Microsoft

The class of 2030 and life-ready learning: The technology imperative

A summary report

Acknowledgements

Methodology

Our research drew on multiple sources, including surveys of 2,000 students and 2,000 teachers across Canada, Singapore, the United Kingdom, and the United States; an in-depth review of 150 pieces of existing research; and interviews with 70 thought leaders, including educators, researchers, policy makers, and technologists.

Contents

Learners and learning take center stage

The ways people interact, socialize, and work are shifting rapidly. By the time the kindergartners of today become the graduates of 2030, the world will be vastly different from anything previous generations have experienced.

Unprecedented opportunities for collaboration, the progressive automation of lower-skilled jobs, employers' demands for workers with more well-rounded skills, and students' desire and expectation to operate with autonomy and choice all indicate that our education system needs to prepare students for the future in a very different way than it has in the past.

Advances in technology will cause major disruptions in the workforce, as automation could replace up to 50 percent of existing jobs in the U.S. alone. Occupations associated with lower

education attainment levels will decline by up to 11.5 million jobs in the U.S. by 2030.[i] At the same time, the fastest growing occupations will require higher-level cognitive skills in areas such as problem solving, critical thinking, and creativity, and 30 to 40 percent of jobs will require explicit social-emotional skills.[ii]

30–40%
require soft skills
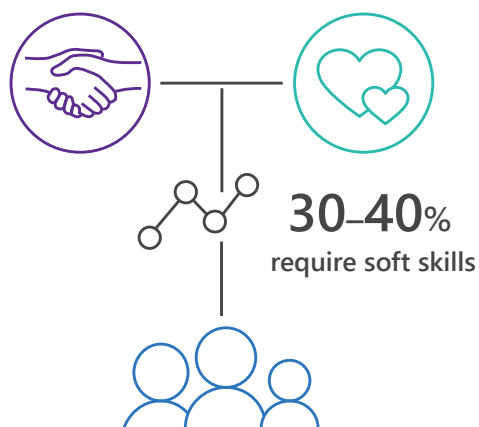
Given our current education systems, however, less than 50 percent of students will be prepared for the fastest growing jobs. Coupled with the increased urgency and complexity of the global challenges these students will face—as well as the opportunity to innovate at a speed and scale never imagined before—we are compelled to better understand a viable path forward.

As a result, over the past several months we have undertaken a research collaboration with McKinsey & Company's Education Practice to examine what teachers and school and system leaders can do to ensure today's students will be ready to thrive in 2030 as well as the role technology can play. Most importantly, we focused on our subjects: the young people who make up the class of 2030 and those closest to their world.

A dominant theme of our findings is a need for greater student-centricity and a heightened focus on learners. The students we surveyed were clear: they want to develop the skills to navigate their own learning—to explore and make choices that unlock their curiosity and potential. And they want teachers

who know and understand them as individuals to help guide them on their educational journey.

Our research also indicates new thinking and practices are needed to ensure students develop both the cognitive and social-emotional skills necessary to succeed in their personal and professional lives. While the class of 2030 will need deeper cognitive skills in priority areas such as creativity and problem solving, social-emotional skills such as relationship building, self-awareness, and self-recognition will be increasingly important, since they not only support academic learning but also promote well-being. To meet these needs, technology will play an increasingly critical, complementary role in how students learn and how educators support them.

Social-emotional skills are already in high demand, but short supply, in the workforce. In a survey of several thousand employers, 58 percent said new college graduates are not adequately prepared for today's workforce, noting a particular gap in social-emotional skills. Fifty-five percent of youth agree.[iii]

58%
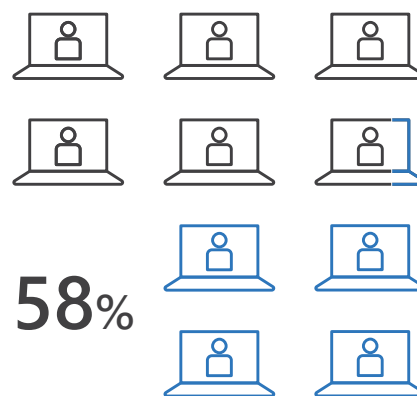
Yet our results reveal meaningful gaps between student and teacher perceptions of current teaching practices around social-emotional skills. While roughly 50 percent of the teachers we surveyed reported that they offer feedback on students' social-emotional skill development, only about

30 percent of students agreed. A similar gap exists in terms of the overall prioritization of social-emotional skills, with students rating the need higher than teachers; and in terms of whether students feel they have strong relationships with their teachers, with students less likely to report strong bonds.

