>; Jen Vanek, *Using the PIAAC Framework for Problem Solving in Technology-Rich Environments to Guide Instruction: An Introduction for Adult Educators*, commissioned paper (Washington, DC: Program for the International Assessment of Adult Competencies, 2017), [https://static1.squarespace.com/static/51bb74b8e4b0139570ddfo20/t/589a3d3c1e5b6cd7b42cddcb/1486503229769/PSTRE\\_Guide\\_Vanek\\_2017.pdf](https://static1.squarespace.com/static/51bb74b8e4b0139570ddfo20/t/589a3d3c1e5b6cd7b42cddcb/1486503229769/PSTRE_Guide_Vanek_2017.pdf); **Benó Csapó** and Joachim Funke, eds., *The Nature of Problem Solving: Using Research to Inspire 21st Century Learning* (Paris: OECD Publishing, 2017), [www.oecd.org/education/the-nature-of-problem-solving-9789264273955-en.htm](http://www.oecd.org/education/the-nature-of-problem-solving-9789264273955-en.htm); Organisation for Economic Co-operation and Development, *Skilled for Life? Key Findings From the Survey of Adult Skills* (2013), [www.oecd.org/skills/piaac/SkillsOutlook\\_2013\\_ebook.pdf](http://www.oecd.org/skills/piaac/SkillsOutlook_2013_ebook.pdf); and Bobby D. Rampey et al., *Highlights From the U.S. PIAAC Survey of Incarcerated Adults: Their Skills, Work Experience, Education, and Training*, Program for the International Assessment Of Adult Competencies: 2014, NCES 2016-040 (Washington DC: U.S. Department of Education, National Center for Education Statistics, 2016), <https://nces.ed.gov/pubs2016/2016040.pdf>.

<sup>4</sup> Digital US Coalition, *Building a Digitally Resilient Workforce: Creating On-Ramps to Opportunity* (Boston: Digital US, World Education, May 2020), <https://digitalus.org/wp-content/uploads/2020/06/DigitalUS-Report-pages-20200602.pdf>.

<sup>5</sup> Medha Tare, Sarah Cacicio, and Alison R. Shell, *The Science of Adult Learning: Understanding the Whole Learner* (Washington, DC: Digital Promise, 2021), <https://digitalpromise.org/wp-content/uploads/2020/12/Adult-Learner-White-Paper-1.pdf>.

<sup>6</sup> Kaisa Pihlainen, Kristiina Korjonen-Kuusipuro, and Eija Kärnä, “Perceived Benefits from Non-Formal Digital Training Sessions in Later Life: Views of Older Adult Learners, Peer Tutors, and Teachers,” *International Journal of Lifelong Education* 40, no. 2 (2021): 155-169, [www.tandfonline.com/doi/full/10.1080/02601370.2021.1919768](http://www.tandfonline.com/doi/full/10.1080/02601370.2021.1919768).

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<sup>7</sup> Kerolyn Ramos Garcia et al., “Improving the Digital Skills of Older Adults in a COVID-19 Pandemic Environment,” *Educational Gerontology* 47, no. 5 (2021): 196-206, [www.tandfonline.com/doi/full/10.1080/03601277.2021.1905216](http://www.tandfonline.com/doi/full/10.1080/03601277.2021.1905216); and Pihlainen, Korjonen-Kuusipuro, and Kärnä, “Perceived Benefits from Non-Formal Digital Training Sessions in Later Life,” [www.tandfonline.com/doi/full/10.1080/02601370.2021.1919768](http://www.tandfonline.com/doi/full/10.1080/02601370.2021.1919768).

<sup>8</sup> Rebecca Eynon, “Becoming Digitally Literate: Reinstating an Educational Lens to Digital Skills Policies for Adults,” *British Educational Research Journal* 47, no. 1 (2020): 146-162, <https://bera-journals.onlinelibrary.wiley.com/doi/10.1002/berj.3686>.

