WORLD ECONOMIC FORUM

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Platform for Shaping the Future of the New Economy and Society

Schools of the Future

Defining New Models of Education for the Fourth Industrial Revolution

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Contents

Key Findings ____ 4

Introduction ____ 5

Education 4.0: A Global Framework for Shifting Learning Content and Experiences Towards the Needs of the Future ____ 7

- Shifting learning content ____ 7
- Shifting learning experiences ____ 11

Schools of the Future ____ 14

- Methodology ____ 14
- The Green School ____ 15
- Kakuma Project, Innovation Lab Schools ____ 16
- The Knowledge Society ____ 16
- Kabakoo Academies ____ 17
- TEKY STEAM ____ 18
- Accelerated Work Achievement and Readiness for Employment (AWARE) ____ 18
- iEARN ____ 19
- South Tapiola High School ____ 19
- Pratham's Hybrid Learning Programme ____ 20
- Anji Play ____ 21
- Prospect Charter Schools ____ 21
- Tallahassee Community College, Digital Rail Project ____ 22
- Innova Schools ____ 23
- British School Muscat ____ 23
- Skills Builder Partnership ____ 24
- Skilling for Sustainable Tourism ____ 24

Conclusion: An Action Agenda to Accelerate the Transition to Education 4.0 ____ 26

Notes ____ 27

References ____ 28

Acknowledgements ____ 30

Project Team ____ 33

Key Findings

In the context of job disruption, demand for new skills and increased socioeconomic polarization, primary and secondary school systems have a critical role to play in preparing the global citizens and workforces of the future. Education models must adapt to equip children with the skills to create a more inclusive, cohesive and productive world.

This white paper is the outcome of a global consultative process initiated by the World Economic Forum's Platform for Shaping the Future of the New Economy and Society to identify promising models of quality education for the Fourth Industrial Revolution. It is the first output of the Forum's Education 4.0 initiative, which aims to catalyse systems change by mobilizing a broad and innovative coalition of relevant stakeholders around new models, new standards and a new momentum for action to transform the future of education.

Eight critical characteristics in learning content and experiences have been identified to define high-quality learning in the Fourth Industrial Revolution—"Education 4.0":

1. **Global citizenship skills:** Include content that focuses on building awareness about the wider world, sustainability and playing an active role in the global community.

2. **Innovation and creativity skills:** Include content that fosters skills required for innovation, including complex problem-solving, analytical thinking, creativity and systems analysis.

3. **Technology skills:** Include content that is based on developing digital skills, including programming, digital responsibility and the use of technology.

4. **Interpersonal skills:** Include content that focuses on interpersonal emotional intelligence, including empathy, cooperation, negotiation, leadership and social awareness.

5. **Personalized and self-paced learning:** Move from a system where learning is standardized, to one based on the diverse individual needs of each learner, and flexible enough to enable each learner to progress at their own pace.

6. **Accessible and inclusive learning:** Move from a system where learning is confined to those with access to school buildings to one in which everyone has access to learning and is therefore inclusive.

7. **Problem-based and collaborative learning:** Move from process-based to project- and problem-based content delivery, requiring peer collaboration and more closely mirroring the future of work.

8. **Lifelong and student-driven learning:** Move from a system where learning and skilling decrease over one's lifespan to one where everyone continuously improves on existing skills and acquires new ones based on their individual needs.

Through a global crowdsourcing campaign, the World Economic Forum identified 16 examples of schools, education programmes and school systems that are paving the way toward Education 4.0, as defined above, based on the uniqueness of their approach, demonstrated impact and geographical diversity. These examples are meant to serve as inspiration for the shift towards a more holistic transformation of education systems globally.

Introduction

As globalization and rapid advancements in technology continue to transform civic space and the world of work, education systems have grown increasingly disconnected from the realities and needs of global economies and societies. In the context of job disruption and increased polarization, primary and secondary school systems have a critical role to play in preparing the global citizens and workforces of the future. Education models must adapt to equip children with the skills to create a more inclusive, cohesive and productive world.

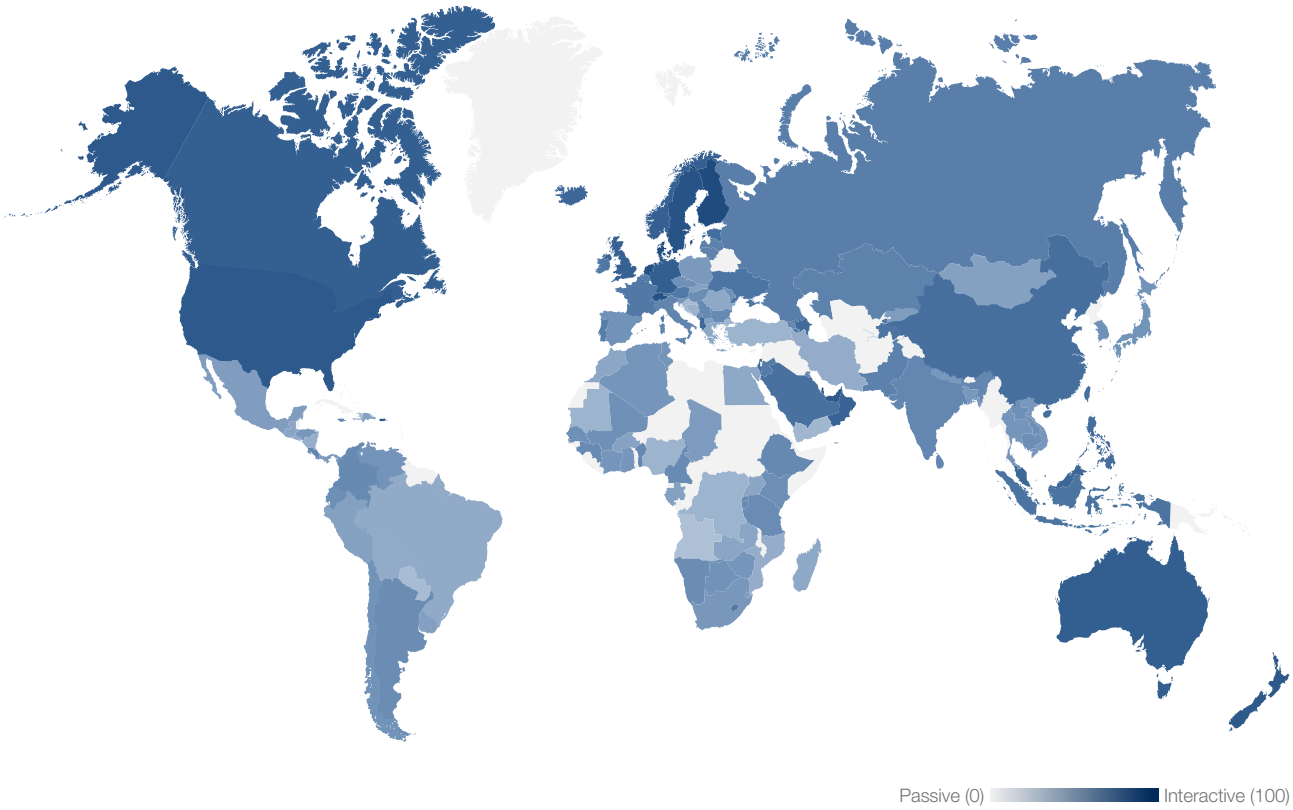
The need for new education models in the Fourth Industrial Revolution

The standardized model of direct learning widely used in mainstream education today was largely influenced by the needs of the First and Second Industrial Revolutions, when the mass production of uniform talent was used to fill repetitive, process-oriented early manufacturing jobs.[1] Although most education systems have continued to operate business-as-usual, innovation has driven economies toward new models of productivity. The Third and Fourth Industrial Revolutions introduced production automation and intangible value creation.[2] These new drivers of growth created massive shifts in the skills required to contribute to the economy and the ways in which people work, raising questions about the adequacy of current education systems in keeping pace with these changes.

Many of today's school children will work in new job types that do not yet exist, most of which are likely to have an increased premium on both digital and social-emotional skills.[3] They will be introduced to wholly new business models whose workforces are much more distributed. In an increasingly interconnected world, future workers will be expected to collaborate with peers residing in various parts of the globe, understand cultural nuances and, in many cases, use digital tools to enable these new types of interactions.[4]

Yet many education systems in developed and developing economies alike still rely heavily on passive forms of learning focused on direct instruction and memorization, rather than interactive methods that promote the critical and individual thinking needed in today's innovation-driven economy (see Figure 1).[5] In many parts of the world, learning is confined

Figure 1: In your country, how do you characterize the style of teaching?



Source

Executive Opinion Survey, World Economic Forum, 2019.

to only those with direct access to physical school buildings, and quality is reserved for those who can afford to pay for learning outside of traditional public schools.

These outdated systems limit access to the skills needed to drive prosperous economies and pose risks for global productivity. According to one recent estimate, as much as US$11.5 trillion could be added to global GDP by 2028 if countries succeed in better preparing learners for the needs of the future economy.[6]

At the same time, education systems play a key role in defining the values and norms that enable positive human interaction. In addition to 'hard' skills, such as technology design and data analysis, it is crucial that schools also foster human-centric skills—cooperation, empathy, social awareness and global citizenship—that enable children to shape future societies that are inclusive and equitable.

In this context, education, business and public-sector leaders must think beyond 'business-as-usual'. Transitioning all education systems to ones designed for the Fourth Industrial Revolution—"Education 4.0"—has tremendous potential to better prepare children for the future of work, revive pathways to social mobility, improve productivity and enhance social cohesion.

Education 4.0: Defining and catalyzing quality learning in the new economy

There is strong evidence that education is a key contributor to relative social mobility, the social and economic status of an individual relative to their parents.[7] While primary school enrollment has seen mass expansion in the last few decades—more than 90% of primary school-age children worldwide are enrolled in school today[8]—studies suggest that increased access has not necessarily translated into increased levels of relative social mobility.[9]

One key barrier is the quality of learning. Education quality, particularly in childhood years, has a significant impact on later life and earnings outcomes.[10] Yet the definition of quality has been largely debated, with additional uncertainty created by new advances in technology. While many technologies have emerged as potential solutions to global education gaps, technology use is not an end in itself, but rather can serve as a tool to enable new approaches. Few technologies can fulfill their potential in the absence of a fundamental reconfiguration of the substance of learning. Without consensus around a normative vision for education in the new economy and society, fundamental innovation in primary and secondary school content and delivery has remained limited.[11]

Clearly defining quality learning in the Fourth Industrial Revolution is thus an important first step in setting the direction of innovation in education and reviving it as a pathway to social mobility and inclusion in the future.