The teachers we surveyed recognize that distinct, integrated approaches where social-emotional skills are woven into the learning program are critical. Implementation, however, proves challenging. Nearly 40 percent of teachers told us they do not teach social-emotional skills through such structured approaches due to a lack of time and support as well as rigidly standardized curricula, among other challenges.

How can we reimagine approaches to teaching and learning that provide our young people with the skills and support they desperately need?

Personalized learning, optimized and scaled by technology, will play a critical role in shifting from an education model driven by standardized courses and curricula to a student-centered model customized to individual needs with a greater emphasis on social-emotional skills.

> Tools that support personalized learning approaches will elevate, rather than diminish, the critical role of the teacher.

Tools that support personalized learning approaches will elevate, rather than diminish, the critical role of the teacher. Indeed, teaching, as a profession is projected to grow by 3 to 9 percent in the next decade. But teaching will shift to more of a coaching model, as technology advances allow teachers to spend less time on routine tasks and give them new ways to understand and interact with their students.

Teachers already embrace the need for this shift, with 67 percent of those we surveyed agreeing that learning ought to be personalized. However, about 30 percent of teachers who say they are "highly motivated" to personalize their lessons do not feel they have the time, curriculum and assessment resources, or flexibility to do so.

Technology tailored to the needs of students and educators can help. We estimate that technology can help teachers reallocate 20 to 30 percent of their time so they can focus more on student-centric activities such as building deeper one-on-one relationships, refining individual lesson plans, or providing real-time and personalized feedback to students.

up to **30**% more time
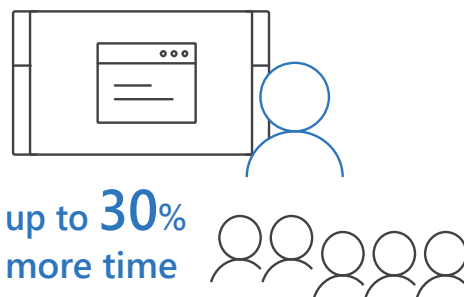
While saving time is a critical enabler for teachers, we also took a deeper view in analyzing existing and emerging technologies and found three that are already proving to be powerful for enabling the education needs called out in this research.

Collaboration platforms give students new opportunities to interact and work together and provide teachers with new ways to engage their own professional communities, create customizable lesson plans, and provide real-time, personalized feedback to students.

Artificial intelligence (AI) gives teachers and schools new ways to understand how students are progressing and allows for highly customized, timely, and targeted curation of content.

Mixed reality creates immersive learning experiences for students that foster increased cognitive and social-emotional growth.

Providing more students with enhanced learning experiences could generate substantial social and economic gains. If strong social-emotional skill development and personalized learning are adopted by the many teachers who are motivated to do so, by 2040 we could see 1,000,000 more college graduates per year and an incremental annual GDP boost in the U.S. alone of up to $600 billion a year. We believe similarly dramatic gains are possible in other economies.

The changes we've outlined are necessary because today's students will need new strengths and unprecedented versatility to navigate the world of 2030 and beyond. Technology can help teachers and schools prepare the class of 2030 for successful personal and professional lives. The imperative for change is clear. And the time to start is now.

A paradigm shift
for the class of 2030

By the time today's kindergartners enter the workforce, activities will substantially change across most occupations and will increasingly require the application of expertise and creative problem solving, as well as collaboration, management, and the development of people.

The McKinsey Global Institute (MGI) estimates that, globally, about half the work people are paid to do today could be automated by existing technology by 2030, and up to 375 million people may need to switch occupational categories between now and then.[iv]

Yet MGI also predicts that new jobs created by technology, rising incomes, and consumption as well as by investments in infrastructure and renewable energy will fuel strong growth in global employment. So, there will be plenty of jobs.

The qualities the job market demands will change in fundamental ways, however. Most professions will require strong cognitive abilities in numeracy, literacy, problem solving, critical thinking, and creativity.[v] The complexity and the nature of tasks will also demand increasing and deeper interactions between workers, elevating the need for social-emotional skills.

Based on MGI's analysis of labor demand, the occupations likely to see the largest growth by 2030 are those that are not easily automated and those linked to macroeconomic trends such as aging populations, rising incomes, and higher spending on technology. The role of the educator will continue to rise in importance, as education is predicted to be one of the occupations to grow across the next decade.