<sup>9</sup> Alexandra Wicht, Stephen Reder, and Clemens Lechner, “Sources of Individual Differences in Adults’ ICT Skills: A Large-Scale Empirical Test of a New Guiding Framework,” *PLOS One* 16, no. 4 (2021), <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0249574>.

<sup>10</sup> Amanda Bergson-Shilcock, *Digital Equity for an Inclusive Economic Recovery: Retail and Hospitality* (Washington, DC: National Skills Coalition, July 21, 2021), <https://nationalskillscoalition.org/resource/publications/digital-equity-for-an-inclusive-economic-recovery/>.

<sup>11</sup> Eynon, “Becoming Digitally Literate,” <https://bera-journals.onlinelibrary.wiley.com/doi/10.1002/berj.3686>.

<sup>12</sup> Digital US Coalition, *Building a Digitally Resilient Workforce*, <https://digitalus.org/wp-content/uploads/2020/06/DigitalUS-Report-pages-20200602.pdf>.

<sup>13</sup> DRAW Practitioner Questionnaire

<sup>14</sup> DRAW Practitioner Questionnaire

<sup>15</sup> DRAW Practitioner Questionnaire

<sup>16</sup> J. Goumas, personal communication, September 15, 2021.

<sup>17</sup> Mark Muro et al., *Digitalization and the American Workforce* (Washington, DC: Brookings, November 2017), [www.brookings.edu/research/digitalization-and-the-americanworkforce](http://www.brookings.edu/research/digitalization-and-the-americanworkforce).

<sup>18</sup> UpSkill America, *Insights From Businesses: How Digital Transformation Is Impacting Work and Skill Needs* (Washington, DC: The Aspen Institute, 2021), [www.aspeninstitute.org/wp-content/uploads/2021/09/Insights-from-Businesses-How-Digital-Transformation-Is-Impacting-Work-and-Skill-Needs.pdf](http://www.aspeninstitute.org/wp-content/uploads/2021/09/Insights-from-Businesses-How-Digital-Transformation-Is-Impacting-Work-and-Skill-Needs.pdf).

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<sup>19</sup> Will Markow and Debbie Hughes, with Andrew Bundy, *The New Foundational Skills of the Digital Economy: Developing the Professionals of the Future* (Boston: Burning Glass, 2018), [www.burning-glass.com/wp-content/uploads/New Foundational Skills.pdf](http://www.burning-glass.com/wp-content/uploads/New_Foundational_Skills.pdf).

<sup>20</sup> UpSkill America, *Insights from Businesses*, [www.aspeninstitute.org/wp-content/uploads/2021/09/Insights-from-Businesses-How-Digital-Transformation-Is-Impacting-Work-and-Skill-Needs.pdf](http://www.aspeninstitute.org/wp-content/uploads/2021/09/Insights-from-Businesses-How-Digital-Transformation-Is-Impacting-Work-and-Skill-Needs.pdf).

<sup>21</sup> Bergson-Shilcock, *Digital Equity for an Inclusive Economic Recovery*, [www.nationalskillscoalition.org/wp-content/uploads/2021/07/7.20-NSC-digitafactsheet\\_hospitality.pdf](http://www.nationalskillscoalition.org/wp-content/uploads/2021/07/7.20-NSC-digitafactsheet_hospitality.pdf).

<sup>22</sup> Bergson-Shilcock, *Digital Equity for an Inclusive Economic Recovery*, [www.nationalskillscoalition.org/wp-content/uploads/2021/07/7.20-NSC-digitafactsheet\\_hospitality.pdf](http://www.nationalskillscoalition.org/wp-content/uploads/2021/07/7.20-NSC-digitafactsheet_hospitality.pdf).

<sup>23</sup> DRAW Technical Working Group feedback form, Anson Green, May 10, 2022.

<sup>24</sup> Jill Castek et al., *Advancing Digital Equity in Public Libraries: Assessing Library Patrons' Problem Solving in Technology-Rich Environments* (Portland, Oregon: Portland State University, 2018), [https://pdxscholar.library.pdx.edu/digital\\_equity/](https://pdxscholar.library.pdx.edu/digital_equity/).

