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The Global Convergence of Learning, Technology, and Workforce Development

A Framework for Accelerating Skills Needed to Thrive in the Workforce



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Introduction

Convergence—the bringing together of two or more discrete entities, ideas or phenomena can be viewed as a crossing of boundaries between distinct disciplines that enables disruption and the formulation of innovative solutions to complex, universal challenges.

From a technological standpoint, convergence is considered a merging of different technologies into an integrated or unified functionality. Take the smartphone, for example. This class of mobile phone combines the capabilities of a telephone, camera, media player, and Internet browser into one integrated device, creating an entirely new level of functionality. The successful fusion demonstrates how technological advancement can help to solve complex challenges and open new pathways that individual capabilities, when used in isolation, simply cannot.

As convergence branches out from the technology domain to impact the world's citizens and the global economy at large, it has quite obvious crosscutting and societal implications. It is "a deep integration of knowledge, tools, and all relevant areas of human activity to allow society to answer new questions, to create new competencies and technologies, and overall to change the respective physical or social ecosystems".¹

Through global convergence, a new universe is made possible: one of discovery, innovation, and opportunity. Existing human and systems-based challenges can be transcended to achieve improved conditions for lifelong learning, work, and quality of life.

With this context, it is time we recognize that learning, technology, and workforce development are experiencing a global convergence. In today's technology-driven world, knowledge and information are growing exponentially. As globalization and advancements in technology reshape society, they also generate an accelerated pace of change that is outpacing humans' ability to adapt. This requires new approaches to workforce development and how we upskill and reskill learners to better meet the demands of today and the future. For potential learners, a worldwide increase in the ownership of devices, growth in technological fluency, and an upsurge in global connectivity can equate to expanded access to digital learning and just-intime resources for knowledge and skill development. For educators and instructors, traditional instructional approaches (e.g. lectures) have evolved to more experiential and transformational methods (e.g. problem-based learning) and teachers are able to improve their practices through the sharing of resources and experiences in online communities.

Learning, technology, and workforce development are now converging to a collective crest. There may be no better time to ride this global convergence wave as we seek to solve tomorrow's challenges today by accelerating the crucial skills needed to thrive in the workforce.

> "The fourth industrial revolution, however, is not only about smart and connected machines and systems. Its scope is much wider. Occurring simultaneously are waves of further breakthroughs in areas ranging from gene sequencing to nanotechnology, from renewables to quantum computing. It is the fusion of these technologies and their interaction across the physical, digital and biological domains that make the fourth industrial revolution fundamentally different from previous revolutions."

> > Klaus Schwab, World Economic Forum Founder and Chairman, 2017







Highlights

This white paper identifies the current global convergence of learning, technology, and workforce development and lays out MassiveU's framework for accelerating the skills needed to thrive in the workforce.

Contents





Workforce Development

The Future of Work

Since the first Industrial Revolution, innovation has steadily redefined how and where we work. Yet, the accelerated pace at which technology is advancing today, coupled with the scale at which it could potentially disrupt work, is unprecedented.

Work, as we know it, is undergoing rapid change. Increased globalization and accelerated technological advancements such as automation, robotics, algorithms, big data analytics, artificial intelligence (AI), and machine learning are disrupting jobs and redefining the skills needed to thrive in the workforce.

Disruption of Jobs

Technological change is predicted to upend the nature of jobs. Research on the potential effect of automation on the global economy finds that the impact will be felt by everyone, from miners, clerks, and landscapers, to dental lab technicians, fashion designers, insurance sales representatives, and even CEOs.²

In a canvasing of experts by the Pew Research Center and Elon University's Imagining the Internet Center, respondents predicted that the development of automation enabled by emerging technologies will reduce the number and types of jobs over the coming 10 to 20 years.³ Researchers estimate that about 47 percent of total US employment is at risk. It is calculated that the global adaptation of currently demonstrated automation technologies could impact 50 percent of the world economy, or 1.2 billion employees and \$14.6 trillion in wages. According to estimates by labor economists, "one more robot per thousand workers reduces the employment-to-population ratio by about 0.18-0.34 percentage points and wages by 0.25-0.5 percent".⁴

Along with industry experts, companies are also expecting a shift from work tasks being completed by humans to machines. According to a World Economic Forum Report, in 2018, 71% of total task hours across 12 industries were performed by humans, compared to 29% by machines. By 2022, these numbers are expected to shift to 58% of task hours performed by humans and 42% by machines. ⁵

It is estimated that 85% of the jobs that today's learners will be performing in 2030 have yet to be invented. ⁶ The impacts of emerging technologies on future jobs will be nothing short of game-changing.

