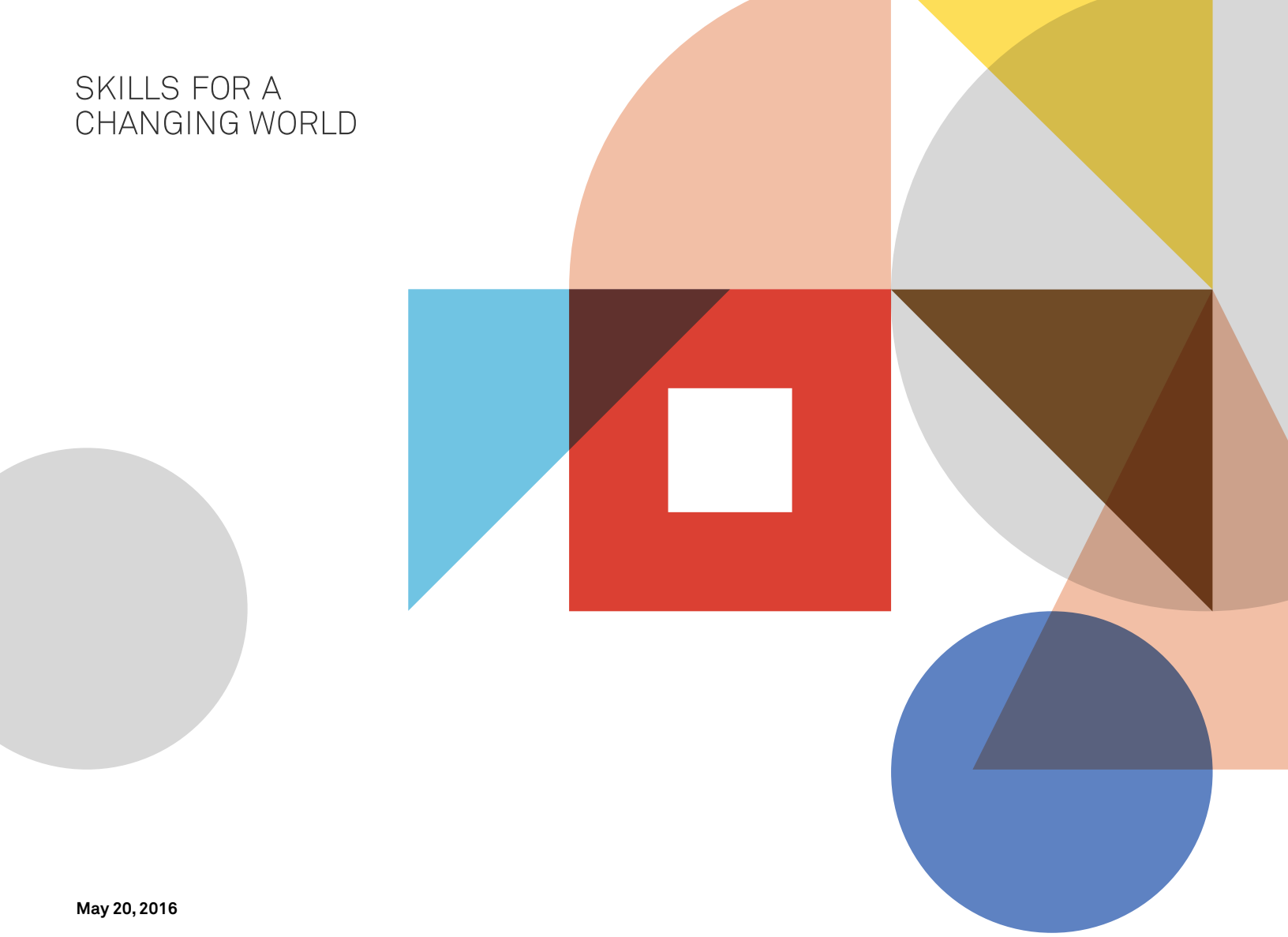
SKILLS FOR A
CHANGING WORLD



May 20, 2016

Skills for a Changing World:

Advancing Quality Learning for Vibrant Societies

Rebecca Winthrop and Eileen McGivney

Rebecca Winthrop is a Senior Fellow and
Director of the Center for Universal Education at Brookings

Eileen McGivney is a Research Analyst at the
Center for Universal Education at Brookings

Skills for a Changing World is a project of the Center for Universal Education at Brookings and the LEGO Foundation that seeks to ensure all children have high-quality learning opportunities that build the breadth of skills needed to create a productive, healthy society in the face of changing social, technological, and economic demands.

Acknowledgments

We owe special thanks to Priya Shankar for her invaluable research assistance on this paper. We would also like to thank our colleagues who generously contributed thoughts and guidance, especially Kate Anderson, Esther Care, Kathy Hirsh-Pasek, and Timothy P. Williams.

Support for this publication and research effort was generously provided by the LEGO Foundation.

Preparing Children for the Future

How can we best prepare children for success in their lives and livelihoods? From hunter-gatherer societies to early civilizations, and into modernity, generations have grappled with this key question. As they do, our definition of what counts as a high quality education has evolved, as have the sites used to prepare children for their future.

Peter Gray, an educational psychologist who has studied hunter-gatherer education as far back as 10,000 B.C. says, "Children had to learn an enormous amount to become effective adults."[1] Communities of old taught children survival skills like crafting tools, tracking animals, distinguishing edible from poisonous plants, and how to negotiate with other groups and learn the social dynamics of their own. The ancient Greeks educated youth in part through "skhole,"—the root for the English word "school." Here the intention was to develop free men into good citizens who could apply classroom knowledge through debate and critical thinking.[2] The Protestant Church added an impetus for spreading education to the masses because they believed literacy was an important tool for religion. Thus education was for a broad group and came to promote reading along with religious and moral values.[3] Until the 20th century the Gurukula training system in India paired students with gurus to live with and learn from them spiritual, academic and artistic skills, where "learning was a continuous process, and the ultimate target was self-refinement and self-realization."[4] With the Industrial Revolution came the need for occupation-driven education through apprenticeships, whereby youth learned trades and skills for work.[5] However, 20th century schooling focused broadly on preparing children in core competencies such as reading, writing, and arithmetic, something deemed important for the changing nature of work.[6]

Throughout history families, employers, and communities have asked what skills and competencies children need to fit into the larger society and how to best cultivate those very skills. Our current world and the changes coming in the future require education to prepare children for a world of rapid change in technology, increasing interconnectedness, and new forms employment. No longer is the focus on mastering content knowledge sufficient in the age of Google. Thriv-

ing in today's fast changing world requires breadth of skills rooted in academic competencies such as literacy, numeracy and science, but also including such things as teamwork, critical thinking, communication, persistence, and creativity. These skills are in fact interconnected. As young people are better able to manage their emotions, for example, their ability to focus helps them learn to read and by working on science projects together they learn how to collaboratively solve problems. This interplay of skills is central to both the concept of breadth of skills as well as to the educational strategies needed to help young people cultivate them. Ultimately, young people today must be agile learners, able to adapt and learn new things quickly in a new fast-changing environment.

In short, the world is constantly changing. It always will be. But recognizing the nature of these changes is key to examining the current context in which we live, and the major changes to be expected in our future that should inform how we think of education today. Within this context, a key concept is respect for the breadth of skills. Many stakeholders have articulated the need for the breadth of skills approach. It is now central that we explore how to align those aspirations with delivery of education.

© UN PHOTO/MARCO DORMINO

Global Context:

Living in a Changing World

Throughout time, education has been the way human beings pass down knowledge, values, and culture to subsequent generations. Yet, contextual factors define what kind of change each era faces, and what tools are needed to best deal with that change. Currently, there are changes in at least three notable domains with major implications for education: technology, work, and globalization. Within each of these domains there is promise for a better future where the world is more connected, efficient and equal. However each also has a flip side, perils that can come with rapid change leave large communities behind and fail to maximize every member of society's potential. Today and in the future, we will need young people who are prepared to harness these promises and mitigate these challenges.

