

## ***The promises and perils of new technologies to improve education and employment opportunities***

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Summary: Digital technologies are rapidly developing and transforming the way individuals work, learn, and participate in civic life. As digital innovations become more available and present opportunities to make quality learning and career opportunities more accessible across the globe, established educational institutions, administrative data systems, and regulatory frameworks have struggled to adapt. Through our research on the landscape of digital micro-credentials, we hope to provide insights and policy recommendations to decisionmakers and stakeholders to expand access to skills and quality jobs to the most disadvantaged across the world.

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The rapid expansion of new technologies within education ecosystems in most countries has contributed to the proliferation of alternative models of education, learning, and skill signaling in global labor markets. From digital badges to bootcamps to learning and employment records (LERs), a wide range of public, private, and non-profit initiatives and platforms have emerged to address the ongoing demand for education and new skills among employers and workers alike. Beyond simply moving existing courses and curricula into an online environment, the latest wave of educational innovation represents a more fundamental shift in how education and skills data are gathered, stored, taught, verified, accessed, and signaled in the labor market. Some experts refer to this shift as “Education 3.0.”

At Brookings, we have recently embarked on a new research agenda focused on understanding where and how these digital innovations in skills and employment pathways are evolving, with a special focus on the extent to which they may expand opportunities for the most vulnerable individuals globally. Our goal is to make the education innovation ecosystem more accessible to non-technical audiences, and specifically to inform decisionmakers worldwide about the promises and perils of these initiatives for expanding access to opportunity.

**What are the trends in digital innovations in skills and employment pathways, and why should we care?**

Although, initially, the impact of technology in education and labor markets mainly focused on moving existing classes and curricula online and the creation of online job sites like *Monster.com*, more recently technologies such as machine learning, learning platforms, virtual reality, and distributed ledger technologies, including blockchain, have enabled many more fundamental shifts in the nature of how education and labor markets function (Table 1).

**Table 1. The evolution of education and skills pathways**

	<b>1.0 Analog</b>	<b>2.0 Online</b>	<b>3.0 Platform</b>
<b>Conceptual and foundational learning</b>	In person, classroom-based instruction	Online courses (recorded), remote instruction (live), hybrid online and in person instruction	Dynamic learning and credentialing platforms, modularized courses with digital badging, artificial intelligence to suggest jobs or learning progressions
<b>Hands-on learning</b>	In person, on-the-job learning in a workplace	Live or recorded demonstrations, hybrid work-based learning and online instruction	Virtual and augmented reality training, interactive gamified courses or problem-solving activities, real-time assessment using platform data
<b>Matching process</b>	Paper applications, help wanted signs, classifieds	Online job boards, applications, professional networking sites	Artificial intelligence to suggest potential jobs, candidates, or professional connections; integration with learning platforms to suggest matches; skills-based hiring algorithms

<b>Skill signaling</b>	Paper diplomas, degrees, transcripts, certificates, licenses	Online degrees and e-certificates; online certification or professional license exams	Digital badges, nanodegrees, targeted skills-bundling through digital wallets, artificial intelligence in candidate selection algorithms
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In a rapidly changing economy and technological landscape, individuals are using micro-credentials to differentiate themselves in the job market, keep their skills fresh in their industry, and continue working while they advance their education to reduce the financial burden of pursuing a more traditional degree. The landscape of digital credentials takes various forms and digital credentials can also serve as a bridge to support a career change (Figure 1). However, just having a lot of new options to get a credential on their own may not generate upward mobility or support career pivots at scale. Building more permanent onramps and transitions will also require institutional adaptation and formal recognition of learning, such as enabling learners to have their previous experience or micro-credentials recognized for transfer across education or labor market institutions, addressing information asymmetries about career options, and incentivizing employers (especially small and mid-sized companies) to offer more professional development to keep their skills fresh or move up within the organization.

**Figure 1. Examples of digital credentials**

Badges: Badges are shareable digital credentials that visualize learning and skill achievements. Badges can be shared on resumes, social media, and e-portfolios.

Certifications: Learners can be certified in specific skills, industries, and technologies and showcase certification from training programs for employers or educational institutions.

Nanodegrees: Nanodegrees are short-term credentials with skill-specific curricula designed to help learners attain a job after the course of study.

Competency-Based Assessments: Like an exam, competency-based assessments reflect a learner’s knowledge, abilities, and outcomes. After completion of the competency-based assessment, learners may receive a badge or digital credential.

But, despite the rapid development of technology and rising demand for competency-based learning, traditional higher education often excludes many workers and learners because of rigid course structures, expensive programs, and the lack of programs designed to meet the needs of working adults or learners with family care responsibilities, as opposed to someone moving sequentially from secondary to post-secondary education. Across most higher education institutions, course credit requirements or a set number of hours in a structured curricula must be met to attain a degree. And few allow learners to receive credit towards a degree based on previous digital learning, such as micro-degrees, credits from massive open online courses (MOOCs), or other digital credentials.