- 3 The Future of Jobs and Jobs Training. Lee Rainie and Janna Anderson, Pew Research Center, 2017.
- 4 Robots and Jobs: Evidence from US Labor Markets. Daron Acemoglu and Pascual Restrepo, 2017.

5 The Future of Jobs Report. The World Economic Forum, 2018.

Disruption of Jobs

Potential impacts of emerging technologies on the future of jobs

Automation risk by job type, %





² Technology, Jobs, and the Future of Work. James Manyika, McKinsey Global Institute, 2017.

⁶ Emerging Technologies' Impact on Society and Work in 2030. Institute for the Future (IFTF), 2017.

The Global Skills Crisis

As rapidly emerging technologies disrupt the nature of work, they will also redefine the skills required of human workers. This shift in skills is expected to result in worker shortages and mismatches that negatively impact the global economy and workforce. Skill shifts in the workforce are predicted to leave companies challenged with finding the talent they need, ultimately resulting in lost production.⁷ Without adequate skill development, the employees of today and tomorrow will face an increased risk of experiencing economic disadvantage, unemployment, and dependency on social benefits.⁸ With the employment landscape advancing at such an accelerated pace, it will be critical for learners, educators, and organizations, alike, to both anticipate and prepare for future skill requirements.

As the gap widens between the skills the workforce has and the skills employers will be looking for, what skills will be needed for humans to succeed in the future workforce? The OECD identifies three foundational skills (literacy, numeracy, and problem solving in technology-rich environments) that "provide a foundation for effective and successful participation in the social and economic life of advanced economies".⁹ Yet, technological proficiency is only one piece of the future's skills puzzle, as 'human' skills such as creativity, originality and initiative, and critical thinking, to name a few, will only retain or increase their value. The World Economic Forum (WEF) recognizes the importance of 'human' skill in its three broad categories of skills to meet the needs of a 21st century marketplace: foundational literacies, competencies, and character qualities.¹⁰

What skills will see the greatest shift in the future? MGI research predicts the following coming shifts in demand for workforce skills by 2030:

- 55% growth in demand for technological skills (basic digital skills and advanced IT skills and programming).
- 24% rise in demand for social and emotional skills (leadership and managing others).
- 8% increase in demand for higher cognitive skills (creativity and complex information processing and interpretation).¹¹

Comparing skills demand, 2018 vs. 2022

Top 10

Then, 2018	Trending, 2022	Declining, 2022	
 Analytical thinking and innovation Complex problem-solving Critical thinking and analysis Active learning and learning strategies Creativity, originality and initiative Attention to detail, trustworthiness Emotional intelligence Reasoning, problem-solving and ideation Leadership and social influence Coordination and time management 	 Analytical thinking and innovation Active learning and learning strategies Creativity, originality and initiative Technology design and programming Critical thinking and analysis Complex problem-solving Leadership and social influence Emotional intelligence Reasoning, problem-solving and ideation Systems analysis and evaluation 	 Manual dexterity, endurance and precision Memory, verbal, auditory and spatial abilities Management of financial, material resources Technology installation and maintenance Reading, writing, math and active listening Management of personnel Quality control and safety awareness Coordination and time management Visual, auditory and speech abilities Technology use, monitoring and control 	

"The modern global economy doesn't pay you for what you know, because the Internet knows everything. The world economy pays you for what you can do with what you know."

> Source: Andreas Schleicher, Deputy Director for Education and Skills, Special Advisor on Education Policy to the Secretary-General, OECD

"To thrive in today's innovationdriven economy, workers need a different mix of skills than in the past. In addition to foundational skills like literacy and numeracy, they need competencies like collaboration, creativity and problem-solving, and character qualities like persistence, curiosity and initiative."

Source: World Economic Forum, 2015

Source: World Economic Forum, 2018

7 Skill Shift Automation and the Future of the Workforce, McKinsey Global Institute, 2018.
8 Better Skills, Better Jobs, Better Lives: A Strategic Approach to Skills Policies. OECD, 2012.

9 Literacy, Numeracy and Problem Solving in Technology-Rich Environments: Framework for the OECD Survey of Adult Skills. OECD, 2012.