Technology

Technology from the wheel to the printing press to the mobile phone has shaped human history and will undoubtedly continue to do so. Today, computers and the digital revolution are spreading across the globe, creating connections we have never before imagined and possibilities and perils only before dreamed of in science fiction. Whether it is called the second machine age, the Digital Revolution, or the 4th Industrial Revolution, technologists, economists and academics are all concerned with recent rapid technological advances and what they imply for the future. While artificial intelligence, exponential increases in computing power, and expanding mobile networks hold promise to make our lives easier and safer, they also threaten to leave those at the bottom even farther behind if not evenly distributed.

In their account of technological evolution, MIT technology and business experts Eric Brynjolfsson and Andrew McAfee argue that the Digital Revolution is transforming people's relationship to cognitive or mental work much in the same way the Industrial Revolution transformed people's relationship with physical work.[7] For example, even a decade ago the ability of a self-driving vehicle to navigate a car through traffic, identify other cars around it, and maneuver amidst other drivers seemed far too complex. Yet recent advances in artificial intelligence have put Google's self-driving cars on the road. IBM's Watson, a computer with multiple artificial intelligence applications, has managed not just to beat a human in chess, but also win *Jeopardy!*, "a game that requires not only encyclopedic recall, but also the ability to untangle convoluted and often opaque statements."[8] It is not just that technology can do what we previously needed humans for but also that machines are increasingly working together without human interaction at all. The Internet of Things (IoT) does this by connecting objects, appliances and devices online: A car can automatically navigate to your next calendar appointment; an alarm clock can alert a coffee maker; and your refrigerator can order more milk when you run out. While these may seem like mundane examples, the potential to transform our world is tremendous. IoT enables our devices and objects to become active participants in our environment "capable of recognizing events and changes in their surroundings and are acting and reacting autonomously largely without human intervention in an appropriate way."[9] Six years ago the number of connected "things" surpassed the number of people in the world, and it is estimated by 2020 50 billion devices and objects will be on IoT.[10]

Many of these technological advancements have followed and even outpaced Moore's Law, the observation in 1965 by the cofounder of Intel Gordon Moore that computing power will double every two years.[11] Since its original conception, the law has been found to be applicable to more technologies than the original estimation for transistors, including supercomputer efficiency and internet speeds. It has also been applicable much longer than initial predictions, and instead is expected to describe advancements well into the future. In the words of Brynjolfsson and McAfee, this is central for how digital technology will progress and shape our world in a different way than previous innovations: "While transistors and the other elements of computing are constrained by the laws of physics just like cars, airplanes, and swimmers, the constraints in the digital world are much looser."[12] They further describe that digitization--the process turning information and media like text, video, photos and sound into the code that is understood by computers--is moving much faster than Moore's Law would even predict. This combined with the exponential increases in computing power place us at an inflection point in history where technology promises to bring momentous change to our world.

Importantly, these advances in technology are by no means reserved for industrialized countries. Thanks to mobile phones, experts estimate that this type of technology can reach every person in the world. One estimate finds that, by 2020, more people in the world will have smart phones than electricity.[13] Already today, 70 percent of households in the bottom fifth of the population have mobile phones, providing their main source of internet access, in developing countries.[14] The improvements in technology have helped increase access and decrease prices, and the average mobile subscriber cost decreased by 99 percent from 2005 to 2013.[15] Developing countries have been able to "leapfrog," or bypass hard-wired communications technology into much cheaper digital technology. A recent study by Afro Barometer found that in 35 African countries cell phone service coverage has spread much faster than other utilities. More citizens had access to cellphone service than electricity, piped water, paved roads, or sewerage.[16] This has already spurred numerous innovations from solar-powered phone chargers to low energy consuming lights to mobile banking, where countries such as Kenya are the global leaders.

The increased connectivity has changed the pace at which knowledge and information are dispersed, opening up access to people around the globe of all socioeconomic levels. Google's partnership with libraries around the world, for example, has digitized and made available online 20 million books previously confined to the walls of elite institutions.[17] A movement for open educational resources has taken shape so course materials can be shared broadly at no cost, revolutionizing distance education and even heralded as a "social transformer."[18] These developments are especially promising for those who traditionally have not been able to access quality higher education. For example, recent research has shown a large share of Massive Open Online Courses' user base in developing countries are from low- and middle-income groups, and have a higher percentage of female users than elsewhere.[19]

The promises of these new technologies are enormous, for example diagnosing diseases and prescribing treatment without human error or deploying systemically programmed devices that can make our cities "smarter" and safer. Yet there are potential downsides as well. Privacy and data security issues are deeply debated, as are questions of automation and job loss.[20]

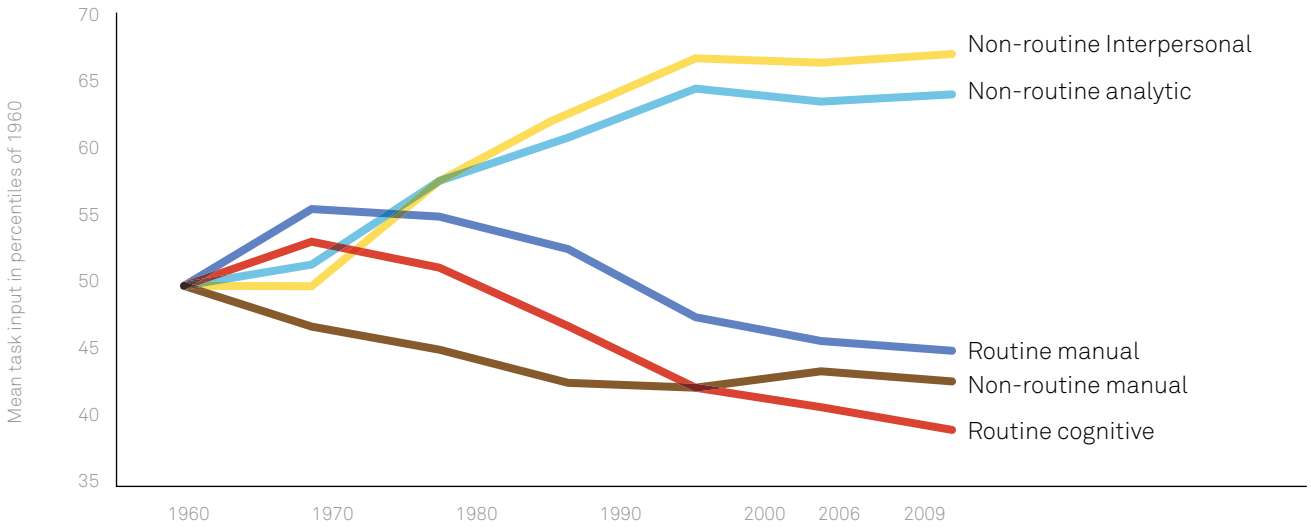
Work

The way we work is being redefined for future generations. Harvard economists have shown that automation has "hollowed out" the U.S. labor market over the last 50 years. As **Figure 1** shows, jobs that require mostly routine tasks are decreasing, including routine "cognitive" skills like accounting as well as routine manual skills like those on an assembly line.[21] This means that many of the jobs that arose in the 20th century have been increasingly automated since 1960. Jobs requiring analytical and interpersonal skills, or "non-routine" skills, are on the rise and taking a larger share of the labor market.[22]

This is not a phenomenon unique to the U.S. economy. Research from the World Bank has demonstrated similar findings using data for 30 other countries, both low- and high-income, showing jobs requiring non-routine skills are globally on the rise. Interestingly, the cross-country comparison shows that in many middle-income countries routine cognitive skills are still of high importance, in contrast to trends in high-income countries where these have been automated.[23] However, this may be only a matter of time as countries continue to increase their income levels, while analytical and interpersonal skills will likely become more important. For most countries manual skills are decreasing or staying stable and are expected to become less and less important over time.

