the Education Commission

Background Paper

The Learning Generation

Innovation and Technology to Accelerate Progress in Education

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The Center for Universal Education at the Brookings Institution

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Innovation and Technology to Accelerate Progress in Education

Report to the International Commission on Financing Global Education Opportunity

By Rebecca Winthrop, Eileen McGivney, Timothy P. Williams, and Priya Shankar
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Executive Summary

Sustainable Development Goal 4, to ensure inclusive and quality education for all and promote lifelong learning, sets out a grand ambition for education systems around the globe to achieve not just universal primary schooling, but to expand universal education from early childhood to secondary school and achieve relevant learning outcomes. While the Millennium Development Goals helped propel millions of children into primary school, meeting this larger goal in the coming decade and a half will require accelerated progress and a break from business as usual.

This report, prepared by researchers from the Center for Universal Education at the Brookings Institution for the International Commission on Financing Global Education Opportunity, describes the major gaps in education and the need for innovation to meet ambitious goals. Not only are children in low- and middle-income countries about 100 years behind their peers in measures of schooling, but rapid advances in technology, changes to the world of work, and the complex global challenges we face today call for a broader set of competencies every young person will need to be successful. To thrive in a changing world, young people will need skills and competencies that include information literacy, flexibility, critical thinking and collaboration in addition to academic knowledge.

To achieve this broader vision of education will take new approaches that can reach children who have not yet been reached, get better results in learning outcomes, and drive down costs. This study surveyed the current landscape of innovations in education by conducting a scan and compiling an inventory of programs, schools, and tools currently being used around the globe to achieve these aims. To be as inclusive as possible, the scan included innovations which have not yet been proven through rigorous evaluations as well as many small-scale innovations.

We find that innovation is happening all over the world in many different contexts and by a diversity of actors, and that those which hold the most promise for accelerating progress for marginalized children can be categorized into four broad areas:

1) Hands-on, Minds-on Learning: Innovations from high-tech schools to programs in the slums are incorporating an active, student-centered approach to transform the teaching and learning environment
2) Elevating the Education Workforce: Models that connect teachers to each other and leverage technology or community members are unburdening teachers, while other innovations are helping bring more people into teaching
3) Streamlining Schools: In various contexts schools are deploying technology to help improve back-office efficiencies, collect better data, and streamline communication inside schools and with parents
4) Activating Communities for Accountability and Delivery: Communities around the world are leveraging their resources to demand and deliver education, and new approaches are engaging communities through data to improve school accountability

Introduction

At no point in history have more children across the globe been enrolled in formal education. From urban areas to some of the most remote parts of the earth, today more than 90% of all children are enrolled in primary school. The mass delivery of formal educational infrastructure to young people can be seen as one of the most visible development efforts the world has ever seen. But the successful effort to expand children' education has obscured a central dimension of educational development: more children have more years of schooling—but what are they learning? A growing body of evidence has suggested that we are in the midst of a global learning crisis. Pedagogical practices and curricula used in schools are ill equipped to allow children to learn the skills they will need for the future. If education systems in their current form fail to improve learning outcomes, it is because the design of the way education is delivered itself is flawed. In a failed system, incremental improvements are insufficient to bring about the transformational shifts to curriculum and pedagogy needed to get better results. Put simply, in an age of Google, education based upon rote memorization of material will fail children terribly. There is an urgent need to rethink the way education is done, how it is delivered, and what types of skills children will need to become thriving members of their society. In other words, can we aspire to not merely make a failed institution incrementally better, but rather, transform the way we deliver education?

To address this gap, this report has been prepared for the International Commission on Financing Global Education Opportunity. We contend that the model of schooling that was fit for purpose in the age of industrialization, standardization, and information scarcity is no longer best suited to the rapidly changing world we now live in. Our goal was to look at ways to accelerate progress in education by examining alternatives models that could be used to improve learning outcomes. We recognized that children must acquire a suite of skills and competencies in addition to literacy and numeracy.

While there are immense challenges to rethinking how education can be done differently and more effectively, in this report we offer reasons to be hopeful. In a global scan, our research team at the Center for Universal Education compiled nearly 700 cases of innovative approaches to education from around the world. This effort enables us to take a snapshot of how different stakeholders in education are innovating to improve education and to deliver the breadth of skills children will need to be successful and productive member of society.

Throughout the report, we attend to the three core areas of interest to the Commission, including (1) getting better results, (2) driving down costs, and (3) delivering education to children who have not yet been reached. We also highlight the role of how technological innovations might be used to contribute to the core aims of the Commission. While technological innovation is not a new idea in itself, we contend that the age of technology in which we now live is at an exciting tipping point, one in which technology is not only better but also cheaper. It holds the potential to, at once, improve education quality while also driving down costs.

In Part I of the report we offer a theoretical and empirical overview of what we call 'the breadth of skills,' referring to critical skills like literacy and numeracy that education systems currently focus on,

and in addition skills such as critical thinking, problem solving and communication. We describe the types of skills that will be needed for the changing, technology-infused world in which we live and the sense of urgency in which national and local education systems must be developed to deliver upon the breadth of skills in new and innovative ways. In Part II, we turn to the heart of the report. We describe our approach to undertaking an inventory of nearly 700 innovations from around the globe. Drawing from this work to introduce to the Commission what we characterize as four key 'actions' that we contend are feasible and important in innovating education systems in such a way that can best deliver the breadth of skills. The four key actions include: (1) Hands On, Minds On Learning; (2) Elevating the Education Workforce; (3) Streamlining Schools; and (4) Activating communities for accountability and delivery. The report ends with a brief set of conclusions and recommendations.

Part I: Skills for a changing world: Delivering the breadth of skills for all[1]

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 skills. Ancient Greeks taught debate and citizenship through the "skhole." In the Indian Gurukula training system young people learned academic, artistic, and spiritual skills. In the United States and Europe, apprenticeships equipped young people with a specific trade, while the 19th and 20th centuries focused on universal schooling which prioritized core competencies such as reading, writing, and arithmetic. In each of these societies education was tailored to the context and demands of the age, and often did not look like our schools of today.

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 via memorization sufficient in the age of Google. Thriving 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. 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 and adaptable learners who are capable of learning new things quickly in a rapidly-changing environment.

This section explores the breadth of skills needed for a changing world as follows. First, we outline three important areas of change that contribute to the global context in which education must operate,

[1] This section draws heavily on our recent publication- in some areas drawing directly from the language, argument, and structure of: Winthrop, Rebecca and Eileen McGivney. *Skills for a Changing World: Advancing Quality Learning for Vibrant Societies.* Washington, D.C.: Brookings Institution, 2016.

namely technology, the world of work, and globalization. Next, we explore the skills needed in order to deal with these changes, and lay out how political aspirations have long aimed to develop many of these skills through education systems. We then look to the current global skills gaps and equity gaps that are leaving the most marginalized children behind. Finally, we call for thinking differently about education and schooling in order to close the gaps and better deliver breadth of skills to all children in the world.

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 complex global challenges. 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 accompany rapid change can 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

From the wheel to the printing press to the mobile phone, technology has shaped human history and will 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 their implications. While artificial intelligence, exponential increases in computing power, and expanding mobile networks hold potential 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.[1] For example, even a decade ago the ability of a self-driving vehicle to navigate 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."[2] 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."[3] 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.[4]

Many of these technological advancements have outpaced Moore's Law, the observation in 1965 by the cofounder of Intel, Gordon Moore, that computing power will double every two years.[5] 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."[6] 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 exclusive to 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.[7] Already today, 70 percent of households in the bottom fifth of the population in developing countries have mobile phones, providing their main source of internet access.[8] 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.[9] 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.[10] 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.[11] 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."[12] 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.[13]

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.[14]

And yet access to technology remains limited for the world's poorest. The World Bank's 2015 World Development Report Digital Dividends showed that a large number of the world's population is connected somehow. However, with 3.2 billion Internet users worldwide, there is still a digital divide. Almost 60 percent of the population is offline, and the most marginalized are least likely to live in areas with any access to mobile or internet access.[15] Getting the poorest young people in the world connected and teaching them digital literacy can have a huge impact on their livelihoods.[16]

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. [17] This means that many of the jobs that arose in the 20th century have been increasingly automated since 1960. However, high-skill jobs requiring analytical and interpersonal skills, which are "non-routine", are on the rise and taking a larger share of the labor market.[18] Their research has also shown that the middle- and low-skill end of the labor market has also shifted from jobs requiring routine tasks such as manual labor to those in services like janitors, home health aides, and food service workers, "which are difficult to automate because they rely heavily on dexterity, flexible interpersonal communication, and direct physical proximity."[19] This indicates a further layer of polarization between high- and low-skill occupations, with many jobs being automated in middle-skill occupations and forcing increased employment in low-skill services.

Figure 1

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.[20] This may, however, 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. There is thus also the threat that as economies develop, more workers could be driven into low-wage and low-skill service work.

Increased automation has been accompanied with other shifts in the workforce. The report *The Future of 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.[21] 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.

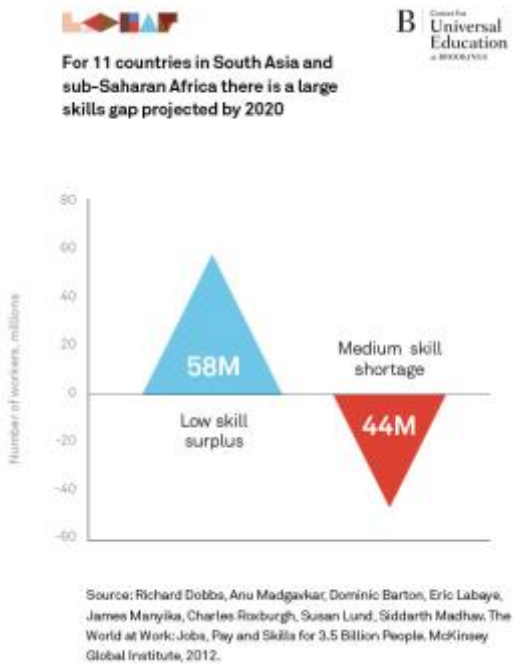
However, automation and other changes to the world of work also can have many negative consequences. The demonstrations of taxi drivers against Uber in cities across the world are just one indication of this issue. Unemployment continues to rise as technology disrupts labor markets and automation increases 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.[22] 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 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.[23] The World Bank's Enterprise Surveys have also found that inadequate skills are a major constraint to businesses' productivity and development.[24] 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.[25]

Figure 2



Complex Global Challenges

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, or clothes made in one country to be worn in the next, 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.[26] Global coordination has enabled quicker and more effective responses to rising health epidemics such as the Ebola Virus.[27] 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.[28] These examples suggest the merits of globalization on individuals, on systems, and on markets.

At the same time, the impact of globalization remains uneven.[29] 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 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.[30]

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 one estimate of the world's population predicted to reach 11.2 billion by 2100,[31] and doubling in urban areas by 2050.[32]

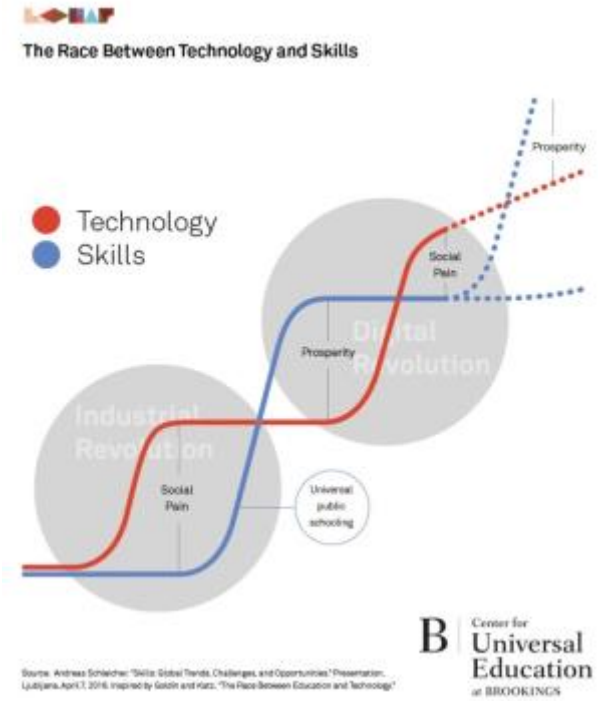
The environment is certainly not the only global issue that urgently needs cross-border solutions. The world is also facing a migrant and refugee crisis larger than any since the end of the Second World War, calling for a globally coordinated effort. At the end of 2014, the number of forcibly displaced populations, including refugees, internally displaced persons, asylum-seekers, and stateless people, rose to a staggering 59.5 million.[33] 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 Monetary Fund, recently called for a "bigger, bolder, and broader approach," for international cooperation to stem humanitarian and economic toll, looking beyond national borders.[34]

Skills Needed for Today's Changing World

The rapid advances in technology, changing employment, and globalization threaten to leave many behind, destabilizing societies and leaving complex global problems unsolved. But equipping future generations with the right mix of skills can help us use these trends to shape thriving societies. Over time, education has both responded to changes in the wider world and also spurred new advances in societies.

The spread of universal, compulsory schooling as we know it was both driven by and instrumental in creating new holders of knowledge, building nations, the human rights movement, and the increased technology in the workplace. [35] The "Race between Education and Technology," as economists Claudia Goldin and Lawrence Katz have argued, particularly illustrates how changes in industry and technology result in social pain, but equipped with the proper skills to maximize that technology then can generate prosperity (see Figure 3).

Figure 3



Regarding our current and future world, the integration and navigation of information will be as important as the learning of content.[36] 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 an array of different skillsets that can prepare today's children 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.

Breadth of Skills to Complement Technology:

"Seizing the future in the digital revolution is not chance or fate— it is a matter of skill and foresight." - UNDP Human Development Report 2015: Work for Human Development

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 is also essential. 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.[37]

Breadth of Skills for Better Employment:

"The knowledge economy no longer pays you for what you know... the world economy pays you for what you can do with what you know."[38] –Andreas Schleicher, OECD

Strong skills and abilities are key for being productive at work, which in turn boosts economic growth as a whole. For example, new research from economists Eric Hanushek and Ludgar Woessman has found that differences in skills—not educational attainment—explain differences in economic growth across countries.[39] For their analysis, they use student achievement tests of cognitive skills to compare across countries, showing that strong ability in literacy, numeracy and science is a key driver of productivity and significantly boosts economies. In fact, the authors estimate that if all countries possessed the cognitive skill level of Finland, often a top scorer on international exams, global economic growth could be 8.5-13.8 percent higher. [40]

However, 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 as well as critical thinking. 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.[41] 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.[42] 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."[43] To meet the demands of the workforce and mitigate rising levels of unemployment, skills that bring value to employers are crucial.

Breadth of Skills for Global Citizenship:

"We must foster global citizenship. Education is about more than literacy and numeracy. It is also about citizenry. Education must fully assume its essential role in helping people to forge more just, peaceful and tolerant societies."[44] - UN Secretary General Ban Ki Moon in 2012

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." [45] 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.[46] As Bill Clinton put it, "creative networks of collaboration"[47] 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.

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, [48] 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.[49] 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.[50] 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 .[51]

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."[52] 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.[53] 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 ones fullest potential and on true learning acquisition. This vision was reaffirmed in 2000 with the Dakar Framework for Action. [54]

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.[55] 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 towards this goal with over 50 million more children entering primary school from 1999 to 2015.[56] 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.[57] 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. [58]

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,

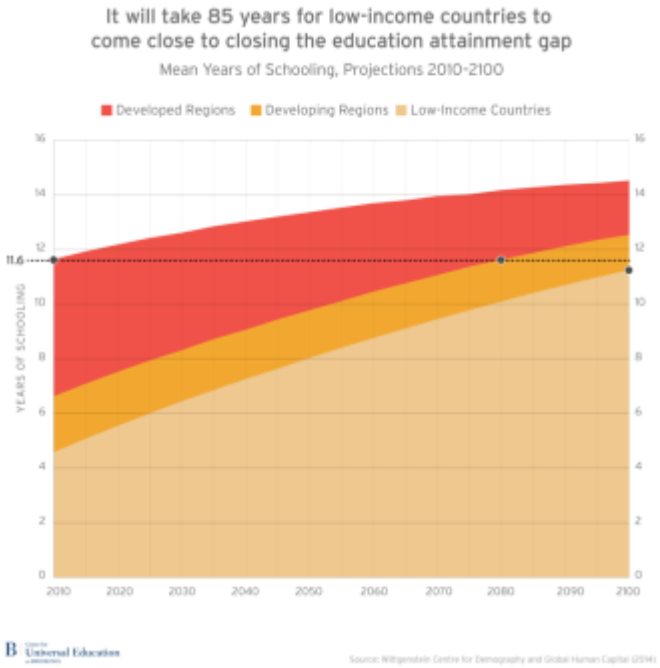
the task force articulated a vision of learning they felt was relevant globally. They identified several domains of learning around which young people, no matter where they lived, should have the opportunity to cultivate skills. Importantly, the final recommendations of the task force called for helping children develop breadth of skills. These include literacy, numeracy, and science, but importantly also include social and emotional learning, communication, critical thinking, and creativity (see Annex).[59]

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 a 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.[60] 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.

Global Gaps in Skills

While enrollment in primary school has improved in recent decades, there are still major gaps in access and learning outcomes, particularly in developing countries. In many places, increased primary school enrollment has not translated into increased completion and transitions into higher levels of school. This has left schooling levels in developing regions approximately 100 years behind those in developed countries. For example, in South Asia and Africa, youth and adults reached an average of 5 years of schooling in 2010, 100 years after that level was reached in Europe and its offshoots.[61] Even more concerning is that the slow progress on completion and transitions into secondary school is projected to result in a persistent gap that will take nearly 100 more years to close, as shown in Figure 4.[62]

Figure 4



There is an urgent need to focus on the most marginalized children, who especially face barriers to accessing and completing their schooling. This is true for the world's poorest children, those living in rural areas, girls, and children living in conflict or affected by disasters. For example, there won't be universal lower-secondary school completion for the poorest girls in sub-Saharan Africa, until 2111.[63] In 35 crisis-affected countries there are 75 million children and youth who are out of school.[64] For Syria alone, a country that had nearly universal primary school enrollment before the conflict, 4 million children in the country and neighboring host countries are out of school.[65] These challenges place marginalized children farthest behind in accessing education and achieving literacy and numeracy.