**Why digital credentials (and what are potential risks)?**

One remedy to the structural barriers in traditional higher education is the “stackable” or modular feature of digital micro-credentials. Digital micro-credentials may serve the most purpose when used to complement or “stack” upon an individual’s current education or training. Unbundling longer-term credentials into modular and stackable micro-credentials enables learners more flexibility to make progress on their own schedule while still progressing to a more advanced level of training or a formal degree. The added flexibility that new technologies, such as cloud-based learning platforms or virtual reality, bring can also make learning accessible in places and ways that were not possible before.

Globally, the majority of the labor force does not have a postsecondary degree, and as economies adapt to the future of work, it is critical that the rising demand to gain new skills, remain competitive, and learn through accessible mediums is met. Digital credentialing platforms are inherently flexible because of their potential reach individuals of all ages, education levels, socioeconomically and racial/ethnic groups, and industry backgrounds. Further, digital credentials and badges may benefit industry sectors in times of skills shortages and economic recessions because learners could receive relevant training and certification in months, rather than years. Whether digital micro-credentials benefit historically disadvantaged groups or further marginalize them will largely depend on the details of how they are implemented, articulated as legitimate learning pathways, and governed to protect learners from exploitative practices.

However, digital micro-credentials may also create new obstacles to learning and equity. For example, governments have to recognize them as equivalent learning steppingstones along a path to a degree if they are to hold the same value or to be easily transferred across institutions without the learner having to repeat coursework. In addition, because of the expense associated with formal higher education degree programs in many countries, learners who use micro-credentials in their learning path also must qualify for financial aid and other supports that students frequently rely on to complete their program. Finally, decisionmakers will need to address the digital divide – access to broadband, connected devices, and digital literacy – to avoid reproducing inequities in access to education. As digital micro-credentials scale to meet demand, they may create additional barriers for the most marginalized communities unless governments take parallel steps to prioritize digital inclusion.

### **Who is leading these efforts and where, and why does it matter?**

One billion new users have been added to the internet since 2016, and yet 3.7 billion people remain offline with no access to internet, connectivity, or digital literacy skills (UN-Habitat, 2021). The digital divide is the global phenomenon of technological fragmentation, wherein a significant number of communities lack access to information and communication technologies (ICTs). Furthermore, the COVID-19 pandemic has exacerbated inequities and disparities of education systems, with 191 countries and 1.5 billion students affected by school closures (UNESCO, 2021).

As we began this research project, we found that the leading edge of education technology initiatives are led by governments, education institutions, the private sector, and civil society organizations in the world's most wealthy, industrialized countries. Yet, youth and adults in low-income countries and in marginalized communities within wealthy countries have the most to gain from the promises of greater access and customization that the latest technologies can bring. They are most likely to be excluded from traditional high-quality education opportunities or to have their skills and experience overlooked in the hiring process. Thus, ensuring that the initiatives being developed in more advanced economies are designed to meet the needs of individuals who are largely excluded from existing education and labor market institutions is critical for realizing the promise of digital credentials to improve skills and employment pathways for all.

The lack of engagement of stakeholders and end users in the development of education technologies of the future is concerning for many reasons. First, technologies such as blockchain for education or learning and employment records are evolving without much input from education leaders in lower income countries – which ultimately could limit their reach and relevance. Second, there has yet to be a major investment in gathering user input into the design of tools like digital wallets or learning and

employment records. This creates the risk of limited buy-in from end users or tools that do not support them in practice, because they were built with untested assumptions. Finally, the lack of engagement of technology experts upfront in the design of regulations and governance frameworks for new technologies and data systems, such as cloud-based administration or privacy laws, is also problematic if the resulting rules or laws are not feasible to implement, have unintended consequences (e.g., for security), or fail to address underlying structural inequities, such as digital infrastructure and literacy. The emerging coalitions and multi-stakeholder pilots and user-centered design elements in the U.S. context will be important for shaping whether not the value proposition is clear to the intended end users – learners, businesses, or government agencies. Similar collaborations may be necessary to launch in other countries and contexts.

Today, the playing field for learners and workers is determined by where one lives, as well as one's socio-economic background, gender, and race and ethnicity. These inequities in access to opportunity are not just an ethical or moral problem-for decisionmakers, they also constrain innovation and economic growth by sidelining talented individuals who never got an opportunity to reach their potential and instead get trapped in low wage, dead end jobs. Through our research, we hope to provide insights and policy recommendations to decisionmakers and stakeholders to expand access to skills and quality jobs to the most disadvantaged across the world.