About this report

This white paper is the outcome of a global consultative process initiated by the World Economic Forum's Platform for Shaping the Future of the New Economy and Society to identify promising models of high-quality education for the age of the Fourth Industrial Revolution. It is the first output of the Forum's Education 4.0 initiative, which aims to catalyse systems change by mobilizing a broad and innovative coalition of all relevant stakeholders around new models, new standards and new actions to transform the future of education.

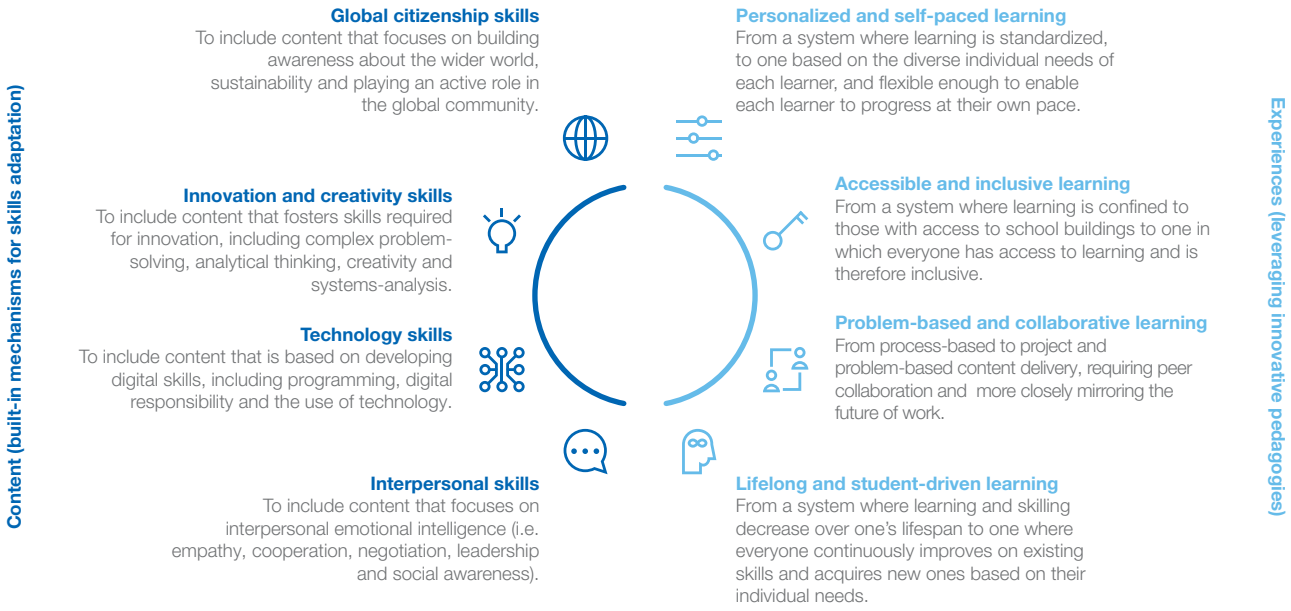
Based on extensive community consultation, the first section of the white paper proposes a global framework for Education 4.0: eight critical shifts in learning content and experiences to redefine quality learning in the new economy. It provides a set of guiding principles by which to realize education systems—in developed and developing economies alike—that more closely mirror the future of work, provide children with the skills to thrive in the new economy, and adapt to children's future economic and social needs. For economies in which education systems are lagging by today's standards, the Education 4.0 framework provides a vision to enable leapfrogging to the learning of the future.

The second section of the white paper illustrates 16 schools, school systems and educational initiatives that are pioneering aspects of the eight criteria and the transition to Education 4.0 globally. These examples—identified through a global crowdsourcing campaign in the second half of 2019—may serve as inspiration for driving holistic and transformative action on this important agenda.

The final section of the white paper calls for public-private action to connect, scale and mainstream these promising new models, standards and approaches, and ensure access to Education 4.0 for all.

Education 4.0: A Global Framework for Shifting Learning Content and Experiences Towards the Needs of the Future

Figure 2: The World Economic Forum Education 4.0 Framework



Shifting learning content

Children must be prepared to become both productive contributors of future economies, and responsible and active citizens in future societies. Realizing this vision requires children to be equipped with four key skill sets: 1) Global citizenship; 2) Innovation and creativity; 3) Technology; and 4) Interpersonal skills. While these are essential in addressing the most urgent emerging needs, education systems must also implement agile mechanisms for skills adaptation to ensure they remain future-oriented. The following proposal for shifting the content of learning is designed to build upon and enhance basic foundational skills, such as reading, numeracy and writing. Enabling these shifts will require close collaboration between public and private sector leaders to align on definitions and assessment of these skills and to break down these skillsets into implementable curricula.

Global citizenship skills

Income inequality has increased in high-income and emerging economies over the last few decades.[12] With the key drivers—including market concentration, inequality of opportunity, globalization and technological change—seemingly out of the control of individual citizens, these trends have the potential to create a general sense of unfairness and increase social polarization. At the same time, human activity continues to push planetary boundaries, posing further risk to growth and equality. Children must have the skills to navigate this new context, maintain social cohesion, promote sustainability and be agents of positive change.

While globalization and technology have been key drivers of these trends, they have also created a more interdependent world, presenting an opportunity for individual citizens to play a greater role in addressing these challenges on a global scale. Creating future citizens that enable a more cohesive world will

require school systems to focus on helping children develop a general awareness about the wider world, an understanding of the interconnectedness of global issues, and their duty and agency in playing an active role in the global community.

These skills can be broadly incorporated into learning environments through formal and informal mechanisms. While content specifically focused on global citizenship exists, it is also possible to integrate these skills into existing curricula. A sustainability lens, for example, could be incorporated into a science and technology project, and global awareness can be fostered by exploring moments in history through the perspectives of different people around the world. Global citizenship education can also take place outside of the classroom through activities such as volunteering, community service and campaigning.[13] Many schools, for example, leveraged the global climate change protests over the course of 2019 as a pivotal moment for teaching children about the power of civic engagement.

New communication technologies can enable global citizenship education. Virtual classrooms and video conferencing, for example, can connect children from classrooms in various parts of the world, allowing them to exchange ideas and learn about global challenges through different lenses. Online, interactive maps can help young people understand where they are in the world. Virtual and augmented reality can transport learners into new environments, allowing them to draw interconnections between challenges faced in various parts of the world. Social media has also played a key role in helping children to organize themselves around global issues. Such interactions can have a powerful effect on children's understanding of the world beyond their immediate surroundings and can help build the empathy necessary to support a more inclusive world.

Governments can promote global citizenship learning by setting clear national standards. In Italy, for example, the Minister of Education recently announced that public schools will require all students in every grade to study climate change and sustainability as part of the national curriculum.[14] As part of the new Welsh education reform – Curriculum for Wales 2022 – the development of "ethical, informed citizens of Wales and the world" is one of the four key focus areas of the new curriculum.[15]

Businesses can also provide children positive examples of global citizenship. The recent announcement from the US Business Roundtable on stakeholder capitalism provides an opportunity for companies to lead by example and invite children to learn from their social impact initiatives.[16]

Innovation and creativity skills

Innovation, flexibility and adaptation to change have become key drivers of growth and value creation in the Fourth Industrial Revolution. In an ever-changing economic context, countries that can quickly generate and adopt new ideas, processes and products will have a competitive advantage.[17] Yet an economy's ability to form effective innovation ecosystems largely depends on their human capital. To productively contribute to a future economy, children must develop the skills necessary to generate new ideas and turn those concepts into viable and adoptable solutions, products and systems.

Skills that enable innovation include curiosity, creativity, critical thinking, problem-solving and systems analysis[18]—all of which are set to be in high demand in the labour market in coming years.[19] The process of ideation and iteration in innovation also requires active, rather than passive, learning styles. From an early age, students must learn to actively engage with material through critical analysis and fundamental questioning of existing norms and systems.

Playful learning can enable innovation skills. Structured and unstructured play activities enable children to tap into their natural curiosity, learn through trial and error, and explore new solutions to challenges.[20] This approach can be applied within formal and informal education. In Finland, New Zealand and Estonia, for example, playful learning has been widely adopted and forms the basis of early childhood education.[21]

Collaboration with people of diverse backgrounds can also help foster innovation skills. School enrollment and classroom grouping should consider diversity across a range of factors, including gender, race, ethnicity, ability, sexual orientation and language.

While innovation extends far beyond technology, digital tools can help foster these skills. Online education and coding games can help facilitate experiences for children that allow them to contextualize learning while channeling their creativity into creating their own online worlds. Applications such as Dassault Systèmes' SOLIDWORKS, for example, can help children express themselves creatively using design and engineering.[22]

These approaches are at odds with traditional forms of top-down direct teaching methods where students are passive recipients. Fostering innovation and creativity will require a shift toward more interactive methods of instruction where teachers serve as facilitators and coaches rather than lecturers. It will also require collaboration between education systems and the private sector to understand how skills development in these areas can support real-world innovation needs.

The Real Play Coalition—a partnership between the LEGO foundation, National Geographic, Unilever, the Ingka Group and UNICEF—is an example of a private sector-led approach that aims to create a movement toward playful learning to build creativity and innovation skills. It provides resources for playful activities that can take place either at home or in school.[23]

Technology skills

Technology design and programming are two of the key skills set to be in high demand over the coming years as technology adoption continues to impact business growth.[24] While skilled human capital is a key contributor of technological progress and adoption,[25] economies today fall far behind the new frontier of digital skills demand (see figure 3).[26] To capitalize on the full potential of the Fourth Industrial Revolution, businesses and economies must foster technology skills in the workforce of the future.