In addition to the access gaps, the quality of schooling is low in many developing countries, and those children who do have access to and attend school are falling behind in literacy and numeracy. UNESCO estimates that there are 250 million children in the world who lack basic literacy and numeracy proficiency, of whom 130 million children are in school but are not learning. [66] Our recent study *Millions Learning: Scaling Up Quality Education in Developing Countries* summarized many findings on learning outcomes that point to massive failure in schools: [67]

> "For some countries, the situation is staggering. RTI International's study of Early Grade Reading Assessments revealed in 2011 that "worrying proportions of students are not learning to read at all within the critical first two or three years of schooling."[68] In 2008 in Mali, depending on their language and region, 83-94 percent of second graders could not read a single word. In India fewer than half of rural fifth grade students could read a second-grade text in 2014, and just 26 percent could do division.[69] In Kenya, Tanzania and Uganda in 2013 less than a third of third

> graders had second-grade level literacy and numeracy skills. The picture into the future is grim as well. Despite limited data, it has been estimated it could take more than 100 years just for students in developing countries to reach today's average level in developed regions when it comes to science—and they might never close the gap in math."[70]

These poor learning levels are not a phenomenon of only low- and middle-income countries. Education systems in developed countries struggle to equip all their students with literacy and numeracy as well. The recent PIAAC surveys of youth and adults' skills in high-income countries show that many who have completed schooling are not reaching proficiency in a number of domains. In the United States, for example, a fifth of adults who have completed high school are at or below basic literacy levels, meaning they cannot locate specific information in a text that has little competing information. [71] Across all the countries surveyed nearly 3 in 10 adults scored below basic literacy and numeracy proficiency levels despite being high-income countries with high levels of schooling completion. [72] Surprisingly, across countries surveyed as many as 25 percent of the adults with low levels of literacy had completed tertiary education.[73]

On top of the gaps in literacy and numeracy, education systems across the globe are failing to prepare young people with many other skills that are also necessary to thrive in our current world and into the future with changes to technology and the world of work. Employers around the world identify lack of candidates' "workplace competencies" such as communication and teamwork as a barrier to filling positions.[74] As cited above, the World Bank's Enterprise Surveys have also found that inadequate skills are a major constraint to businesses' productivity and development.[75] These employer surveys have been conducted in all regions of the world, in high- and low-income countries, and show that the gaps in competencies like critical thinking, flexibility, and problem solving.

Unfortunately there is little data to assess what the gaps are between skills we know all young people need to thrive in their lives and what schools are preparing them with. The recent PIAAC survey of adults in high-income countries found that while even though most people complete at least basic education in these countries, they lack many of the skills that are important for thriving in a changing world. For example, among adults in the United States, not even 40 percent of them scored a Level Two on problem solving skills in a technology-rich environment.[2] Similarly, less than 50 percent of Japanese adults score at a Level 2 or higher in problem solving, though they score high in literacy and numeracy skills.[76] For young people in the United States, access to technology has not translated into true digital literacy, with the same surveys finding that "15 year olds who showed some of the highest rates of advanced web-browsing skills ranked lowest for problem solving with technology."[77] On the PISA assessment of 15 year olds who are in school from 65 high- and middle-income countries, motivation to learn, self-efficacy and openness to problem solving were all correlated with better performance in mathematics, yet many students are lacking these competencies and skills. Fewer than 60% of students in high-income OECD countries indicated perseverance when faced with problems or intrinsic

[2] According to the OECD Skills Survey, a level two score on problem solving skills is defined by respondent's ability to use both generic and more specific technology applications, which may involve multiple steps and operators. In this case, the goal of the problem may have to be defined by the respondent.

motivation to learn math.[78] 15 years olds are similarly lacking in creative problem-solving skills, and while approximately 11% of those in high-income OECD countries can manage complex problems, "on average across OECD countries, about one in five students is able to solve only straightforward problems – if any – provided that they refer to familiar situations."[79]

The lack of critical skills for success could have grave implications for the future. If all young people in the world do not achieve high levels of the breadth of skills from literacy and numeracy to critical thinking and perseverance, we will fail to make the most of technology, changes to work and solving global challenges.

Thinking Differently to Deliver the Breadth of Skills

> *"Our standard approach to schooling did not arise from scientific research on how children learn, and it certainly did not arise from any research that brought Darwinian evolutionary insights to bear."*[80] Peter Gray, Educational Psychologist.

The Sustainable Development Goals present an important opportunity to improve our education systems and improve teaching and learning to deliver breadth of skills, but it will require thinking differently about education. How can we deliver on the aspirations that national and international governments have for decades aimed for? New models of schooling that capitalize on children's natural propensity to learn, that recognize the interplay between developing academic, social, and emotional skills, and that give teachers the tools to be effective will be needed to accelerate progress.

Cultivating breadth of skills and closing the global skills gaps will not be achieved by continuing with business as usual, where learning is limited to school. Learning not only occurs inside schools for a set number of years of a child's life, but rather begins at birth, is influenced by many people and can be enhanced by environments outside of school. Typically, school across the globe runs from age 6 to 16, encompassing primary and lower secondary school.[81] Yet learning is not confined to these years, nor is it confined to a formal classroom. Early childhood is a critical window for brain development and children are learning constantly in their early years from their parents, the environment around them as well as from educators.[82]

Early childhood is when brain formation takes place that can set the foundation for learning later. Jack Shonkoff, neuroscientist and director of the Harvard Center on the Developing Child, has written extensively on how brain development in the early years is so important for later outcomes. In *From Neurons to Neighborhoods*, he and colleagues show that "neurochemistry of early brain development [is] essential to the brain's capacity to learn from experience and is likely to play an important role in the regulation of behavior."[83] Similarly, neuroscientist Louis Cozolino emphasizes brain development in young children as the key for learning later in life, as the brain forms capacity for attachment, emotional regulation and self-esteem at young ages.[84] Research has shown that such skills predict early literacy, vocabulary and math skills.[85] Kathy Hirsh-Pasek and Roberta Golinkoff's research on the science of child development points to the kernels of "learning to learn" skills that are developed in preschool, and

make it easier by age 10 for children to apply knowledge to new situations and understand new relationships between people or objects.[86]

The powerful foundations for learning in early childhood explain the huge returns that high-quality early childhood education provide. Adults who received early childhood education earn higher wages, perform better later in school, are less likely to commit crimes and lead healthier lives. For this reason, the cost-benefit ratios show averages of 4 to 5 times the amount invested for every dollar spent on early childhood development.[87] Nobel Prize-winning economist James Heckman has shown the return on an investment from the early years through the lifecycle, with the highest returns in early ages and declining through adolescence.[88] The World Bank's STEP survey of adult skills showed that "adults who participated in early childhood education as children have higher reading literacy proficiency and are more likely to have started primary education at the right age than those who did not participate."[89]

In addition to rethinking where and when learning occurs, we need to look to models that capitalize on what we know about teaching and learning, that if we want active citizens and critical thinkers, we must build active environments that go beyond lectures and memorization of basic subjects. For many decades experts in education and pedagogy have emphasized the need for education to be an active endeavor that children and adults alike engage in through the world around them.[3]

Still today the dominant model of schooling that we see in place around the globe can generally be termed the "transmission model" of education. This is what will sound most familiar 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 not emphasized, and learning is supposed to be an individual, "in-the-head" endeavor.[90] In most places, schools focus on a narrow set of competencies like literacy and numeracy, those being emphasized in assessments but "those narrower goals grew out of an emphasis on content knowledge accumulation to the exclusion of much else."[91] Our current world requires education systems that emphasize educating the whole child.

Alternative Models to Accelerate Progress

The good news is that many teaching and learning strategies can engage students in learning subject-matter content while developing many other skills and competencies. Lecturing and memorization can lead to surface understanding, but the ultimate goal in education is learning experiences that lead to transfer, or the ability to apply what has been learned to new and different contexts.[92] Active, student-centered learning can achieve this by engaging students in practice that demonstrates what they are learning through real-world problems. Team projects foster collaboration alongside learning content, giving students autonomy to inquire into their own interest shows their abilities to self-regulate and

[3] See, for example, the work of Paolo Freire in defining the "banking" model of education wherein facts are deposited into students' minds versus the "problem-posing" pedagogy in which students learn by investigating the world around them. John Dewey, as early as the turn of the 20th century, also wrote that school should be more like life itself, than preparation for life.

think critically about a subject. In their recent book, *Becoming Brilliant,* child development experts Kathy Hirsh-Pasek and Roberta Golinkoff give dozens of examples of how throughout our whole lives, inside and outside classrooms, active experiences and solving problems by communicating with others is how we learn everything from basic facts to competencies like creativity and self-regulation.[93]

An entire field devoted to studying the ways people achieve true learning and transfer, the learning sciences, has identified many options for learning environments to capitalize on evidence from neuroscience, psychology and education. Many in this field point to the social foundations of learning, how brain development does not happen in a vacuum, and in fact learning is grounded in human interaction, communication and collaboration.[94] Other findings from the learning sciences point to the need for learners to be active and in control of their own education, and grounded in the world around them.[95] Studies by economists have also pointed to the need for education and training to focus on mentorship and scaffolding of children's learning through hands-on experiences.[96] Many of these strategies are what we term "hands-on minds-on" learning, described in detail in Part II.

Yet despite this overwhelming evidence of effective strategies for how people learn breadth of skills- from academic content knowledge, to creativity and social skills- our schools generally have maintained classrooms across the globe based on the teacher-centered transmission model. The reliance on passive learning strategies as the status quo could be one of the reasons many investments and reforms in education around the globe have failed to achieve results. Take technology as an example. Many believed investing in computers in classrooms would transform our education systems, but this largely failed to be true. A recent report from Stanford educational researchers reviewed technology use in the United States and found that most computer-based instruction has failed to provide increases in learning because it replicated the activities done in workbooks, or a drill-and-practice model, particularly in schools with low-socioeconomic status students.[97] Their research finds that what is important for effective use of technology is that it employ interactive learning, that it's used to help students explore and create rather than "drill and kill," and that instruction strikes the right balance between technology- and teacher-provided.

Education will need to break from many of its current practices in order to meet the aspiration of delivering high-quality education and a breadth of skills to all. Education systems must consider that learning occurs in and outside the classroom, with early childhood a critical period for laying the foundation, and youth requiring opportunity to learn through relevant experiences outside the classroom as well. Inside classrooms and in the formal system, active, student-centered learning that better develops full breadth of skills will need to replace the teacher-centered model that dominates schooling today.

Part II: Four innovative actions to accelerate progress

It is clear that continuing with business as usual will not sufficiently accelerate progress. In Part II of this paper, we seek to identify promising approaches to education to close gaps and improve outcomes. We

begin by first describing the focus of our study and the particular approach we adopted to this investigation. We then shift to propose and describe four key actions that we see as crucial in improving education quality and the breadth of skills.

Focus of our study

The focus of our study was guided by four overarching objectives:

First, we attend to the Commission's key areas of interest. Our key focus areas were guided by three priority areas that the Commission was interested in exploring, including:

1) **Getting better results:** Currently, too many children are attending school without achieving basic learning outcomes. Many more are not achieving the full breadth of skills they will need to be successful in a changing world. We sought to find innovative approaches that can improve learning levels for a variety of skills including literacy, numeracy, and 21st century skills.
2) **Driving down costs:** Financing education is a major concern. Expanding education access and improving outcomes will cost much more than governments and donors can currently do on their own. For this reason, we sought to identify innovations that can improve the efficiency and effectiveness of children's education.
3) **Reaching those not yet reached:** Despite notable improvements in education access, millions of marginalized children fail to enroll or complete a full course of education. Expanding access to education and learning to those who are out of school, do not have access to early learning or secondary education is an important global goal. We aimed to find innovative models of bringing learning opportunities to children who are the farthest behind.

Second, we focus on the future and promising new models of schooling. Our study focuses on identifying models that are committed to doing things differently in education. The interest in new models arises from The Commission's forward-looking agenda, to answer questions of what education will look like and cost into the future, with an understanding that there are many promising practices emerging today that can accelerate progress. We did not study deeply the evaluations literature of more traditional interventions, which has been done by other researchers in background work for the Commission. We also focused on primary and secondary education as other reports for the Commission aimed to cover early childhood and higher education.

As we compiled information on innovations we looked for examples which had some evidence of impact, from rigorous external evaluations to internal program evaluations, as well as those that had reached some scale. We did not, however, restrict ourselves to studying only those innovative approaches that were proven in order to get a better picture of many future-oriented approaches that have not been in place long enough to be backed up by data. In addition to those with proven models, we aimed to highlight promising examples that exhibit many of the same core principles in a variety of contexts. The cases highlighted here are therefore illustrative, and are not an endorsement of a particular program but rather used to show the real-world application of innovative approaches that can better deliver breadth of skills.

Third, we highlight the role of new technology in improving education access and quality. Many have talked about how technology might be used to improve education outcomes. In our study, we seek to extend this argument by highlighting ways in which new technology can contribute the core aims of the Commission, including getting better results, driving down costs, and reaching those who have not yet been reached. To be sure, the idea of technology as part of the solution is not new to education debates. Radios, television, and computers have been in classrooms for decades, with varying degrees of effectiveness. However, we contend that technology is at a tipping point, one in which technology is not only better but also cheaper; thus, it holds the potential to, at once, improve education quality while also driving down costs.

Finally, we were informed by our study *Millions Learning: Scaling up Quality Education in Developing Countries*. Our recent Center for Universal Education report took an in-depth look at fourteen cases where education interventions scaled up while achieving improved learning outcomes. Through the literature review on scaling and analysis of the cases, many lessons emerged that are relevant to innovations in education such as the design and delivery of effective approaches. We drew on the findings to inform our approach to this report, as well as referring directly to many of the cases to highlight key principles of innovation. These cases are backed by robust evidence of learning outcomes as well as achieving significant scale, and therefore illustrate practices that are proven in addition to the promising cases we have chosen to demonstrate diverse applications of innovation.

Methods: A global snapshot of education innovation

In this section we describe the methods we used to explore innovations in education. Later in this paper, we use the information gathered to suggest four key actions for accelerating progress toward the breadth of skills.

Innovation can be defined in many different ways. We consider innovation to be effective when it creates new and sustainable ways to solve problems. Innovations can be a new idea developed from scratch. However, some innovations have been around for decades but have not yet been taken to scale. Innovations can also take the form of an improvement or modification of an existing practice or invention. In short, for this project, we consider innovation to be "a break from previous practice, occurring when different points of view or existing practices are framed, imagined, or combined in new ways."[98]

Developing a Catalog of Education Innovations

To understand how innovation is carried out, we needed to cast a wide net. We did so by developing an inventory of innovations with the aim of taking a snapshot of what is being done by groups and initiatives whose efforts have been previously flagged as 'innovative.' By collecting information on a variety of approaches operating in different contexts, we were able to observe applications of practices to deliver breadth of skills currently in use and which may hold promise elsewhere. Our analysis helped identify some of the common characteristics and differences among innovations.

Our criteria for building the database was to scan approaches that had been identified as innovative by other sources, and so we drew from previous efforts to compile information about innovation in education. We systematically cataloged the approaches in order to be able to compare them to one another, including classifying what and how the intervention was innovating the existing model, who is delivering it, who is funding it, where it is operating, and when available data on the costs, effectiveness and scale of the innovations.

This approach to identifying innovations does not permit generalizability, as our sample was neither random nor comprehensive. It is biased toward the characteristics selected by the lists we drew from, and so does not represent the entire field of education innovation. However, our approach enabled us to observe how practices such as hands-on minds-on learning that can improve the delivery of breadth of skills are being applied in a variety of contexts.

While we aimed to be as comprehensive as possible, we were not able to add every innovation from the following sources to our list. In some cases, we were limited by available information in English. For example, while there are more than 200 Ashoka Changemaker schools, only 85 had completed standardized school profiles, and so those were included. In other cases, we looked specifically for technology-enabled approaches to be sure they were represented. In others we were limited by our own scope of not heavily featuring early childhood education and higher education. Finally, we were limited by time.

We identified 672 innovative models of education from the following sources: R4D Center for Education Innovations Program Database, Ashoka Changemaker School Profiles, applicants to CUE's *Millions Learning* Study, World Innovation Summit on Education Awardees, InnoveEdu, and OECD Centre for Educational Research and Innovation, among others.

This catalog included a diversity of approaches for how innovation has been conceptualized and implemented in order to improve children's educational experiences and learning outcomes, while also showing the bias of the sources drawn from. For example, the R4D database and the Millions Learning case studies focus on low- and middle-income countries, showing a possibly disproportionate number from the developing world. However, what the database does show is that innovation is happening all over the globe, despite the common refrain that education is resistant to change.

Table 1

EFA Region	%
Sub-Saharan Africa	41
South and West Asia	28
North America and Western Europe	19
Latin America and the Caribbean	13
East Asia & the Pacific	8
Central Asia	3
Central and Eastern Europe	4
Arab States	7
Global	1

Our database shows innovation is happening across the globe, by many different actors and in different forms. The innovations we reviewed were financially supported by foundations (32 percent), government (26 percent), and donations (20 percent)—with fewer innovations charging fees and receiving private sector support (15 percent each). In terms of delivery, 70 percent of innovations we cataloged are being delivered by NGOs, with fewer delivered by government (16 percent) or the private sector (13 percent).

Most of the innovations we reviewed aimed to improve teaching and learning, rather than other goals of increasing enrollment, completion, financing, or efficiency. For example, 41 percent aim to improve literacy and 33 percent numeracy, while just 10 percent have a goal to increase access and 12 percent to increase enrollment. Over one-third (39 percent) of all the innovations aim to improve 21st century skills, signaling an important focus on delivering a breadth of skills within our scan. Additionally, 30 percent have the goal to improve teaching as well.

The database includes innovations being implemented within and outside schools, multi-country interventions that have reached millions of children and whose effects had been evaluated through randomized trials as well as those of modest scope and impact but whose approach holds promising elements of innovation. While this scan sought ways to improve education for the poorest, we also looked at ways in which innovations found in higher-income settings could be applied to developing-country contexts—for example, the application of technology to improve learning. We looked at examples of innovative approaches that had evaluation effectiveness data from rigorous external evaluations down to the program level. But we were also not restricted to looking only at those with

robust evaluations, because we wanted to get a better idea of new future-oriented innovations to highlight promising trends and directions without excluding those for which evaluations have not yet been carried out.

Developing this catalog of innovations enabled us to undertake two analyses. First we studied innovations in the database itself along with the literature and findings from *Millions Learning* in order to identify key characteristics. Through this we arrived at four salient themes—or actionable points—that we believe can improve education to deliver breadth of skills and which will be of core interest to the Commission. We then selected specific cases of innovation that exemplified each of these themes to qualitatively investigate their significance in further detail. We wish to point out that throughout this paper we chose particular cases of innovation that highlight areas of promise. The cases we selected do not signify endorsement by the study authors. Rather, they were selected to serve two functions. First, they offer a theoretical argument to improve some of the key outcomes of concern to the Commission. Second, they offer a feasibility argument in that the cases offer a proof of concept on the ground.

We hope that our analysis can raise questions and generate ideas for the Commission to carefully think through how education can be done more effectively—and differently. When available, costing data and impact assessments from innovations were also added to the database and integrated into a separate analysis.[99]

Four actions of innovation to address the Commission's questions:

From our analysis, we developed four key areas for action. We believe these four actions can improve education's ability to deliver the breadth of skills by getting better results, driving down costs, and reaching those who have not been reached. The four key actions have examples working on the ground in low- and high-resourced environments, with and without technology, and with proven effectiveness at scale as well as some that are just in their early stages. The threads that tie them together are solutions that address challenges education systems are facing around the world, and which can be adapted to meet the needs in many different contexts.