10 New Vision for Education: Unlocking the Potential of Technology. World Economic Forum, 2015.

11 Skill Shift Automation and the Future of the Workforce, McKinsey Global Institute, 2018.



"A reskilling imperative: By 2022, no less than 54% of all employees will require significant re- and upskilling. Of these, about 35% are expected to require additional training of up to six months, 9% will require reskilling lasting six to 12 months, while 10% will require additional skills training of more than a year."

Source: World Economic Forum, 2018

"In the modern "flat world," the "Three Rs" simply aren't enough. If today's students want to compete in this global society, however, they must also be proficient communicators, creators, critical thinkers, and collaborators (the "Four Cs")."

Source: National Education Association, 2012

Bridging the Skills Gap

Given the impending wave of disruption, it is estimated that by 2022, "no less than 54% of all employees will require significant re- and upskilling".¹² As competition for high-skill workers increases, low-skill workers will face potential displacement or insufficient work. Research finds that companies intend to hire and retrain high-skill workers and employees in high-value roles, leaving behind those who need reskilling and upskilling the most, the ones least likely to receive such training.¹³

Many see personal reskilling and upskilling as a constant. A 2016 Pew Research Center survey, "The State of American Jobs", found that:

- 54% of workers say it will be essential for them to get training and develop new skills throughout their work life in order to keep up.
- 35% of workers, including 27% adults with at least a bachelor's degree, say they don't have the education and training to advance in work.¹⁴

So, what can be done to prevent the lose-lose scenario of talent shortages, mass unemployment, and increased inequality? Research recommends several solutions to effectively bridge the skills gap:

- "It is critical...that individuals take a proactive approach to their own lifelong learning."¹⁵
- "A mindset of agile learning will also be needed on the part of workers as they shift from the routines and limits of today's jobs to new, previously unimagined futures."¹⁵
- "Changes in educational and learning environments are necessary to help people stay employable in the labor force of the future."¹⁵
- "The education system will need to adapt to prepare individuals for the changing labor market. At the same time, recent IT advances offer new and potentially more widely accessible ways to access education."¹⁶
- *"Embrace technology-enabled solutions. Such solutions, including richer information signals, can be used in the labor market to improve matching and access and bridge skills gaps."*¹⁷

How to get students ready for the world of work?

6

District Administrators say:

- Integrating workplace skill development into curriculum
- 2 Leveraging digital tools and products to support student learning
- Increasing STEM career exploration
- J opportunities for students

Parents say:



of parents say that the effective use of technology within school is important to their children's future success



of parents say it's extremely important

Source: Speak Up, 2017

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- *12, 15 The Future of Jobs Report. The World Economic Forum, 2018.*
- 13 Skill Shift Automation and the Future of the Workforce, McKinsey Global Institute, 2018.
- 14 The State of American Jobs. Pew Research Center, 2016.
- 16 Information Technology and the U.S. Workforce: Where are We and Where do we go from Here? National Academies of Sciences, 2017.
- 17 Technology, Jobs, and the Future of Work. James Manyika, McKinsey Global Institute, 2017.

"Whereas pre-21st century learning paradigms catered reasonably well for the pursuit of the moral purpose of education in turning out school leavers with specialized skills that were applicable in highly compartmentalized and specialized Industrial Age economies, 21st century skills require a new paradigm... Teaching our students so that they become well-equipped with the 21st century skills is the new learning paradigm. Source: Charles Kivunja, 2014

Whereas pre-21st century learning paradigms catered reasonably well to fostering specialized skills that were applicable in Industrial Age economies, 21st century skills require an entirely new paradigm. The essential skills for 21st century learning and occupations fall into four domains:

- 1. Core subjects and skills such as the orthodox 3Rs that every educated person should have mastery of.
- 2. Learning and innovations skills domain requiring skills such as critical thinking and problem solving.
- 3. Career and life skills domain, calling for skills such as collaboration, teamwork and leadership.
- 4. Digital literacy skills domain, requiring skills such as computer literacy and digital fluency.

The essential skills for 21st century learning and occupations relate not just to the application of technology but, more importantly, to the ability to engage in independent critical thinking and a high level of problem solving, often using technology. The following competency frameworks provide a foundation for fostering essential 21st century skills by developing the whole person across multiple intelligences:

The Four Cs

Recognizing that all learners need educational experiences to build knowledge and skills for success in a globally and digitally interconnected world, Partnership for 21st Century Skills (P21) has developed a framework for 21st century learning. This collective vision describes the "skills, knowledge and expertise students must master to succeed in work and life; it is a blend of content knowledge, specific skills, expertise and literacies".¹⁸ The three Rs of reading, writing, and arithmetic are no longer sufficient for today's learners, who must also develop the essential skills necessary to compete in today's global economy, or what P21 refers to as the 4Cs: critical thinking, communication, collaboration, and creativity.¹⁹ While not the only skills needed for success in the 21st century, the 4Cs are part of the new learning paradigm.