Increased automation has been accompanied with other shifts in the workforce. The report *The Future of*

Figure 1 **Non-routine Tasks on the Rise in the U.S. Labor Market**



Source: David H. Autor and Brendan M. Price. "The Changing Task Composition of the US Labor Market: an Update of Autor, Levy and Murnane (2003)". MIT Mimeograph, Massachusetts Institute of Technology, 2013.

Jobs prepared for the World Economic Forum describes how businesses are already experiencing the impact of changing business models such as flexible work schedules, the sharing economy and technological change.[24] In many ways these have made employees' and employers' lives easier, by allowing for remote work, increasing connectivity, and helping find employees with the right skills. It has also provided choice for consumers and made use of our resources more efficient, as Uber has done with maximizing the cars on the road and Airbnb with unused housing space.

However, automation and other changes to the world of work also can have many negative consequences. The demonstrations of taxi drivers against Uber in cities across the world are just one indication of this issue. Unemployment continues to rise as technology disrupts labor markets and automation increases globally. *The Global Risks Report 2016* analyzed the largest risks the world is currently facing, and unemployment and underemployment are the top risk in 31 countries. It reported, "With a growing mismatch between the skills demanded by the fast-changing jobs market and those possessed by unemployed workers, businesses are struggling to recruit workers with the capabilities they need," and massive unemployment can lead to social unrest and global instability.[25] Into the future, technology will be capable of many more tasks that previously required a human element, putting more and more people out of work across those that we consider high- and low-skilled occupations, including doctors, lawyers, and taxi drivers.

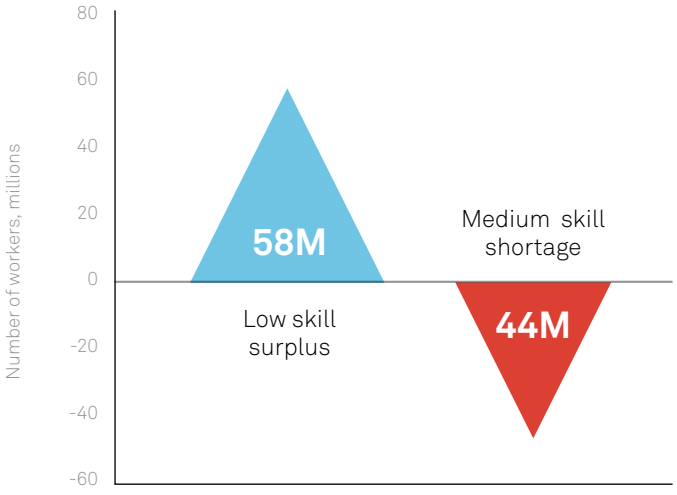
The skills mismatch and hiring talent is of great concern to employers around the globe. The Manpower Survey, the largest global survey of employers covering 42 countries in developed and developing regions,

finds that they struggle to find candidates with the right mix of skills even in countries where education levels are high. While many employers cite lack of technical skills, such as those from STEM fields or vocational skills, in the latest survey 17 percent of employers find "lack of workplace competencies" like communication and teamwork, a barrier to hiring talent.[26] The World Bank's Enterprise Surveys have also found that inadequate skills are a major constraint to businesses' productivity and development.[27] The current situation points to a skills mismatch that will have serious repercussions into the future.

The mismatch of skills is amplified by many demographic shifts. For example according to McKinsey, between 2010 and 2030, 60 percent of the increase in the workforce will come from India, Africa and Southern Asia, regions where school attainment are lagging behind. Additionally, highly-educated regions like North America and Europe will see a decline in working-age adults as their population ages. In sub-Saharan Africa and South Asia, these demographic changes, combined with the unequal distribution of education, are causing a surplus of low-skilled workers—58 million more than jobs to fill in 2020—and a shortage of medium-skilled workers—44 million fewer than needed in 2020, as **Figure 2** shows.[28]

Figure 2

For 11 countries in South Asia and sub-Saharan Africa there is a large skills gap projected by 2020



Source: Richard Dobbs, Anu Madgavkar, Dominic Barton, Eric Labaye, James Manyika, Charles Roxburgh, Susan Lund, Siddarth Madhav. The World at Work: Jobs, Pay and Skills for 3.5 Billion People. McKinsey Global Institute, 2012.

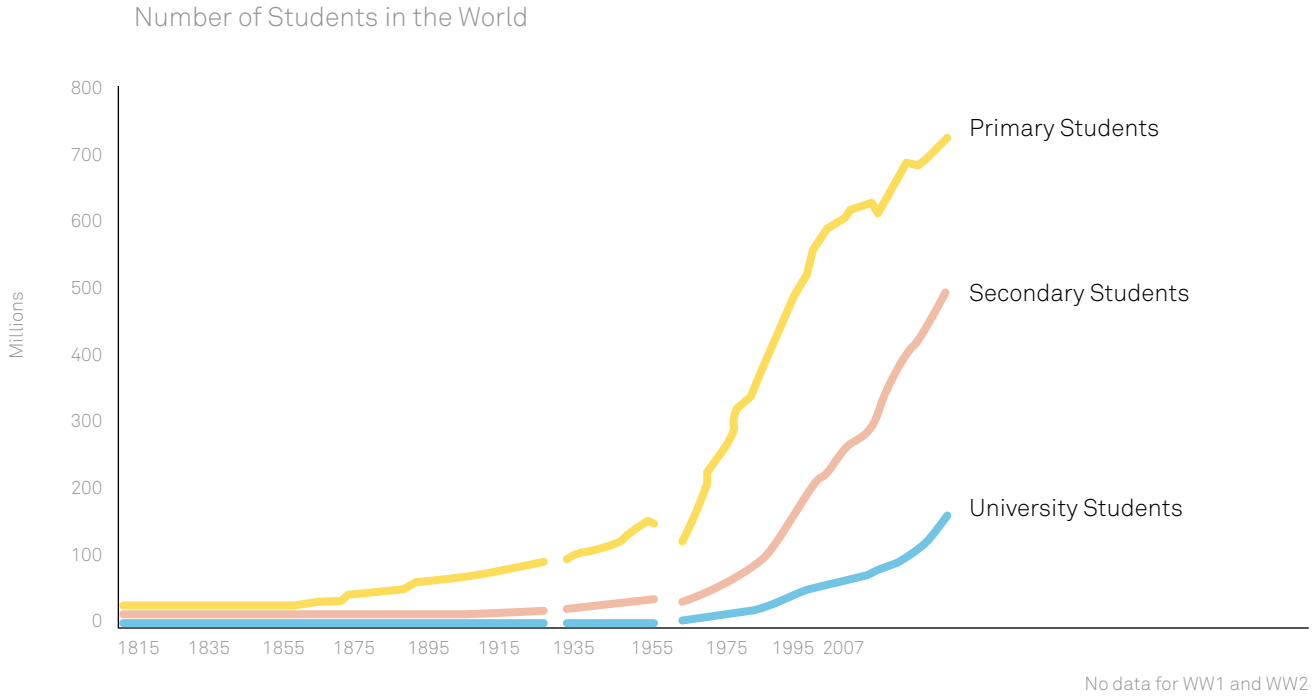
Globalization

The current era of globalization has transformed the landscape of how goods and information flow. This not only helps us connect with people and places far from our shores and allows fresh fruit to be consumed in winter, it also enables important solutions to pressing problems. For example, in health, solutions in the Global North such as vaccine and drug production have been providing improved health in the Global South.[29] Global coordination has enabled quicker and more effective responses to rising health epidemics such as the Ebola Virus.[30] Globalization has also transformed trade. For example world exports grew about twice as fast as the world's average gross national product in the last 35 years of the 20th century.[31] These examples suggest the merits of globalization on individuals, on systems, and on markets.

At the same time, the impact of globalization remains uneven.[32] As the boundaries of communities and nations that contained our problems and solutions fade, we need new approaches to many of the most important issues today. We need young people who are not only well-versed in their chosen discipline but also who are creative and collaborative and can find ways to cross boundaries and address global problems from climate change to health epidemics to insecurity.