At the same time, studies suggest that public policy frameworks have not kept pace with the level of innovation in most economies.[27] It will therefore be critical that alongside the hard skills of technology design and development, children also understand principles of digital responsibility. The combination of these skills will help them shape the future policies and practices that enable technology to be a positive driver of growth. In the UK, for example, 99% of teachers agree that this skill should be part of the school curriculum.[28]

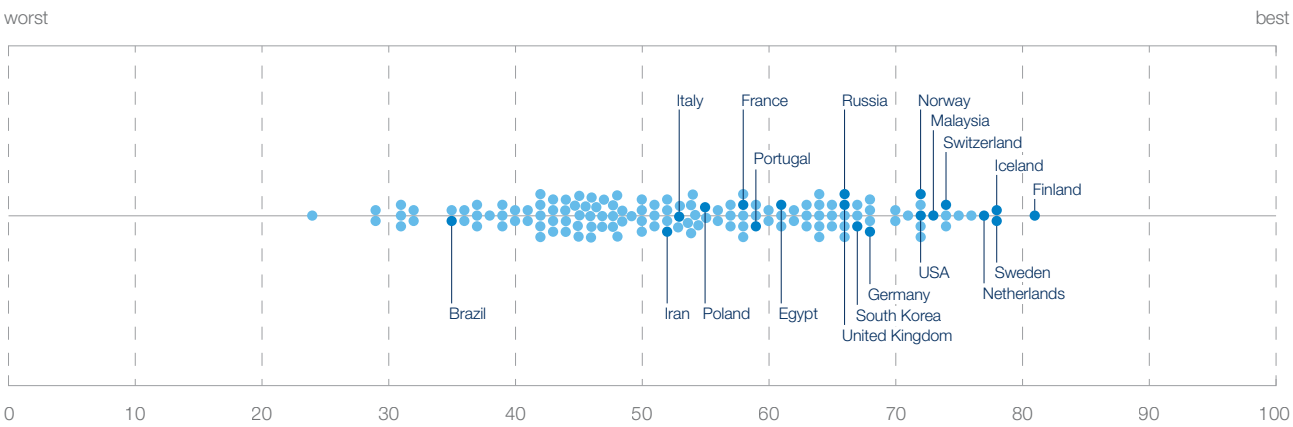
Such a shift in learning content would help children develop healthy relationships with technology, understand principles for managing digital risk and security, and build awareness about their duty as responsible developers and consumers of technology. Teaching methods that leverage computational thinking—combining math, science and digital literacy to help students understand how to approach problems in the way that a computer would—can support the integration of technology skills into school curricula. For example, after learning about climate change, students might use tools such as the Raspberry Pi or Scratch to design a website that increases awareness about this challenge.

Education technology can also help foster these skills. Tools such as CodeAcademy and Code.org, for example, offer resources for teaching programming, and help students develop fluency in the use of digital technology by creating unique interactive stories, animations, games, music and art.[29]

Enabling this shift toward technology skills will require public-private collaboration to ensure that schools have both the infrastructure to enable digital learning and the job market insight into the technology skills that will be most relevant to employment in the future. Many companies are already working closely with schools to enable this vision. Verizon's Innovative Learning Programme, for example, works with schools across the United States to provide free technology, internet access and a technology-focused curriculum to under-served communities to bridge digital divides.[30] Think tank DQ Institute is also promoting multistakeholder collaboration to foster digital skills through their Global Standards for Digital Literacy and the Coalition for Digital Intelligence, which aims to set a global standard for digital intelligence.[31]

At the national level, education ministries can play a fundamental role in fostering technology skills. The United Arab Emirates Ministry of Education, for example, has launched the Artificial Intelligence and Robots Competition Series, which engages over 3,000 youth annually in national and international robotics, programming and technology competitions.[32] These competitions serve as the culminating events for over 31 education centers across the country working with children on technology skills.

Figure 3: Which countries have the digital skills to master the Fourth Industrial Revolution?



Source

Global Competiveness Report, World Economic Forum, 2019.

Interpersonal skills

As technology continues to automate routine tasks, human-centric skills will provide a distinct advantage over machines in the workplace. In fact, employers report leadership, social influence and emotional intelligence to be among the high-demand interpersonal skills of the future.[33]

Fostering these skills can help children develop healthy relationships with others and consider different views, which can complement and augment other skills of the future. For example, a child who can consider the perspective of someone with a disability or someone with non-binary gender identity may be able to innovate new products, approaches and services that are more inclusive of all segments of society. Similarly, a child who has honed their communication and leadership skills might be able to more easily persuade others to activate their global citizenship and take action on economic and social issues. In an increasingly interconnected world, these skills will become ever more essential in shaping future leaders that champion more inclusive economies.

Studies show that developing these non-cognitive skills at an early age can also have a lasting positive impact on individual outcomes in the long term beyond employment, including higher wages, better health and lower chances of being involved in crime.[34]

Teaching methods that emphasize cultural awareness and diversity are one avenue by which this learning shift can be achieved. These approaches can be formally taught in courses that focus on social and emotional development or be integrated into existing curricula. For example, a class on persuasive writing can incorporate communication skills by having students give a persuasive speech in a public setting. These skills can also be taught informally through various interactions. The CASEL Guide to Schoolwide Social Emotional Learning, for example, provides a tool for implementing school-wide social-emotional learning, including through interactions with student support services, discipline policies, and community partnerships.[35]

Ensuring diversity within schools and classrooms is another avenue for helping children foster interpersonal skills. Diverse schools enable children to collaborate and interact with people with different perspectives, which can help them exercise more inclusive and empathetic leadership in the future.

Communication technologies that connect classrooms in various parts of the world can support such learning. For example, a teacher may use Skype or other videoconferencing platforms and apps to have their students deliver persuasive speeches to children in other parts of the world. Such an exercise would add an additional layer of complexity to a simple persuasive writing activity, as students will then need to consider the point of view of and influence people outside of their own contexts. These technologies can also be powerful collaboration tools, and can enable students to co-create presentations and projects in a truly global team made up of learners from around the world.

Box 1: Innovative pedagogies

Pedagogy is the combination of teaching approaches and learning principles that underpins education systems. While many different approaches exist, much literature has emerged suggesting five key approaches for driving innovation in education systems:

1. **Playful:** an approach that creates joyful experiences to enable children to find meaning in learning through active thinking and social interaction. It includes free play, guided play, and games.[1]

2. **Experiential:** an approach that integrates content into real-world applications. This approach includes project-based and inquiry-based learning.[2]

3. **Computational:** an approach that supports problem-solving enabling students to understand how computers solve problems.[3]

4. **Embodied:** an approach that incorporates the physical body into learning through movement.[4]

5. **Multiliteracies:** an approach that focuses on diversity and the multiple ways in which language is used and shared and connects learning to cultural awareness.[5]

Notes

[1] The LEGO Foundation, *Learning Through Play: a review of the evidence*, 2017.
[2] The Brookings Institution, *Learning to Leapfrog: Innovative Pedagogies to Transform Education,* 2019.
[3] Ibid.
[4] OECD, *Teachers as Designers of Learning Environments,* 2018.
[5] Ibid.

Governments and business can support interpersonal skills development by aligning on and clearly defining the key competencies required for the future of work and the future of citizenship. The International Labour Organization, for example, has developed a guide that defines broad skills required for employability, including communication and team work, along with specific definitions of the key abilities within those skillsets.[36] Similarly, leaders can collaborate to set new standards for what learning interpersonal skills could look like, as it is an area where there has been little consensus. The Skills Builder Partnership, for example, enables schools, families and private sector leaders to align on a common framework for building teamwork and leadership skills, with specific activities and milestones for skills mastery. The framework is informed by over 60 organizations, and the programme connects business leaders with schools to foster those skills through workshops in their offices (see page 24).

Shifting learning experiences

The transition to Education 4.0 will also require learning mechanisms that more closely mirror the future of work, and that take full advantage of the opportunities offered by new learning technologies. The shifts in learning content and experiences are not mutually exclusive. Creating learning ecosystems that are personalized and self-paced; accessible and inclusive; problem-based and collaborative; and lifelong- and student-driven can help unlock, for example, the interpersonal and innovation skills needed for the future, much in the same way that global citizenship can help create learning that is more inclusive. These shifts in learning experiences must be accompanied by vetted innovative pedagogies—teaching principles and strategies that underpin learning (see Box 1).

Personalized and self-paced learning

Today's children are growing up in a world of abundant choice and personalized experiences enabled by technology. They have on-demand access to the videos and shows they'd like to watch, friends are one message away, and they can customize their mobile devices with the applications they find most useful, listed in the order that is most efficient for them to access. While there are many debates about the ethics of children's use of technology, it is abundantly clear that personalization as a general concept is quickly becoming an expectation and a reality.

In the world of work, skills disruption will require organizations to be much more agile in delivering working and learning experiences that are tailored to the individual needs of their workers. Much work is being done by private sector chief human resource officers on customizing work experiences to enable lifelong learning and integrating alternative work models to improve flexibility.[37]

Yet even though children will enter workplaces and have experiences that are more customized and agile than ever before, most education systems continue to take a standardized approach to learning. Shifting to a more personalized and flexible model can not only help schools more closely mirror the realities of work and life outside of school, but it has also proven to show better student outcomes. One study shows that the adoption of personalized learning methods—including designing individual learning journeys, progression based on skills mastery, and flexible learning environments—had significant positive effects on student math and reading performance over the course of two years.[38]

There are multiple pathways by which personalized learning can be delivered. One approach is to reduce class sizes to enable teachers to provide more personalized feedback—yet this seems unrealistic given that massive gaps already exist in the teaching workforce.[39] Many classrooms opt for a small-group approach to learning, where most students in the classroom engage in independent learning and reading while the instructor rotates between smaller groups according to the specific skills those children need. Other pathways to create choice include providing multiple options for students to show their knowledge (such as presentation, songs, video, etc.), using project-based learning where children choose their own focus areas, and creating flexible physical and digital learning spaces.

Technology can also accelerate this shift in learning. Individual students can learn by using digital courseware, such as the ones provided by Khan Academy,[40] as the teacher works with smaller groups. These tools also enable students to progress through content at their own pace.

Other education technology companies help customize experiences by supporting learning outside the classroom. China's 17Zuoye, for example, offers a platform that provides learning content aligned with the national curriculum, provides individualized homework support, and suggests personalized study plans for students based on their level of skills mastery.

Technology can support personalization in developing economies as well. M-Shule, for example, is a mobile learning platform that serves millions of primary school students in Kenya and Sub-Saharan Africa.[41] They use adaptive learning technology to analyse each student's skill level and develop personalized learning journeys. The programme is SMS-based, which makes it potentially accessible to the 456 million mobile phone users on the continent.[42]

Public-private collaboration can have a tremendous impact on shifting toward personalization in Education 4.0. Closer cooperation between education ministries and education technology companies, for example, can help ensure that innovation in this sector is channeled toward instruments that support the kind of personalization needed in classrooms.