Social and Emotional Learning (SEL)

According to the Collaborative for Academic, Social, and Emotional Learning (CASEL), social and emotional learning (SEL) is defined as "the process through which children and adults understand and manage emotions, set and achieve positive goals, feel and show empathy for others, establish and maintain positive relationships, and make responsible decisions".²⁰ SEL has been found to enhance individuals' capacity to integrate skills, attitudes, and behaviors to deal effectively and ethically with daily tasks and challenges. CASEL's integrated SEL framework promotes intrapersonal, interpersonal, and cognitive competence. Within the framework exist five core competencies: self-awareness, self-management, social awareness, relationship skills, and responsible decision-making.

ISTE Technology Standards

To truly prepare students for success in a digital world, a common language is needed for sharing ideas and best practices. The International Society for Technology in Education (ISTE) Standards, a framework developed by ed tech experts and adopted worldwide, accomplishes this. The standards provide a shared vision for digital age learning to prepare learners to thrive in a constantly evolving technological landscape. The seven standards for students (complete with subordinate competencies) consist of: empowered learner, digital citizen, knowledge constructor, innovative designer, computational thinker, creative communicator, and global collaborator.²¹

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19 Preparing 21st Century Students for a Global Society: An Educator's Guide to "the Four Cs." National Education Association, 2012.

20 Retrieved 13 April 2019 from www.casel.org/core-competencies

21 Retrieved 13 April 2019 from /www.iste.org/standards/for-students



¹⁸ Framework for 21st Century Learning. Partnership for 21st Century Skills, 2009.

Technology

Digital Around the World

Not only is technological advancement accelerating at an exponential rate, but so too is the rate at which new technologies are adopted by consumers. With rising global connectivity, instant communication, and established infrastructure systems, new ideas and products can be dispersed at rapid speeds in today's world. This is how new technologies are getting into the hands of global consumers faster than ever before.²²

The ubiquity of smartphones is keeping them at the center of the consumer internet economy, with an unprecedented range of connected devices. Today, over 5 billion people have mobile devices, up 100 million since 2018. This number is projected to grow to 5.9 billion by 2025, equal to 78% of the world's population.²³ The gap in connectivity is also closing. Between 2018 and 2019, more than one million people came online for the first time.²³ By 2025, the total number of mobile internet subscribers is expected to reach 5 billion.²⁴



Broadband mobile connectivity is improving. In 2018, 2G was surpassed by 4G—now the leading mobile technology globally, with 3.4 billion connections (43% of total connections). 4G is predicted to climb to 60% of global mobile connections by 2023. In South Korea, US, and Japan, 5G is rapidly growing. By the end of 2019, sixteen additional major countries will have launched 5G networks.²³

Technological fluency is also expected to rise over the next ten years. In developing countries, smartphone users will climb to increased engagement levels. In the most advanced countries, the digital users of today (using desktops, tablets, and smartphones) are predicted to become the augmented users of tomorrow, adopting emerging technologies such as smart devices, augmented reality, and virtual reality.

As individuals and economies become more connected, more mobile, and more digital, it is expected that these trends will only accelerate.

Worldwide internet users from 2014-2021

Comparing the number of internet users to total population



Broadband mobile connectivity





"The power and reach of the virtual world is growing constantly. [With today's digital learning tools,] a student in a developing country can now access the libraries of prestigious universities anywhere in the world; an unemployed person can retrain and improve job prospects in other fields; teachers can gain inspiration and advice from the resources and experiences of others. With each of these achievements, the online world brings about another realworld victory for education, dialogue, and better understanding between peoples. "

> Source: Dr. Hamadoun I. Touré Secretary General, International Telecommunication Union (Broadband Commision Working Group on Education, 2013)

Digital Learning Evolution

For more than a century, education has taken place in a physical classroom, between approximately the hours of 8:30 a.m. and 3 p.m. Yet, with the emergence of technology, that model has been turned on its head. Learning, both formal and informal, can now take place at any time, anywhere, and on any device. Digital learning has evolved over the years through the advent of Learning Management Systems (LMSs), Massive Open Online Courses (MOOCs), adaptive learning, big data analytics, virtual reality, and augmented reality. As technology continues to evolve, more shifts are likely to occur.