For one, many environmental problems do not have boundaries. The effects of climate change may be

Figure 3 **Schooling has spread rapidly in the last 200 years**



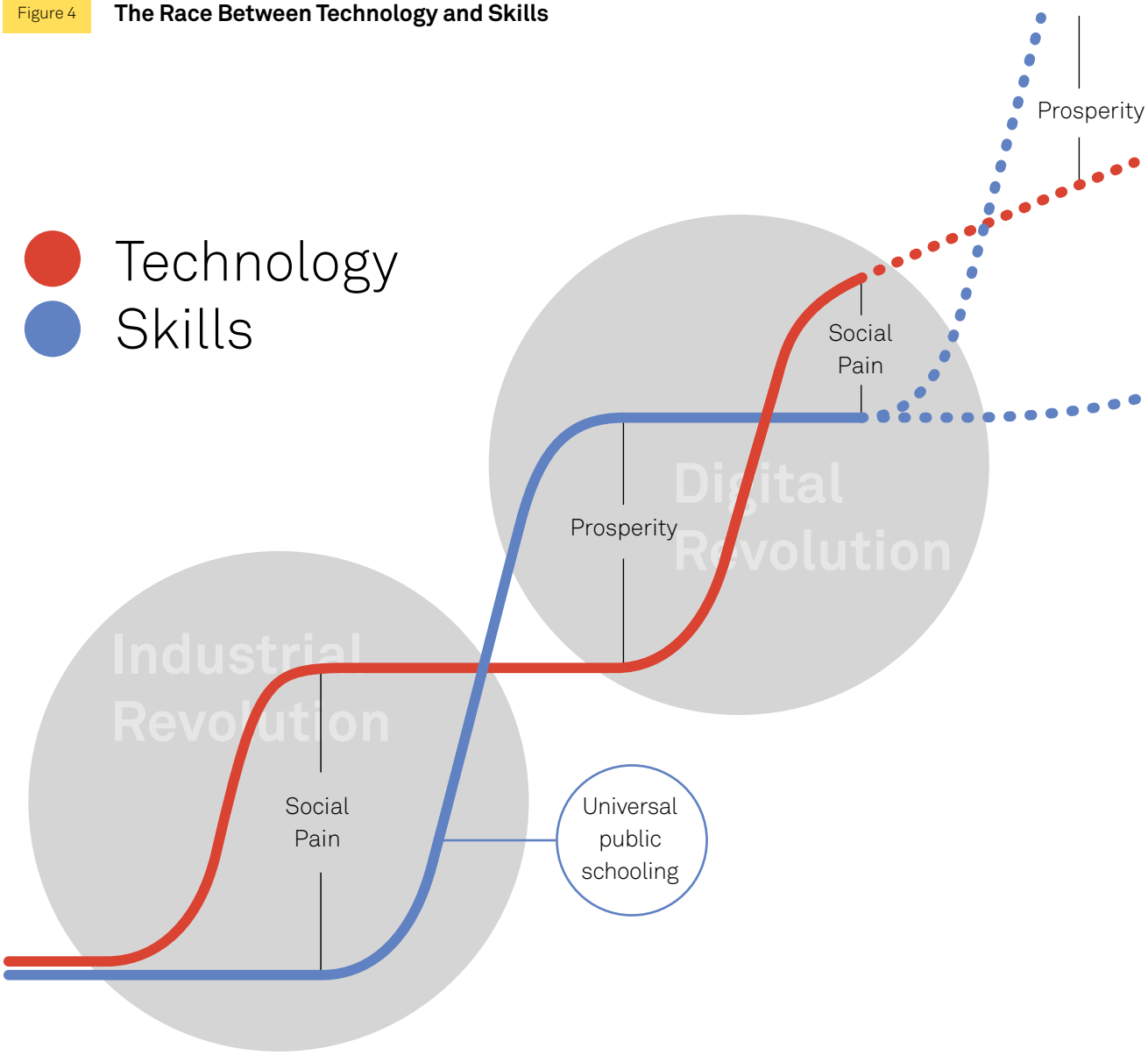
Source: Evan Schofer and John W. Meyer. "The Worldwide Expansion of Higher education in the twentieth century" American Sociological Review 70, no. 6 (2005): 898-920.

caused on one side of the globe and felt on the other. Small increases in the Earth's temperature can have a massive impact on the environment by creating extreme weather patterns, altered ecosystems, and risks to human health, food supply, and safety. A warmer planet also impacts agricultural and worker productivity, predicted to reduce global GDP more than 20 percent by 2100 if risks go unmitigated.[33]

Yet we have seen over the past few decades that national reductions in carbon emissions have not done enough to curb climate change. International coordination is necessary to seriously address the problem. The recent COP21 agreement demands greater collective action—from governments to citizens, from ministries of finance to ministries of environments, from the United Nations to the G-20, from the private sector to civil society. This is only compounded by rapid population growth, with the world's population predicted to reach 11.2 billion by 2100,[34] and doubling in urban areas by 2050.[35]

The environment is certainly not the only global issue that urgently needs cross-border solutions. The world is also facing a migrant and refugee crisis larger than any since the end of the Second World War, calling for a globally coordinated effort. At the end of 2014, the number of forcibly displaced populations, including refugees, internally displaced persons, asylum-seekers, and stateless people, rose to a staggering 59.5 million.[36] Conflict in Syria, ongoing violence in Iraq and Afghanistan, abuses in Eritrea, and poverty in Kosovo are all drivers of the refugee and migration crisis. The global nature of the problem calls for international coordination and a global solution. Christine Lagarde, the managing director of the International

Figure 4 **The Race Between Technology and Skills**



Source: Andreas Schleicher. "Skills: Global Trends, Challenges, and Opportunities." Presentation, Ljubljana, April 7, 2016. Inspired by Goldin and Katz, "The Race Between Education and Technology."

Monetary Fund, recently called for a "bigger, bolder, and broader approach," for international cooperation to stem humanitarian and economic toll, looking beyond national borders.[37]

How Can We Understand Education in This Context?

Knowing that every era of history has required education to fit its needs and unique context, what is the context that brought about our current education systems? Schooling, particularly universal or mass schooling as the main venue for education, is a relatively new phenomenon. As **Figure 3** shows, 200 years ago a very small portion of the world's population attended school. Outside Northern Europe and its offshoots, no region had more that 10 percent of children enrolled in primary school in the early 1800s.[38] But today more than 90 percent of children are in primary school across the globe.[39] The spread of schooling is an impressive example of scaling up, spreading in countries democratic and autocratic, with strong and weak economies, and varying levels of corruption.[40] As we have argued elsewhere, the major forces that drove every country to establish universal and compulsory education through the 20th century were the advent of the university as holder of knowledge, fostering nationalism, the human rights movement, and the industrial revolution's increasing technology in the workplace.[41]

The role of industrialization in creating our current model of schooling is especially important, and many continue to call our current schooling system a "factory model".[42] As manual labor became automated—turning manufacturing from a highly skilled vocation into mass production—the skills needed by workers changed. Turning from specialized vocational training to generalized curricula that focused on literacy, numeracy, arts, and sciences allowed workers to be more productive working with technology in "blue collar" occupations as well as "white collar" ones in services and office work.[43]

Education systems did not evolve overnight to respond to the new needs of the workforce. Andreas Schleicher from the Organisation for Economic Co-operation and Development has pointed out that historically we have seen lags between the technological progress in the Industrial Revolution and education's evolution, "as technological progress accelerated, education failed to keep pace, leaving vast numbers of people struggling to adapt to a rapidly changing world and contributing to widespread suffering. It took a century for public policy to respond with an effort to provide universal access to schooling."[44] **Figure 4,** inspired by economists Claudia Goldin and Lawrence Katz's work on the race between education and technology, shows how this progression leaves delays where education plays catch-up during periods of social pain, eventually leading to prosperity that comes from having the right combination of technology and skills. This echoes how technology has impacted industry itself, with lags between the invention of a technology and its ability to disrupt current systems of production so that it maximizes productivity.[45]

What is the Right Mix of Skills Needed for Today and into the Future?