We have organized the rest of this section around these four key actions that we think best reflect the dataset while also attending to the core commitments of the Commission. The four actions include:

1. **Hands On, Minds On Learning:** Based on what we know from the learning sciences, innovations employing these student-centered, experiential, hands-on and playful learning strategies hold promise to get better results for breadth of skills.
2. **Elevating the Education Workforce:** In our scan of innovations we found many approaches working to elevate the education workforce, by unburdening many of the many tasks on teachers' plates, training and supporting teachers, changing the role of the teacher and bringing in more people to be educators.
3. **Streamlining Schools:** Many innovations we found cut costs, improve accountability, and centralize (or decentralize) supports in an effort to enable educational systems to more effectively deliver quality education in an efficient and effective way.

4. **Activating communities for accountability and delivery:** Models of innovation in education are activating communities to build demand for high-quality education and hold education systems accountable, in addition to ways communities are leveraging resources to help deliver education.

Action 1: Hands On, Minds On Learning

How can education programs and policies provide children with the skills they need to become healthy and active members of society? How can learning cultivate empathy, foster resilience, encourage creativity, and promote cognitive processing? We subscribe to the view that learning happens best when it is done in a way that is both practical, relevant, engaging—rather than theoretical and decontextualized. We reference this idea in shorthand as Hands On, Minds On learning.

We consider Hands On, Minds On learning to be educational activities that are dynamic, relevant, and applied. Others have used language to express similar ideas, such as experiential learning, student-centered learning, or playful learning. Collectively, these ideas advance approaches that have an empirical basis in the learning sciences. Hands On, Minds On activities have been linked to better cognitive, social,[100] and emotional processes, which in turn, facilitate the uptake of learning. Hands On, Minds On also appeals to our common sense: children learn best when they are engaged.

Hands On, Minds On activities center upon the concept of **active learning**. Active learning can be defined as "anything that involves students in doing things and thinking about the things they are doing."[101] Active learning activities vary in how and where they are applied. They can occur within the context of a lecture or classroom activity or outside school and in doing so, transform the conventional learning environment from within.

One of the hallmarks of active learning is that it is also **student-centered**. Innovations can take a variety of forms, but each places the learner, rather than the institution (i.e. the school), at the center of the innovation design. The aim of active learning is to engage young people in the curriculum in a genuine way that helps them focus, to solve problems, resolve disputes, and develop strategies that will enhance the core skills they will need to be able to thrive.[102]

Initiatives which are consistent with a Hands On, Minds On approach often utilize active learning through **project-based learning** activities.[103] Project based learning is an attempt to distance the way education is done from the oft-distilled forms that we see in classrooms today, in which children are asked to ingest material through rote memorization and didactic pedagogy. These approaches are not well-suited to prepare children with the types of skills and approaches to learning that they will need for the future. Activities which utilize project-based learning are characterized by being adaptable, integrated, and dynamic. They are well-suited to respond to real-world challenges in that they focus on integrating and linking complex challenges to real-life solutions. Project based learning marks a distinct shift for the relationship between teacher and learner. The teacher becomes a facilitator and guide that encourages children to explore different avenues for learning to occur. It focuses on real world problems

that students are interested in. As they continue to gain new knowledge they can apply this to new problems.

Project-based learning can take on a wide range of forms, both in and outside of conventional learning environments like the classroom. At the conceptual and analytic core of project-based learning is to have children attempt to resolve practical problems with real world relevance. For example, children could be asked the question, "Why does it rain?" But rather than memorize and recite a series of steps for how precipitation occurs, their teacher can ask them to work in groups to produce a report, one which requires them to use critical thinking skills, creativity, and teamwork to accomplish the task.

As referenced in Part I, Hands On, Minds On is oriented toward ensuring that young people are learning in ways that will prepare them for the future that awaits them. This approach to learning is well-suited to help children acquire **breadth of skills** such as social and analytical skills, technical skills, higher-order thinking, and dependability. [104] The need to prioritize the full breadth of skills will better equip young people for the rapid changes in the world of work. Children learn to work together, to collaborate, and to develop empathy.[105]

Activities which align with a Hands On, Minds On orientation are currently not standard practice in global education. But the good news is that there are innovations taking place around the globe that are aligned with a Hands On, Minds On approach. The innovations we examined varied considerably in terms of context, approach, and target population. For example, some took place within the institutional context of the school, while others occurred in other sites such as the workplace or even within the home. Innovations that included a Hands On, Minds On component constituted a large proportion of our database. We found that 46 percent of the innovations included an emphasis on student-centered learning, personalized learning, gamification, an adaptive learning platform, or a project-based learning component. Most (78 percent) innovations occurred within schools. For those innovations aimed at improving skills, 57 percent aimed at improving literacy, 45 percent focused on numeracy, and 47 percent sought to improve 21st century skills.

We have divided up the rest of this Hands On, Minds On learning section as follow. First, we introduce alternative models for delivering quality education to marginalized children. Second, we uncover supplemental approaches that improve learning. Third, we discuss new approaches to strengthening learning within schools. Throughout our investigation, we often chose to highlight local, less well-known cases, as well as better-documented cases. The cases are not meant to represent the best models or approaches to learning; in fact, the efficacy of some of the approaches are still being debated. Rather we selected these cases to examine their experience of developing and delivering innovative approaches to improving children's learning. As such, they are illustrative models. Throughout the cases, we also sought to draw attention to factors thought to be of interest to the Commission, including reaching out-of-school children, driving down costs, and improving learning outcomes.

Hands On, Minds On Learning			
Intervention/Country	*Description*	*Technology Used*	*Context Needed*
Reaching Those Who Haven't Been Reached			
eLearning Sudan (Sudan)	NGO that reaches children affected by conflict by delivering national curriculum on interactive tablets	Tablet; digital games	Government out-of-school curriculum; electricity for charging tablets
Kibera Girls Soccer Academy (Kenya)	NGO secondary school in Kenya slum that augments national curriculum with experiential learning opportunities for girls	Not a focus	National secondary curriculum; parental and community participation
Improving Results			
Collège Catts Pressoir (Haiti)	NGO secondary school in Haiti that focuses on applied learning to address community needs	In process online portal for schools to collaborate, as it plans to scale	Effective public private partnership; fee-paying students
Literacy Education Math Lab (Columbia, Dominican Republic, Panama)	NGO that uses low tech puzzles and games to teach breadth of learning skills in or out of schools	Low tech puzzles and games	Willing adult or youth (e.g. teacher, mother, community leader, older sibling); basic materials to create board games
Escuela Nueva (Originated in Colombia, now 16 countries)	NGO that advances a pedagogical approach whereby teachers become facilitators of learning;	Deliberately resisted adding technology	Facilitators as teachers; student-centered curriculum; effective government and civil society partners
RN Podar (India)	Private school in India that has pioneered a flipped classroom approach to learning	"Flipped Classrooms," Blending learning approach including Skype classes with subject experts, Google apps, WhatsApp to engage community members	Partnerships with tech community; integration of national curriculum; electricity at school and at home; fee-paying students
Digital Equalizer (India)	NGO that introduces learning labs and ICT into government schools that would otherwise have no access to technology	Computers with Windows-based operating system	Private sector partners to procure technology at discounted rate; integration of national curriculum; electricity at school; buy-in of government schools

Akazi Kanoze (Rwanda)	USAID-funded project, implemented by NGO EDC, that delivers locally developed workforce readiness training curriculum and transition services, including formal training and mentorship, for youth who have discontinued their formal education; entrepreneurship curriculum currently being adapted for all secondary schools	Not a focus	Workforce development curriculum; partnerships with NGOs, government, and private sector for practical training
Sistema de Aprendizaje Tutorial (Honduras)	NGO provides alternative secondary education for rural youth with a focus on applied learning	Not a focus	Community tutors to learn alongside students; intensive training for tutors in SAT pedagogy; public-private-partnership

Alternative delivery models to reach children at the margins

Despite the immense efforts to ensure all children are able to attend school, a large number are still unable to do so. Reasons include endemic poverty, gender inequalities, household obligation, and concentration situations of adversity such as armed conflict and natural disaster. However, **it is too limiting to focus on getting unreached children into the setting of the classroom**. Instead, we are concerned with ensuring that they are receiving an opportunity to learn. A Hands On, Minds On approach suggests that effective learning does not necessarily need to occur in the classroom. **"Delivery innovations" signify pioneering attempts to provide formally recognized schooling in new ways to young people that that otherwise would not be reached**.[106] In this section, we offer four examples of ways in which children can receive high quality education, including the delivery of competency-based curriculum, the importance of an interactive component to learning, utilizing teachers as learning facilitators, and ensuring that learning activities are contextually relevant and localized.

Delivering education in concentrated situations of adversity

Case: eLearning Sudan

One approach to delivering education to hard-to-reach children is through an accelerated curriculum. The benefits of this approach are twofold: first, it is designed to reach young people that have previously discontinued their formal education; and second, an accelerated curriculum enables children to learn the same type of content found in a national curriculum. **eLearning Sudan** powerfully illustrates how its learner-centered accelerated curriculum has been used to reach children who would have likely discontinued their studies otherwise in a conflict-affected setting.

eLearning Sudan was developed out of a sense of urgency. Conflict, along with endemic political and economic security, have negatively impacted the national education system. If nothing was done, the concern was that an entire generation of war affected children are at risk for missing out on the opportunity to learn. Yet, the construction of brick and mortar schools will likely take decades. In concentrated situations of adversity, delivering any form of formal education can be an immense challenge—it can be such a challenge that efforts to ensure children are learning are often not given a high priority. There is an urgent need for innovative and disruptive approaches to deliver quality education to young people. But how might this be done when the entire education system is under threat by political and economic instability? The ongoing conflict in Sudan has left over 2 million children unable to access primary school.[107] The education system lacks trained teachers, adequate school infrastructure, and its budget is not capable of responding to the country's educational needs.[108] School enrollment is low and dropout is high. There are grave concerns that an entire generation of young people is at risk of failing to receive a basic education. [109]

eLearning Sudan is a project introduced by War Child Holland, the Ministry of Education of Sudan, and its associated partners. It could be described as a highly 'disruptive innovation,' in that rather than making adjustments to an existing system it breaks the mold entirely. The delivery of the curriculum bypasses the traditional structure of the education system. It recognizes that in the current context of Sudan, such a conventional approach will not suffice. eLearning Sudan has introduced an alternative approach, intended to be both "affordable and empowering," for some of the most marginalized children in the country.[110] eLearning Sudan offers children, many of whom have never had the chance to attend school, the opportunity to learn through an innovative approach to delivering the curriculum that utilizes tablets for a self-directed and personalized program. It aims to improve learning outcomes, reduce disparities, and harness the power of cost-effective, adaptable, and scalable technology. It has the potential to serve as a model for the Commission, for its effort to apply disruptive technology to educate conflict affected young people who would have otherwise likely failed to receive an education.

eLearning Sudan was the result of a shared vision led by War Child, the Ahfad University for Women, and the Ministry of Education in Sudan. It also collaborated with the Netherlands Organisation for Applied Scientific Research, which has extensive experience in learning and in gamification.[111] The basic approach for eLearning Sudan was to develop a way to provide quality education to young people who would have otherwise dropped out, rather than waiting for schools to be built. [112] The core innovation is around the application of technology to learning. This enabled it to have a program that was, at once, local and potentially scalable.

The curriculum for the program piggybacked on the curriculum already developed by the Ministry of Education of Sudan to reach out-of-school students. eLearning Sudan took this curriculum, digitized it, and delivered it to children in remote areas using tablets, giving them a personalized experience in which they can teach themselves. It developed simple educational games that are child centered using custom-built, open access software. The graphics of the program are not imported from a western country but instead locally developed. Drawings from Sudanese children were used to inform the design of the learning environment. The instructions in the curriculum use audio and video, so children who are unable to read or write can still listen and watch the videos. The curriculum and games are customizable

for children. In one of the games, for example, children can learn through a game designed around an occupation that they are likely familiar with, such as a brick maker, goat herder, nurse, or teacher.

eLearning Sudan utilizes technology to advance an innovative, Hands On, Minds On pedagogy and curriculum. War Child and its local partners worked to digitize and adapt the country's existing out-of-school curriculum in order to deliver it to isolated communities using software. Given the urgency of the situation, the program focuses on delivery of the curriculum directly to children. That the program focuses on digital content enabled it to forego teacher training and focus directly on implementation.[113] eLearning Sudan allows children to complete Book 1 of the primary mathematics curriculum through tablets. Book 1 covers the first three years of the national math curriculum.[114]

The brilliance of eLearning Sudan is the way in which the program utilizes technology to deliver a Hands On, Minds On approach to improving learning. It turned the curriculum into a series of digital games using custom-built open access software. The adaptive design of the software enables children to also learn at their own pace. Children themselves are present in the instructional videos, so as to explain new concepts in a familiar and accessible way. Children who complete the program can get certified by the Ministry of Education to advance to secondary school.

Evaluation of the program is still in its early stages, but the results thus far are promising. A six-week pilot occurred in 2012-2013[115] with 66 children in three remote villages, plus a control group of twenty children. The results of this small-scale study were positive. All children improved their mathematics skills and those with the lowest scores on the pre-test showed the most gains. The program notes that that the program holds promise in developing robust monitoring and evaluation processes, because individual child progress can be tracked on the tablets. Learning is also measured through using the Early Grade Math Assessment (EGMA) evaluation method.[116] A larger trial of the program involving 600 children was completed in late 2015.[117] Preliminary results have been exciting. Children who participated in the program scored significantly higher in math on a pretest-posttest compared to a control group who did not participate in the program. In addition, progression of the game was also linked to mathematics proficiency. Children who completed a higher percentage of the game had higher scores on their math tests.[118] In short, eLearning Sudan has succeeded in providing quality education to young people in a way that exemplifies the underlying principles of a Hands On, Minds On approach. It has been identified by UNICEF as holding the potential to transform education programs in the developing world. The content and curriculum are currently being adapted for conflict affected children in the Middle East.

Re-imagining the curriculum within schools

Transformative adjustments to the curriculum could also be done within the institutional context of the classroom as a way to deliver a child-centered approach to learning. For example, one of the Millions Learning case studies, **Escuela Nueva (EN**) is a multi-grade classroom model of schooling. It started in the jungles of Colombia in the 1970s to reach rural children, where there was limited infrastructure for schools and teachers were scarce. **EN transforms the conventional teaching and learning environment by compelling students to work through lessons at their own pace with the teacher as a facilitator**. EN

integrates active, self-paced learning throughout multi-grade classrooms. Children work in small groups on different subjects with learning guides, which are designed for self-instruction and offer activities and instructions. The schools practice "flexible promotion" based on achieving the objectives of each grade (competency-based). There are study corners for each subject and a library. Teachers are trained through workshops on the methodology and also in-service training. Escuela Nueva's model includes innovations in the following areas, including (1) a flexible curriculum with an emphasis in participatory learning and an emphasis on 21st century skills; (2) community outreach through incorporating community members and the establishment of a student government; (3) innovative teacher training and evaluation through workshops, study groups, and opportunities to collaborate and share best practices; and (4) advancing a system of administration that is intended to be cost-effective, replicable, and scalable through collaboration with education officials at the regional and national levels.[119] EN is a great example of scaling in many different contexts and the adaptability of effective pedagogy through hands-on minds-on learning. EN is particularly compelling because of the way it transforms learning and teaching from within the education system and in the context of limited resources. Additionally, it has shown evidence of adaptability. It has been implemented in some form in 16 countries and had been adapted to urban contexts. In terms of demonstrable impact on the breadth of skills, a UNESCO study found participants in EN's Learning Circles improved children's scores in math and languages by 18 and 14 percent, respectively, compared to the national average. Other studies have found impacts in areas such as democratic behavior[120], civic behavior, social self-concept, third grade mathematics and third and fifth grade language,[121], and socialization.[122] The costs of the program vary. For example, a 1991 study[123] in Colombia found that the program cost about 5 to 10 percent higher than the cost of a traditional school. These costs included $15 for study guides, $150 to 225 for the library, and $82 per year for teacher training. Fundraising materials were estimated to cost about $25 per student.

Developing breadth of skills

Another key challenge that many educators face is how to deliver the breadth of skills to young people residing in isolated, rural communities**. Sistema de Aprendizaje Tutoria (SAT)** has attempted to address this gap by offering an alternative secondary school program for rural youth who have finished primary school. Its flexible, six-year program focuses on the **ensuring young people acquire relevant knowledge, skills, and service-oriented values that they need to be productive community members**. SAT provides alternative lower and upper secondary education to rural youth in a way that integrates relevant theory and practice so that they can continue to work on their agricultural and livelihoods pursuits. The program's trained tutors use a "learn by doing" methodology, such as learning math and science in the context of agricultural innovation, to promote rural education and community development in marginalized communities. Grounded in the Baha'i principles, SAT emphasizes civic engagement, social justice, and female empowerment, in addition to an emphasis on academic skills. SAT is accredited and recognized by governments in Colombia and Honduras, allowing graduates to continue on to university or to get jobs that require secondary degrees.

This hands-on approach has been effective to cultivate breadth of skills. The program has demonstrated impressive impact. Children in SAT villages in Honduras scored 45 percent better in literacy and numeracy than children in neighboring government rural schools. In terms of social impact, qualitative

studies suggest that SAT students in Honduras had a stronger sense of social responsibility to their communities, and female SAT students felt they had an enhanced capacity for self-determination and ability to make strategic life choices. Since its inception 40 years ago, SAT has reached approximately 300,000 students in Latin American alone. In partnership with the Honduran government, for example, total expenditures are estimated to be around $450 per student per year. SAT is now implemented by a number of local NGOs in Colombia, Honduras, Nicaragua, Brazil, and Ecuador. Guatemala also hosted an SAT program until 2005. SAT has also been adapted to other countries in Africa, Asia, and the Pacific as a sister program known as Preparation for Social Action.

The development of the breadth of skills can also take the form of work readiness and vocational training for young people who have discontinued their education. Akazi Kanoze (AK) is a USAID-funded program, implemented by Education Development Center (EDC) that reaches urban and rural youth in Rwanda. Secondary school in Rwanda dropout remains high. When children leave school, most do not have the training and skills necessary to secure wage employment or to develop a small business. To address this gap, Akazi Kanoze aims to reduce youth unemployment and to equip out of school youth with the personal and livelihood related skills needed to improve their employment prospects. Since 2009, the program has reached over 18,000 youth ages 14 to 35 with relevant support, hands-on training, and links to employment.[124]

Akazi Kanoze introduced the *Rwandan Youth Work Readiness Curriculum*.[125] The curriculum consists of a series of modules aimed at workforce development skills training and aims to strengthen vocational training with training on transferrable and life skills, such as savings groups, financial literacy, entrepreneurship training, and through training in personal development and professionalization. Program participants receive about 100 hours of work readiness training followed by another 35 hours of entrepreneurship training.[126] Akazi Kanoze also links the curriculum to internships, apprenticeships, and entrepreneurship opportunities where participants gain experience in trades related to market demand.[127] To facilitate this work, AK has formal links with over 45 NGOs, government agencies, and the private sector, which serve as placements sites for youth participants.[128]

The results of the program's randomized controlled trial suggest that AK has been beneficial in strengthening employment outcomes and work readiness. [129] Participants in rural areas were 12 percent more likely to be employed compared with those who did not participate in the program. Participants also achieved gains in work readiness, skills development, and financial management. At the end of the study, 70.1 percent of Akazi Kanoze youth felt they had the skills needed to apply for a job compared with only 48.9 percent of youth in a control group, and 55.1 percent of AK youth knew the formal elements of a business plan compared with 48.9 percent in the control group. The program also impacted employability. Program documentation suggest that average cost budgeted for the program was between $600 and $650[130] per beneficiary. AK notes that this cost is quite low compared to other interventions offering a similar range of services, which they found to cost closer to $1,000 to $1,200 per beneficiary. Another lasting success of AK is the government's buy-in to the program and its emphasis on workforce development and entrepreneurship. The *Rwandan Youth Work Readiness Curriculum* was designed to reach young people who had discontinued their studies. However, the

government is currently integrating elements of the program into the national secondary school curriculum.