- "By 2030, workers will create new work infrastructures to acquire the skills and knowledge they will need to execute their work successfully. They will routinely improvise, learn from each other, and make their own way... Most will partner with machines to learn while on-the-gig." ²⁵
- "To acquire the necessary knowledge, some will use AR technologies to perform unfamiliar and complex tasks on the job... Workers, wearing an AR headset, will be fed the information that they need in real-time and in their field-of-vision so they can do the work. Others will depend on apps and services that are designed to engage users in learning during the idle moments of their lives... to turn every waiting opportunity into a learning opportunity (a practice called 'wait-learning')." ²⁵
- "As the transfer of knowledge will be increasingly offloaded to emerging technologies, individuals will shoulder the burden of using these
 new technologies to acquire necessary skills to demonstrate proficiency. As a result, people will need to know how to access information
 and learn through immersive and experimental media such as AR and VR... This will require both access to technology as well as increased
 confidence in their know-how to utilize emerging technologies." ²⁵

The evolution of learning and development

	1998 - 2002	2005	2010	2017	2020
	E-learning and blended	Talent management	Continuous learning	Digital learning	Intelligent learning
Formats	Course catalog Online university	Learning path Career track	Video, self-authored Mobile, YouTube	Micro-learning Real-time video Courses everywhere	Intelligent, personalized,
Philosophy	Instructional design Kirkpatrick	Blended learning Social learning	70-20-10 taxonomies	Design thinking Learning experience	
Users	Self-study Online learning	Career-focused Lots of topics	Learning on demand Embedded learning	Everyone, all the time, everywhere	machine-driven
Systems	LMS as E-learning platform	LMS as talent platform	LMS as experience Platform	LMS invisible Data-driven, mobile	

Source: Deloitte, 2017







Student access to mobile devices

Of district **administrators** say it is important for students to **access mobile devices** at school to support learning

49% Of principals say they are already seeing positive academic results when they assign devices to students to use exclusively at school

Students

with device

Students

without device

Learning behaviors changing as a result of mobile availability

		Source: SpeakUp, 2018
Text teachers with questions	20%	14%
Watch videos to learn how to do something	38%	28%
Read online books or articles	43%	32%
Text classmates to ask about schoolwork	45%	38%
Get online reminders about tests or project due dates	53%	39%
Take photos of assignments or textbook pages	54%	42%
Email teachers with questions	59%	42%
Search for info online	74%	65%

Digital Learning Revolution

A revolution in digital learning is underway. Digital technologies are changing the learning landscape and connecting learners to just-in-time resources for knowledge and skill development.

With global consumers adopting new technologies at an exponential rate, a notable increase in worldwide internet use and broadband connectivity, and predicted gains in global consumers' technological fluency, accessibility to digital learning grows more widely than ever before.

- In a survey of more than 2,800 demographically-diverse teachers, parents, and students, 75% of teachers indicated that digital learning content will totally replace printed textbooks by the year 2026.²⁶
- This sentiment is echoed by Technavio analysts: "The demand for digital textbooks is increasing at a rapid rate in the US because of their low cost compared to printed textbooks. The increasing prices of raw materials and the growing environmental concerns associated with the paper that is used to manufacture printed textbooks further boost the demand for digital textbooks in the US." ²⁷
- "With the advent of Internet-enabled smartphone devices such as mobile phones and tablets, the reading preference of customers is shifting from traditional print formats to smartphone device-compatible formats. Consumer demand for content on-the-go has shown a rapid increase over the last few years. Several leading publishers of educational content are increasingly offering a wide range of digital content, which customers can access through their smartphone devices."²⁷
- "Several countries are adopting various initiatives to enable better use of digital technology in education. For instance, in 2018, the European Commission announced the adoption of the Digital Education Action Plan for the development of digital competence in education in the EU member countries. The plan primarily emphasizes the adoption of digital technology devices in educational institutions to develop digital literacy and promote digital skills and competencies among students."²⁷