Our current world presents a specific set of challenges. Technological innovations, changes in the workforce and the global nature of many problems we face require a big shift in our approach to how education is delivered. Information is exploding with some suggesting the global information base is doubling at a rapid pace—soon every 12 hours.[46] As author Daniel Pink and others have argued, the integration and navigation of information will be as important as the learning of content.[47] Young people will increasingly need to focus on making use of what they know and less on just mastering bodies of knowledge.

In the wake of these vast changes scientists, educators and policymakers have suggested a growing number of skill sets thought to prepare today's chil-

dren for tomorrow's challenges. The new demands of our societies require cultivating the breadth of skills. Breadth of skills refers to a range of important skills that include the basics that many education systems currently focus on, such as literacy, numeracy and content knowledge in academic subjects as well as information literacy, flexibility and problem solving.

In the age of information, a focus on breadth of skills can complement technology. The new digital economy requires individuals to be able to filter, analyze, and create meaning from the vast amounts of information available online. Skills like complex reasoning and creative thinking can empower individuals to take full advantage of opportunities in the digital world. Digital literacy also becomes essential and as societies continue to digitize, lacking digital skills will be like not knowing how to read and write. The Mozilla Foundation's map of web literacy outlines what digital literacy entails from navigating and exploring, to building content or coding, and collaborating with others and participating in online communities.[48]

As industries change and new jobs are created, young people will have to continue to learn new skills, many of which will require interpersonal skills like collaboration and communication as well as higher-order thinking and dependability.[49] Employers echo labor market analysis in saying that a combination of technical skills along with skills like communication and work ethic, is what jobs require but are lacking in the talent pool.[50] Google, for example, currently looks for employees whose top skills are learning ability and leadership—with content expertise falling at the bottom of their criteria.[51] Across the developing world higher-order thinking, social skills, and self-motivation are "highly valued by employers and supported by a strong base of research evidence."[52] To meet the demands of the workforce and mitigate rising levels of unemployment, skills that bring value to employers are crucial.

The global nature of our communications and the problems we face also requires young people to interact with diverse communities and be aware of how their actions impact others. In 2012, the U.N. Secretary General Ban Ki Moon in his global education initiative put forward a vision for global citizenship education that would "shape a sustainable future and better world… promote peace, mutual respect and environmental care."[53] Global citizenship prioritizes the cultivation of citizens who actively care about the world, who work together to solve problems, who are proactive contributors to more inclusive and peaceful societies.[54] As Bill Clinton put it, "creative networks of collaboration" [55] are key for mobilizing leaders, organizations, and resources across various sectors. Without a shared consciousness, the interconnected challenges of the 21st century will only continue to escalate.

Breadth of Skills

Knowing how to read and write is absolutely essential to interacting with the world, and research has shown that math and science skills are significant drivers of productivity. Recent work by economists Eric Hanushek and Ludgar Woessmann finds that if all countries possessed the skill level in these domains of Finland, often a top scorer on international exams, global economic growth could be 8.5-13.8 percent higher. [56] But importantly the breadth of skills necessary to be successful in today and in the future also encompasses a host of other skills and competencies, such as teamwork, collaboration, critical thinking, perseverance, communication, and so on.

A focus on breadth of skills means educating for a mastery of a wide range of competencies that will help mitigate the challenges posed by our changing world context. While many presume that there is a tension between teaching subject-specific content and teaching other skills like self-regulation, information literacy or problem solving, they are intrinsically interconnected.

Many educationalists have supported broad aims for education. More than 100 years ago pedagogy expert John Dewey wrote that he saw an unproductive divide between what he called two "sects:" those who saw education's purpose to focus on subject matter, and those who aimed for personality and character education to be the priority. Dewey instead argued for an approach encompassing both.[57] Even the inventors of standardized testing, which focused on what's known as the "cognitive" skills of literacy, numeracy and science, intended for assessments to move toward including broader sets of skills and competencies rather than continue to assess such a narrow snapshot.[58] In their recent book, Kathy Hirsh-Pasek and Roberta Golinkoff describe how breadth of skills interact and build off each other, synthesizing evidence on child development. Content is not learnable if communication skills are not in place, and critical thinking operates on content, not in a vacuum. In this way, the skills build on and reinforce one another. And any skill set proposed as a model of breadth must do the same.[59]

To accomplish this we also need to expand our conception of where and when learning happens. As education evolved from many different models in past generations into the current model of schooling, many assume that learning, education, and school are one in the same. But children are learning all the time, and it is imperative that we broaden education to include home and community environments rather than merely formal school environments. This naturally opens up a vision of education that can encompass life-long learning, starting from early childhood through adulthood.

Thinking Differently to Cultivate Breadth of Skills

Learning and cultivating breadth of skills requires us to rethink how we educate young people. For more than a century, the dominant form of education has been mass schooling, employing a teacher-centered, "knowledge transmission" model.[60] This is what will likely sound familiar to most as a definition of school. Teachers are responsible for imparting knowledge to students, generally placing them at the front of a classroom, with a chalkboard and rows of students facing them. This makes the role of the teacher a content expert and lecturer, the social and collaborative nature of learning is often ignored and learning is supposed to be an individual, "in-the-head" endeavor.[61]

Yet we know from education and learning experts that in order to reach a deeper level of understanding takes practice. It requires being able to demonstrate that knowledge learned in one setting can be transferred and applied in other contexts.[62] Active learning strategies that place the child at the center and allow them to guide and practice their own learning through projects, collaboration, and inquiry are effective ways for teaching content knowledge as well as developing a range of other competencies. Because skills build off one another, effective teaching and learning practices will teach children how to be good communicators and critical thinkers through literacy and numeracy education, what Nobel laureate James Heckman argues, "skill begets skill…learning begets learning."[63] So while many make distinctions between teaching content versus character, or "hard" skills versus "soft" skills, this is a false dichotomy.[64] In order to improve in science, literacy and numeracy we need to effectively foster the full breadth of skills. But doing so will take a big shift in our educational environments, both inside classrooms between teachers and students as well as outside the classroom.

Political Aspirations for Education that Promotes Breadth of Skills

In addition to educationalists and child development experts who argue that cultivating breadth of skills is centrally important for learners,[65] there is also longstanding and widespread political agreement

across ministries of education on this vision. For example, one study of OECD countries surveyed 36 countries and found that all of their national educational objectives and curriculum frameworks included social and emotional skills like working with others and managing emotions among their academic ambitions.[66] Similarly a recent book by Harvard educational researchers Fernando Reimers and Connie K. Chung finds that in the six countries studied each included in their mission, curriculum and standards elements of cognitive, interpersonal and intrapersonal skills as goals for their education systems.[67] A global study comparing curricula throughout the 20th century from around the world showed that in addition to math and language, the overwhelming majority of countries also include arts, some kind of moral or religious education, health and physical education, and technical training as well.[68]

Given the priority that so many national education systems give to breadth of skills, it should come as no surprise that this is reflected at the global level. For example, across multiple global agreements from human rights law to global development goals, there are many examples of political leaders articulating an education vision that places an emphasis on breadth. For example, the 1948 Universal Declaration of Human Rights laid out education as a human right, but did not limit the purpose of education to academic skills, and rather declared it "shall be directed to the full development of the human personality."[69] Subsequent human rights instruments from the 1966 International Covenant on Economic, Social, and Cultural Rights and the 1989 Convention on the Rights of the Child expand on this vision.[70] The world's education ministers have also articulated on multiple occasions an education vision that prioritizes a holistic education. In 1990 the World Declaration on Education for All affirmed that the focus of basic education must be on learning to reach one's fullest potential and on true learning acquisition. This vision was reaffirmed in 2000 with the Dakar Framework for Action.[71]