Net impact of automation on occupations
2016–2030, % change

		Net change, millions	Number of jobs in 2030, millions
Technology professionals e.g., software developers	25 to 30	0.8 to 1.0	3.9 to 4.0
Care providers e.g., doctors, nurses, childcare workers	20 to 30	3.0 to 5.0	19.2 to 21.1
Builders e.g., architects, construction workers	−5 to 35	−0.4 to 2.7	7.4 to 10.5
Managers and executives	5 to 15	0.5 to 1.1	7.9 to 8.6
Professionals e.g., engineers, lawyers, scientists, finance specialists	5 to 10	0.8 to 1.7	16.6 to 17.5
Educators e.g., school teachers, education support workers	3 to 9	0.3 to 0.8	9.9 to 10.4
Creatives e.g., artists, designers, entertainers, media workers	6 to 8	0.1 to 0.2	2.1 to 2.2
Other jobs–unpredictable environments e.g., specialized mechanics, emergency first responders	−3 to 8	−0.4 to 1.0	12.5 to 13.9
Customer interaction e.g., personal-care workers, food service, sales workers	−3 to 1	−0.9 to −0.4	26.8 to 27.3
Office support e.g., computer support, clerks, administrative assistants	−23 to −20	−5.4 to −4.6	17.8 to 18.6
Other jobs–predictable environments e.g., production workers, transportation, equipment operators	−30 to −25	−7.4 to −6.6	17.9 to 18.6

Illustrative example: United States

Exhibit 1: Across advanced economies, the occupations likely to have the largest job growth by 2030 are care providers, technology professionals, managers, educators, and builders.[vi]

While demand for many high-skill occupations will continue to grow, demand for low-skill occupations will decline. Routine and repetitive tasks such as retrieving information and recognizing known patterns and predictable activities such as call center support will increasingly be performed by machines.[vii]
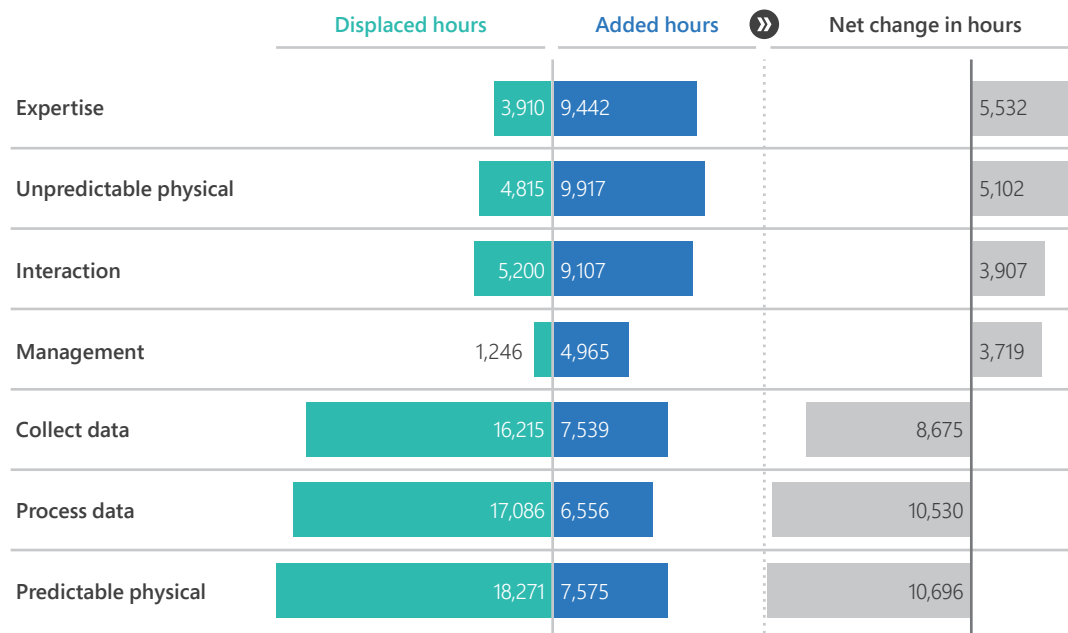
These long-term trends are already creating imbalances in the job market. Increasing numbers of employers in the U.S. and other developed economies indicate that they cannot find enough qualified candidates to fill their openings for high-skill positions. In a recent survey, nearly 40 percent of employers said the primary causes of entry-level vacancies are gaps in required skills, including teamwork, work ethic, leadership, problem solving, and creativity.[viii]

Additionally, today's students will enter a workforce in which up to 10 percent of jobs are projected to be in brand new job categories.[ix] In the U.S. alone, this could present over 12 million new roles. Technology will drive the creation of many of these new jobs as well as redefine the job functions of almost all other positions that are not at greatest risk of automation. Preparing for this new world of work will likely require that the class of 2030 take higher education courses that don't exist today or develop skills we don't yet know are important.