26 Digital Education Survey. Deloitte, 2016.27 Digital Education Publishing Market in the US 2019-2023. Technovio, 2019.





Learning

Learning and the Fourth Industrial Revolution

World Economic Forum (WEF) Founder and Chairman Klaus Schwab describes how our society is entering a "Fourth Industrial Revolution" (4IR). Characterized by a range of new technologies that are fusing the physical, digital, and biological worlds, Schwab argues that 4IR developments are affecting all disciplines, economies, industries, and governments, and are even challenging ideas about what it means to be human.²⁸

To meet the challenges of the 4IR, education and lifelong learning will be of critical importance to equip present and future generations. This demands a reimagining of the standard model of education, still widely implemented in today's formal education systems. However, as Graham Brown-Martin observes, "Rather than transforming education, teaching, and learning to meet the challenges of the 21st century, we are witnessing a digitization of 19th and 20th century practice to be delivered by 21st century platforms."²⁹

How did education get to a point where the focus of student learning became understanding not how to learn, but how to pass a test?

In "Optimising Learning: Implications of Learning Sciences Research", R. Keith Sawyer makes the following observations about schooling:³⁰

- The schools we have today were designed around commonsense assumptions that had never been tested scientifically.
- Knowledge is a collection of facts and procedures for how to solve problems.
- The purpose of school is to get those facts and procedures into students' heads. People are considered educated when they possess a large collection of facts and procedures.
- Teachers know these facts and procedures and their job is to transmit them to students.
- Simpler facts and procedures should be learned first, followed by progressively more complex facts and procedures. Definitions of *simplicity* and *complexity* and the sequencing of material were determined either by teachers, textbook authors, or expert adults, but not by studying how children actually learn.
- Success of schooling is determined by testing students to see how many of these facts and procedures they have remembered.

As Brown-Martin points out, "This transmission and acquisition model of schooling is referred to by learning scientists as instructionism because it assumes that the core activity of the classroom is instruction by the teacher. It is also often referred to as the 'standard model' for education. Standard model schools effectively prepared students for the industrialized economy of the early 20th century, transmitting a standard body of facts and procedures to students. The goals of standard model schools were to ensure standardization where all students memorized and master the same core curriculum. Schools were structured and regimented in a manner explicitly analogous with the industrial-age factory (R. Callahan, Education and the Cult of Efficiency, 1962), and this structural alignment facilitated the ease of transition from school student to factory worker."³¹

But, when we consider the challenges of the 4IR, and the knowledge and skills required to thrive, we think of "creativity, innovation, ingenuity, higher order and critical thinking to solve complex and abstract problems as well as how to get along with one another and become civically engaged."³¹ We think of a reimagined approach to learning: one that goes beyond just foundational skill development (literacy and numeracy) by fostering the development of 21st century skills, social and emotional learning competencies, and character qualities.

11

"Ubiquitous, mobile supercomputing. Intelligent robots. Self-driving cars. Neurotechnological brain enhancements. Genetic editing. The evidence of dramatic change is all around us and it's happening at exponential speed... We are at the beginning of a revolution that is fundamentally changing the way we live, work and relate to one another...the Fourth Industrial Revolution."

"By one popular estimate, 65% of children entering primary school today will ultimately end up working in completely new job types that don't yet exist."

Source: World Economic Forum, 2016.



²⁸ The Fourth Industrial Revolution. Klaus Schwab, 2017.

²⁹ Education and the Fourth Industrial Revolution. Graham Brown-Martin, 2017.

³⁰ Optimising Learning: Implications of Learning Sciences Research. R. Keith Sawyer, 2008.

^{31.} Education and the Fourth Industrial Revolution. Graham Brown-Martin, 2017.

Learning and the Fourth Industrial Revolution

Reimagining the Standard Model of Education

	First Industrial Revolution	Fourth Industrial Revolution		
Learning Outcomes	Mastery of knowledge and basic skills	Development of whole person across multiple intelligences (e.g. emotional, intellectual, social)		
Teaching & Learning Approaches	Instructionism, transmission of knowledge (e.g. lecture)	Constructivism, learning by doing (e.g. problem-based learning, design thinking).		
Educator Roles	Expert ("Sage on the stage")	Facilitator ("Guide on the side")		
Learner Experience	Instructor-centered factory model: Passive, structured, directed, en masse	Student-centered custom model: Active, self-directed, personalized, exploratory, gamified		
Expertise	"Teacher knows best"	"Anyone can teach"		
Target Age	K-12	Lifelong learning regardless of age, socio-economic status, location, skill		
Access	Physical classroom	Any time, anywhere, any device		

Source: Awaken Group, 2017

Learning Reimagined

There are alternatives to the standard model of instructionism that can serve to better prepare lifelong learners for the future world of work. Constructivism is one alternative. "Where instructionism regards education as the transmission of knowledge, constructivism believes that education is a reconstruction of knowledge where learning is experiential and situated within a professional and social context". In other words, learning by doing.