In this light, the global Millennium Development Goals (MDGs) appear to be an exception to the articulated aspiration for the breadth of skills. These goals were established in 2000 to unify global efforts toward solving eight world problems from poverty to HIV/AIDs to child mortality.[72] Education was also included and the focus was on expanding access to school and ensuring all girls and boys enroll in and complete primary school, channeling the world's attention to one important piece of the broader Education for All agenda. Indeed, much progress was made toward this goal with over 50 million more children entering primary school from 1999 to 2015.[73] But while children had more access to school, many were not learning. Increasingly data on the poor reading ability of many children who spent years in school began to paint a worrisome picture.[74] This issue was surfaced globally thanks to efforts on the ground from multiple actors, including those engaged in citizen assessments and those working to develop and adapt the *Early Grade Reading Assessment* tool that was open source and available to all to use. Ultimately, UNESCO's Global Monitoring Report estimated that 250 million children around the world are not learning the basics of literacy and numeracy, over half of whom have spent four years in school.[75]

In 2011, the UNESCO Institute of Statistics and the Center for Universal Education at the Brookings Institution jointly convened the Learning Metrics Task Force with the expressed goal of promoting access plus learning as the frame for the global education agenda. The task force sought to reintroduce the focus on learning into whatever global framework followed the MDGs by engaging in robust debates with many actors from policy makers to academics to teachers to students. Ultimately, after examining academic literature, inputs from diverse consultations across the globe, and existing global frameworks, the task force articulated a vision of learning they felt was relevant globally. They identified several domains of learning around which young people, no matter where they lived, should have the opportunity to cultivate

skills. These include literacy, numeracy, and science, but importantly also cover breadth of skills including social and emotional learning, communication, critical thinking, and creativity (see **Annex 1**).[76]

Today, the MDGs have been replaced by the Sustainable Development Goals, which were adopted by 193 countries in September 2015. This new set of global goals is much broader than the MDGs and covers a wide range of issues from health to women's empowerment to climate change. The education goal is focused on both access to education as well as the quality of learning and at its core emphasizes lifelong learning. The goals specifically mention literacy, numeracy, and breadth of other skills and competencies such as those related to early childhood development and those needed for education for sustainable development, global citizenship, and entrepreneurship.[77] The Sustainable Development Goals present an important political opportunity to make the big shift our current global context is calling for, namely improving the relevance of our education systems across breadth of skills.

Aligning Aspirations for Breadth of Skills with Education Delivery

Perhaps the most important question for us all now is how to help young people around the world cultivate breadth of skills. What types of teaching and learning experiences will build the competencies that young people need? How should we seek to accelerate progress to deliver on the world's aspirations, and global commitments, to doing just that?

The Center for Universal Education is embarking on a new project, Skills for a Changing World, to explore these questions. A central focus will be on how and where can children's learning take place to cultivate breadth of skills and what new models can help leapfrog progress and scale this to all young people, especially the most marginalized.

In formal learning contexts we focus on how the components of the education system can work together across curriculum, assessment, and pedagogy to conceptualize and implement learning attuned to today's needs. Formal education systems are just one element in a bigger ecosystem of learning. Informal learning environments are routinely present in the life of a child. These are provided at home by parents and caregivers and within communities in public spaces and learning institutions such as museums and libraries. Just as different areas of formal education systems must coordinate, society at large needs to work together across many areas of policy and public awareness.

Positive impact on society is possible only with equitable learning opportunities to develop breadth of skills. Every child needs the full range of skills to proactively adapt to changing demands in life, learning, and work. Marginalized groups such as poor girls and youth affected by violent conflict especially need breadth of skills to support them in life transitions and to break cycles of injustice they face.

We are also aware that existing models of education might not be enough to enable widespread transformation in an ecosystem that currently is not systematically helping all children and youth develop breadth of skills. As so many other industries have responded to the advancements made in technology and information, we seek to innovate education by exploring new models that more quickly accelerate the pace of change and effectively provide the quality learning that all children will require to lead fulfilling and healthy lives to contribute to vibrant societies.

ENDNOTES

1 Gray, Peter. "The evolutionary biology of education: How our hunter-gatherer educative instincts could form the basis for education today." *Evolution: Education and Outreach* 4, no. 1 (2011): 28-40.

2 Rihill, Tracey Elizabeth. "Teaching and Learning in Ancient Athens." *Greece & Rome* 50, no. 2 (2003): 168-190.

3 Soysal, Yasemin N. and David Strang. "Construction of the first mass education systems in nineteenth-century Europe." *Sociology of Education* 62 (1989): 277-288.

4 Kaladhara, V. "From Meditative Learning to Impersonal Pedagogy: Reflections on the transformation of an Indian Gurukula." Qui Parle: Critical Humanities and Social Sciences 20, no. 1 (2011): 207-218.

5 Bailyn, Bernard. Education in the forming of American society: Needs and opportunities for study. Vol. 3. New York: WW Norton & Company, 1972.

6 Khan, Salman. *The One World Schoolhouse: Education Reimagined*. New York: Twelve, 2012.

7 Brynjolfsson, Erik, and Andrew McAfee. *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. New York: WW Norton & Company, 2014.

8 Markoff, John. "Computer Wins on 'Jeopardy!': Trivial, It's Not." *New York Times*, February 16, 2011. Accessed May 18, 2016. http://www.nytimes.com/2011/02/17/science/17jeopardy-watson.html?pagewanted=all&_r=0.

9 IERC. *Internet of Things: Position Paper on the Standardization for IoT Technologies.* European Research Cluster on the Internet of Things Position Paper. Brussels: European Commission, 2015.

10 Federal Trade Commission. Internet of Things: Privacy and Security in a Connected World. Washington, D.C.: Federal Trade Commission, 2015. https://www.ftc.gov/system/files/documents/reports/federal-trade-commission-staff-report-november-2013-workshop-entitled-internet-things-privacy/150127iotrpt.pdf.

11 Brynjolfsson, Erik, and Andrew McAfee. *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. New York: WW Norton & Company, 2014.

12 Brynjolfsson, Erik, and Andrew McAfee. *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. New York: WW Norton & Company, 2014.

13 Cisco. Cisco Visual Networking Index: Global Mobile Data Traffic Forecast Update, 2015-2020. White Paper. San Jose, CA: Cisco, 2016. http://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/mobile-white-paper-c11-520862.html.

14 World Bank. *World Development Report 2016: Digital Dividends*. Washington, D.C.: World Bank, 2016. http://wwwwds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2016/01/13/090224b08405ea05/2_0/Rendered/PDF/World0developm0000digital0dividends.pdf.

15 Bezarra, Julio et al. *The Mobile Revolution: How Mobile Technologies Drive a Trillion-Dollar Impact.* Boston, MA: Boston Consulting Group, 2015. https://www.bcgperspectives.com/content/articles/telecommunications_technology_business_transformation_mobile_revolution/.

16 Mitullah, Winnie V., Romaric Samson, Pauline M. Wambua, and Samuel Balongo. *Building on progress: Infrastructure developments still a major challenge in Africa*. Afrobarometer Round 6, Dispatch No. 69. Ghana: Afrobarometer, 2016.

17 Google. "Google Books." Accessed May 16, 2016. https://www.google.com/googlebooks/library/.

18 Wiley, David, Tom Caswell, Shelley Henson, and Marion Jensen. "Open Content and Open Educational Resources: Enabling universal education.." *International Review of Research in Open and Distance Learning* 9, no. 1 (2008).

19 Garrido, Maria, Lucas Koepke and Scott Anderson. *The Advancing MOOCs for Development Initiative: An examination of MOOC usage for professional workforce development in Colombia, the Philippines, and South Africa*. Seattle: Technology & Social Change Group, University of Washington Information School, 2016.

20 Federal Trade Commission. *Internet of Things: Privacy and Security in a Connected World*. FTC Staff Report. Washington, D.C.: Federal Trade Commission, 2015. https://www.ftc.gov/system/files/documents/reports/federal-trade-commission-staff-report-november-2013-workshop-entitled-internet-things-privacy/150127iotrpt.pdf.