Accessible and inclusive learning

Despite massive expansion of public education in recent decades, learning remains inaccessible to many children around the world. In fact, 258 million primary and secondary school-aged children around the world are out of school today.[43] Some experience physical barriers, including conflict and lack of basic infrastructure. In other parts of the world, private education has emerged as an alternative to underperforming public education systems, creating new financial barriers to quality learning.

But access may also be limited for children enrolled in school. The standardized approach to learning, for example, may not be adequate for the estimated 93–150 million children living with disabilities.[44]

As education continues to be a key driver of social mobility and well-being, learning systems must shift toward more accessible, and therefore more inclusive, methods to ensure access to opportunity for everyone. Without such a transformation, current trends risk further exacerbating inequality.

Furthermore, increasing accessibility in learning today is a pathway for shaping diverse talent pools in the future. In increasingly innovation-driven economies, diverse talent will have positive implications for innovation and future growth.[45]

Multiple modalities for learning—including visual, audial, tactile and kinesthetic methods—can be integrated into existing curricula to help students engage with material in different ways. Instruments geared toward students with special needs, such as weighted accessories and tactile stimulants can be used to create learning environments that work for everyone. Ensuring diverse representation in learning material, such as book characters and historical figures, can also make learning more accessible to children of various backgrounds.

Technology can help increase accessibility. Text-to-speech technology, for example, can help students who are visually impaired and those who have difficulty decoding text to access content. Digital courseware and communication technology can have a ground-breaking impact on those without physical access to education by connecting children with teachers and learning resources from other parts of the world.

Virtual labs can also provide students access to experiences that their own schools and communities may not be able to provide. EdTech companies such as Labster and Praxilabs, for example, have designed online lab simulation experiences to help teach science subjects in places that may not have access to science facilities.[46]

Governments and non-profits can work together to shape more inclusive education systems. In Sweden, for example, a local organization distributed author Chimamanda Ngozi Adichie's We Should All Be Feminists to every 16-year-old student in the country in 2015 to spark dialogue about feminism.[47]

The private sector can also champion inclusive and accessible education systems by providing the necessary physical and digital infrastructure. South African mobile communications company Vodacom, for example, offers an e-school for their customers, complete with self-paced video lessons, homework support and self-assessment tools.[48] Similarly, IBM partnered with schools in the United States to create the P-TECH model for students aged 9–14. The schools enable students to earn a high school and two-year post-secondary degree in a STEM (science, technology, engineering and math) field at no cost. In this programme, students have access to mentorship and learning experiences through worksite visits and paid internships in companies within the information and communication technology (ICT) industry.[49]

Problem-based and collaborative learning

In traditional standardized learning models, teachers impart direct knowledge to students by demonstrating processes and formulas to arrive at one answer. These formulas are memorized, and children imitate these processes to solve other similar problems.

The issue with this approach is that today's innovation-driven economy depends on the creation of wholly new ideas, services, products and solutions, and there is no process or formula for doing that. Creativity and innovation cannot be imitated. They require individuals to try solutions and iterate based on how well their design addresses the given challenge. In many cases, there may be multiple solutions and designs that solve the same problem. Such innovation can rarely occur through isolated thinking, and requires children to work on building physical, digital or hybrid solutions together.

To foster this kind of thinking, education systems will need to shift from a process-based, to a problem-based approach to learning. Studies show that this method improves students' problem-solving skills, as well as their perceptions of the learning environment. It enables children to feel ownership of their learning and creates a stronger sense of community in the classroom.[50]

Making this shift requires taking an open-ended, rather than single-answer, approach. It means that classrooms must enable children to try different solutions and compare results to iterate and build on others' ideas, rather than focusing on identifying one correct answer. This shift will also require children to be more collaborative as they learn to expand on and improve each other's ideas.

Problem-based learning can be implemented by assigning students collaborative projects to create solutions to real-world challenges. Through a project-based approach, students need to research the topic and understand the various viewpoints, ideate and design a solution, and then finally develop a prototype.

For example, a typical classroom may teach children about cubic volume by demonstrating a formula—length multiplied

by width and height—and then asking them to apply this abstract procedure they've just memorized to find the volume of different box sizes. A problem-based approach may instead ask students to design a container that can hold 25 toys of a certain size and will protect the toys from water damage as they are transported in the snowy season. Children may do research about water-resistant materials, take different approaches to estimating what the size of the container should be, and each container may look different, while still solving the same problem. By presenting the challenge in an open-ended way, children can tap into their creativity and innovation without the pressure of arriving at one single answer.

While not a requirement, technology can certainly facilitate collaborative, problem-based learning approaches. Cloud-based tools, for example, can allow students to work on the same documents from different locations, and build on each other's work. Virtual and augmented reality can add a layer of challenge to problem-solving by transporting students to new geographies and having them solve problems in areas outside their known contexts.

The private sector can play a key role in fostering the right kind of problem-solving to help children transition to the future of work. Microsoft, for example, has partnered with The Knowledge Society (TKS)—an extracurricular programme in the United Kingdom—to provide their high school students with real challenges that the company is facing. In one project, Microsoft asked learners to evaluate the company's Artificial Intelligence (AI) School and provide feedback on its strategic direction.[51]

Lifelong and student-driven learning

According to one estimate, by 2022 alone, everyone will on average need an extra 101 days of learning to keep pace with the changing world of work.[52] While traditional education systems have been designed to decrease learning with age, a new system must emerge whereby people engage in lifelong learning to navigate future job disruptions. To realize this vision, a love of learning must be instilled in children from a young age.

Fostering this mindset will require student agency to be a key factor in schooling. Notable experts have long-championed student-centred approaches, highlighting that children are naturally inclined to be curious, and student choice helps to activate that natural curiosity.[53] Choice can be integrated into project-based learning approaches by providing students multiple options for projects and allowing them to choose their own strategies for arriving to a solution.

Creating a love of lifelong learning will also require shifting to a system of learning for learning's sake, rather than for specific rewards or to pass standardized testing. While assessment is important for ensuring quality and accountability toward outcomes, more progressive forms that incorporate student choice could be an effective way of taking the focus away from test scores. For example, a school might give students the option of showcasing what they have learned about gender equality by giving a speech, creating a work of art, creating a film or writing an essay. While these are different formats, they can all give teachers and families deep insight into the child's understanding of the material, while giving children agency.

Activating inquiry-based and open-ended methods of teaching can also support lifelong learning. As children create solutions and learn to iterate and improve those solutions based on observation, they will be driven to learn for the sake of improving the quality of their own work, rather than to impress adults with their ability to arrive at the right answer.

Digital courseware can help facilitate learner-driven approaches by allowing students to choose the material they would like to engage in and giving them flexibility about when they want to engage in the material. Teachers can use these resources to engage students with learning of their choice as they pull out small groups for more personalized and targeted instruction.

Learning management systems can also help teachers keep track of the multiple learning journeys created by student choice. If tailored to teachers' specific needs, these systems can provide an integrated view of student progress, lessons, projects and next steps.

Governments can facilitate this shift to lifelong and student-driven learning. Finland, for example, does not have national standardized tests, but rather pulls samples of students to evaluate learning. This system enables children to focus on the joy of learning, rather than the pressure of assessment.

Public-private collaboration will also be key to fostering lifelong learning systems. To ensure that children can transfer their skills throughout the different phases of their learning, for example, a shared language for skills must be created.[54]

Schools of the Future

Given the urgent need for stakeholders to co-create education systems that deliver on children's future needs, the experiences of a range of pioneering education institutions—"Schools of the Future"—may provide inspiring examples to guide the transition to Education 4.0 globally. As learning is increasingly becoming more lifelong and taking place outside traditional school walls, this white paper's definition of "school" in this context is quite broad, encompassing traditional schools, extracurricular programmes and other configurations where learning occurs. While each individual initiative described in this section has a unique approach, enabling mechanisms are highlighted to show how these methods could be unlocked, connected, replicated and scaled in new contexts to create system-level change.

Methodology

After a series of consultations with experts, key business leaders, practitioners and policy-makers to align on the Education 4.0 framework, the World Economic Forum launched a global crowdsourcing campaign in the second half of 2019 to find inspiring examples of Schools of the Future. Key criteria for schools to be considered included:

- Alignment with the Education 4.0 framework
- Potential for scaling up
- A multistakeholder approach to design and implementation
- Demonstrated improvement in student outcomes, access to learning or learning experiences

Ideas were collected via an online submission form over the course of one month. Individuals were able to submit ideas either on behalf of their implementing organization or as a third party. Over 70 submissions were received and analysed for alignment with the Schools of the Future criteria.

Of those submissions, 16 case studies—two exemplars per dimension of the Education 4.0 framework—were chosen based on the uniqueness of their approach, demonstrated impact and geographical diversity.

While the following case studies do not represent a comprehensive overview of all innovative and most impactful schools and school systems in the world, they do provide a guiding principle for other actors hoping to drive transformational

Figure 4: Schools of the Future

change in education. Some of the featured schools are private in nature but aim to promote inclusivity and access within their learning approaches, and offer unique models that could be adopted and scaled within public school systems more broadly.

While every selected school/school system demonstrates characteristics that align to all eight dimensions of the Education 4.0 framework, the list is organized according to the key features within the framework that make that approach unique. Case studies also include the supporting mechanisms that enable its implementation, and measures of success, according to its own assessment measures.

Global Citizenship Skills

A focus on building awareness about the wider world, sustainability and playing an active role in the global community

Indonesia

Green School: Creating a Generation of Future Green Leaders

The Green School, opened in Bali in 2008, is committed to education that promotes sustainability and shapes future green leaders. It currently serves more than 800 students aged 3–18, with plans to expand to New Zealand, South Africa and Mexico by 2021.

What makes this model unique?

Students at the Green School apply learning to the real world through a global citizenship and sustainability lens, and truly take advantage of the natural world to tap into their curiosity, empathy, and creative thinking skills.

The school's physical space supports critical thinking, creativity and entrepreneurship. Learning takes place in a completely natural and sustainable environment that includes wall-less classrooms and a structure built entirely out of bamboo. The BioBus, a cooking-oil-fueled vehicle designed by Green School students that saves over four tons of carbon emissions per year, transports students to and from school. The campus includes an Innovation Hub—a maker's space with woodworking equipment, 3D printers and laser engravers—and a Project Hub, where students pitch project ideas to be used in the classroom.

The school's location is integral for enabling students to connect directly with nature and consider ways to help the planet. In the early years, for example, children spend a significant portion of their time in the gardens and kitchen, developing empathy for nature and a general awareness about where their food is sourced. All students help maintain a sustainable environment in the school, and in the 2017–2018 school year produced over 150 kilogrammes of edible produce per month.