Another alternative is situated cognition. "The teaching methods of the standard model assume that conceptual knowledge is independent of the situations in which it is learned and used. On the other hand, situated cognition is a theory which emphasizes that people's knowledge is constructed within and linked to the activity, context, and culture in which it was learned. Thus, learning is social and not isolated, as people learn while interacting with each other through shared activities and through language, as they discuss, share knowledge, and problem-solve during these tasks."

Constructivism is not a new idea, given that its contributors include educational theorists (Piaget, Vygotsky and Dewey, to name a few) from the early 20th century. Yet, its characteristics and desired outcomes are far more in line with the needs of 21st century learning.

- "Such [constructivist] approaches to education elevate the practice and craft of teaching as well as the art of learning by stimulating problem solving, higher order thinking, creativity, collaboration and critical thinking."³²
- "By encouraging students to use active techniques (experiments, real-world problem solving) to create more knowledge and then to reflect on and talk about what they are doing and how their understanding is changing, students ideally become 'expert learners'." ³²
- "The teacher makes sure she understands the students' preexisting conceptions, and guides the activity to address them and then build on them with the objective that the students learn 'how to learn'." 32

Some constructivist teaching and learning methods that are well-suited to 21st century learning include: problem-based learning, project based learning, inquiry-based learning, design thinking, challenge-based learning, collaborative problem solving, and creative problem solving. It is here where learners can solve authentic, real-world problems while developing essential 21st century skills that prepare them to thrive in the uncertain future.





Forging the Future Workforce

Stakeholders and Their Roles

The lifelong employability imperative³³ impacts us all as we strive to help future workers continually and successfully adapt to the evolving demands of work. While companies can play an instrumental role in the reskilling and upskilling of the future workforce, learning technology providers, content providers, educational institutions, educators, and future workers alike have active roles to play.



Companies

Collaborate with stakeholders to define the competencies required of future employees and identify critical gaps. Drive adoption of new technologies, provide continuous learning through on-the-job training, and establish a culture of lifelong learning. Embrace next generation learning technologies to improve learner engagement and outcomes.



Learning Technologies

Leverage emerging technologies to provide learning analytics that can better tailor instruction to learners and translate performance outcomes (e.g. foundational literacies and 21st century skills) achieved by learners to potential employers. Boost learner engagement by making learning more dynamic, interactive, and social.



Content Providers

Design learning content to better develop STEM and 21st century skills and foster adaptive and lifelong learning mindsets. Better adapt content to multiple audiences and deliveries. Embrace technology-enabled solutions that drive learner engagement and measure 21st century learner outcomes. Consider self-contained specific learning (microlearning).

Educational Institutions

Build course outcomes around competencies that match to job demands and skills needed based on workforce analytics. Embrace approaches to measure 21st century skills, such as problem solving and critical thinking. Break from degree dependency and embrace alternative credentialing systems (e.g. micro credentials, portfolios). Foster the adoption of new technologies. Embrace next generation learning technologies to improve learner engagement.



Educators

Integrate the teaching and development of 21st century skills into instructional design and delivery. Focus on skills and mindsets that cut across disciplines and occupations to help develop cross-sector mobility, helping individuals use their skills in new occupations and sectors.³³ Redesign and establish new metrics to measure skills in a broader sense. Model and facilitate the use of new technologies.



Future Workers

Adopt a mindset of lifelong learning. Take a proactive approach to continuous, agile, and adaptive learning of new knowledge and skills. Adopt the use of new technologies.

33 Competitive Advantage with a Human Dimension: From Lifelong Learning to Lifelong Employability. McKinsey Quarterly, 2019.



- "In the face of these great uncertainties, prediction is a fools' game. We must imagine, not predict; restructure, not plan. And be prepared to adapt at every point...we're all in this together: technology, business, government, and civil society must all be part of the solution." Source: Anne-Marie Slaughter and Roy Bahat, 2016.
- "Individuals, employers, and governments will need to align their efforts if we are to sustain a stable, just, and productive society as the future of work evolves." Source: Junko Kaji, 2017.