21 Autor, David H., Frank Levy, and Richard J. Murnane. "The Skill Content of Recent Technological Change: An Empirical Exploration." No. w8337. National Bureau of Economic Research, Cambridge, MA, 2001.

22 Autor, David H. and Brendan M. Price. "The Changing Task Composition of the US Labor Market: an Update of Autor, Levy and Murnane (2003)". MIT Mimeograph, Massachusetts Institute of Technology, 2013.

23 Aedo, Cristian, Jesko Hentschel, Martin Moreno, and Javier Luque. "From occupations to embedded skills: a cross-country comparison." *World Bank Policy Research Working Paper* 6560, World Bank, Washington, D.C., 2013.

24 World Economic Forum. *The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution.* Geneva: World Economic Forum, 2016.

25 World Economic Forum. *The Global Risks Report 2016*. Geneva: World Economic Forum, 2016.

26 ManpowerGroup. *2015 Talent Shortage Survey.* Milwaukee, WI: Manpower Group, 2015. http://www.manpowergroup.com/wps/wcm/connect/db23c560-08b6-485f-9bf6-f5f38a43c76a/2015_Talent_Shortage_Survey_US-lo_res.pdf?MOD=AJPERES.

27 World Bank. *World Bank Enterprise Surveys*. Washington D.C.: World Bank, 2016. http://www.enterprisesurveys.org/.

28 Dobbs, Richard, Anu Madgavkar, Dominic Barton, Eric Labaye, James Manyika, Charles Roxburgh, Susan Lund, Siddarth Madhav. *The World at Work: Jobs, Pay and Skills for 3.5 Billion People*. New York: McKinsey Global Institute, 2012.

29 Ruth Levine, What Works Working Group, Molly Kinder. *Millions Saved: Proven Successes in Global Health* Washington, D.C.: Center for Global Development, 2004.

30 World Health Organization. *Health in 2015: from MDGs to SDGs*. Geneva: World Health Organization, 2015.

31 Soubbotina, Tatyana P. *Beyond Economic Growth: An Introduction to Sustainable Development*. Washington, D.C.: The World Bank, 2004.

32 Birdsall, Nancy. *Asymmetric Globalization: Global Markets Require Good Global Politics*. Washington, D.C.: Brookings Institution, 2003. http://www.brookings.edu/research/articles/2003/03/spring-development-birdsall.

33 Burke, Marshall. "The global economic costs from climate change may be worse than expected." Brookings Institution (blog), December 9, 2015. http://www.brookings.edu/blogs/planetpolicy/posts/2015/12/09-global-economic-costs-from-climate-change-worse.

34 United Nations, Department of Economic and Social Affairs, Population Division. *World Population Prospects: The 2015 Revision, Key Findings and Advance Tables.* Working Paper No. ESA/P/WP.241 New York: United Nations, 2015. http://esa.un.org/unpd/wpp/publications/files/key_findings_wpp_2015.pdf.

35 World Economic Forum. *The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution*. Geneva: World Economic Forum, 2016.

36 UNHCR. *Global Trends Report: World at War*. Geneva: United Nations High Commissioner for Refugees, 2015. http://www.unhcr.at/fileadmin/user_upload/dokumente/02_unhcr/events/Global_Trends_2014.pdf

37 International Monetary Fund. "Conflicts and the Refugee Crisis: An International Call for Action." IMF Seminars Event Video. Washington, D.C.: International Monetary Fund, April 15th 2016. http://www.imf.org/external/POS_Meetings/SeminarDetails.aspx?SeminarId=118.

38 Dorius, Shawn F. "The Rise and Fall of Worldwide Education Inequality from 1870 to 2010 Measurement and Trends." *Sociology of Education* 86, no. 2: (2013): 158-173.

39 UNESCO. *Education for All 2000-2015 Achievements and Challenges*. Education for All Global Monitoring Report. Paris: UNESCO Publishing, 2015.

40 Pritchett, Lant. *The Rebirth of Education: Schooling Ain't Learning*. Washington, D.C.: Center for Global Development, 2013.

41 Winthrop, Rebecca and Eileen McGivney. *Why Wait 100 Years? Bridging the Gap in Global Education.* Washington, D.C.: Brookings Institution, 2015.

42 Khan, Salman. *The One World Schoolhouse: Education Reimagined*. New York: Twelve, 2012.

43 Goldin, C.D. and L.F. Katz. *The Race Between Education and Technology*. Cambridge, MA: Harvard University Press, 2007.

44 Schleicher, Andreas. "How can we equip the future workforce for technological change?" World Economic Forum Agenda (blog), December 17, 2015, https://www.weforum.org/agenda/2015/12/how-can-we-equip-the-future-workforce-for-technological-change

45 Brynjolfsson, Erik and Andrew McAfee. *The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies*. New York: WW Norton & Company, 2014.

46 IBM. *The Toxic Terabyte: How Tata-Dumping Threatens Business Efficiency*. London: IBM United Kingdom Limited, 2006.

47 Pink, Daniel H. *A Whole New Mind: Why Right-Brainers will Rule the Future.* New York: Riverhead Books, 2005.

48 Mozilla. "Why Mozilla Cares about Web Literacy." Accessed May 2, 2015. http://mozilla.github.io/webmaker-whitepaper/.

49 Lippman, Laura et al. Key *'Soft Skills' that Foster Youth Workforce Success: Toward a Consensus*. Washington, D.C.: Child Trends, 2015.

50 ManpowerGroup. *2015 Talent Shortage Survey*. Milwaukee, WI: Manpower Group, 2015. http://www.manpowergroup.com/wps/wcm/connect/db23c560-08b6-485f-9bf6-f5f38a43c76a/2015_Talent_Shortage_Survey_US-lo_res.pdf?MOD=AJPERES.

51 Friedman, Thomas L. "How to Get a Job at Google." *New York Times*, February 22, 2014. Accessed May 16, 2016. http://www.nytimes.com/2014/02/23/opinion/sunday/friedman-how-to-get-a-job-at-google.html.

52 Lippman, Laura et al. *Key 'Soft Skills' that Foster Youth Workforce Success: Toward a Consensus.* Washington, D.C.: Child Trends, 2015.

53 UNESCO. "Global Citizenship Education: An Initiative of the Secretary-General." Accessed May 16, 2016. http://www.unesco.org/new/en/gefi/about/an-initiative-of-the-sg/.

54 UNESCO. "Global Citizenship Education." Accessed May 16, 2016. http://en.unesco.org/gced/.

55 Clinton, Bill. *Clinton Foundation 2012 Annual Report*., New York: Clinton Foundation, 2013.

56 Hanushek, Eric A., and Ludger Woessmann. *The Knowledge Capital of Nations: Education and the Economics of Growth*. Cambridge: MIT Press, 2015.

57 Dewey, John. *The Child and the Curriculum*. Chicago: University of Chicago Press, 1902.

58 Kamenetz, Anya. *The Test: Why Our Schools are Obsessed with Standardized Testing But You Don't Have to Be*. New York: Public Affairs, 2015.

59 Hirsh-Pasek, Kathy and Roberta Golinkoff. *Becoming Brilliant: What Science Tells us About Raising Successful Children*. APA Lifetools: Books for the General Public. Washington, D.C.: American Psychological Association, 2016.

60 Vosniadou, Stella. *How Children Learn*, Education Practices Series-7. Washington D.C.: International Bureau of Education, 2001.

61 Vosniadou, Stella, and Xenia Vamvakoussi. "Examining mathematics learning from a conceptual change point of view: Implications for the design of learning environments.", in Verschaffel, Lieven et al. *Instructional Psychology: Past, present, and future trends–Sixteen essays in Honour of Erik De Conte (Advances in Learning and Instruction),* Oxford, UK: Elsevier Science Ltd.