This combination of existing imbalances against an evolving job landscape fundamentally changes how primary and secondary education systems around the world need to help students strengthen their social-emotional skills and deepen their cognitive skills. Beyond the needs of the workforce, society as a whole will demand increased social-emotional skills and higher cognitive abilities from its citizens. Even as technology becomes more pervasive, people will need the distinctly human capabilities to contribute as engaged and informed citizens, to think critically and analytically, to form relationships, and to build the next generation of society.

Total hours by activity type, U.S. example
Millions of FTE hours, Midpoint automation

	Displaced hours	Added hours		Net change in hours
Expertise	3,910	9,442		5,532
Unpredictable physical	4,815	9,917		5,102
Interaction	5,200	9,107		3,907
Management	1,246	4,965		3,719
Collect data	16,215	7,539		8,675
Process data	17,086	6,556		10,530
Predictable physical	18,271	7,575		10,696

Exhibit 2: Future jobs will require more application of expertise, non-routine physical tasks, interaction and management tasks.[x]

Sharpening the focus on social-emotional skills

The strongest signal from our study was the need for teachers, schools, and school leaders to help students develop stronger social-emotional skills. While not new in education, these skills are newly important and are taking center stage alongside cognitive skills and content knowledge in the classroom and in the workforce.

Studies show social and emotional competencies can increase cognitive skills, measured by academic achievement tests, by up to 11 percent.[xi] In fact, student mindsets are twice as predictive of a student's academic achievement than their home environment or demographic, according to a McKinsey analysis.

Core elements of social-emotional learning

The Collaborative for Academic, Social, and Emotional Learning (CASEL) explains social and emotional learning (SEL) as students obtaining skills that "enhance [their] capacity to integrate skills, attitudes, and behaviors to deal effectively and ethically with daily tasks and challenges." CASEL's SEL framework encompasses five core competencies: self-awareness, self-management, social awareness, relationship skills, and responsible decision making. Social skill deficits also create major obstacles for a significantly large subgroup of learning-disabled students and adults.

For more, visit: https://casel.org/core-competencies/

Cognitive skills that drive learning

While definitions of cognitive skills vary, many agree that these skills consist of core academic knowledge as well as higher-order skills that apply this knowledge to answer questions and solve problems. In a study of more than 150 countries, The Brookings Institution found that more than 70 percent of education systems prioritize the following six cognitive skills: literacy, numeracy, communication, creativity, critical thinking, and problem solving.[xii]

For more, visit: https://www.brookings.edu/research/skills-for-a-changing-world-2/

Social-emotional skills provide students with the perspective and flexibility necessary to function at a high level even when faced with uncertainty, change, pressure, stress, and other work and life challenges. This is critical, because change and uncertainty are going to be increasingly pervasive for the class of 2030. Trends indicate the class of 2030 will change jobs more frequently than any previous generation, as across nearly all industries, the impact of technological and other changes is shortening the shelf life of employees' existing skill sets.

For example, the rise of the gig economy, with its emphasis on short-term project work, is expected to further amplify the need for flexibility from students entering the workforce. In 2014, 91 million people worked in the gig economy in the U.S., according to tax forms filed with the IRS, or nearly 30 percent of the American population.

In addition to the numerical rise in expected lifetime jobs among this generation, "on average, by 2020, more than a third of the desired core skill sets of most occupations will be comprised of skills that are not yet considered crucial to the job today, according to our respondents. Overall, social skills—such as persuasion, emotional intelligence, and teaching others—will be in higher demand across industries than narrow technical skills, such as programming or equipment operation and control. In essence, technical skills will need to be supplemented with strong social and collaboration skills."[xiii] These social competency-based hiring criteria are very familiar to large technology companies, where hiring for the ability to collaborate effectively or earn trust have long been part of both recruiting ethos and criteria for advancement.