Supplemental education to be used in and out of schools

Hands On, Minds On also implores us to consider specific models of learning opportunities that can be used to augment the classroom experience. These models are aimed to span across the full breadth of learning, from core academic skills to 21st century experiences. They can be used with within schools by teachers, in extracurricular afterschool activities, or by children outside of school or at home. The common theme that holds these models together is that at their core they include an interactive component that facilitates skills acquisition.

Gamification

Project-based activities often incorporate games or play into the educational milieu, an innovation which is often referred to as gamification. Gamification can be defined simply as "the use of game design elements in non-game contexts."[131] Project-based learning through gamification has the potential to enable young people to creatively engage with the subject matter in ways that compel them to innovate, imagine, and learn through play[132].

The **Literacy Education Math Lab (LEMA)** utilizes low-tech puzzles and games that allow children to teach themselves basic literacy and numeracy skills within a matter of months. It also helps children develop skills such as communication, peer-to-peer learning, collaboration, and problem solving.[133] This program uses low-tech board games that are cheap, replicable, and fun- and claims users can learn literacy and numeracy basics in just 4-6 months. Launched in 2012, LEMA illustrates a Hands On, Minds On approach to learning through the introduction of a curriculum aimed at transforming how children learn. LEMA offers a logical series of activities to develop non-cognitive skills such as communication, peer-to-peer learning, collaboration, and problem solving – along with math and literacy. The program uses board games that are cheap, replicable, and fun. The curriculum of LEMA proves a playful, active-learning space for the exploration of reading, writing and math. The labs can be established in or out of the school and are the responsibility of what are referred to as 'learning coaches' who include mothers, community leaders, youth, or teachers.[134] In 2012, LEMA held three pilots in Columbia. It has since moved to replicate its programs in the Dominican Republic and Panama. It also has plans to expand to six schools in India.

Gamification also offers an example of how Hands On, Minds On activities can benefit from the introduction of low-cost forms of technology to improve the breadth of skills. As the example of eLearning Sudan above suggests, technology holds the potential to facilitate learning through games as way that is sophisticated, cheaper, and accessible to low-income countries. Another example can be found in a software application developed in Norway called **DragonBox**,. It illustrates a Hands On, Minds On approach to an innovative curriculum because the aim of the software is to teach children how to learn by emphasizing that mastery of concepts must occur before learning subjects. Put another way, DragonBox teaches children how to learn so that they can then acquire skills. DragonBox uses games to deliver math skills in a natural, fun, and creative way. **The application translates symbolic world of a**

digital game into mathematical meaning in order to make it relevant for schools. The point is to encourage students to articulate what they learn through the learning process. Children not only learn math skills but also develop self-reliance. It moves away from learning math by rote memory and focuses on developing an intuitive understanding of what numbers mean and how they are used. Literacy is not required, and the software can feasibly be applied to different contexts. DragonBox has also partnered with a large Norwegian education publisher to do scale is project to the entire 1st and 2nd grade math curriculum for student-teachers.

Wraparound services to augment learning

Learning can also occur by providing opportunities for young people to experience the world around them as a way to develop the breath of skills. Consistent with a Hands On, Minds On approach was providing wraparound services and opportunities for children that enabled them to understand their situation differently. An example of such a holistic approach to learning is located in a large slum in Nairobi, Kenya at the **Kibera Girls Soccer Academy (KGSA)**. The school helps reach those who have not been reached in an area without access to secondary school, and offers the national secondary curriculum to some of the most vulnerable girls in the area. But what makes the school innovative are the opportunities offered outside of the general curriculum: microfinance training, sports, and arts are given priority as extra-curricular activities. As part of their Hands On, Minds On approach, KGSA aims to inspire girls and expose them to the world outside their home community. Participation in clubs offer additional opportunities to acquire knowledge, gain exposure to different careers, and provide the chance to meet people from outside the slum. These types of opportunities are valuable to the girls, who would not otherwise gain such exposure.[135] By supplementing the delivery of the national curriculum with opportunities for practical experience and exposure, KGSA ensure that girls receive the type of wraparound educational experience that they need to thrive.

New approaches in schools

We identified transformational models for learning that occur within the context of the school that sought to develop the breadth of skills. The core of our focus centered upon how children's educational experience of schooling can link to real-world concerns and issues, provide opportunity for project-based learning including outside the classroom, and be interactive. Approaches used in schools must be flexible, adaptable, and able to respond to conditions and processes that impact upon children's learning. Adaptive pedagogy is designed to respond to the needs of learners. Adaptive pedagogy is important because it is premised on the idea that that children do not learn at the same rate or in the same way. Innovations which employ an adaptive pedagogy are tailored to the learning needs of individuals, making them effective potentially more effective but also inherently challenging to implement.

Adapting the learning environment

One way in which adaptive learning can occur is to adapt the curriculum to environmental conditions in order to ensure that what children learn reflects their surroundings. **Collège Catts Pressoir** is a secondary school in Haiti. It utilizes hands-on learning activities to teach academic and non-academic

skills to students. The program has a particular focus on addressing real community need through project-based learning activities. For example, the program has encouraged students to become agents of change through environmental action in response to the deforestation that has negatively impacted the country. Students at Collège Catts Pressoir bring seeds to school that they have collected and sorted. To ensure the proper use of the seeds, Collège Catts Pressoir collaborates with community organizations that plant them. One organization uses cherry seeds to generate income for the community as they train local micro-entrepreneurs to process cherries. Since the start of the project, 1.2 million trees have been planted in ten communities. The reforestation project has been replicated in other schools across the country.[136] The school is currently working with the Ministry of Education to replicate its model nationally through technology and distance learning programs.

Adapted learning through technology

One of the benefits of technology is the potential it has to include an adaptive function in order to meet the learning needs of individual learners. We've seen examples of this already in the case of eLearning Sudan, which used an innovative software platform to enable children on the margins to complete primary education. There are other examples as well. **RN Podar** is a private school in Mumbai that caters mainly to middle-income students. It is one of the highest achieving schools in the country. The school administration considers RN Podar to be a laboratory of experimentation. It is Hands On, Minds On in the way it has introduced innovative, student-centered ways to improve learning within the setting of the classroom. RN Podar uses technology to advance a blended learning approach in the classroom, engage with community members using WhatsApp, Skype classes with subject experts, Google Apps, and social media to create an environment that focuses on academic proficiency as well as bring joy to learning. Of particular salience to Hands On, Minds On, RN Podar was the first school to pioneer a 'flipped learning' classroom in India. That is, students watch pre-recorded lessons at home, and this frees up classroom time to engage with teachers in a deeper way through problem solving, discussion, analysis, learning activities, peer learning, and the application of knowledge. A flipped classroom means lecture hours can be used to provide more personalized supports and solutions for children. It allows for learning to be self-directed, self-paced, personalized, and customized.[137]

Another way in which adaptation can be understood is by providing young people to technology through project based learning. **Digital Equalizer** uses such an approach. It introduces young people to foundational concepts including the promotion of 21st century skills and training in ICT while improving learning outcomes. Based in India, Digital Equalizer works with government schools and within the national curriculum, and in doing so, seeks to bridge the digital divide for students who normally would not have access to such technology. Digital Equalizer equips schools with computers and Internet access. The computing technology is procured at discounted rated through partners such as Hewlett Packard.[138] Through the provision of hardware, software, and training, Digital Equalizer is trying to infuse 21st century skills into academic content so that young people can join a competitive, modern workforce. The program costs about $10 per student each year.[139] In terms of effectiveness, a 2004 pilot project in Karnataka showed that over a three-year period, pass rates in math and science increased by 13 percent. A 2009 review of math and science scores by the Punjab government and found that there was a statistically significant difference in schools that had the Digital Equalizer program.[140]

Hands On, Minds On learning: Contextual Requirements for Innovation
While each innovation profiled here exemplifies an application of hands-on, minds-on learning, the context in which it is developed and implemented is important, especially for cost considerations. Schools and communities need to take into the requirements underpinning the different models, for example:
1. **Schools that leverage community experiences:** A number of the innovations profiled here have found low-cost ways of integrating hands-on, minds-on learning into their curricula and schooling model, particularly by working in the communities around them. Kibera Girls' Soccer Academy, for example, is a secondary school that offers the state's secondary school curriculum, but supplements learning with student-led co-curricular activities like sports and clubs related to issues facing their community. The Living School, while operating in a rural area of a high-income country, similarly leverages the local farms in their community to teach "eco-citizenship." And College Catts Pressoir, a private school in Haiti has integrated community projects also related to farming and science to give students hands-on experiences. This requires a whole-school model to be in place with teachers, students and infrastructure, yet gives a model for low-cost ways of altering teaching and learning practices to provide hands-on minds-on learning opportunities.
2. **High-resource, high-tech environments:** RN Podar school in India offers students opportunities to direct their own learning through use of technology. Hands-on minds-on learning is implemented with success through a high-tech environment as well as encouraging student community-driven projects, which also allows their school to reach many students in an urban environment, over 3,000. With tuition totaling $1,500 per student per year, this model could be best used in environments where technological and financial resources are available. DragonBox is another example, which has potential for broad reach as it costs $4.99 to download and does not require literacy, however does require access to a smartphone or other device.
3. **Filling gaps with hands-on tools:** In some cases hands-on minds-on learning is deployed through applications and games that allow marginalized children to direct their own learning. eLearning Sudan is suited to reaching out-of-school children who otherwise would not have access to education. Similarly, LEMA is a low-tech game used both in and outside schools to accelerate learning basic skills through self-directed learning. While utilizing technology drives up the costs, internal records have estimated about $172 per student for the three-year curriculum, both innovations have potential to scale to many learners out of school.
4. **Holistic model that prioritizes hands-on, minds-on learning:** Other examples of hands-on minds-on learning come through the provision of a whole school or program model, such as the case of Akazi Kanoze and Escuela Nueva. These incur more costs as they require the development of curriculum, materials, teachers, and infrastructure, but can still operate in low-resource contexts where high-quality options for education and training are not present. In the case of Escuela Nueva, an additional 5-10 percent expenditure than a traditional school

helps improve learning and retention. Akazi Kanoze is estimated to cost $600 per beneficiary, not a low-cost option for many but still lower than many workforce training programs that average $1,000-1,200 per beneficiary.

Hands On, Minds On: How can technology improve children's learning?
1. **Improve scale of outreach while driving down costs.** In the case of Digital Equalizer and eLearning Sudan we saw cases in which technology operates as a platform. These cases required up-front investments in both hardware and software, but they have demonstrated applicability to improve children's learning at a local level. They also hold potential for adaptation and scalability to other contexts as technology becomes cheaper the greater number of users, and can enable rapid scale.
2. **Develop 21st century skills.** Technology is not only a tool to improve children's learning; using a computer, tablet, or mobile device as also imparting important skills in themselves that children must be familiar with in the 21st century, including digital literacy but also collaboration, self-regulation and creativity. Cases such as Digital Equalizer, RN Podar, and eLearning Sudan highlight the ways young people can learn a breadth of skills through the integrated use of technology.
3. **Personalized learning.** Cases drew attention to the potential of technology to respond to the learning sciences and in particular, our recognition that effective learning must be applied. Cases such as eLearning Sudan, RN Podar, Dragonbox, and Digital Equalizer illustrate ways in which young people can interact with technology in a way that enhances their learning, particularly by being able to move at their own pace and working with software that can adapt to what they do and do not yet know. Technology can break curricula into modules that allow children to work at their own pace.

Action 2: Elevating the Education Workforce

There is a great need to expand and support the education workforce. Evidence shows that high-quality teaching significantly impacts student learning. In Latin America, a study of 15,000 teachers showed that being taught by a strong teacher is more important than being in a good school. [141] Studies from other regions have shown similar results.[142] Yet many countries struggle to train and support enough high-quality teachers to meet the demands of their education systems. In the innovations scanned, 36 percent were employing new and different approaches to supporting teachers or teaching.

One major challenge in the education workforce is providing effective training and support for teachers. Studies have shown that teacher training often reinforces teacher-centered pedagogy through lectures rather than modeling effective teaching through hands-on practical training.[143] In a survey of teachers from 34 countries, most of which are high-income, the OECD found that "most teachers are still teaching largely in isolation."[144] Half of teachers surveyed reported rarely or never team teaching with their colleagues and 46 percent reported never receiving feedback on their teaching from school leaders.

Many innovative approaches we found are aiming to remedy this situation by leveraging **peer-learning and collaboration among teachers to improve training and support.**

Additionally, teachers are burdened with crowded classrooms, a range of administrative tasks, difficulty designing lessons, and finding content. They are expected to be experts in academic subjects, child development and pedagogy, adept at managing a classroom and discipline along with collecting data and carrying out administrative duties. In many places, teachers have to wait months for their paychecks and are forced to hold multiple jobs to make ends meet.[145] In Pakistan, teachers report spending more than 50 days of the year on non-teaching related duties related to elections, vaccinations, and enrollment drives.[146] To quote the *Millions Learning* study, the view that teachers are a general public workforce and "that education is a panacea solution to many social ills, places a very large, and perhaps unfair, burden of responsibility on teachers."[147] The study found that, when looking at approaches in low- and middle-income countries that have scaled up with improvements in learning, **elevating and unburdening teachers was a key strategy** used by many. We similarly identified many promising innovations that are working to unburden teachers.

Developing countries are also facing massive teacher shortages- 2.7 million fewer teachers were employed than were needed in 2015.[148] At current trends, over 25 million new teachers will need to be recruited by 2030 just to ensure every child can attend primary school, let alone secondary and early childhood education.[149] The shortage is most acute in the countries farthest behind, especially sub-Saharan Africa, which according to the UNESCO Institute of Statistics accounts for two thirds of the additional teachers needed to achieve universal primary education by 2030.[150] In order to meet the overwhelming demand for teachers, many innovations are **expanding the workforce by broadening pathways into teaching**.

In this section we explore 20 examples where innovative approaches focused on elevating and expanding the education workforce. These promising approaches were used in a variety of contexts and high- or low-tech environments, and they illustrate practices with broad applicability to get better results and reach those who have not been reached.

Elevating the Education Workforce			
Intervention/Country	*Description*	*Technology Used*	*Context Needed*
Reaching Those Who Haven't Been Reached			
Amazonas Media Center (Brazil)	Government program uses digital satellite technology to deliver live lessons to hard-to-reach children	Two-way video system that uses digital satellite technology	Two-way video technology; electricity; connectivity; trained facilitating teacher per school; expert teacher per subject
Sesame Street (Global)	NGO educates preschool-aged children through various electronic and	Television, radios, videos, websites, tablets,	Local co-production teams to tailor content; context-specific platform often

	print media on math, literacy, health and social-emotional competencies in and outside classrooms and through community and parent engagement strategies	smartphones, depending on context	requires electricity, television, radio or mobile device; community facilitators
Improving Results			
STIR: Schools and Teachers Innovating for Results (India)	NGO that focuses on teacher motivation and incentives for teacher collaboration	Not a focus	Universal schooling with teachers in place; school buy-in; modes of transport for school visits and methods for communication
Digital Study Hall (India)	NGO uses hub-and-spoke model to provide video lessons to teachers	Television; DVD's; mobile phones; internet	Master teachers to create video content; electricity; television, phone or computer
Video Technology for teachers in Pakistan (Pakistan)	NGO trains teachers and students to use pocket size projectors to play instructional videos	Battery-powered pocket sized projects; videos held on flash memory	Government curriculum to align with; instructional video that are contextually relevant
Lesson Study (Zambia)	Government program offers a peer-to-peer teacher training practice	Not a focus	Teacher buy-in; established professional development program; alignment with government curriculum
Edmodo (United States)	Free platform from an ed-tech company for educators to communicate, collaborate, and integrate digital content	Software platform available for mobile and desktop	Smartphones, tablets or computers; internet connectivity; teachers and/or students adept at using technology
Educate (Uganda)	NGO and government delivers entrepreneurship training and mentorship to secondary school students	Mobile money platforms; SMS data collection to assess students' and graduates	Secondary schools with teachers; entrepreneurs/Educate! graduates for mentors; open source curricular materials; mobile phones for data and money collection; school and teacher buy-in
Pratham's Read India (India)	NGO and government provide remedial	Back office technology to collect data	Locally recruited and trained volunteers or

	education to children in rural areas at school and in intensive camps		teachers; effective government partners
Teach For All (Global)	Network of NGOs that recruit top-performing graduates and professionals to teach in underserved communities	Not a focus	Pre- and in-service training for teachers; government buy-in; partnerships with teacher organizations and training institutions; partnerships with schools and governments
Sistema de Aprendizaje Tutorial (Honduras)	NGO provides alternative secondary education for rural youth with a focus on applied learning	Not a focus	Community tutors; training materials in SAT pedagogy; learning materials and study guides; community buy-in; government recognition of alternative curriculum
Badiliko Digital Hubs (Nigeria)	NGO introduces ICT within clusters of schools or community centers	Microsoft-supported computers and software	Community spaces; solar power; government and private sector partners; computer labs; teachers
Khan Academy (Global)	NGO offers free instructional videos and practice exercises for students K-12, available in a variety of languages	Digital video content streamed from YouTube via computer, tablet, or smarthphone	Internet connection; device
Khan Academy Lite (Global)	Khan Academy videos in an offline format	Digital video content viewed offline via computer, tablet or smartphone	Requires device with content previously downloaded
Teacher Community Assistance Initiative (Ghana)	NGO trains high school graduates in communities to offer remedial education	SMS used for monitoring and evaluation	Recruitment and training of high school graduates
Pixatel (India)	Tablet-based adaptive learning platform that provides personalized math exercises and allows teachers to assess student progress in real-time from an ed-tech company	Tablet; cloud-based platform	Tablets; teacher buy-in and training; occasional but not constant internet access and electricity; established schools with funding

INJAZ (Jordan)	NGO provides weekly entrepreneurship and work readiness programs for secondary and post-secondary students	Not a focus	School buy-in; volunteers from local businesses to teach
Edunova (South Africa)	NGO that trains unemployed youth to develop ICT in schools	Relevant ICT for schools	Willing youth to participate in training; school demand to address delivery challenges of ICT
Driving Down Costs			
Worldreader (Sub-Saharan Africa)	NGO provides access to culturally and linguistically relevant digital books	Digital books; tablet	Partnership with local publishers; teacher training to ensure maximum integration; tablet or other device to download and read books
Photomath (Global)	Smartphone application reads math problems through device camera and provides step-by-step solutions from an ed-tech company	Smartphone with camera	Smartphone; electricity; access to internet to download application; math textbook or workbook (does not yet recognize handwritten text)
The African School for Excellence (South Africa)	Low-Fee Private secondary school that uses rotating classroom with lead teachers and teaching assistants to keep costs low	Google classroom on in-classroom computers; developing centralized administrative and data systems with technology	Teachers trained in rotational model and student-centered pedagogy; computers in classrooms equipped with Google classroom; fee-paying secondary school students in urban slums; school leader responsible for school environment; location to build specialized school building

Supporting and developing teachers through peer-learning and collaboration

In our scan of innovative models, we identified a large number which are working to improve teacher training. Seventy-eight percent of the innovations that aim to improve teaching are doing so through teacher training. We found that the most promising innovations went about this by improving collaboration and peer learning between teachers.