<sup>25</sup> ISTE, SkillRise Framework (2019), <https://skillrise.org/framework>.

<sup>26</sup> European Commission, DigComp 2.0., Digital Competence Framework for Citizens (2021), [https://joint-research-centre.ec.europa.eu/digcomp\\_en](https://joint-research-centre.ec.europa.eu/digcomp_en).

<sup>27</sup> European Commission, DigComp 2.0., [https://joint-research-centre.ec.europa.eu/digcomp\\_en](https://joint-research-centre.ec.europa.eu/digcomp_en); and Crown, Essential Digital Skills Framework (2018), [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/738922/Essential\\_digital\\_skills\\_framework.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/738922/Essential_digital_skills_framework.pdf).

<sup>28</sup> Stacey Wedlake et al., *Digital Skill Sets for Diverse Users: A Comparison Framework for Curriculum and Competencies* (Seattle: University of Washington Information School, Technology & Social Change Group, 2019), <https://tascha.uw.edu/publications/digital-skillsrecommendations-for-city-of-seattledigital-equity-initiative/>.

<sup>29</sup> ISTE, SkillRise Framework, <https://skillrise.org/framework>.

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<sup>30</sup> Priyanka Sharma, Jen Vanek, and Alison Ascher Webber, *Leveraging Technology to Increase Economic Opportunity for Adults: Field Testing Tools That Break Barriers to Learning and Employment* (Boston: World Education, March 2019), <https://edtech.worlded.org/wp-content/uploads/2019/10/ttale-report.pdf>.

<sup>31</sup> Suzanne Smythe, Anke Grotlüschen, and Klaus Buddeberg, “The Automated Literacies of E-Recruitment and Online Services,” *Studies in the Education of Adults* 53, no. 1 (2021): 4-22, <https://www.tandfonline.com/doi/full/10.1080/02660830.2020.1855870>.

<sup>32</sup> Julia Ticona, Alexandra Mateescu, and Alex Rosenblat, *Beyond Disruption: How Tech Shapes Labor Across Domestic Work & Ridehailing* (New York: Data & Society Research Institute, 2018), [https://datasociety.net/wp-content/uploads/2018/06/Data\\_Society\\_Beyond\\_Disruption\\_FINAL.pdf](https://datasociety.net/wp-content/uploads/2018/06/Data_Society_Beyond_Disruption_FINAL.pdf).

<sup>33</sup> Amanda Bergson-Shilcock, *Boosting Digital Literacy in the Workplace* (Washington, DC: National Skills Coalition, December 2020), <https://nationalskillscoalition.org/resource/publications/boosting-digital-literacy-in-the-workplace/>.

<sup>34</sup> UpSkill America, *Insights from Businesses*, [www.aspeninstitute.org/wp-content/uploads/2021/09/Insights-from-Businesses-How-Digital-Transformation-Is-Impacting-Work-and-Skill-Needs.pdf](http://www.aspeninstitute.org/wp-content/uploads/2021/09/Insights-from-Businesses-How-Digital-Transformation-Is-Impacting-Work-and-Skill-Needs.pdf).

<sup>35</sup> Stephen Ezell, *Assessing the State of Digital Skills in the U.S. Economy* (Washington, DC: Information Technology & Innovation Foundation, 2021), <https://itif.org/sites/default/files/2021-us-digital-skills.pdf>.

<sup>36</sup> A 2018 report from Burning Glass Technologies and the Business and Higher Education Forum, *The New Foundational Skills of the Digital Economy: Developing the Professionals of the Future*, used a combination of resume data and job-posting data to identify in-demand skills across sectors, with an emphasis on the broader digital economy, not just the most digitally intensive jobs. The authors identified 14 foundational skills across three skill groups that have seen an average increase in demand of 32 percent over the past five years: managing data, software development, and analyzing data.

<sup>37</sup> See, for example, “51 In-Demand Tech Skills for Technology Careers,” Indeed (2021), <https://www.indeed.com/career-advice/career-development/in-demand-tech-skills>.