Helping students develop greater social-emotional skills will not only help them in their professional lives but also will help them pursue happier and healthier personal lives. Research has found that high-level social-emotional skills developed during childhood are correlated with a number of beneficial long-term health and well-being outcomes as adults, including lower rates of obesity, substance abuse, and criminal activity, and greater satisfaction in relationships and positive contributions to society.

Given the mounting evidence of the importance of social-emotional skills, their development should not be left behind. While most students will develop some amount of social-emotional skills incidentally— through influences in their environment, interactions with parents, teachers, and friends, and their own self-reflection—more needs to be done to proactively develop and apply these skills at the scale and depth the class of 2030 will need. Andreas Schleicher, Director for Education and Skills at the Organization for Economic Cooperation and Development (OECD), believes we should be teaching and rewarding collaboration as well as individual academic achievement, enabling students to think for themselves and to act for, and with, others.[xiv]

While the need for social-emotional skills is clear, our research highlighted differences between the social-emotional skills students and teachers prioritize and how well-equipped teachers feel to teach these skills. This variation was mirrored in how both groups described their experiences of social-emotional skills as part of the learning program.

Teacher-student skill priority gap
Average across four countries
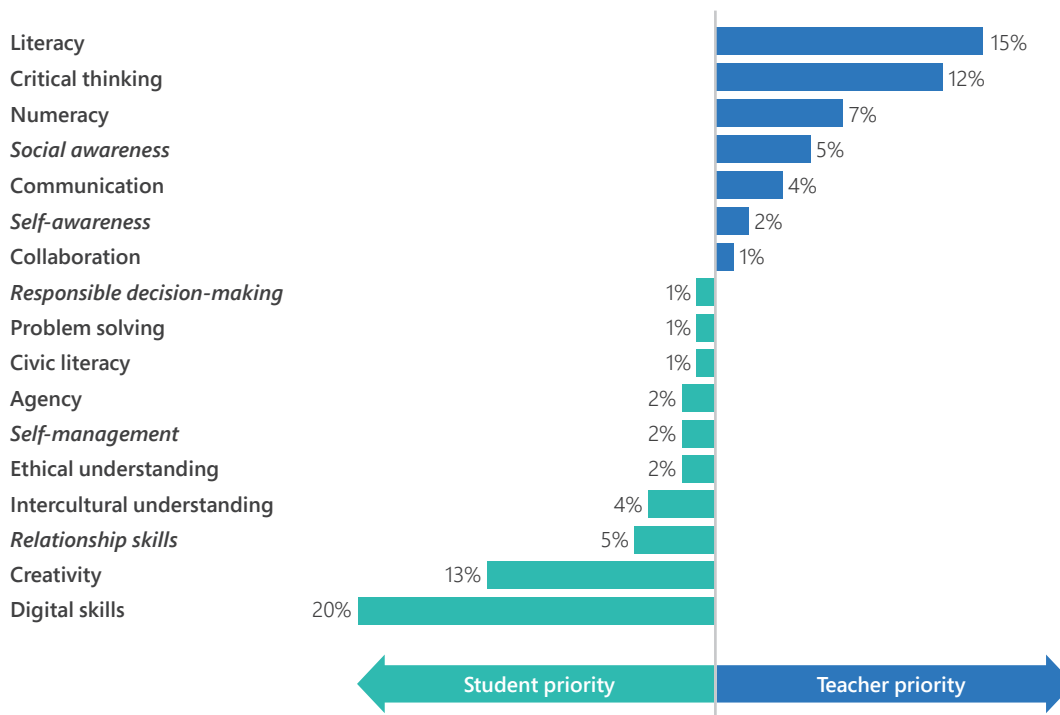
Exhibit 3: This chart shows the percentage point difference between teachers and students on the skills they prioritize most, based on the average priorities for each group across the four countries in the study.

One critical area is feedback. We know feedback is one of the most effective ways to improve learning, yet only 33 percent of students across our four sample countries agreed or strongly agreed they receive feedback on social and emotional outcomes.

We discovered differences in perception, too. Roughly 60 percent of teachers reported that they provide students with feedback on a range of skills, including social-emotional skills. But when we asked students a similar question, only 30 to 40 percent agreed that they receive feedback on their social-emotional skills.