In India, STIR Education does this by facilitating networks of motivated “teacher changemakers,” who in turn help support and motivate other teachers. Edmodo, a global education technology platform, has

developed a teacher collaboration website set up to function as a Facebook for teacher to share resources and collaborate across the globe. In sub-Saharan Africa the Badiliko Digital Hubs employs a peer-learning model that brings teachers together for ICT training and then in turn trains them how to train their colleagues. Each of these illustrate the core component that supporting collaboration can improve teaching and learning in diverse contexts.

Case: STIR Education

Recognizing that talented and motivated teachers were the key to addressing India's learning crisis, Sharath Jeevan founded **Supporting Teachers for Innovating Results (STIR)** in 2012 to assist teachers with innovating and making change in their classrooms. Initially, STIR saw the solution to teacher capacity and motivation as one that could be addressed through funding them to experiment, and so STIR at first focused on identifying and funding "micro-innovations" that teachers could implement in their classrooms. This description from a 2013 article describes how STIR got its start:

> "STIR was launched in Delhi in 2012 with an ambition to build on what the Heath brothers—in their book *Switch*—call the "bright spots" that already exist in the education system. Our organization identifies, tests, and scales micro-innovations—that is, low-cost (often no-cost), teacher-led practices that have the potential to make a significant positive impact on student learning. One micro-innovation was developed by Sajid, a principal in a school attached to a madrasa in East Delhi. Sajid films his teachers' lessons and asks them to review the film using a structured self-reflection sheet, then shares his own feedback. Another example is a student letterbox, developed by a teacher named Jasbeer, which allows students to share concerns and questions with her in writing; this closes the distance between teacher and student, and allows Jasbeer to monitor student writing."[151]

But after the first round of micro-innovations, they realized that encouraging new ideas was only the initial step in improving teaching. The real value came from the collaboration and face-to-face interaction that teachers had with each other. The collaborative network of the "bright spots" did more to motivate, empower, and ignite a spark in teachers than simply encouraging innovation on its own.

STIR's model now focuses more heavily on connecting teachers to one another and helping them to see themselves as agents of change within education systems. Their model identifies teachers with potential to be changemakers through its applications for micro-innovations. It then works to support and train those teachers to implement their innovations and learn from the successes and failures. The training and support STIR offers aims to increase the number of evidence-based practice into their day-to-day practice.

The second component of STIR's model encourages the changemaker teachers to spread their knowledge and innovations with their peers. After the first year of training and innovation support, teachers join a local network that includes other teachers, school leaders and government officials. Through these networks teachers can learn from each other and share best practices, connect with NGO partners, and advocate for reform to governments. This model of professional development aims to empower teachers beyond simply giving them new knowledge and skills but rather building in the

necessary collaboration and motivation that develops a culture of continuous improvement and larger system change.

While still a very new organization, STIR is on its way to reaching a large scale. In 2013 the organization spread to Uganda, and as of 2016 STIR has worked with 23,203 teachers in 7,174 schools through 846 teacher changemaker networks impacting 874,790 students across India and Uganda. They have signed MOUs with the government of Uttar Pradesh in India and the Ministry of Education, Science, Technology, and Sports in Uganda, both of which allow STIR to integrate their model directly in the public school systems. They have built broad support, partnering with many NGOs as well. Their aim is to build a network of one million teacher changemakers by 2021, reaching 40 million children.

Currently they are undergoing an evaluation to study their model's impact on student learning and teacher motivation. Its initial studies have shown promise. In Uganda, a group of teachers who engaged with STIR were four times more likely to be on time for work. A non-random sample of students in Delhi showed learning gains in math and reading scores. STIR's partner organization in India, Room to Read, reported teachers who engaged with STIR spent 10 percent more time on task than others.

While these results aren't definitive, STIR is a promising model for education systems to incorporate peer learning and collaboration among teachers. Additionally, it is relatively low-cost, given the context of an education system that has already achieved near-universal access. STIR costs $200 per teacher per year, translating to $6 per student impacted, while operating on top of the established school system. When asked where STIR would not be effective, Jeevan replies that they rely on the existing system, where there are schools with teachers and most children are enrolled. The context of an established system is important, as Jeevan notes that their model would not work in areas where children were not in school.[152] Thus, STIR is a good example of a way to get better results, with its aim to solve the learning crisis.

Many other examples in our database employed teacher collaboration and peer learning to get better results using a variety of means from high- to low-tech. Edmodo employs an online platform that helps teachers collaborate in and outside their local communities, the Badiliko Digital Hubs use ICT training hubs to engage teachers in their "cascade" model of peer-to-peer teacher training. In the Lesson Study program, the government of Zambia worked to incorporate a peer learning model developed in Japan that helps teachers learn and use evidence-based practice in their teaching. Together these show the different ways NGOs, governments, and companies can apply the principle of training and supporting teachers through collaboration and peer-learning.

In the case of **Edmodo**, technology is the major enabler that can help improve teaching all over the world where teachers have access to connected devices. The platform functions as a kind of Facebook for the classroom, developed to be a social network that has the social foundation of teaching and learning ingrained within it. Founded in 2008, it was a response to increasing numbers of teachers using Facebook to communicate with each other and their classes, capitalizing on the need for collaboration tools that are educator-focused. The platform is free for teachers and students to use, but charges for some of the district-level administrative functions and content. What it offers to teachers is an easy

"one-click" format that allows them to share content, access professional development, administer assignments and assessments to students- moving from their local community to a global one seamlessly.

The value of Edmodo does not necessarily seem to be its platform for sharing and assessing content between teachers and students, in fact programs for decades have used technology for this purpose. Rather, its interface that operates as a social network, that looks and acts like an application most teachers are already familiar with, Facebook, and the multiplying effect that connection and collaboration can have appear to be its added value**.** In the same way that STIR works to build physical networks among educators to help support them, Edmodo focuses on the power of virtual communities. Currently they have nearly 65 million users in 190 countries, both teachers and students, and are integrated into 370,000 classrooms. It is available in 17 languages, with plans to expand further. While there aren't any studies of how Edmodo improves teaching and learning, the number of teachers who have opted to take up the platform is a marker of its potential. Anecdotal evidence points to the ease of use and satisfaction of teachers. According to a company-administered case study of the Chesterfield County Public Schools in the US, "Our qualitative data indicated that, according to teachers, key Edmodo adoption factors were the opportunities for 'unstructured' professional development (PD), familiar user interface, ease of formative assessment, and increased student engagement. Students required no training, appreciated the message notifications, mobile apps, and the ability to communicate with their teachers and classmates outside of formal class time."[153]

Edmondo is working directly with some governments to implement its platform at scale in setting such as the state of Aguascalientes in Mexico. While the platform is free and easy to use, it will only function in high-resource environments where teachers and students have access to smartphones, tablets or computers and also are connected to the internet. Currently 50 percent of their users are in the United States.

Other examples employ the principle of peer-to-peer professional development in a more low-tech environment.

The Lesson Study program in Zambia, one of the Millions Learning case studies that achieved improved learning outcomes at scale, is an in-service teacher training program where teachers worked together to plan, observe, and give feedback to each other in learner-centered teaching methodologies. The collaborative nature of the training is a key element to improve teachers' skills, rather than top-down professional development activities. From the Millions Learning case study:

> "Implemented by the Zambian Ministry of General Education in partnership with Japan International Cooperation Agency (JICA), [it] is a peer-to-peer collaborative learning practice where primary or secondary level teachers share knowledge and skills to continuously improve teaching through a monthly cycle of Plan-Do-See activities. Every month, depending on the calendars of individual schools and the number of teachers available, teachers conduct Lesson Study activities where fellow teachers plan and observe a lesson followed by a discussion about ways to constructively improve these lessons. Through these conversations, teachers learn

> techniques to improve learner-centered teaching methods and develop problem solving and critical thinking skills. The method aims to strengthen school systems by encouraging teamwork among teachers and improving supervision among school managers."[154]

This collaborative training was so popular that even teachers not involved in the program began to implement the model at other schools in Zambia. The program is currently being adapted and implemented in at least 21 other countries across sub-Saharan Africa.

This is a good example of implementing collaborative learning among teachers at scale, and through the public system. Lesson Study leveraged existing government structures and support for in-service teacher training, focusing on changing the existing methods of professional development rather than adding on a donor project. Its model has been effective at changing teaching practices to incorporate more active, hands-on minds-on learning. In terms of student impact, "results from an internal monitoring and evaluation study completed in 2010 found that after three years of introducing Lesson Study in Central Province, students' pass rates were 12.4 percent higher in physics and chemistry and 19.2 percent higher in biology, compared to schools in other provinces."[155] Over ten years, Lesson Study reached 46,058 teachers, resulting in reaching 1.8 million students in more than 50 percent of government primary and secondary schools by 2015.[156]

The Badiliko Digital Hubs employ what they call a "cascading" training model. Teachers attend training on ICT at local "hubs," and are also trained to train their colleagues when they return to their schools. This makes the innovative aspect more than just novel use of technology, but actually building leadership capacity within teachers and assisting them to train each other on best practices. The model is widely applicable, the hubs are run in existing structures such as community centers, with a setup that makes computer labs run at 60 percent of the usual cost, powered by solar and using long-range wireless to reach rural areas. Badiliko Digital Hubs are present across Ethiopia, Ghana, Kenya, Nigeria, Tanzania and Uganda, and have reached more than 3,500 teachers to date.

These four innovations exemplify how teaching can be improved through peer learning and collaboration in many different contexts. Additionally, this shows a variety of actors can have an impact on teaching practice- in these cases an NGO, a private company, a national government, and partnership between a technology company and NGO.

Unburdening and elevating teachers

A number of education models are working to unburden teachers by leveraging technology or other community resources to take tasks off teachers' plates and allow them to focus more heavily on instruction and facilitating learning. Our scan of innovations found that 18 percent of those that are innovating to improve teaching are doing so through changing the role of the teacher, in most cases by providing resources or tools to ease their workload and unburden them from the many extra tasks they have. The cases below provide examples of how this is being done, through technology that can provide content or personalized instruction, by defining different types and roles of teachers, and by leveraging members of the community to assist in instruction.

Digital content to unburden teachers

Digital content can unburden teachers from many of their tasks related to planning lessons and needing to be an expert in many subject areas. **Khan Academy** is one example of digital content that can assist teachers in spending more time on facilitating learning without needing to be an expert in many subjects. A set of free online instructional videos, Khan Academy aims to rethink the role of the teacher by providing instructional content from experts across a number of fields. They have pioneered the "flipped" classroom, in which students can study concepts and content independently, allowing the teacher to build "playlists" for students based on where they need improvement and practice. The teacher then can focus on more active learning facilitation in the classroom, engaging students in discussion, group work or practice rather than transmitting content. Students also can use the videos on their own as a form of tutoring or remedial assistance.

The interesting aspect of Khan Academy is its ability to provide tools for educators that unburden them from the tasks of lecturing content, and its flexibility allows them to use the modular format to put together "playlists" of lessons for different students. While most of the videos and content require a high-tech environment where students and teachers have access to devices and are connected to the internet, the content has been adapted also to function in rural and low-technology environments. One interesting example of this has been a project in Pakistan piloted by the NGO Society for the Advancement of Education (SAHE) to equip teachers in remote areas with videos to assist their instruction. The project has adapted Khan Academy math instructional videos in Urdu that can be played on battery-powered pocket-sized projectors that do not need electricity or internet connectivity to function, a relatively low-cost alternative. Teachers can incorporate the videos into their lessons to unburden them from needing content knowledge on every math topic and allow them to focus on facilitating instruction. In partnership with the Punjab Directorate for Staff Development, the program also provides training and support for teachers and schools. Khan Academy has been adapted in other ways as well, for example the volunteer-driven initiative KA Lite which adapts the content to be used offline,[157] and "Kahn Academy on a Stick" which formats the videos to be transferred to a flash drive and also used offline.[158]

Considering the costs of developing Khan Academy are quite low per-student, diversifying the provision of this type of content to more low-cost devices could make it a cost effective tool for teachers. According to Khan Academy their operating budget is $7 million, and they reach 10 million students per year, placing the per-student cost below $10 per year. Teachers in the United States using Khan Academy in their classrooms have reported that it helped improve student's math understanding, problem-solving skills and giving students ability to learn and apply concepts above their grade level.[159] Considering these potential impacts this kind of content that includes instructional videos and assessments of student learning could be a promising application of unburdening teachers to improve learning.

PhotoMath, an educational mobile application also shows that technological resources for teachers have the potential to be extremely cost-efficient as they scale up. The application assists students working on math problems, either for homework or other study materials. Using the application, students can take a picture of a math problem they are having difficulty solving and receive step-by step

guidance on how to solve it. The latest version includes functions of a scientific calculator, the problem solutions are accompanied with explanations about what formulas to use as well, and it is localized to sixteen languages. The application is free to use, and currently the company has been backed by investors and venture capital.[160]

This kind of application can provide another tool for teachers to use, who cannot be present with every student as they do their homework or even in classrooms when teachers with large classes cannot provide personal instruction on every practice problem. In many ways it could also supplement the work of a private tutor who provides guidance on solving practice problems- at a fraction of the cost. The sheer scale of Photomath makes it incredibly cost effective, as unlike hiring tutors the more students who use it, the cost per-student falls dramatically. Michael Staton of Learn Capital, a venture capital firm that has invested in Photomath , explains how on average it helps learners solve 3 million math problems every day- something it would take 250,000 hours of tutoring to accomplish. Photomath's daily operating budget is just $550, meaning they spend less than 1/5 of one penny per learner they reach.[161] One of the greatest potentials for these types of tools to unburden teachers is the fact that they can reach massive scale at extremely low costs, something physical materials or human resources cannot.

Similarly, **Worldreader,** an NGO with users in 69 countries across the world and another of *Millions Learning*'s case studies, also aims to bring contextualized and low-cost content into the hands of teachers, aiming to make teachers more easily engage students in lessons and build a culture of reading. They offer a number of programs that vary from providing access to e-books, loaded onto e-readers or accessed from other devices, to school programs that equip classrooms fully with devices, content, technical support, and teacher training. Their model saves over traditional books, and they estimate that the average e-book they provide costs $0.80 for each additional copy versus $4.00 for paper books. However, even with falling costs of devices the full program comes out to $16.20 per student to deliver, making it fairly expensive for some settings. However, their program has shown promise in improving learning outcomes, and for many areas which still do not have access to textbooks it would assist teachers in accessing and providing quality content in many languages. According to the Millions Learning Case study:

> "According to teachers participating in the iREAD Ghana Study (2011-12), this access has given them a greater range of resources to draw upon while planning their lessons, improving the overall quality of the content covered in class.[162] E-readers have also saved them time from having to search through the limited books in their schools' libraries or from having to pay to use internet cafes to conduct background research. They have also been able to "push" textbook materials and supplemental learning materials to students' e-readers without having to worry about access to the material for all students or burdening students with extra costs."[163]

Pixatel, a tablet-based adaptive learning platform, is another example of a tool that can unburden teachers by providing personalized math activities and practice problems, while at the same time giving teachers instantaneous assessments of their students' abilities. The program has taken two major curricula used for grades 1-5 in the state of Punjab in India and adapted them into modules to practice

the content through games and practice problems based on areas of the curriculum. The platform adapts to student learning, tailoring the practice sets based on a student's ability. This is promising for improving student engagement. The games help students learn where they make mistakes and encourages them to continue trying until they get it right. On the back end, it gives teachers access to data on how their students are performing without needing to invest time in grading and returning the problem sets, and shows how much time each student has spent in each module.

Interestingly, Pixatel's founder Prabhjot Singh explains that they have had more success than previous educational technologies by approaching their product as a tool to help teachers rather than simply an infusion of technology into classrooms.[164] While their tools don't require teachers to have knowledge of technology, the company recognizes that they do need teacher buy-in to be successful. They accompany their program with teacher training, some related to using the devices, but also general professional development. For example, they recently offered a 1-2 day professional development retreat for teachers in the 25 schools they are currently operating in.[165] Singh also identifies their alignment with the curriculum and working to be sure modules are broken down to match how teachers teach their lessons have been a key factor in teacher uptake and comfort with the technology. Taking the tasks of grading and administering practice problems off teachers' plates also assists them in doing their job better. Currently Pixatel is working with J-PAL to evaluate their impact, but preliminary results report the weakest students and girls have benefitted the most, and teachers report student have greater confidence and a better attention span.[166]

Cost is certainly a barrier to the scale Pixatel can reach. Their cloud platform allows devices to function in a low-resource environment without high connectivity, but the cost of devices is high. Their website claims that an entire school can be equipped with the platform, devices and training for $10,000. On the other hand the adaptive software itself is being driven down to low costs. The aim is to be at $5 per student for the program, and to offer it for download to use on any device. Currently they are operating in about 50 low-fee private schools, but are talking with governments to scale into public schools as well. They have received stage two funding from USAID's Development Innovation Ventures to scale.[167]

Digital Study Hall (DiSH), an NGO program in India, takes this concept one step further. While Khan Academy, World Reader, and Photo Math are examples of tools targeted at students that teachers can use to ease their burden, DiSH works directly through teachers to help them improve. They provide primary and secondary school teachers in remote areas with videos to use to teach their students content and that model effective pedagogy so they can learn to be better teachers. Digital Study Hall uses "mediation-based" pedagogy, which refers to giving a classroom teacher a quality model on videotape which the teacher then uses with his/her students. The video provides an example, a lesson plan, and a content and methodology model. DiSH works through a network of hubs and spokes, with hubs that work on content production and spokes that operate in urban slum schools. DiSH further creates a digital database of curriculum implemented by the government, with 260 teachers trained in delivering the video technology and 4,100 students who receive the content. The DiSH database contains more than 3,000 lessons in five major local languages and 500 other educational videos.[168] In this case technology amplifies existing human resources, using simple videotapes. This gives teachers

more resources at their fingertips in terms of content materials in areas where textbooks and other learning materials are scarce, and very few teachers receive in-service training as well.

An additional function of DiSH is to help teachers connect, collaborate, and build their community. The program features a mobile phone messaging system for teachers to participate discussions and problem-solving on lessons and assignments, as well as allowing students to engage. This has been identified as a key motivator for both teachers and students, and especially giving teachers a personalized resource to help them improve their teaching.