All learning is directly connected to real-world application. In middle school, for example, students built a functional cable and bamboo bridge across the Ayung river as part of their math class. The project was entirely student-led, including the design, cost estimation and construction processes. At the high-school level, Green School students worked with those at the University of Cologne to design and build a new and sustainable solar and hydropower system for the school.[55] They also started their own fashion company, which donates a portion of sales to help children in India and Indonesia buy school uniforms.

The school takes a thematic and interdisciplinary approach to teaching content and offers courses in digital citizenship and technology.

Enabling mechanisms

The Green School partners with private sector companies to support their curriculum. In 2018, for example, it partnered with Sunseap, Singapore's largest clean energy provider, to help the school with its goal of being completely off the grid. The goal is part of a student-driven initiative, Operation Rain or Shine, which aims to help the school become a model of renewable energy.

The Bali school also leads an educator course open to teachers around the world for training on pedagogy and design principles of a nature-based curriculum. To date, nearly 700 teachers from over 50 countries have participated in this immersive programme.

Measures of success

A 2012 qualitative study of the Green School found that this model has had a particularly positive impact on students with special learning needs. In fact, these students showed lower levels of stress, greater resilience, less distraction, higher self-esteem and greater motivation to learn at the Green School than similar students in other schools.[56]

In addition to creating impact for their own students, the Green School is also paving the way for other nearby schools to transition toward greener models. In 2017, for example, they supported seven local schools with replicating their waste-management system. Their Kul Kul Connection programme supports an additional 350 local children learn about sustainability. Beyond Indonesia, the school's training programme enables teachers around the world to scale their sustainability and exploratory learning approach.

The school's impact also extends to the environment. In the 2017–2018 school year alone, student-led energy projects led to seven new renewable energy systems implemented at the school. In their latest annual report, the school shows a 40% reduction in their environmental footprint. In fact, it uses just 10% of the energy consumed by other schools.[57]

Kenya

Kakuma Project, Innovation Lab Schools: Driving Action on the SDGs through Global Cross-Cultural Exchange

In 2015, Koen Timmers donated his laptop to the Kakuma refugee camp in Kenya to connect international volunteer teachers to refugee children and offer free distance learning. The concept has since expanded to include 350 teachers across six continents offering courses in English, Math and Science via Skype to children in the camp. The model of the Kakuma project is now under development to expand as the network of Innovation Lab Schools to Tanzania, Uganda, Nigeria, Malawi, Morocco, Argentina, South Africa, Brazil and Australia. The schools aim to train 10,000 teachers and offer free quality education to 1,000,000 students by 2020.

What makes this model unique?

The Innovation Lab Schools have developed their own curriculum that combines the 17 UN Sustainable Development Goals with STEAM (science, technology, engineering, arts and math) learning to foster empathy and global citizenship. The Lab partnered with We Care Solar, which supplies a solar suitcase—a folding solar panel that offers free and sustainable power—to support learning in areas without direct access to electricity.[58]

In addition to lessons delivered by international volunteer teachers, the model trains a local teacher from the camp to guide weekly small-group international cultural exchanges via Skype with other classrooms around the world.

The Lab has launched several global student month-long Innovation Projects, challenging learners to design new solutions to combat climate change and build empathy across cultures. Students present findings and solutions in nontraditional formats including videos and cross-country pitch presentations.

To date, the Lab in the Kakuma project has lacked the infrastructure to allow more than 20 students to join a session at any given time. A physical school is now under construction to house 200 children from the camp in digital classes, as well as a training centre to help local refugees become teachers.

Enabling mechanisms

Innovation Lab Schools leverage video conferencing and virtual communication technologies such as Skype and Empatico to help students interact with other learners around the world.

The Labs hire one refugee in the camp as a consultant, who then trains the teachers on how to use Skype and manage technical aspects of the lessons. Teachers also receive training from international teachers via Skype.

The Labs rely on a multistakeholder approach to design and implementation, partnering with Jane Goodall's Roots and Shoots, Microsoft, LEGO Education, the Varkey Foundation's Global Teacher Prize, Edukans and many others.

Measures of success

Three hundred fifty global teachers across 75 countries currently offer free education to children who would otherwise not have access, increasing their likelihood of being relocated to other parts of the world. These sessions also offer opportunities to expose children to the world outside their camp.

Innovation and Creativity

A focus on skills required for innovation, including complex problem-solving, analytical thinking, creativity and systems analysis

Canada

The Knowledge Society: Combining Hard and Soft Skills to Create the Next Generation of Innovators

The Knowledge Society (TKS), founded in 2016 in Toronto, is an extracurricular three-year programme for students aged 13–18 that focuses on building technology and entrepreneurial skills. Core sessions run from September to June alongside the academic school year for a 10-hour total weekly extracurricular commitment. Today the programme has expanded to New York, Las Vegas, Ottawa and Boston.

What makes this model unique?

The Knowledge Society was designed to mirror the learning and working environments of major technology companies, exposing learners to the most cutting-edge innovations, such as blockchain, robotics and artificial intelligence, to help them understand how to use these tools to drive positive change in the world.

The programme partners with companies such as Walmart, Airbnb and TD Bank to expose students to real-world challenges those organizations are currently facing. TKS students use the McKinsey & Company consulting framework to work through those challenges and present their recommendations to the organizations.

TKS is a three-year programme. Year 1 is dedicated to building foundational technical and communication skills. Throughout this period, students learn about and explore over 40 different technologies, and then choose the technologies that most appeal to them. During Year 2, students focus on their technology of choice and expand their technical skills within that area of focus. In Year 3, students build their own innovative and disruptive companies. Throughout this period, students hone their soft skills to communicate the potential impact of their innovations.

Projects are entirely self-paced—students may spend anywhere between three to 10 months studying one technology.

Enabling mechanisms

The programme developed its own online platform to provide

students resources and content to support their projects. Students are also able to exchange ideas and connect with each other via the platform.

TKS partners with a major innovator company in each of the cities in which it operates, such as Zappos in Las Vegas and Microsoft in New York. These innovators support the programme by providing students with real-life challenges related to their current work, mentors, internships and access to innovator conferences. With Microsoft, for example, students evaluated the Artificial Intelligence (AI) School and provided feedback on their strategic direction, product experience, and growth strategy.

Measures of success

By the end of their third year, all students in the programme have designed their own company, many of which have been converted to real companies. G-nome, a blockchain-based application that compensates users for uploading anonymous genetic information to diversify gene-editing lab data pools, was developed by a teenage TKS student and was acquired by a blockchain start up. Another student co-founded a company that uses machine learning to improve vaccines. A third student founded a company that's partnering with the Sinai Health System to develop a wearable, non-invasive blood-testing device.

Although internships are not guaranteed by the programme and must be obtained based on skills and merit, all participating students typically obtain a summer internship by the end of the programme. Hiring partners include Microsoft, Deloitte and IBM, among others.

Students have also been invited as speakers to some of the largest technology conferences, including Web Summit, SXSW, TEDx and the Consumer Electronics Show.

Mali

Kabakoo Academies: Applying Innovation Skills Directly to Local Contexts

Youth account for nearly 60% of unemployment in Africa, according to the World Bank.[59] Misalignment between schools and employers and expensive models of high-quality learning limit access to the skills needed to enter the labour market, resulting in about 10 million young Africans struggling to find jobs each year. Kabakoo—which means "to wonder" in the Bamanan language in West Africa—is a pan-African network of schools that aims to help solve this challenge by empowering young Africans with the innovation skills needed to be employable within their local contexts, with a focus on small-scale manufacturing. The pilot Academy launched in Bamako in 2018 and has since then expanded to three campuses in Mali and Madagascar. The programme has trained nearly 500 learners across middle school, high school and university levels in rapid prototyping, robotics, web design and biotech, among other frontier topics. By 2021, they hope to scale their model to other African cities.

What makes this model unique?

Kabakoo's curriculum focuses on ensuring employability among their students and immediate applicability of content to the local context. Part of their approach is to help students rapidly develop market-ready protypes to solve relevant local problems through a sustainability lens. Students freely choose the local issues that most resonate with them, and then take part in courses and group projects to develop innovative solutions to those issues. Students are currently developing, for example, West Africa's first citizen platform to fight ambient air pollution and have designed and prototyped a low-cost tool for monitoring air quality. Data from the monitors is directly loaded to the online platform so that community members can inspect the air quality in various parts of the city. They used 3D printing to develop the prototype, and programming skills to command the device. Another group is designing tools for decentralized and small-scale waste recycling, and a third is developing a solution for automating farm irrigation.

The pilot Academy was purposely built in a low-income neighborhood to physically reduce the distance between learners and high-quality learning. There are no educational prerequisites to participate Kabakoo other than the ability to read and write. To enable maximum access, students have the option of entering income sharing agreements, and paying only after they have secured a job or set up their own business.

Enabling mechanisms

Kabakoo works closely with local businesses to help their students identify issues within the community that require innovative and urgent action. They also rely on professionals in other countries—including in China, the United States and Germany—to serve as distance coaches and mentors for project groups. The model relies on peer learning, with each project team assigned a coach rather than a "teacher" in the traditional sense of the word.

The Academy has also designed its own online platform that enables students to track their progress toward the seven habits of Kabakoo: explore the world around them; know themselves; communicate effectively; create, connect and share their work; and reflect. Each habit has 20 dimensions and 64 sub-dimensions on the platform, enabling students to share a common language for skills.

Measures of success

Since Kabakoo's launch in 2018, various projects have already been prototyped and implemented. The Breathe, Africa! project, for example, has launched citywide efforts to monitor the air quality in various parts of Bamako. Stations were sponsored by local companies and organizations, and metrics are visible on an online platform, also designed and programmed by Kabakoo students.

As part of their commitment to Kabakoo, alumni of the programme are required to act as facilitators for a period after graduation, creating a multiplier effect for the broader community by encouraging all graduates to contribute to the programme's success.

Technology Skills

Focus on developing digital skills, including programming, digital responsibility and the use of technology

Viet Nam

TEKY STEAM: Pioneering a New Model for Fostering Technology Skills

Founded in 2017, TEKY is the first STEAM (Science, Technology, Engineering, Art and Mathematics) academy in Viet Nam for children ages 6–18. They have established 16 labs in five cities nationwide and partnered with 30 schools across the country to deliver 9–18 month-long technology courses. TEKY also designed a coding camp, where students engage in learning technology skills over holiday periods, and is developing an e-learning platform to deliver their programmes to students in more remote provinces in the region.