62 Vosniadou, Stella. *How Children Learn*, Education Practices Series-7. Washington D.C.: International Bureau of Education, 2001.

63 Heckman, James. *The Economics of Investing in Children*. Dublin: UCD Geary Institute, 2006. http://www.ucd.ie/geary/static/publications/policybriefings/geary_report1.pdf.

64 Grob-Zakhary, Randa. "Challenging the Myth of Content vs. Character Education in the Age of Common Core." Brookings Institution (blog), January 13, 2015. http://www.brookings.edu/blogs/education-plus-development/posts/2015/01/13-content-character-education-grob-zakhary.

65 See, for example: Zull, James Ellwood. *The art of changing the brain: Enriching teaching by exploring the biology of learning*. Sterling, VA: Stylus Publishing, LLC., 2002.; Mikulas, William L. *Psychology of Learning: Readings.* Chicago: Nelson-Hall Inc., 1977.; Cozolino, Louis. *The Social Neuroscience of Education: Optimizing Attachment and Learning in the Classroom (The Norton Series on the Social Neuroscience of Education)*. New York: WW Norton & Company, 2013.; McClelland, Megan M., Claire E. Cameron, Carol McDonald Connor, Carrie L. Farris, Abigail M. Jewkes, and Frederick J. Morrison. "Links between behavioral regulation and preschoolers' literacy, vocabulary, and math skills." *Developmental psychology* 43, no. 4 (2007): 947.; Vosniadou, Stella. *How Children Learn*. Education Practices Series-7. Washington D.C.: International Bureau of Education, 2001.

66 OECD. *Skills for Social Progress: The Power of Social and Emotional Skills*, OECD Skills Studies. Paris: OECD Publishing, 2015.

67 Reimers, Fernando M. and Connie K. Chung. *Teaching and Learning for the Twenty-First Century.* Cambridge, MA: Harvard Education Press, 2016.

68 Benavot, Aaron, Yun-Kyung Cha, David Kamens, John W. Meyer, and Suk-Ying Wong. "Knowledge for the masses: World models and national curricula, 1920-1986." *American Sociological Review* (1991): 85-100.

69 UN General Assembly, Resolution 217A, "Universal Declaration of Human Rights,". 1948 http://www.un.org/en/universal-declaration-human-rights/.

70 UN. General Assembly, Resolution 2200A (XXI), "International Covenant on Economic, Social and Cultural Rights,", December 16, 1966. Human Rights Office of the High Commissioner and UN General Assembly, Resolution 44/25, "Convention on the Rights of the Child.", November 20, 1989.

71 UNESCO. *World Declaration on Education For All and Framework for Action to Meet Basic Learning Needs.* Paris: UNESCO, 1990. http://unesdoc.unesco.org/images/0012/001275/127583e.pdf/.

72 United Nations. *Millennium Development Goals Report 2015.* New York: United Nations, 2015. http://www.un.org/millenniumgoals/.

73 UNESCO. *Education for All 2000-2015 Achievements and Challenges*. Education for All Global Monitoring Report. Paris: UNESCO, 2015. http://unesdoc.unesco.org/images/0023/002322/232205e.pdf.

74 Gove, Amber, and Peter Cvelich. *Early reading: Igniting Education for All*, A report by the Early Grade Learning Community of Practice. Research Triangle Park, NC: Research Triangle Institute, 2011.

75 UNESCO. *Teaching and Learning: Achieving Quality for All*. Education For All Global Monitoring Report. Paris: UNESCO, 2014. http://unesdoc.unesco.org/images/0022/002256/225660e.pdf.

76 LMTF. *Toward Universal Learning: Recommendations from the Learning Metrics Task Force.* Montreal and Washington: UNESCO Institute of Statistics and Center for Universal Education at Brookings, 2013.

77 The Global Goals for Sustainable Development. "Goal 4: Quality Education." Accessed April 13, 2016. http://www.globalgoals.org/global-goals/quality-education/.

Annex 1: Learning Metrics Task Force Global Framework of Learning Domains

Note: This framework is intended for the purpose of the Learning Metrics Task Force to identify areas in which to measure learning outcomes. It is not intended to be used as a framework for policymaking, curriculum or instruction.

	Physical Well-Being	Social and Emotional Development	Culture and the Arts
Postprimary Level	• HEALTH AND HYGIENE • SEXUAL AND REPRODUCTIVE HEALTH • ILLNESS AND DISEASE PREVENTION	• SOCIAL AWARENESS • LEADERSHIP • CIVIC ENGAGEMENT • POSITIVE VIEW OF SELF AND OTHERS • RESILIENCE/"GRIT" • MORAL AND ETHICAL VALUES • SOCIAL SCIENCES	• CREATIVE ARTS • CULTURAL STUDIES
Primary Level	• PHYSICAL HEALTH AND HYGIENE • FOOD AND NUTRITION • PHYSICAL ACTIVITY • SEXUAL HEALTH	• SOCIAL AND COMMUNITY VALUES • CIVIC VALUES • MENTAL HEALTH AND WELL-BEING	• CREATIVE ARTS • CULTURAL KNOWLEDGE
Early Childhood Level	• PHYSICAL HEALTH AND NUTRITION • HEALTH KNOWLEDGE AND PRACTICE • SAFETY KNOWLEDGE AND PRACTICE • GROSS, FINE, AND PERCEPTUAL MOTOR	• SELF-REGULATION • EMOTIONAL AWARENESS • SELF-CONCEPT AND SELF-EFFICACY • EMPATHY • SOCIAL RELATIONSHIPS AND BEHAVIORS • CONFLICT RESOLUTION • MORAL VALUES	• CREATIVE ARTS • SELF- AND COMMUNITY-IDENTITY • AWARENESS OF AND RESPECT FOR DIVERSITY

Literacy and Communication	Learning Approaches and Cognition	Numeracy and Mathematics	Science and Technology
• SPEAKING AND LISTENING • WRITING • READING	• COLLABORATION • SELF-DIRECTION • LEARNING ORIENTATION • PERSISTENCE • PROBLEM SOLVING • CRITICAL DECISION-MAKING • FLEXIBILITY • CREATIVITY	• EVERYDAY CALCULATIONS • PERSONAL FINANCE • INFORMED CONSUMER • DATA AND STATISTICS	• SCIENTIFIC APPROACHES • ENVIRONMENTAL AWARENESS • DIGITAL LEARNING
• ORAL FLUENCY • ORAL COMPREHENSION • READING FLUENCY • READING COMPREHENSION • RECEPTIVE VOCABULARY • EXPRESSIVE VOCABULARY • WRITTEN EXPRESSION/ COMPOSITION	• PERSISTENCE AND ATTENTION • COOPERATION • AUTONOMY • KNOWLEDGE • COMPREHENSION • APPLICATION • CRITICAL THINKING	• NUMBER CONCEPTS AND OPERATIONS • GEOMETRY AND PATTERNS • MATHEMATICS APPLICATION	• SCIENTIFIC INQUIRY • LIFE SCIENCE • PHYSICAL SCIENCE • EARTH SCIENCE • AWARENESS AND USE OF DIGITAL TECHNOLOGY
• RECEPTIVE LANGUAGE • EXPRESSIVE LANGUAGE • VOCABULARY • PRINT AWARENESS	• CURIOSITY AND ENGAGEMENT • PERSISTENCE AND ATTENTION • AUTONOMY AND INITIATIVE • COOPERATION • CREATIVITY • REASONING AND PROBLEM SOLVING • EARLY CRITICAL THINKING SKILLS • SYMBOLIC REPRESENTATION	• NUMBER SENSE AND OPERATIONS • SPATIAL SENSE AND GEOMETRY • PATTERNS AND CLASSIFICATION • MEASUREMENT AND COMPARISON	• INQUIRY SKILLS • AWARENESS OF THE NATURAL AND PHYSICAL WORLD • TECHNOLOGY AWARENESS

SKILLS FOR A CHANGING WORLD

B | Center for Universal Education at BROOKINGS