Elevating Teachers' Roles

Innovations are also changing the role of the teacher to unburden them. In the Amazonas state of Brazil, thousands of remote villages are scattered along rivers and through jungles, making access to secondary school a major challenge. To solve this problem, the state's secretary of education pioneered the **Media Center**, a schooling model that placed an expert teacher to develop content and lecture through a two-way video system from a studio in the capital, while classrooms in 1,000 villages were managed by a facilitating teacher to work with classes in-person. This model was studied in the *Millions Learning* report as an effective approach to reach the marginalized at scale. The key component of this model is that it takes the traditional roles of a teacher and allocates them between two distinct types of teachers, one who delivers content, and the other who manages classroom learning. This unburdens teachers from needing to both be experts in many areas of content and lesson design and facilitate learning. It also alleviates the education system from needing to place many content-specific teachers into every school by using technology to scale the expert teachers' lessons and instead needing just one generalist teacher at each school.[169] The Media Center has been effective at improving access to secondary school for youth in 6,000 extremely remote communities, the dropout rate falling by half since 2007 and progression rates increasing by 16 percent. Demand for the model led to an expansion to middle school and adult education, and it has been adapted to seven other states with difficult to reach or marginalized populations. Along with the increases in access, students have performed well on Brazil's national exams and a rigorous evaluation of its impact on learning is currently being conducted. Media Center's model is less clear how much it saves in terms of costs, costing $280 per student per year for the classrooms but also incurring large costs for transportation of students from their own villages to the neighboring classrooms.[170]

The African School for Excellence, a low-fee private school in South Africa similarly works to unburden teachers by changing their roles and altering the learning environment, but in an urban environment. They employ a "rotational" model in their classrooms, meaning students rotate between teacher-facilitated lessons, small group peer learning activities, and individual work on computers.[171] This model allows the school to facilitate the learning process effectively, as it places the teacher in the role of the facilitator rather than direct instructor, and also enables them to have larger class sizes due to the classroom model, and the school can higher fewer, highly-skilled teachers. They are currently spending 60 percent per student of what traditional government secondary schools spend, in large part due to the need for fewer teachers.[172]

Leveraging Community Members

Another way that innovations are unburdening teachers is by leveraging human resources from within communities to take on additional teaching and learning tasks. Teachers often have the responsibility of teaching additional subjects and areas of the curriculum, and their role is often stretched thin by teaching to large groups of learners who are at widely varying levels. Many innovations have found that bringing in community members can alleviate and unburden teachers to provide instruction on different subjects or provide personalized instruction.

In the case of **Educate!,** an entrepreneurship education program studied in *Millions Learning* started in Uganda, the program leverages local entrepreneurs to teach their curriculum. This allows secondary schools to add a course and develop additional skills in their students while not adding more to teachers' plates. The program has had success with mentors, the young entrepreneurs who are graduates of the program themselves and have experience running their own businesses.[173] **INJAZ**, a program in Jordan trains volunteers from businesses to teach workplace relevant skills and financial literacy to help improve graduates' employability. Over the past 15 years, they have reached 1.2 million youth and trained bore than 27,000 volunteers.[174] Similarly, **Pratham's Read India** program has looked to volunteers as well as teachers to help direct instruction in their "teaching at the right level" methodology. Through small group tutoring during and after school that provides instruction based on each student's level they have achieved gains in both literacy and numeracy.[175] Each of these exemplify the resourcefulness organizations can employ to get better results without overloading teachers, and without needing to invest in technology, rather they can look to those in the community to share their expertise.

In terms of cost-effectiveness, the programs will certainly vary by whether they train volunteers or paid employees. Educate!'s model costs $100 per learner in Uganda, which at full scale is predicted to fall to $63. INJAZ's volunteer-driven model is of significantly lower cost, with funding over 15 years totaling $20.4 million and translating into $17 per student reached by the program. Read India's model offers different combinations of volunteers and using existing teachers, and costs approximate $10-15 per child. These effective approached provide an interesting alternative to the standard schooling model that can leverage human resources in the community. Much can be learned in this sense from the health sector, which has developed a model to train community health workers to take on many tasks that previously required doctors, but have helped expand access to care across the globe. (See Box: Community Health Workers)

Community Health Workers
Community Health Workers (CHWs) cover a spectrum of salaried or volunteer, professional or lay workers who are integrated into health systems with varying degrees of training and competencies.[176] The global health movement has increasingly emphasized the frontline role CHWs can play in increasing access to quality health services. Relying on community members is a particularly strategic move to meet the shortages of highly skilled health workers in low-resource environments.

Additionally, CHWs are found most effective when supported by a clinically skilled health workforce, especially in maternal care. This growing body of evidence has motivated investments in CHWs as a means to reach the Millennium Development Goals and Sustainable Development Goals. Given the parallels between the health and education workforce, an important strategy can be drawn: leveraging community members' expertise is a crucial means to help support teachers inside and outside the classroom. With systematic training, deployment and supervision, engaging CHWs can function as an effective subsystem to supplement a larger health system.[177]

Expanding the Education Workforce

Finally, many innovations are expanding the teacher workforce by broadening the pathways into teaching. In addition to those innovations that leverage resources from communities to unburden teachers, others are broadening the pathways into teaching to help broaden the education workforce in creative ways. In our scan of alternative models of schooling, we found that 21 percent of innovations focused on teachers were bringing more people into teaching.

Read India, Educate! and INJAZ are all examples of bringing in community members to expand the education workforce, working hand-in hand with classroom teachers. Other innovations we found are taking this a step further and aiming to open up new pathways to who can become a teacher, such as Teach for All, a case study from *Millions Learning*.

Teach For All is a global network of 40 partner organizations in countries around the world that work to bring people from outside the education sector into teaching, and as their long-term theory of change, into lifelong efforts to improve education systems. The model aims to address educational inequities by recruiting top talent to serve for two or more years in as teachers in high-need schools. The Teach For All model aims to address the issue that teaching is often considered a low-prestige profession, and may not attract the brightest university graduates.[178] Teach For All has helped open up new pathways into teaching for many of these people who did not consider teaching or a career in education, helping to expand the teacher workforce.

The Teach For All model is not necessarily the most cost-effective way of recruiting teachers, as it is a fairly high-cost model. Furthermore, the aim of the Teach For All network, in the words of founder Wendy Kopp, "is not to grow to the point where the partnering organizations provide all – or even a substantial portion – of a nation's teachers of leaders. Rather, the goal is for each national organization to reach a scale at which it produces enough leaders to ultimately transform the system."[179] In this sense Teach for All's innovative approaching to bringing talent into education holds value in its alumni, who often go on to found schools, education non-profits or companies, work in government, or stay in the classroom and become head teachers or school leaders. As quoted in the *Millions Learning* Case Study on Teach For All:[180]

> "For example, 85 percent of Teach for America and 74 percent of Teach First alumni continue to work in the field of education as teachers, school leaders, or state or district leaders. The Teach First numbers also include work across other sectors that include policy, government, and

business.[181] A recent Harvard University study found that Teach for America's impact on its participants is ultimately a higher awareness and conviction that children from low-income backgrounds can have the same academic achievement as those children coming from more affluent backgrounds. The study goes on to show that these participants also more strongly believe that the achievement gap is solvable and that participation in Teach for America increases the likelihood that a career in education will be pursued."[182]

Other innovations are building the workforce to fill gaps where students do not have schooling options. For example, **Sistema de Aprendizaje Tutoria (SAT)**, the alternative secondary school program described above for its hands-on minds-on innovative approach and in *Millions Learning*, uses a model of tutors rather than teachers. These tutors have an alternative pathway into teaching, as SAT provides their training and it is not required they hold a teaching qualification. The tutors are trained as facilitators rather than instructors, and using SAT's experiential learning model, they are encouraged to learn alongside their students. This has allowed youth in isolated communities the opportunity to continue their education where previously there were not enough teachers, or a model that was flexible enough, for them to access school.[183]

Teacher Community Assistance Initiative (TCAI) in Ghana is a tutoring program that employs youth to serve as teaching assistants. Similar to Pratham's Read India program that implements "teaching at the right level" through small group instruction, TCAI has experimented with different models to provide instruction to pupils in grade 1-3. The models with the most success have been those that employ teaching assistants. These are youth who have finished secondary school and who offer to teach the weakest students during or after school- rather than training teachers on targeted instruction for students at different levels. An RCT was conducted that shows this is an extremely cost-effective innovation, at approximately $20 per student per year while resulting in .13-.14 standard deviations improvement in test scores, or about $100 per 1 SD in student achievement.[184]

Sesame Workshop exemplifies an approach where gaps need to be filled and teachers are not present at all, and was studied in *Millions Learning* for its large scale and effectiveness at improving learning. Now available in over 150 countries, Sesame Workshop provides early childhood education programming for children and families, both to complement the early childhood education that children attend, and to supplement for those who do not have access to preschool or trained early childhood education providers. In this case, actors, writers, and curricular experts fill in for teachers using entertaining and educational content. As the Millions Learning case summarizes, "Sesame Street was conceived in the late 1960s against the backdrop of the Civil Rights movement, which—among its many accomplishments—focused national attention on the gaps in school readiness between low-income minority children and their privileged counterparts. Since then, Sesame Workshop has tailored its programming directly to the needs and developmental level of its target audience: preschool children, especially those who are underprivileged and have no other access to pre-school education."[185] The program uses well-researched content and teaching methods to bring learning opportunities for young children though any means possible. The program has been delivered through television, radio, video,

books, and recently digital technology and social media. Each month Sesame Workshop reaches over 156 million children worldwide.[186]

Edunova offers the Commission a resourceful model for mobilizing unemployed youth in communities to improve the use of ICT in schools in South Africa. Edunova sees itself as an integrator: the intervention works across various stakeholder relationships—schools, technical partners, funding partners, and the provincial education department—to develop ICT capacity within school communities.

There is currently a gap between the introduction and application of technologies in South Africa. Launched in 2006, Edunova aims to bridge this gap by supporting schools establish their ICT learning environments. Central to Edunova's approach is activating communities. One of the ways that Edunova aims to leverage communities is by identifying unemployed young adults that are local to school communities. These individuals are then trained in ICT and Edunova's learning-led pedagogy. The intensive training also focuses on continued mentoring so that trainees are able to confidently engage with a diversity of educational actors. After completing the training program, facilitators are placed in surrounding communities to guide educators and to effectively apply technologies into learning and teaching. For additional support, Edunova provides participating schools an online learning environment with access to ICT best practices. The online platform additionally provides access to resources focused on student-centered learning and peer collaboration.[187]

In effect, Edunova hopes to create pathways for facilitators to continue working within their school placements. Edunova envisions facilitators working directly or in partnership with schools to help sustain ICT facilities. Through this system, Edunova delivers an ongoing stream of facilitators to meet the demands of schools that lack guidance on technology utilization.

Edunova's approach relies on community engagement to transform learning environments in South Africa. The takeaway here is how to provide pathways to use human capital in communities, and in doing so, build passion to improve school communities through technology. By recruiting unemployed youth, Edunova is able to help schools with the delivery challenges of ICT. Edunova's strategy is particularly effective because it leverages the supply of unemployed young people to develop technology-enriched learning environments.

Elevating the Education Workforce: Contextual Requirements for Innovation
The innovations profiled here show a wide variety of contextual factors that contribute to their success and overall costs. While the principles of innovation to elevate the education workforce are present across all the innovative approaches, each innovation has a specific set of requirements that have strong implications for their implementation:
1. **Technology for low-resource environments**: Some innovations are finding ways to adapt technology for use in low-resource environments. While still not as cost-effective as those that leverage community volunteers or other low-technology solutions, examples like Pixatel and the Video technology for Teachers in Pakistan show that there is potential to adapt high-

	tech solutions for environments that are not connected to the internet or regular electricity. For Pixatel, the cost of developing the software is very low as it scales, their aim being to keep the program at $5 per student no matter how much additional content is added. Adding in hardware, teacher training, and evaluations, however, is estimated to cost a school $10,000 for the full package.
2.	**Operating within schools:** Many innovations add onto existing schools where students and teachers are already in the classroom and can easily be accessed. STIR founder Sharath Jeevan, for example points out that their model works in the context of near-universal enrollment, where schools exists and have teachers already present. Thus, their $6 per-student cost is in additional to all the efforts it takes to build access to schools. The same is true for Digital Study Hall, Educate!, which costs $100 per student, INJAZ, costing approximately $17 per student, and Read India, which costs $10-15 per student- all of which are innovations that help unburden teachers in the context of environments where students have broad access to education.
3.	**Building a School from Scratch:** Some innovations require significantly more investment in infrastructure, for example SAT and the Media Center. These innovations start from scratch, providing access to education for those who have not yet been reached, but require the provision of all the materials, and finding, placing or training the teachers. In the case of Media Center it also requires setting up classrooms with the appropriate technology and the expense of transporting students to those classrooms. SAT costs $450 per student per-year, and Media Center's model costs $280 per year, excluding student transportation costs.
4.	**High-tech, high-resource environments:** Not every innovation developed for high-resource environments will be applicable in areas serving marginalized populations. For example, Edmodo is a cost-effective innovation, being free for teachers and students, but only in areas where everyone has a smartphone or computer and high levels of connectivity. When calculating costs for areas without this access, the cost of devices and internet provision may make it prohibitively expensive. This is also true for Khan Academy, with the operating costs averaging $10 per student for those who have the hardware to access the free content, although its adaptation to low-connectivity environments, such as Khan Academy Lite, shows such innovations can also be adapted.

Elevating the Education Workforce: How can technology improve teaching?	
1.	**Provide access to content in areas where delivery of textbooks or training for teachers is difficult.** This is case for Khan Academy, Worldreader and Digital Study Hall, each of which aim to equip teachers with tools that can take lesson planning off their plate and make it easier for them to focus on student learning rather than content provision.
2.	**Personalize learning for students and assist teachers in efficiently assessing student learning.** The case of Pixatel shows that teachers are eager to provide their student activities

	that are targeted at their personal strengths and weaknesses, and technology can provide a uniquely adaptive platform. Additionally, these types of technologies collect data on student learning and take the burden of grading off teachers' plates.
3.	**Foster collaboration among teachers to better learn from each other.** STIR, Edmodo, Badiliko Digital Hubs and Lesson Study show the benefits of teachers collaborating and learning from one another, but transportation and physical facilitation remains a challenge in many places. Technology can help improve communication by building social networks among teachers such as Edmodo has done in higher-resource environments.
4.	**Fill gaps when teachers are scarce.** While certainly not considered a high-tech innovation, Sesame Workshop shows how technology can be used to reach those in areas where no early childhood education is present, supplementing for teaching with high-quality programming by any means available to families with young children. Media Center similarly lessens the need for specialist teachers by broadcasting experts and allowing youth in remote areas access to secondary school.

Action 3: Streamlining Schools

We begin this section with a discussion of one of the biggest challenges facing education systems: paper—and in particular, paper based systems of recording and the inherent administrative inefficiencies they represent. Consider, for example, the setting of a school located in a rural remote area. Like anywhere, the systematic recording and reporting of student attendance, teacher absences, examination scores, inventories, and so on is essential. This documentation is often done with photocopied paper forms. An education officer in the area must then collect the forms and personally transport them to the ministry of education. The stack of reports must be entered into a database by enumerators so that the information can later be interpreted. It is an administrative system that is archaic and inherently inefficient. Even in the best of circumstances, these administrative processes present a huge gap between the time of reporting, analysis, and action. In such systems, education stakeholders are unable to understand and respond to local needs in real-time.

These types of administrative challenges are emblematic of a broader set of inefficiencies facing many education systems around the world. But from our global scan of innovations, we have identified promising examples that suggest there is opportunity for transformation and improvement. We identified an assortment of ways in which different education stakeholders, both private and public, are developing new and transformative ways to improve administrative efficiency, particularly through the application of technology. In this section, we center our investigation on how systems of educational administration can be improved. In our global scan, we found 11 percent of innovations were focused on improving administrative efficiency. The innovations we reviewed provide promising examples in areas such as financial management, data processing, organizational restructuring, and the re-envisioning of 'back office' administrative functions.

Streamlining Schools

Intervention/Country	*Description*	*Technology Used*	*Context Needed*
Improving Results			
EduTrac (Uganda/Peru)	Government initiatives supported by UNICEF that offer open access software to facilitate communication between local and national education systems for monitoring and tracking	SMS based data collection; mobile phones	Government buy-in; open access platform for replicability; reliable SMS connectivity
Sematime for Schools (Kenya)	For profit group that works across school ecosystem to facilitate communications via bulk SMS between parents and schools	Platform to send bulk or customized SMS; mobile phones	Parental engagement; household ownership of mobile phone; reliable SMS connectivity
Driving Down Costs			
The African School for Excellence (South Africa)	Private secondary school that uses rotating classroom with lead teachers and teaching assistants to keep costs low	In process of centralizing tech; Computers equipped with Google Classroom in each class	Certified teachers and student teaching assistants; classroom computers; centralized technology for administrative functions
Bridge International Academies (Kenya/Uganda)	For profit company advances low cost, for-profit chain of schools in Africa	Tablets for scripted lessons, back-office functions; customized ERP for payment monitoring	Tablets for teachers; location to build school; fee-paying students; school leader; one smartphone per school; centralized data collection and analysis
Stanford Mobile Inquiry-based Learning Environment (Global)	NGO that introduces a mobile inquiry-based learning environment; provides real-time learning analytics	Mobile-based, either using program for free on connected devices or through SMILE's devices that are linked to a server	Teacher to facilitate use of tool; some access to electricity and internet; mobile devices for students (those purchased through SMILE or other devices on hand)

We have organized our investigation around two key themes that we believe are salient to the aims of the Commission, including (1) enhancing administrative efficiency and (2) improving communication. We will also note that most of the cases we reviewed feature the application of technology as one of the tools that was used to improve administrative efficiency. Indeed, over half (57 percent) of all innovations of administrative efficiency did so by using technology, suggesting that to streamline schools will require utilizing new technologies in such a way that can improve education efficiency.

Enhancing efficiency

To examine administrative efficiency is to consider how education systems might run more smoothly and effectively. Improving efficiency can involve cutting out middlemen. It may also entail restructuring administrative services. In some cases, educational supports may need to be centralized in order to be run better. In other cases, decentralization may need to occur in order for innovations to best respond to locally identified needs. We also found that a cost-savings component is often a natural part of innovations to improve the functioning of administrative processes. As administrative tasks are streamlined, more financial and human resources can be targeted at improving instruction and the teaching and learning environment. In other words, a more effective and efficient system, one aimed at quality, is a better system, one which will be more capable of delivering better education to young people in a more efficient way. Given this context, we now turn to review three innovations, including African School for Excellence, Bridge Academies, and SMILE. These three innovations exemplify different ways that administrative transformation can be possible.