What makes this model unique?

TEKY focuses on teaching technology skills through modules on programming, robotics, website design, multimedia communications and animation. Students spend about 80% of their learning time interacting with technology. Classes are small—between three and eight students—and content is delivered via collaborative projects. The learning journey is entirely student-driven: each student joins several pilot classes before deciding on the technology class that most appeals to them. TEKY leadership collaborates with several education technology partners, including Sigong Media, MIT for Scratch, Tynker, LEGO Education, RoboRobo and Maker Empire, among others, to develop tailored programming that teaches their students critical technology skills for the future. In addition to classes, TEKY hosts an annual Minecraft Hackathon—a national programming competition for over 1,000 students in Vietnam, as well as one internal technology contest every quarter.

Most recently, TEKY collaborated with MasterMind Crate to launch the Tekid-preneur programme, designed to guide students in building and designing their own e-commerce websites, and launched Viet Nam's first virtual reality course for students ages 13–18.

Enabling mechanisms

TEKY has established a research and development team composed of experts and researchers in pedagogy and education technology, responsible for designing the curriculum and continuously improving the quality of their programmes. They work closely with education technology partners to identify the best providers, highlight best practices and tailor the technology to the programme's needs.

The programme also leverages a digital platform through which teachers can share class images, student presentations and learning materials with parents to engage them in student learning.

Measures of success

TEKY students consistently participate in national and international STEM competitions to demonstrate their mastery of technology skills. In 2017, TEKY students won five WeCode International Children's Program medals. In 2019, TEKY students won silver medals at the World Robot Olympiad, a major global science and technology event for teenagers aged 9–21 years old from more than 60 countries.

Indonesia

Accelerated Work Achievement and Readiness for Employment (AWARE): Building a Workforce for the Digital Economy

The Accelerated Work Achievement and Readiness for Employment (AWARE) project aims to build a future-ready workforce with the skills needed to succeed in the digital economy. The first project was a joint initiative between the Education Development Center (EDC)—a non-profit that designs and delivers programmes in education, health and economic opportunity—and the JP Morgan Chase Foundation. Between 2013 and 2015, the project provided work-readiness training and workplace opportunities to students beginning at age 16 in the Philippines and Indonesia. After the success of the first AWARE project, AWARE2 was launched in 2017, specifically focused on expanding workplace readiness within the ICT sector, with further plans to launch a third iteration of the programme soon.

What makes this model unique?

AWARE creates direct links between students, schools and industry leaders to support work-readiness among youth through structured, work-based learning in collaboration with over 65 private sector companies. Partner companies include BMW, Globe Telecom, LG Electronics and Schneider Electric.

The project leveraged the EDC's Work Ready Now! curriculum, which delivers work readiness preparation through eight content modules on skills ranging from interpersonal communication, to leadership, to entrepreneurship and financial fitness; business innovation challenges to address community and business challenges; and projects where students design, build and grow their own businesses.

AWARE also provides intensive two-day bootcamps where students apply core technical skills with local partners in the ICT industry, and opportunities for students to apply skills in web design and digital marketing through simulated "gig economy" jobs.

Throughout the programme, students build a digital portfolio of websites, designs and other digital work products they have developed in collaboration with industry partners.

Enabling mechanisms

The project is funded by the JPMorgan Chase Foundation, and partners with the Department of Education in the Philippines, Indonesia and Thailand.

To support its curriculum and track student progress, the program developed the Work Ready Now! soft skills training toolkit, which includes baseline and end-line assessment tools that measure students' soft skills capabilities and enables student self-reflection.

Measures of success

The first AWARE programme trained 4,347 students on Work Ready Now! and 98% of them were placed in structured, on-the-job training. Nearly half of that cohort has already been employed.

AWARE has also trained over 200 ministry officials in Indonesia and the Philippines on their approach. The Indonesian Chamber of Commerce and Industry is now exploring expanding the AWARE approach to all its members.

In its first year of operation, AWARE2 trained more than 90 teachers and 2,000 students and engaged over 100 firms in work-based learning programmes. Assessment results from this cohort revealed that 57% of programme participants improved their employability in line with the Work Ready Now! framework.

Interpersonal Skills

Focuses on interpersonal emotional intelligence (i.e. empathy, cooperation, negotiation, leadership and social awareness)

Spain

iEARN: Creating a Global Community of Learners through Virtual Cultural Exchange

The International Education and Resource Network (iEARN) is a non-profit organization founded in 1988 that partners with over 30,000 schools and youth organizations in more than 140 countries. It creates a global community of learners that engage in cross-cultural exchange and collaborate on service-learning projects via an online network. Today, over 2 million students participate in iEARN's collaborative projects worldwide.

What makes this model unique?

Through iEARN, students connect with peers from schools all around the world on issues and projects aiming to create positive change in the world. It offers a menu of over 150 projects, which teachers can integrate into their existing curricula. iEARN's platform provides an online forum for learners to meet one another and collaborate on the same project.
Every project proposed in iEARN must answer the question: "how will this project improve the quality of life on the planet?" and must indicate how their project supports the UN Sustainable Development Goals.

The Future Citizen Project, for example, focuses on exploring the rights and duties of the citizen. Students research local laws, election processes and government systems in their own countries, complete a local service project in their community—such as volunteering at voter polls—exchange findings with students in their project circles, and create a final documentary describing the characteristics of good citizenship skills.

Classrooms have the option of joining Learning Circles—six to eight classrooms that remain together over a 3–4-month period—and can present their findings and results via iEARN's Virtual Project Exhibitions, held twice per year.

Throughout the process, students engage in cross-cultural exchanges and identify commonalities between students in various parts of the world.

Enabling mechanisms

Each participating iEARN country has a country coordinator. Decision-making at the international level is carried out by a Global Assembly, composed of voting members from established iEARN centres.

The iEARN model includes in-person professional development workshops for teachers, which focuses on how to best integrate the iEARN programme into the curriculum. Teachers also receive specific training on how to prepare their students for cross-cultural interactions and how to foster empathy and social awareness among their students. After the workshop, participants return to their schools with a built-in support network—on-going technical and staff development assistance from iEARN staff, as well as an online community of colleagues worldwide. All iEARN training materials are available online for teachers to refer to as they undergo the project process with their students. The network also developed an online platform to enable cross-country collaboration. Students and teachers can use this tool to connect virtually and upload and exchange project materials.

iEARN partnered with a number of private sector and philanthropic organizations, including Intel, Microsoft Partners in Learning, the National Wildlife Federation and the Oracle Education Foundation, among others, to deliver their programmes worldwide.

Measures of success

Several independent studies have examined iEARN's impact on learners. Researchers have found that it has had an overall positive effect on students' levels of motivation, self-esteem, interpersonal interaction, and intercultural awareness.

Finland

South Tapiola High School: Integrating Global Perspectives to Foster Interpersonal Skills

The Finnish school system is consistently ranked as one of the best in the world, with South Tapiola high school ranked as one of the best schools in the country. Founded in 1958, it currently serves over 500 students, combining the Finnish national curriculum with a unique focus on

collaboration through entrepreneurship, active citizenship and social awareness.

What makes this model unique?

South Tapiola High School—also known as ETIS—offers a curriculum that focuses on developing collaboration and interpersonal skills through real-world application. In the school's Young Entrepreneurship Programme, for example, students work in groups to design and create their own business throughout the course of the year. These groups of students go on to compete in national competitions against other student entrepreneurs. In 2016, the I'm Blue NY student-designed company that produces blueberry soda from Finnish blueberries, won best company in the upper secondary and vocational school level at the competition for young entrepreneurs—a competition hosted by Junior Achievement Finland. The student founders of the company then went on to represent Finland in Company of the Year competition in Switzerland.

The school takes a perspective-driven approach to learning. For example, rather than using direct instruction to teach students about the Cuban Missile Crisis, a classroom may instead take the perspective of a particular individual during that time and have students debate different points of view.

Every opportunity is taken to have students experience different points of view. When Saudi teachers came to visit and observe the school, for example, ETIS students hosted an interview with the teachers to write a column for the school magazine comparing the Finnish and Saudi School systems. The school also hosts several international exchange students throughout the year to nurture collaboration with students across different walks of life.

There are opportunities for students and families to engage in collaborative global citizenship activities, too. Since 2006, the school has been supporting the education of 40 Nepalese students per year through student- and parent-led fundraisers. ETIS hosts trips for their students to visit the school in Nepal and take part in cultural exchanges. The school's European Parliament for Young People Programme also provides a hands-on experience for learning civic duty by participating in national and regional sessions with students of different backgrounds to discuss current challenges in the European Union. These experiences allow students to apply learning to the real world and interact and collaborate with students of many different backgrounds.

Enabling mechanisms

The school works with several private-sector companies, including DELL, Hewlett-Packard and Microsoft, to help deliver its curriculum. These partnerships focus on the integration of technology into the curriculum in a tailored way that meets students' needs. Students also provide feedback to the companies on how to improve their products.

The school also builds on an already high-quality national curriculum established by the Finnish government.

Measures of success

ETIS has consistently placed among the top performing schools in Finnish national assessments. In 2019, the ETIS students outperformed national averages in mathematics and chemistry by more than double. A research study of ETIS also showed that students were twice as likely to get into medical school and three times more likely to join law faculties than graduates from average high schools in the country, although this may be influenced by the extremely high entry standards the school has in place.

Personalized and Self-Paced Learning

A system based on the diverse individual needs of each learner, and flexible enough to enable each learner to progress at their own pace

India

Pratham's Hybrid Learning Programme: Empowering Local Communities to Support Student-Centred Learning

Pratham, established in 1995, is one of the largest non-governmental organizations in India, dedicated to improving the quality of education in India by supplementing the work of schools. In 2015, Pratham launched its digital initiative, the Hybrid Learning Programme, a community-driven approach which serves over 90,000 children ages 10 to 14 in about 1,000 villages in India.

What makes this model unique?

Pratham's Hybrid Learning Programme works under two basic assumptions: 1) it takes a village to educate a child, and 2) children are naturally inclined to learn. These two premises underpin the design of the Hybrid Learning Programme. By raising awareness about the status of education in the village and creating ownership of learning interventions among community members, Pratham works with each village to create a physical learning environment for children. It provides the digital infrastructure for these spaces, as well as the learning content—consisting of play-based approaches to learning—to be facilitated by volunteers in the community.