Forging the Future Workforce

The Learn to Earn Ecosystem



Source: MassiveU, 2019

Partnering for Future Success

The message is clear: To effectively bridge the skills gap, forging the future workforce will require a collaborative effort. In a 2018 report on the US workforce, the US Council on Foreign Relations called for a stronger linking between education and employment outcomes.³⁴ In a two-year study of 68 open online courses offered via edX by Harvard University (HarvardX) and MIT (MITx), it was found that improved coordination between companies and educational institutions would be beneficial to further strengthen the retraining of those underserved today.³⁵ Similarly, a 2017 study on German higher education conducted by Stifterverband and McKinsey called for universities to become more proficient in the identification of and reaction to labor market trends.³⁶

No longer can stakeholders such as businesses and educational institutions work in isolation. To successfully prepare the workforce for the evolving demands of the uncertain future, partnerships across the learn-to-earn ecosystem will be essential. Collaborations between employers and other stakeholders can equip learners with a strong foundation of transferable skills while helping them to cultivate a lifelong learning mindset that can prepare them for future careers.

Learning Outcomes & Metrics

An essential step will be to understand the competencies required of future employees and to identify critical gaps in knowledge, skills, and/or attitudes. A 2011 report by the European Commission found that "no accepted taxonomy for description of skills, competencies and occupations exists on a European or even global level" and recommended the development of a competency model of transversal skills that can be regularly updated to ensure greater transferability.³⁷ Companies and stakeholders will need to agree on definitions and qualifications for specific skills and work to address these gaps through partnerships with content providers, educational institutions, and educators. Educational institutions and educators will need to build course outcomes around competencies that match to job demands and skills. Learning technologies will need to provide learning analytics that translate learner performance to potential employers.

Workforce Readiness Standards

14

State and local governments, in collaboration with other stakeholders, can work to develop and implement workplace readiness standards as part of grades 6-12 curricula. An agreed upon set of skills readiness and capacity standards can help to establish bars of achievement to which we can all strive for progress.

34 The Work Ahead: Machines, Skills, and U.S. Leadership in the Twenty-first Century, Council on Foreign Relations. Independent Task Force Report Number 76, 2018.

35 HarvardX and MITx: Two Years of Open Online Courses. Andrew Ho et al., HarvardX Working Paper Number 10, March 2015.

36 Stifterverband, Hochschulbildungsreport 2020, 2017, hochschulbildungsreport2020.de/.

37 Transferability of Skills Across Economic Sectors. European Commission, 2011.



Conclusion & Outlook

As breakthroughs in technology rapidly cross the divide between work tasks performed by humans and those performed by machines and algorithms, the future of work is headed for major transformation. Predicting the future is impossible—the exact timing and impact of these transformations, the jobs that will be lost to machines, and the new jobs that will emerge are yet to be imagined. Yet, the potential shifts and disruptions mean that we live in a time of great promise and great peril. These transformations, if managed wisely, could lead to a new age of promise: good work, good jobs, and improved quality of life for all. But, if managed poorly, this exponential shift could lead to peril: the risk of widening skill gaps, greater inequality, and broader polarization.³⁸

The time to shape our future is now.

By examining imminent technological disruptions, we are able to anticipate changes in the future of work—the nature of jobs and shift in skills—that will place significant challenges over many years on how we work and live. Lifelong learning, formal and informal, will be vital for preparing the global workforce to thrive in this uncertain future. The 20th century model of transmission and acquisition designed to produce a workforce for jobs that no longer exist will fall short of meeting the challenges ahead. The jobs of the future will be the ones that machines cannot replicate. Future jobs will leverage human skills of critical thinking, collaboration, communication, and creativity. We will need emotionally intelligent workers with technological fluency who can work alongside machines.

We will need to reimagine learning by equipping our people with 21st century skills and knowledge in authentic learning environments where learners socially construct their own knowledge, where learning is experiential and situated within a professional and social context, *where learning is doing*. As self-directed learning expands and new credentialing systems expand, proof of competency will be in the real-world work portfolios and showcase of *skills*, the new currency.

With technology adoption climbing at an exponential rate, a notable increase in worldwide internet use and broadband connectivity, and predicted gains in global consumers' technological fluency, we will need to deliver reimagined digital learning to the world's citizens on the devices and channels they prefer so that learning can be accessed by anyone, anytime, anywhere, and on any device.

The global convergence of workforce development, technology, and learning has arrived. And, the time is now for a convergent solution that will accelerate the skills needed to thrive in the future workforce.



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