Case: Bridge International Academies

Bridge International Academies, another of the Millions Learning case studies, is an example of an innovation that has introduced pioneering approaches to improving administrative efficiency and effectiveness. Bridge's model of offering low cost, for-profit schools has enabled it to grow into the largest chain of private schools across Africa.[188] As of 2015, Bridge runs more than 400 schools reaching more than 118,000 students across Kenya and 7 schools in Uganda. It also has plans to open schools in Nigeria and India. [189] Bridge Academies charges on average $6 per month per student, reportedly below the cost of public education, which is estimated at around $26 per month. [4] Research on Bridge indicates positive gains in math, English, and other subjects compared to children in government schools. On EGRA/EGMA, Bridge pupils gained .32 standard deviations on reading fluency and comprehension.[190]

How does Bridge do it? Bridge has developed an impressive model for improving administrative efficiency and cutting costs for its schools by using technology to centralize and standardize many systems. A great deal of debate has swirled around the approach of Bridge Academies, including their for-profit status and that the curriculum is delivered via tablets by un-qualified teachers. [191] However, what seems to be the salient contribution central to the aims of the Commission is its potential to scale using a replicable 'school in a box' model that reduces administrative costs by streamlining back-office functions.

Bridge has innovated in particular ways to improve educational efficiency. Many schools must employ school leaders, secretaries, bursars, and other administrative positions. Bridge has few of these. Rather, it has managed to automate and centralize the duties of these staff members and its academies. It

[4] We must also add the caveat the many of the administrative innovations occurred in private schools. This may be attributable to the fact that private schools have more flexibility or greater need to keep costs low and may be able to innovate in such a way that rewards efficiency and cost-savings measures. We must also account for the fact that the student populations attending public schools is, on average, likely from a lower socio-economic background compared to children whose caregivers can afford to pay for private education.

requires only one non-teaching staff member at each school, called the Academy Manager. Bridge manages professional development, land acquisition, and construction and operations centrally, with one staff member in charge of each function rather than requiring these staff for each school. Most other administrative processes have been centralized and/or automated.

Another central element of Bridge's efficient model has been its use of technology to improve the function of schools. For example, tablets are distributed to teachers in schools from a central office. Schools then use those tablets to collect data, including the progress of lessons that are sent back to academy managers and the central office. [192] Other administrative functions, such as the reporting of attendance, are also recorded electronically, streamlining some of the challenges around paper based forms of data collection we outlined in the opening of this section. Data on attendance, assessment, lessons, school fee collection and other processes are automatically synced to the Academy Manager's smartphone and sent to the central office. This allows for real-time data collection and analysis.

These systems free up time and resources of school managers and teachers for developing content, collecting and reporting data, and managing finances. Bridge also uses regular text messages to communicate with school managers, who can then relay any concerns to students, parents, or teachers. For example, parents can be notified about who owes fees. The school manager can also use text messages to send messages to the central office to follow up with any issues concerning payment or attendance.

Through its 'school in a box' program, Bridge has pioneered an ambitious model that is potentially scalable and replicable. At the core of Bridge's approach is its approach to improving administrative effectiveness. Bridge's approach offers key lessons that the Commission must take note of—in particular, the way it has seamlessly introduced and applied technology to drive down school-related expenditures. As a result of this streamlined approach, Bridge has been able to scale quickly and maintain a basic level of quality through its standardized model—while also keeping fee-related expenditures at a minimum for children and households.

The **African School for Excellence** (ASE) is similarly working to develop an innovative model for improving educational administration in South Africa to allow it to build up a network of 200 schools. In the section above on Elevating the Education Workforce, we noted that that ASE uses an innovative approach to teaching and a rotational class model, which allows them to hire fewer teachers while improving the learning environment. We can also learn from the ways it is using centralized support systems to perform administrative tasks, develop curriculum, and manage finance. The savings they have over government schools are also attributable to some of their administrative efficiency, and their model to scale up depends on their ability to centralize.

This low-fee private secondary school has been able to operate on approximately 60 percent of what it costs to educate a secondary student at a government school. At the same time, its students score 16 percent higher in math and 35 percent higher in English compared with the national average. One of the key ways that ASE has sought to run efficiently is by utilizing teachers more effectively. In general, skilled teachers are the most expensive—and most important—component of any school, particularly at the

secondary school level. For that reason, ASE focuses on peer- and self-directed learning. This allows a smaller number of highly-skilled teachers to instruct a large number of pupils (in 2014 there were four lead teachers for the school's 168 students)[193] while maintaining the ideal learning environment of individual attention.

In conversation with Shirley Eadie, she explained how the school attempts to centralize as many fucntions as possible and reduce the number of administrators needed.[194] Teacher support and curriculum development, ICT, and finanice are all areas for centralization and streamlining. As they look to scale up to 200 schools, they are developing solutions that will collect and analyze data from the classroom to the administration all in one place. In expanding, they aim to have one school manager at each campus, and all other non-instruction functions managed centrally.

In this way, ASE shows a promising model still in development to streamline administrative functions to focus on instruction. With their mission to "decouple costs and quality" of education, the technological and centralized solutions they employ will be interesting for further study.

Our third example of administrative efficiency is the **Stanford Mobile Inquiry-based Learning Environment** (SMILE). SMILE is a software platform and learning management server designed to promote an interactive learning environment. Since 2012, SMILE has reached over 750,000 learners in both high and low resource contexts ranging from California to Ghana to Argentina.[195]

SMILE facilitates interactive learning and better administrative management in formal and informal educational contexts. Teachers use the software on a laptop in order to develop practice tests and generate interactive activities for students. Students can use mobile phones to not only respond to teacher queries but to also generate their own questions and ideas. The software enables teachers to monitor and evaluate these activities in real-time. For example, students can create multiple-choice questions on their phones in class to share with their classmates. Teachers then can filter, give feedback, and evaluate questions based on their level of creativity or depth.[196] SMILE shows how crowdsourced and automated assessment can help teachers focus more on instruction and utilizing student-centered approaches.

The pedagogical orientation of SMILE is consistent with a Hands On, Minds On approach and its emphasis on child-centered learning. However, we also can draw attention to the potential of this software to improve the administrative functions. SMILE enables teachers to review what students are learning in real-time. SMILE enables teachers to monitor classroom interactions, manage homework quality, and track the academic performance of students, producing analytic summaries instantly. [197]

SMILE can be adapted to different contexts. At its most basic level, inputs required include mobile phones for students ($80), a laptop for the teacher ($300), and a server to facilitate the exchange ($100). Alternatively, for higher-resource contexts the application is available online for free, but would requires students and teachers to have their own connected devices. The most sophisticated version of SMILE can use the internet to source ideas and information from around the world. However, a basic version of SMILE utilizes a closed-circuit network that does not require internet, but students and

teachers can still benefit from the core features of SMILE, including its ability to facilitate interaction and the administrative function it offers teachers.[198]

Improving communication between schools and parents

Improved communication and crowd-sourcing is another key way of improving administrative effectiveness and efficiency. In what follows, we will learn from three programs, including **Bridge International Academies, EduTrac**, and **Sematime** which have pioneered innovative ways of communication to improve education within their own work.

The sub-section above described the work of **Bridge International Academies** to provide a low-cost, replicable model to developing country contexts. In this section, we focus briefly on how Bridge uses its model to coordinate with parents. In the case of Bridge, it recognized that administrative efficiency, cost-effectiveness, and communication go hand-in-hand. It has worked to streamline communication with parents. As part of its centralized services, it has an automated 24-hour hotline for parents. Bridge has indicated they receive approximately 3,000 calls per month. This centralized administrative feature of the program is one of the ways Bridge is able to keep costs low while still aiming to be responsive to the needs of its customers.

When we talk about efficiency and improvement of education administration, we are often talking about ways of improving two-way communication. For those responsible for delivering education on the ground, communication is important in order to report the situation they are encountering. Two-way communication also enables education planners to get a good read on the situation on the ground. A good system of communication can add numerous benefits to improving the efficiency and effectiveness of an education system. It can lighten the load for teachers while also reducing costs through the provision of more streamlined and efficiently run services. **EduTrac** is an initiative aimed at improving these systems through the promotion of efficiency and accountability by facilitating communication between national and local education systems. In this case study, we explore the application of EduTrac in the contexts of Uganda and Peru and to look more closely at its intended benefits and the lessons that can be learned to advance the broader aims of the Commission concerning education financing and effectiveness.

EduTrac is a mobile phone based data collection system that uses an open software program called Rapid SMS. EduTrac aims to facilitate communication by functioning as a real-time, easy-to-use information management system. As an open-source software program, EduTrac does not require expensive hardware. This means that it can be adapted for a number of different purposes and by different organizations that can collect data via text messages. The interface and backend are simple enough to be used on all types of phones. For example, a head teacher may receive the question, "Do you have clean water and soap for hand washing today at your school?" or “Did your first grade teacher attend school today?” In Uganda, teachers and head teachers receive different questions on a weekly, monthly, and per-term basis. One question asks head teachers to send a response to the statement: "Has your school received the [its] grant allocation for this term." Meanwhile a question to a primary school teacher may read, "Which sub-themes did you cover this month?" [199]

Text message responses are pinged back to a web-based dashboard. [200] Through this process, EduTrac provides central government and education administrators with a way to identify challenges at the level of the school. It also serves as a way to provide accountability and to promote effective and efficient planning. It has the potential to augment existing education information management systems. One could also imagine its potential to serve complementary functions of importance to the local context, such as reporting child abuse or responding to health-related queries.

To date, EduTrac has been launched in Uganda and Peru. In 2011, UNICEF Uganda worked with Uganda's Ministry of Education and Sports to roll out EduTrac with the goal of strengthening the country's monitoring and evaluation system. [201] EduTrac Uganda also aims to improve two-way communication in the following ways. First, it enables government to reach out to local education systems. It helps the government collect data on enrollment, attendance, school infrastructure, and the delivery of textbooks. In addition, it can query teachers or other local education stakeholders directly to ask questions. EduTrac also enables ground-up communication. For example, those linked into the EduTrac system can send out alerts about concerns of teacher absenteeism or delayed school construction.

EduTrac Uganda was designed to augment administrative efficiency of the education system. Perhaps because it was not designed as a standalone intervention, impact evaluations have yet to be carried out. However, the initiative appears promising. The uptake has reportedly been swift. Countrywide coverage has expanded quickly. By the end of 2015, EduTrac was operating in over 3,500 schools with 10,000 registered users across the country.[202]

In 2015, EduTrac was launched in Peru. Unlike Uganda, where the government's goal was to expand the program nationally, EduTrac Peru has been introduced to improve communication and data quality with an acute focus on some of the most remote areas of the country. Peru's Ministry of Education introduced the program after a recent assessment of performance showed that the lowest performing children attended rural schools in poor areas. Among the barriers the Ministry identified for systemic improvement were attendance rates of teachers and students and the on-time delivery of educational materials. EduTrac was introduced so that the government could have a better understanding of what the situation was on the ground and to respond to locally identified needs. EduTrac Peru is still in an early stage. However, evaluation data has been collected and to determine the feasibility of scaling the innovation to other remote parts of the country. [203]

EduTrac offers an example to the Commission of an exciting way for improving administrative processes. Along with the commitment of UNICEF, EduTrac has benefited from strong government buy-in. Using an open access platform has enabled the initiative to be adapted and applied in a way that reflects the particular context in which it has been introduced. Further, the design of EduTrac also addresses one of the most important concerns of thinking about how technological innovations might be brought to scale: by utilizing mobile phones, EduTrac is using a technological device that most education stakeholders likely own already. In this way, EduTrac cuts down on training costs while also increasing the likelihood that education stakeholders will be able to take up the program. It offers a promising

example of how a simple form of technology can be used to improve collection and communication—even in some of the poorest, most remote contexts.

Sematime for Schools offers another way of improving communication in order to improve education quality. It demonstrates how governments and other actors can utilize low-cost technology to drive down costs while strengthening the lines of communication between parents, administrators, and teachers. Sematime is presently seamlessly integrated into a mobile application and is currently used in over 500 schools and by 2,000 organizations in Kenya. Launched in Kenya in 2010. Sematime for Schools allows schools or individual teachers to send bulk or customized text messages. The platform is simple for schools. They provide a spreadsheet of mobile phone number to Sematime's web-based platform. With this information, schools can use the platform to send bulk messages. Sematime enables schools to communicate with parents through a systematic, cost-effective method that was previously not available without this innovative application of technology. For example, schools can invite parents to school meetings or help them stay informed about emergencies. Schools are also able to send payment requests and reminders to parents, teachers can use a tailored version of Sematime to share examination results or report cards with parents, and it enables school fees or other expenditures to be sent electronically. [204] The platform is free to use for parents. Schools pay for each text message they send. Schools also have an option of buying bulk credit at a lower rate than that offered by other mobile phone carriers. Sematime's services aim to improve communication. Perhaps the most important and innovative aspect of this innovation for the Commission is its aim at streamlining and simplicity. The service utilizes a form of technology that many parents already own and are familiar with, thereby increasing the likelihood of widespread uptake.

Streamlining Schools: Contextual Requirements for Innovation
Many of the innovations that help streamline schools are broadly applicable across systems, assuming schools exist and enrollment is high, these innovations function as innovations within schools for systems that want to drive down costs and improve efficiency. These are not innovations that directly reach students or out-of-school children, but do have different areas of applicability:
1. **Utilizing existing technology:** Driving down costs means leveraging technology that is already present and widely used, and in the case of innovations to improve the efficiency of schools many of them capitalize on the widespread access to mobile phones. EduTrac uses mobile phones and SMS technology which parents, teachers and school leaders have and know how to use. This allows it to reach large scale, and also being an open source platform easily adapted to many other contexts at low cost. Similarly Sematime for schools uses mobile and SMS technology to improve communication, which are free for parents and paid for at a discount rate for schools, about one cent per SMS.
2. **Providing technology to function in difficult environments:** Bridge International Academies and SMILE are two examples of improving efficiency through devices that can operate in areas with low connectivity and often without electricity. Bridge does this through heavy centralization, each school requiring just one smartphone to sync up with the network, and teachers using tablets that do not need to be connected. As for SMILE, its devices are

designed to operate on battery power without a connection to the internet. Providing devices can be costly, and Bridge drives down their costs by limiting the number needed- rather than equipping each student just teachers and school leaders access them, and systems are centralized to cut down the number.

Streamlining Schools: How can technology enhance administrative functions?
1. Drive down costs: Possibly technology's greatest improvement for making schools efficient is its ability to drive down costs of many functions. EduTrac show how SMS messaging can be an effective form of communication, at a fraction of the cost of printing and mailing information between stakeholders. Bridge has cut out the need for expensive financial systems by using mobile money. These are particularly cost effective when leveraging devices stakeholders already own and know how to use.
2. Save time: Teachers and school leaders spend a great deal of time collecting and analyzing data, from administering and grading assessments to collecting information about attendance. Examples like SMILE show how crowdsourcing assessment questions and facilitating automatic evaluation can save teachers time to focus on instruction. And Bridge's systems use technology to draw all the data school leaders need into one place easily.
3. Improve communication: Cases such as EduTrac, Bridge International Academies, and ASE illustrate ways in which technology can facilitate communication between different stakeholders in the education system. EduTrac, for example, aimed to improve dialog between local and national education administrators in order to strengthen the education system operations.

Action 4: Activating communities for accountability and delivery

One of the key themes that emerged from our global scan was the role that communities can play in strengthening education quality. Our investigation revealed myriad illustrations of innovations whose approach could be characterized as 'community based.' Indeed, we take the view that community engagement must occur if innovations have a chance at being successful. The presence of a community based component was included in 28 percent of all the cases of innovation we reviewed. Of those, about 43 percent operated in the public sector, and 11 percent had a focus on including government reforms through policy and advocacy. What we focus on in our scan is a form of community engagement that is more direct: we seek to shift the conversation from engaging communities to activating them, such that community members themselves might be agents of change, capable of pioneering ways to improve learning outcomes of young people.

Activating Communities			
Intervention/Country	*Description*	*Technology Used*	*Context Needed*
Reaching Those Who Haven't Been Reached			

Makoko (Nigeria)	NGO that reaches out-of-school children in innovative physical environment	Not used	Community mobilization to informally deliver primary education
Bunyad Literacy Community Council (Pakistan)	NGO that provides non formal education to illiterate mothers in order to provide education to their children	Not used	Community spaces; flexible timetables for classes to adapt to schedule of mothers
Build Africa (South Africa)	NGO that reach out-of-school children, particularly through community engagement, sensitization, and cross-sector collaboration	Unclear	Strategic engagements across parents, civil society, government, private sector; long-term commitments from communities
Improving Results			
ASER (India)	With NGO Pratham carries out national low-tech literacy and numeracy assessment for communication and accountability; utilizes volunteers to keep costs low and mobilize communities	Not a focus	Fleet of volunteers and trainers; simple household-level literacy and numeracy assessment; effective NGO, national volunteer group, university, and government partners
Construyendo Escuelas Exitosas (Peru)	NGO involves the business community to support schools in marginalized communities	Unclear	Partnerships with local businesses; coordinators to work with schools, teachers, and parents
School Assessment for School Improvement (Pakistan)	Introduces school assessment to support school owners and parents to improve their decision making, while holding (mostly private) schools accountable for minimum standards of quality	Not used	Local partners to develop technical assistance for assessment tools, Partnerships with schools

In this section we have divided our analysis in the following ways. We first take an in-depth look at the case of ASER, a citizen-led approach to assess children's learning, along with Makoko Floating Schools and School Assessment for School Improvement, as a ways to improve accountability of schools and

education systems to their communities. Second we turn to ways in which communities themselves can contribute directly to improving education through the collective provisioning of materials and services.

Improve accountability

In this section, we explore the ways in which communities can be mobilized to improve accountability. Improving learning outcomes of children generally is the responsibility of the government and its development partners. But the government's actual delivery of quality education is done from within communities. How can communities be activated in order to demand better education? To address this question we turn to examine the cases of ASER, Makoko Floating School, and SASI.

Case: ASER

One promising example of communities as a catalyst for change can be found in the case of a community-led assessment taking place across India called ASER, which stands for "the Annual Status of Education Report." ASER helps to identify and quantify the problems facing children's learning, so that it can link this problem with action and advocacy at the local, state, and national levels.

An initiative originally developed by an NGO called Pratham, ASER utilizes a fleet of volunteers across India to administer simple literacy and numeracy assessments at the household (rather than school) level. This household based survey is considered to be particularly important because unlike school-based forms of assessment, ASER aims to account for literacy and numeracy of all children in the community, including those who may not be in a formal education system and is considered to be a pioneer of a citizen-led form of assessment. Through the use of volunteers, the survey aims to be a low-cost form of assessment compared to formal household surveys. On average, ASER costs about $1.55 USD to administer per child. This cost compares favorably to a large study over 13 contexts using more conventional approaches to assessment, where the average cost was about $42 per child surveyed.[205]

Today, ASER stands as the largest national survey of children and the only survey to be carried out on an annual basis in India. The implementation of the ASER survey is a massive undertaking. The survey reaches 16,000 villages, over 300,000 households, and more than 600,000 children.[206] The sample is so large in order to inform district-level government planning processes.[207] In other words, the survey is carefully designed with respect to the enabling environment: a survey of national-level statistics, for example, may bring little to bear on individual states who have ultimate responsibility in delivering education to their constituents. Local-level data can help communities hold their local representatives accountable where their voice is stronger. ASER Centre has 29 state teams spread out across India.[208] It collaborates with approximately 600 district partners. Partners range from NGOs to national volunteer groups to universities and teacher training institutes. [209] To carry out the immense task of the survey, ASER hires 1,000 master trainers each year who are responsibility for training 20,000 to 30,000 volunteers.[210] The program selects 20 villages in each rural district that it works. In each village it then carries out the survey 20 randomly selected households.