There are no teachers in the Programme. Instead the Programme taps into children's natural learning curiosity to enable entirely student-group-led activities, with volunteers acting as supervisors and facilitators. Children form their own groups of 5–6 students, choose the projects they'd like to collaboratively work on, and present what they have learned in front of a live audience. Project focus areas include health, the arts, financial literacy and entrepreneurship.

Pratham provides learning content via an online application. Their resource centre includes over 70 role-play based

English lessons, math-based online games and project ideas that are executed offline.

Enabling mechanisms

The Hybrid Learning Programme leverages several technologies to deliver learning. Speech-to-text technology, for example, is used to support children's reading practices. With the support of private-sector partners, Pratham developed its own customized app, which includes games, quizzes, reading material, assessments and other resources for children, families and volunteers. To ensure accessibility to their content, the Programme also partners with other NGOs to help translate resources into 11 regional languages in India.

The Programme provides families with tablets to enable them to work with their children on activities at home. Resources are made available offline in the case of unstable internet connections.

The Programme is entirely supported by foundations and corporate donors, including Google, the Vodaphone Foundation, and Dubai Cares, enabling Pratham to deliver learning at a cost of about $3 per child per year.

Measures of success

An impact assessment of the Hybrid Learning Programme that compared 139 participating villages against a control group of 99 villages with no intervention found that those with access to the Programme showed the most improvement on science, English and Hindi assessments. Children in the Hybrid Learning Programme performed about 12 percentage points better than control groups in school curricular subjects.

As a proxy for student engagement, the Programme tracks their interaction with the online content resources. On average, students engage with the learning app for an average of 55–60 minutes per day—adding an additional seven hours of learning per week per child.

China

Anji Play: Leading a Revolution of Truly Child-Led Learning and Discovery

Anji Play is an early childhood curriculum established in 2002 that focuses on learning through play and can be applied to any learning setting. It was first implemented in the Zhejiang Province in China with over 14,000 children. It has since been scaled to over 100 public schools in over 34 provinces in China, with additional pilots run in the United States, Europe and Africa, turning Anji Play into an international model for early education.[60]

What makes this model unique?

The Anji Play curriculum uses true play as the mechanism for learning. The basic premise of this model is that any environment can become a learning environment. A minimum of 90 minutes per day is dedicated to outdoor play, using materials such as ladders, buckets and climbing cubes.[61]

Whether indoor or outdoor, the child freely chooses the activity they would like to focus on and engages in a period of focused and uninterrupted discovery, followed by a period of reflection. Children choose play materials from a selection provided by an adult, as well as whether they would like to play in a small group or alone. At the end of the activity, students reflect on what they have learned and share what the experience was like for them. Children may choose to express their reflection through any number of formats, including visual, verbal, abstract or concrete.

Children entirely self-pace and direct the learning journey. Teachers' and adult's main role throughout this discovery process is to support, but not steer the play in any way. They closely observe students' interactions and problem-solving activity, and document what they observe.[62]

Enabling mechanisms

The curriculum provides specific guidance on the kind of materials that could be supplied to promote true play. These generally include relatively low- or no-cost items that are either naturally available in the community, can be sourced second-hand from suppliers and donations, or are materials typically found in classrooms. For example, several activities require only access to nature, such as trees, water, and hills.

Measures of success

The Anji Play model has gained momentum as a global phenomenon, expanding the play-based philosophy of learning to low-income children all around the world. The One City Early Play Centre, for example, led the first US pilot of Anji Learning and plans to expand this approach to 1,100 low-income children by 2022.[63]

Accessible and Inclusive Learning

A system where everyone has access to learning and is therefore inclusive

United States

Prospect Charter Schools: Designing an Inclusive and Equitable Approach to Learning

Many studies have shown that New York City's public-school system is among the most racially and economically segregated in the United States.[64] Prospect Charter School's "diverse by design" model aims to address this challenge by creating truly diverse and integrated learning environments where students can gain a deep understanding of the ways in which alternative perspectives drive innovation and creativity. Today the network spans four primary and secondary schools serving over 1,500 students.

What makes this model unique?

The Prospect Schools closely mirror the city's diversity. At

the Windsor Terrace campus, for example, 41% of Windsor Terrace's 324 middle schoolers are white, 34% are Latino, 11% are black and 6% are Asian. Half of its students are from economically disadvantaged backgrounds, and 25% receive special education services. Similar levels of diversity exist across the network's schools. This level of diversity is achieved via a randomized lottery system that does not consider a student's previous academic performance.

Every detail at each school is planned through the lens of inclusion—from student material to content to art. The school network also hires teachers that reflect the diversity of their student population—more than half of their teachers are people of color. Classes are designed to be inclusive and diverse, ensuring a balance of student race and ethnicity, fluency in English, gender, gender identity and sexual orientation.

The high school also offers embedded honors courses—a model that allows any student to choose to enter honors courses rather than be placed on an accelerated track based on previous performance. The goal of this approach is to ensure equity by removing potential teacher bias in the tracking system, removing testing that has notoriously skewed these accelerated courses toward white, middle-class students, and making more challenging courses less intimidating for students to try.[65]

In addition to fostering inclusion and diversity, the network embeds learning in real-world application leveraging global citizenship skills. Students may be challenged to, for example, design an alternative for single-use plastics.

Enabling mechanisms

To effectively implement this model, every teacher and administrator at the school participates in regular equity and inclusion training.

The network also relies on the support of experts, researchers and NGOs—including the Bill & Melinda Gates Foundation, Columbia University Teachers College and the Diverse Coalition of Charter Schools—to consistently evaluate, validate, codify and scale the network's approaches to integration.

Measures of success

In 2019, Prospect Charter School students outperformed their peers in other New York City Charter Schools and across the state in Math and English Language Arts standardized testing. In math, for example, 73% of students scored proficiency in state exams, compared to a state average of 47%.[66]

United States

Tallahassee Community College, Centre for Innovation, Digital Rail Project: Enabling Access and Inclusion through Truly Mobile Learning

Like many institutions of higher learning, Tallahassee Community College (TCC) has a robust "dual enrollment" programme where college courses are offered to students in primary and secondary schools. TCC's Centre for Innovation drives many of the institution's education partnerships, through which the school aims to carve new pathways to STEM majors and careers and connect with students as early as elementary school to build this pipeline. TCC particularly targets schools within Florida's lowest income zip code through direct instruction, career and technical education exploration, and advising on the transition to college. To support these efforts, TCC partnered with local employers to design the Digital Rail Project.

What makes this model unique?

The Digital Rail Project offers mobile technology labs in 8-meter-long trailers, equipped with a virtual and augmented reality system, robotics, 3D printing and the latest in a range of technologies. These technologies are deployed in underserved neighborhoods and schools, along with a full-time applied science advisory who travels with the Rail. Students engage in projects focused on the application of technology to real world scenarios. For example, in 2019, middle-school students used Ozobot Robots to address a traffic pattern issue in their community.

To ensure alignment with future skills needs, the Digital Rail Project partners with the Business Industry Leadership Team (BILT)—a group led by select deans at TCC in collaboration with over 30 local employers. The BILT meets twice annually to review the programme's skills framework, and votes on the skills that should be prioritized across the curriculum. The deans and faculty then collaborate with education technology company Viridis Learning to design curricula that are aligned to those skills.

Learning materials are available online and activities are designed to stand alone, enabling learners to move through at their own pace.

Enabling mechanisms

The Digital Rail Project partners with Viridis Learning to assess each student upon intake, develop cohorts based on skills and create Skills Passports for each student. These digital passports enable students to connect the skills developed in the Digital Rail Project with the jobs that best match that skill set to enable students to understand their future career pathways.

TCC also designed a Parent Dashboard, which enables parents to see live employment data on the certificate and degree pathways supported by the Rail Project their children have engaged in.

To ensure scalability, TCC faculty and Digital Rail personnel train primary and secondary school teachers on how to replicate and enhance Digital Rail lessons, often donating sample equipment—such as laptops, robots and other education technologies—to partner schools.

Measures of success

The Digital Rail Project's trailer reached over 2,500 students in Tallahassee's lowest-income neighborhoods in the last academic year, immersing them in demonstrations and

customized experiences related to the college's programmes and exposing them to career opportunities in digital media, web design and web programming, app development, 3D printing and rapid prototyping, and cybersecurity.

Problem-Based and Collaborative Learning

Project- and problem-based content, requiring peer collaboration and more closely mirror in the future of work

Peru

Innova Schools: Taking a Multistakeholder Approach to a Collaborative Blended-Learning Model

Peru ranked near the bottom of the OECD's Programme for International Student Assessment (PISA) in 2009, underperforming across metrics measuring reading, math and science skills.[67] To help address this education gap, Intercorp Peru Ltd, IDEO—a design and consulting company—and an engineer by the name of Jorge Yzusqui partnered in 2011 to design Innova Schools as an affordable—$130 per month—high-quality learning alternative.[68] Innova now impacts over 42,000 students in the country, with a goal to reach 60 schools and 50,000 students by 2020. The model focuses on student-centred blended learning, leveraging technology for independent study, and teacher-facilitated project-based small-group learning.

What makes this model unique?

Approximately 70% of students' time at Innova is dedicated to group learning—often in small groups—with the teacher serving as a facilitator.[69] The other portion is focused on independent learning, leveraging online learning tools such as Khan Academy, Aleks and other platforms. Students develop their own objectives and learning journeys, with teachers providing guidance as necessary. The schools offer dynamic workspaces, including mobile walls that enable teachers and learners to easily transition between large- and small-group learning.

Each child participates in the school's Innovation Programme, which challenges students to design unique solutions to a social challenge. Each challenge is designed to be open-ended, enabling students to focus on the ideation and design process rather than finding an "answer" (e.g. "how might we reduce waste in our community?"). Students collaborate to move through the various stages of design thinking—exploration, design, experimentation and sharing—closely mirroring the collaborative process they may experience in the workplace of the future.

Enabling mechanisms

The school network partners with local universities to identify and pilot new education technology and shape their future pipeline of teachers. They have an ongoing partnership with Project Zero at Harvard University to develop inquiry skills training for teachers, for example. Each school also works directly with local NGOs, government and private sector leaders to implement the Innova model.

The network has also created a Teacher Resource Centre—an online marketplace for quality-approved lessons for each subject for each grade. All lessons are designed around common standards, and the marketplace enables teachers to exchange best practices and expertise on lesson implementation.

Finally, the network has a dedicated innovation department, responsible for designing, prototyping and piloting new ideas in four key areas: academics, space, systems and infrastructure. The department ensures that the Innova model is in line with the latest practices in education.

Measures of success

In 2013, 61% percent of Innova second-graders reached proficiency in federal math exams, compared to the national average of 17%. The 2016 Evaluación Censal de Estudiantes, a nationwide assessment for second grade students, showed that 77% of students were on grade level in reading, compared to 53% in other private schools.

Oman

British School Muscat: Leveraging Discovery Learning for Collaborative Learning

The British School Muscat is an international school that serves about 1,200 students from over 70 countries. It was established by a Royal Charter granted by His Majesty Sultan Qaboos bin Said al Said in 1973, which enabled the school to have a degree of autonomy when creating their curriculum model.

What makes this model unique?

The British School Muscat (BSM) has developed a curriculum focused on discovery learning—a student-centered approach where multiple subjects are integrated into collaborative projects focused on the experience rather than the final product or answer. This interdisciplinary approach enables students to draw interlinkages between various content areas and focus on the specific skills to apply that content to the real world.

For example, after learning about the work of naturalists and animal behavioralists—such as David Attenborough and Jane Goodall—students created a campaign about single-use plastics. Throughout this project, students wrote persuasive essays to convince the audience to ban single-use plastics and calculated how much plastic BSM would save if everyone at the school refused to use one plastic bag. They then designed an alternative to plastic bags. This initiative combined science, math, English and public speaking—subjects that in traditional schools may have been separated into independent learning blocks. The school also strongly incorporates student choice. Children

can, for example, spend time in the "risk taking writers" room, where they can write freely about any topic they'd like.

Enabling mechanisms

The school's unique charter has given them the freedom and flexibility to implement innovative approaches to teaching and learning.

The school also works with local businesses to provide real-world based learning. For example, after learning about the history of chocolate, making trial products and conducting market research, students visited local businesses that also make/use chocolate in their enterprise. They took inspiration from these businesses to then create, market and sell their own chocolate brands.

Measures of success

A recent survey shows that over 97% of parents felt their child enjoyed being at the British School Muscat.[70] The school performs well above the UK average in all subjects. In reading comprehension, for example, 94% of BSM students met the expected standard in the 2018–2019 school year, compared to 79% of UK students.

In addition to driving impact for their own students and parents, the school is building strong links with the Oman Ministry of Education; creating opportunities for teachers, leaders and officials to visit BSM to learn about how Discovery Learning is embedded into the curriculum.

Lifelong and Student-Driven Learning

A system where everyone continuously improves on existing skills and acquires new ones based on their individual needs

United Kingdom

Skills Builder Partnership: Scaling a Shared Framework for Lifelong Skills Development

The Skills Builder Partnership is a global partnership that works with schools, teachers, employers and other organizations to build essential skills in children and young people. Its network includes 514 schools and colleges, over 200,000 students and over 700 organizations.

What makes this model unique?

The Skills Builder Partnership links learning to real-world application by connecting schools and employers. Partnering companies, such as JLL, BP and Bank of America, host students in their offices for site visits, meet-the-CEO events and workplace-relevant workshops. Over the 2018–2019 school year, over 121 employers participated in the workplace exchange.

To ensure alignment across participants and ensure that students have a lifelong mechanism for tracking their own skills development, the partnership developed a framework for a shared language for skills. It focuses on building eight essential skills among children and youth, including listening, presenting, problem-solving, creativity, resilience, collaboration and leadership. Each skill is clearly defined and broken down into specific teachable steps, milestones and mastery indicators by age group. Each participant in the global partnership can then use this framework and the related assessments to measure student progress toward mastery of those eight skills. Private-sector partners played a key role in the design of this framework to ensure that the eight essential skills were aligned to their expectations of future employment needs.

The partnership is collaborating with private sector partners to implement this framework in their own organizations to build a shared skills language that follows their participants through to employment.

Enabling mechanisms

The partnership developed two unique tools to measure student progress toward mastery of the eight essential skills: a teacher assessment and a student self-reflection. These tools help schools and organizations understand how to differentiate their approach according to each individual student's needs.

The programme also has its own digital platform with resources for implementors. It includes a bank of skill-specific activities and videos to support learning at each step of skill mastery, a toolkit for employers seeking to work with children and young people to support the development of essential skills, and toolkits for schools on how to integrate the framework into broader school systems.

Measures of success

Students participating in Skills Builder programmes showed 62% more progress towards mastery of essential skills than nonparticipating peers.

Teachers in 12 countries now use the Skills Builder framework, all using a similar approach to build the eight essential skills.

Ecuador

Skilling for Sustainable Tourism: Accelerating Lifelong Learning to Shape a Sustainable Travel and Tourism industry

Ecuador's growing travel and tourism sector is projected to further increase its contribution to the economy's growth in the coming years and is a major contributor to youth employment in the country. Between 2014 and 2015, youth employment generated by this industry grew by 63%.[71] In this context, education non-profit VVOB Education for Development's Skilling for Sustainable Tourism Programme works with a network of 21 schools (over 4,000 students) in the Quito and Manabí provinces of Ecuador to deliver the skills that enable access to employment in this growing market.

What makes this model unique?

The Skilling for Sustainable Tourism Programme brings together key experts and leaders in the travel and tourism industry with the Ministry of Education to design and implement a curriculum that develops Ecuador's future tourism workforce. Quito and Manabí—the programme's two provinces of operation—were intentionally selected based on their tourism potential and the concentration of schools that were already offering tourism-related courses.

The programme aims to improve the quality of tourism courses in these provinces to enable pathways to employment in the sector. The curriculum has a unique focus on enabling sustainability in the country's tourism industry to foster future innovation in the sector. The programme improves the quality of tourism learning through three main levers: training teachers in the latest tourism trends and practices; developing learning content aligned with industry standards; and providing students with workplace learning opportunities. Through this experiential learning approach, the programme exposes students to future employment opportunities, and trains them in an industry-vetted way to increase their employability in the future.

Because of Skilling for Sustainable Tourism's strong alignment with travel and tourism companies, the programme can remain agile and responsive to emerging trends in the industry, creating a new approach to fostering lifelong learning. A steering committee—composed of the education and tourism ministries, as well as sector business leaders—convenes regularly to ensure the curriculum's alignment with industry needs.

Enabling mechanisms

The private sector plays a key role in the development and implementation of the Skilling for Sustainable Tourism programme. A committee of private sector leaders provides insight into the industry and offers recommendations to ensure that the curriculum and programme design are aligned to the latest industry practices. Teacher professional development is partly offered by travel and tourism industry partners to ensure that teachers are aware of the latest skills required to build a thriving and sustainable tourism sector. Business partners also provide internship opportunities for students to gain experience within the tourism sector, and act as judges in relevant inter-school project-related competitions.

The programme's design and implementation are also facilitated by cooperation between the Ministry of Education and the Ministry of Tourism. The former ensures that the programme's implementation in public schools is in line with national standards, while the latter provides insight on strategic partners within the travel and tourism industry that could help drive this initiative.

Measures of success

Many of Skilling for Sustainable Tourism students are employed by the companies they intern with. In addition to creating more agile education systems that directly contribute to local employment and shaping a sustainable tourism industry, the programme contributes to gender parity. About 60% of its beneficiaries are girls, presenting an opportunity to help increase the percentage of women in the workforce through this industry, in a country where women are generally less represented in the workforce.

Conclusion: An Action Agenda to Accelerate the Transition to Education 4.0

There is an urgent need to update education systems to equip children with the skills to navigate the future of work and the future of societies. The Education 4.0 framework provides a vision for how school systems can be updated to deliver on children's future needs. This transformation calls for shifts in learning content to include both the technical and human-centric skills needed to build growing and inclusive economies and societies and shifts in learning experiences that more closely mirror the future of work.

While many schools, programmes and school systems are pioneering the transition to Education 4.0—including the 16 in this paper—creating system-level change will require closer collaboration between education ministries, educators and private sector leaders to connect and scale those efforts to create holistic education systems. Activating Education 4.0 will require greater alignment between actors on defining and assessing the skills of the future, preparing the teaching workforce to lead this transition, and enhancing connectivity across schools and school systems.

To that end, the World Economic Forum's Platform for Shaping the Future of the New Economy and Society invites Ministers of Education, Chief Executive Officers who are champions of education, and other stakeholders to join the Forum platform to define and implement a holistic action agenda to realize Education 4.0. The initiative aims to mobilize key stakeholders in transitioning to Education 4.0 by implementing new national education policies that mainstream these shifts in content and experiences across public education systems; supporting teachers in implementing this new vision through reskilling and upskilling; engaging in continuous global best practice exchange between schools and schooling systems; and building mechanisms for assessing progress against these goals.
The Education 4.0 initiative will contribute to the Platform for Shaping the Future of the New Economy and Society's vision to impact 1 billion people with improved educational and job opportunities by 2030. We call on all stakeholders to join us in this important effort.

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Schools and Organizations that Contributed to the Schools of the Future Campaign

ABE Endorsed KidsMBA

Accelerated Work Achievement and Readiness for Employment (AWARE) Program.

Anji Play

Artificial Intelligence and Robots Series

Bina

British School Muscat

Broadclyst Community Primary School

Brooklyn Prospect Charter Schools

Builders

Business Council of Canada: Business Higher Education Roundtable (BHER)

Cartagena International School

DACZ

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EduScrum

Empowering Leaders of Learning

Garatuja Educacao Infantil

Global Learning Lab, at Teach For All

Hangzhou

Hanoi Adelaide School

Innova Schools

International Education and Resource Network (iEARN)

Just for Arts

Kabakoo Academies

Kakuma Project Innovation Lab Schools

Lab-Ecole (Quebec, Canada)

Le Sallay International Academy

L'Horitzó School

Lycée Benjamin Franklin

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OWN Academy in Hong Kong

Pratham Hybrid Learning Programme

Press Start Academy

Science Technology Engineering Art Math (STEAM) Pathway; Cherry Creek Innovation Campus (CCIC), Cherry Creek Schools District

Shaping Pathways

Shireland Technology Primary

SJSS Innovation lab

Skilling for Sustainable Tourism

Skills Builder Partnership

South Tapiola High School

StriveTogether

Tallahassee Community College

Teach the Future

TEKY STEAM Academy

The Future Project

The Green School

The Knowledge Society

Tiny Monkey Stage

UWC (United World Colleges)

World School

V STEAM Zone

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