But to treat the significance of ASER as only an exercise in large-scale survey administration is to miss the point. The distinguishing feature of ASER is how it has pioneered a citizen-led approach. The process of carrying out the ASER survey is a way of activating communities. It engages ordinary citizens as a way

of raising community member awareness of learning levels as a way to promote action and change. ASER's 30,000 citizen-volunteers is not merely a cost-effective approach or administrative organizational feat, it is a way of mobilizing communities and individuals toward action and advocacy. Put another way, the 'product' of data from ASER is important for advocacy, but so too is the process by which the survey is carried out. While the data that volunteers collect is important, so too is the process of collecting the data as a way to raise citizen awareness of learning levels.[211]

It is also considered to be a citizen led activity because the process of collecting the data is done in a way that directly engages with local community. It raises awareness of "local issues of schooling and learning levels, and triggers discussion about possible solutions to these issues."[212] As the director of Pratham put it: "And over the heads of the children, between parents and neighbours there are conversations about the status of schooling and learning in the community." [213] The process of carrying out the survey engages directly with members of the community, she said. "If you do not know there is a problem, you do not need solutions. It is only when the problem is visible, when you can see it, that it becomes real and alive and demands a solution. At the ground level, it is by involving hundreds of ordinary people in uncovering the problem, by engaging with thousands of parents […] that large scale awareness began to grow."

The focus on the ASER survey is on assessing literacy and numeracy. These are technical learning outcomes. But at its core, the mission of ASER is political. Its focus is on accountability through community engagement. It draws on its vast empirical dataset to place pressure on government to deliver for its constituents. The goal of the ASER Centre is to share its results with a wide audience through dissemination efforts to share with communities, different levels of government, and NGOs. [214]

Of note, ASER's work has not actually been linked to improving learning outcomes. [215] While primary education enrollment is nearly universal, just 40 percent of children able to read well, and 45 percent are unable to do basic math. But as the director the ASER Centre pointed out, to focus only on learning outcomes is to miss the point of ASER, whose contribution must be considered more like a "thermometer" of children's learning.[216] Indeed, at the heart of ASER's work is the communication with national and local governments as well as its citizens. Armed with evidence, ASER uses its survey findings to share a dialogue with governments of each district and state about the education in their communities. It also shares information with the local population. The Government can then apply this data into decision making and policy considerations at the national level.[217] Its survey results appear in a number of national strategic planning documents and economic surveys. [218]

To date, ASER's model of community engagement via annual assessment has been implemented across India. It has also demonstrated scalability and replicability. ASER has informed and inspired other citizen-led assessments beyond India, including: Pakistan, Kenya, Tanzania, Uganda, Mali, Senegal, and Mexico.[219] ASER offers a powerful argument to the Commission for how the power of communities can be harnessed to demand better learning outcomes and education quality.

Advocacy and mobilization via civil society are not the only ways for communities to take the lead in improving children's learning. Communities can demand better education for children in other ways.

Take, for example, the **Makoko Floating School** (MFS). As a prototype floating structure, MFS is an innovative and architectural marvel in its own right, as it aims to deliver education to one of the largest slums in Nigeria, a coastal community called Makoko that has been built up on top of the water. But in addition to the architectural innovation used to provide education to hard-to-reach children, attention must also be drawn to the significant role of the community in supporting the innovation. The story of the Makoko Floating School illustrates how community-centered demand and design can help mobilize people to hold the government accountable on their promise of universal education.

Makoko is an informal slum community of about 85,000 inhabitants. There is no land and no modern infrastructure. For the better part of a century, Makoko has been a hub for fishing and timber industries. Because the region is prone to flooding, most of the 4,000-odd structures in the area have been built on stilts. Built on the water, it has no roads, only waterways.[220]

Before MFS, children in the area had access to one other primary school, which was built on reclaimed land and was frequently threatened by flooding. Makoko came about as a result of community demand. Citing environmental issues and concerns over safety, the government has cleared part of the informal settlement. There were concerns that the entire community would be removed. However, in 2013, a Nigerian architect visited Makoko. He learned of the community's wish to have more educational opportunities for children in the area. The architect worked in conjunction with donors to design and construction MFS.[221] The floating school is three stories high and triangular in shape. It floats on 256 recycled plastic barrels. It can provide education for 100 primary students at a given time. The school has been embraced by the community because it responded to an immediate need. The school provides a central meeting space for the community. The ground floor functions as a playground for children. And as the only public space in Makoko, the school has become a community meeting place.[222]

Despite the presence of an innovative school, Makoko remains an informal settlement. Because the site is technically illegal, residents are not entitled to services. Even though MFS had been a key site of education for the school, the state government initially refused to recognize it as an official school.[223] Without this recognition, the school was not entitled to state funding. However, the community and global advocacy campaigns worked to shift the way MFS was understood by the government: from a school built on an illegal settlement to an innovative attempt to be a catalyst of change for the broader slum community. As the school's designer put it, the recognition of the school "is an important signal for mobilizing the local and global interest that is critical for addressing the challenges and opportunities posed by rapid urbanization and climate change in developing African waterfront cities".[224]

The lesson to be learned is not, of course, that more floating schools must be build. Rather, the takeaway point is that community engagement in innovative models of education can activate them to hold the government accountable. In the case of MFS, the community held the government accountable to providing universal access to school. Despite difficult conditions, the school has become a symbol of how communities can be mobilized to support development in the area. In doing so, MFS has succeeded in delivering primary education to a group of children who would likely have been unable to continue their studies otherwise.

The School Assessment for School Improvement (SASI) project offer an example of a low-cost way to evaluate private and public schools in a way that can leverage communities to demand better quality education. Its evaluations are communicated to parents in order to help them make informed decisions about where to send their children. Results are also received by school leaders as way to contribute to improving quality.

SASI was launched in 2012 by a Pakistan-based NGO called Idara-e-Taleem-o-Agahi (ITA). ITA is particularly interested in assessing the facilities, management, financials, and student performance of low cost private schools. The targeted pilot schools received initial assessments for free, but ITA intends be a fee-charging service in order to be sustainable. Following each assessment, schools receive a comprehensive analytic report. School owners also receive remediation options and follow up evaluations to assess improvements in their schools. Through SASI, ITA hopes that school administrators will be able to address gaps in quality, while parents can be better empowered about the school they choose where to send their child to study.[225]

SASI uses assessments to measure school systems so that parents can make more informed decisions regarding where to send their children, identify gaps in schools, and to build the capacity of school leaders to promote efficiency and quality.

The program has been designed with an emphasis on the enhancement in the following ways: capacity for quality teaching, infrastructure and learning materials, sustainable financial management, and governance and partnerships. SASI's approach to assessment is designed to respond to the following dimensions:

1. Governance and strategy, including school history and profile, governance framework, leadership analysis, and future strategy
2. Student academic achievement, including an analysis of external exam results and a student test prepared by SASI
3. School facilities, including on-site observations and an analysis of the school infrastructure
4. Learning environment, including classroom observations and an assessment of teachers prepared by SASI
5. Parent engagement, including a parent questionnaire and focus group discussions
6. Financial systems and performance, including analyses of sustainability and financial systems[226]

The assessment exercise is followed by an analytical report that is used to engage school administrators. Remediation options such as a directory of service providers and organizations for school improvements are also shared. Follow-up evaluations to assess subsequent improvements are also recommended to school operators. It provides each school with a set of four analytical reports, including:

1. Comprehensive analysis report, including a snapshot of the school's overall performance
2. Educational quality analysis report, consisting of an overview of the school's academic performance teaching environment
3. Financial analysis report, including an overview of the school's financial procedures and sustainability
4. Summary and customized set of recommendations[227]

SASI offers an interesting way for the Commission to consider how to make improvements in education quality at the school level by improving accountability to communities. The implicit intentions of their work would seem to hold schools to account for providing a good educational experience and institutional environment for children. Their findings are then communicated in a way that can help families make informed decisions. The implications of this work seem to be particularly important for fee-paying private schools as a way to ensure a minimum standard of quality. In this regard, SASI has become an important advocate. In 2015, it released a report of its work with 130 fee-paying schools, noting the need to improve education quality in many of the schools it worked with. [228]

Activating communities to deliver

Communities are not only a catalyst for change; they can also help to deliver change themselves. In the section above, we explored ways in which communities can hold schools and systems accountable and activate their demands. We now turn to examine the way that communities can also help to deliver education services themselves. We focus this section on identifying how communities have mobilized themselves to be change agents through the active participation in delivery of education and taking aims to improve impact.

Construyendo Escuelas Exitosas (CEE) is a program implemented by an NGO called Instituto Peruano de Accion Empresarial (IPAE). CEE is an interesting model that is designed around getting better involvement from the business community into education for marginalized children. Their model involves the private sector, public schools, parents and teachers with the mission to make education a concern for more than just the government and students but an effort of the full community. Since its inception in 2007, Construyendo Escuelas Exitosas has established networks in 15 of the 24 regions in Peru, reaching more than 55,000 students in 600 schools.

Their innovative approach allows businesses to choose schools in marginalized communities that they would like to support and funds their community engagement and teacher support program. The businesses work with coordinator in a community that works with schools, teachers, parents and community leaders.

> *"Construyendo Escuelas Exitosas highlights the role of the local community in shaping the learning environment and educational experience of each child. The program originated with an emphasis on developing a model for rural schools in poor areas. It now works in regions throughout Peru, specifically targeting primary schools in the poorest communities where*

government resources may not reach and children are in need of greater attention. The program partners with local businesses that choose which schools to fund. To date, local businesses in Peru have donated more than $25 million USD."[229]

Construyendo operates with the recognition that formal education also requires engaging with the community, including local leaders, parents, and organizations. As part of its model, the organization hires and trains a coordinator to live in a particular participating area for about five years. During this time, the coordinators visit homes and classrooms and develop relationships with teachers and parents.

In each region that the program works, it works on multiples levels.[230] At the level of the community, Construyendo develops a network of 10 schools and 25 teachers. In these networks, various education stakeholders such as teachers, school administrators, and parents have the chance to share their experiences and get community feedback on issues pertaining to education. At the level of the school level, teachers and school administrators work closely with parents to determine the school's curriculum and goals. Finally, within each school, teachers and parents collaborate to resolve any problems and to identify ways in the learning environment at home can be improved.

To date there is not any publicly available data on how effective this program is. But the takeaway message for the Commission must center on how demand may be built for innovation and changes to schools by involving employers who have a stake in education and fostering 21st century skills. This illustrates how education cannot be the sole responsibility of schools, but instead is a team sport that involves the entire community.

As the Commission considers approaches to be sure all young people have the opportunity to learn, one of the biggest challenges they face is how to reach children who are not currently enrolled in an education system. One of our key tenants we hope to advance is that efforts to reach out of school children must involve a multiplicity of actors such as civil society, government, and businesses. Working together can help to activate communities and develop new ways of reaching children whose educational options may be limited. **Bunyad Literacy Community Council** (BLCC) is a small, community-based organization in Pakistan. Through an initiative called "Increasing Enrollment in District Rahim Yar Khan," BLCC has developed an innovative approach to activating communities and engaging them in reaching out of school children: by providing support to their mothers.

In 2013, BLCC launched their program aimed at increasing enrollment in Punjab. BLCC recognizes that a key driver for increasing enrollment is understanding the needs of low-income communities. It identified parental support as key for getting children into schools and generating community buy-in. And so the project aims to build community demand for children's education by targeting illiterate mothers. This approach is a holistic community intervention that aims to increase enrollment rates through non-formal primary schools and maternal literacy centers. The project grew out of an effort to inform communities on the importance of education through awareness campaigns, newsletters, and meeting.

The effort to promote maternal literacy is central to BLCC's theory of change, for one because there was a stated need for literacy skills. But it is also a way to sensitize mothers to the potential and power of gaining essential skills: if mothers are receiving training in literacy, the idea is that they will potentially

be receptive to ensuring that their children also receive the opportunity to learn. Held in existing community spaces, these Mother Education Centers provide basic education to illiterate mothers to generate demand for out-of-school children and garner their support. The timetables for the classes are flexible enough to adapt to the schedule of the mothers.

The program is small and relatively new. No formal evaluation has taken place. But BLCC has already enrolled 646 out-of-school children in 10 community-based schools. As of June 2013, Five Mother Education Centers serving 150 mothers have also been established. In the future, BLCC seeks to establish a network of communities with whom it works. communities; ensure that village citizen groups take on an administrative role to implement and sustain project; involve the district education department; establish a book bank; continually build the capacity of school management." [231]

The lesson to be learned from the work of BLCC is how to activate communities in a way that they find meaningful. This was not done as a way for only improving enrollment rates or learning outcomes, but as a way to take small steps toward wholesale transformation through genuine engagement of children and their mothers.

Finally, **Build Africa** works with communities to improve the quality of education in rural areas of Kenya and Uganda. It currently serves about 63,000 learners across 140 facilities and schools. The project works across different areas ranging from early childhood development to income generating activities. But the common thread in all of its activities is Build Africa's commitment to activating communities as a core component to improving education quality. For example, it works to improve learning environments in a way that brings on board community members, parents, local government officials, and teachers.

The lesson we can learn from Build Africa is the inclusive nature of how communities are to be understood. They work with parents but also engage with donors, civil society, government, and business. Through these strategic engagements, Build Africa seeks to build demand and promote accountability in order to reach out-of-school children whose educational options are limited.

Build works directly with communities. For instance, Build works within school environments to create three year plans to engage communities and to increase community accountability for teacher absenteeism. These three-year plans work to gain the commitment of community members through material provisions, financial support, or time building classrooms or gardens. Through a combination of educational and income-generating opportunities, Build emphasizes the right to education in the face of restrictive cultural practices through formal training sessions and advertisements through media. Build Africa subscribes to the idea that buy-in of local communities and local government is a key strategy that will ultimately translate into improved learning for children.

Build Africa's approach to its work, whether it is early childhood development or vocational training, centers not only on the learner or the school. They aim to activate communities. They reach out to parents by promoting parental engagement in their children's learning, while simultaneously working to strengthen children's learning environment through improving teaching and strengthening school management.

Activating Communities: Contextual Requirements for Innovation
Strategies to activate communities do seem to cross contexts, with many of the innovations we looked at employing similar strategies to engage communities in education:
1. **Available Manpower:** Activating communities to build demand and improve education certainly takes manpower. From ASER's use of volunteer networks to lead their assessment and build their advocacy efforts to the private sector involvement of Construyendo Escuelas Exitosas, each of the innovative approaches to community engagement required drawing on the efforts of people willing to get involved. This manpower was channeled in different ways. For ASER and the Mokoko school communities were activated to advocate or hold the government accountable, requiring some kind of mechanism for public comment and opinion to be taken to the government.
2. **Mobilize resources:** In the case of Constuyenedo, the key to activating communities is to mobilize resources from the business community, involving them in school improvement as well as contributing funds. This model would work well where there is interest from diverse stakeholders including the business community to help improve schooling.

Activate Communities: What role can technology play in activating communities?
1. **Improve communication and engage more people:** Technology did not feature heavily in the innovations we profiled on community engagement. However it does hold promise for improving communication between schools and communities, much in the same way described through the innovations that streamline schools. Edunova, one community engagement innovation that harnessed ICT did so by using digital literacy training to engage youth in communities, showing the potential for technology to improve engagement.

Conclusion

We face an important moment for global education. The Sustainable Development Goals call for ambitious progress, ensuring all children receive a high-quality education that develops the breadth of skills they will need to be successful in a changing world. If young people are equipped with the holistic set of skills from literacy, numeracy and science to flexibility, creativity and teamwork, we can expect to see our societies thrive under new technology and jobs, with a world filled with truly global citizens.

But the current pace of change will not get us to the grand vision. Massive skills gaps threaten to hold back progress, and many practices in schooling systems are no longer sufficient to create the lifelong learners we need. This situation calls for accelerated progress and new ways of delivering education that we know will cultivate the breadth of skills.

This report has shown how many of these new models transform the learning environment into an active, collaborative space by embodying hands-on minds-on learning strategies and unburdening teachers. Our scan of nearly 700 innovations in education revealed that many actors on the ground are trying new ideas and implementing approaches that could contribute to transformative progress. What's more, many are implementing core effective areas of innovation in widely different contexts, showing that innovation in education is happening everywhere.

When looking to the future of education, the Commission should consider four key strategies for innovation in education which our research found hold promise to get better results, drive down costs, and reach those who have not been reached. Namely, these are hands-on minds-on learning, elevating the education workforce, streamlining schools and activating communities.

Annex: Learning Metrics Task Force Global Framework of Learning Domains

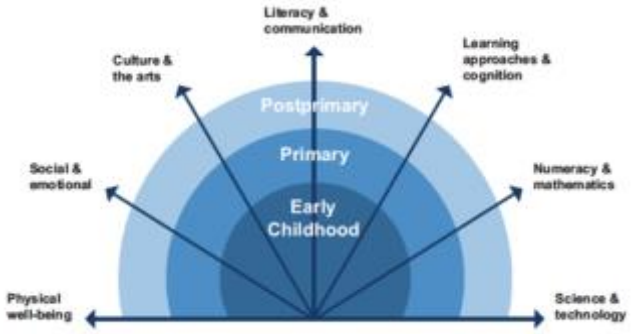


Table 2: Global Framework of Learning Domains*

Domain	Description	Subdomain Examples*
Physical well-being	How children and youth use their bodies, develop motor control, and understand and exhibit appropriate nutrition, exercise, hygiene and safety practices.	• Physical health and hygiene • Food and nutrition • Physical activity
Social and emotional	How children and youth foster and maintain relationships with adults and peers. Also, how they perceive themselves in relation to others.	• Social and community values • Civic values • Mental health and well-being
Culture and the arts	Creative expression, including activities from the areas of music, theater, dance or creative movement, and the visual, media and literary arts. Also, cultural experiences in families, school, community and country.	• Creative arts • Cultural knowledge • Self- and community identity • Awareness of and respect for diversity
Literacy and communication	Communication in the primary language(s) of the society in which children and youth live, including speaking, listening, reading, writing, and understanding the spoken and written word in various media.	• Speaking and listening • Vocabulary • Writing • Reading
Learning approaches and cognition	Learning approaches describe a learner's engagement, motivation and participation in learning. Cognition is the mental process of acquiring learning through these various approaches.	• Persistence and attention • Cooperation • Problem solving • Self-direction • Critical thinking
Numeracy and mathematics	The science of numbers and quantitative language used universally to represent phenomena observed in the environment.	• Number concepts and operations • Geometry and patterns • Mathematics application • Data and statistics
Science and technology	Science is specific knowledge or a body or system of knowledge covering physical laws and general truths. Technology refers to the creation and usage of tools to solve problems.	• Scientific inquiry • Life science • Physical science • Earth science • Awareness and use of digital technology

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