50% of students
rank social and emotional skills
in their top 5 priorities

but only

30% of teachers
rank social and emotional skills
in their top 5 priorities

60% of teachers
feel they provide feedback
on social and emotional skills

but only

30–40% of students
feel they receive feedback on
social and emotional skills

Among the teachers we surveyed, 63 percent said they intentionally integrated social-emotional skill-building into lessons and other learning experiences while the remaining 37 percent taught it opportunistically, if at all. While 63 percent of teachers embracing social-emotional learning is encouraging, the growing mismatch between job requirements and available talent suggests that more needs to be done.

> While 63 percent of teachers embracing social-emotional learning is encouraging, the growing mismatch between job requirements and available talent suggests that more needs to be done.

Using principles from learning science, schools and school systems can design programs and curricula to intentionally teach and scale social-emotional learning. A 2011 meta-analysis of school-based social-emotional interventions found that programs that employ best practices—such as using sequenced activities, applying active learning strategies, allocating specific time for skill development, and using clear learning objectives—have a positive, statistically significant effect.[xv] There is a path for schools and teachers to develop skills that are critical to work and life outcomes for the class of 2030.

We studied several existing approaches and found two with especially strong promise to support both social-emotional and cognitive skill development at scale: employing curricula that explicitly promotes social-emotional skills and personalizing learning to the needs of each student. Both strategies require giving teachers greater flexibility in their curriculum choices and more time for direct interactions with students.

Many schools and school systems are already tackling the challenge of preparing the next generation for life, learning, and living by explicitly prioritizing social-emotional skills.

Singapore's Ministry of Education established a framework of social and emotional outcomes

that is integrated into the national curriculum, including suggested pedagogy and assessment strategies. Social and emotional skills are taught explicitly during a guidance period, and all teachers are expected to integrate and model social-emotional skills in their classrooms.

In Australia, the Australian National Curriculum identifies "general capabilities," including the personal and social capability, which addresses self-management, self-awareness, social management, and social awareness. These capabilities are intended to be addressed in all learning areas and at every stage of a student's schooling. Curriculum areas with the highest proportion of content descriptions tagged with personal and social capability are provided to teachers through the online curriculum portal.

And in the U.K., a 2015 review of social-emotional programs[xvi] found several with significant positive impact on students' social-emotional skills including coping skills, self-esteem, resilience, problem-solving skills, and empathy.

All of these are encouraging signs that educators around the world are sharpening their focus on developing their students' social-emotional skills. Our survey suggests that an especially promising way to accelerate social-emotional skill development will be for teachers and schools to take greater advantage of personalized learning approaches, which are increasingly leveraging technology to give teachers new and broader ways to measure students' progress on key competencies and to help customize instruction to meet individual needs.

Personalizing learning to accelerate progress

"Modern learning experience design should center attention on the needs of students; approaching learning as a fluid, holistic, seamless set of experiences. Modern learning experience designs include inquiry-based learning, project-based learning, challenge-based learning, phenomenon-based learning, and personalized learning."

Dr. Cathy Cavanaugh
Catholic Education of Western Australia (CEWA)

For decades, evidence has shown that personalized learning is the most effective way to develop deeper cognitive skills. Benjamin Bloom's landmark study from 1984, "The 2 sigma problem," found that students who received personalized instruction in the form of one-on-one tutoring outperformed 98 percent of traditionally taught students.[xvii]

Better than 98%
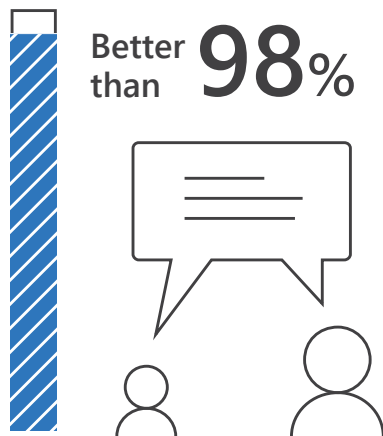
A shift in school philosophies and practices to place greater emphasis on the individual needs of each student can help students develop a stronger sense of self-efficacy, a skill that is shown to be a key indicator of success in learning, life, and work. According to research by the OECD, for instance, students with strong math self-efficacy—described as students' convictions that they can successfully solve mathematics problems when they encounter them—scored 49 points higher, on average, in mathematics on the Programme for International Student Assessment.

To make learning more student-centric, strategies and tools must help identify where students are in their learning, help understand what motivates them, and provide the flexibility for students to move through content at a pace that best suits them. All of this must be done while supporting the role of the teacher to interpret, synthesize, and act on these insights in the context of other information and variables. One requirement for achieving student-centricity is ensuring that
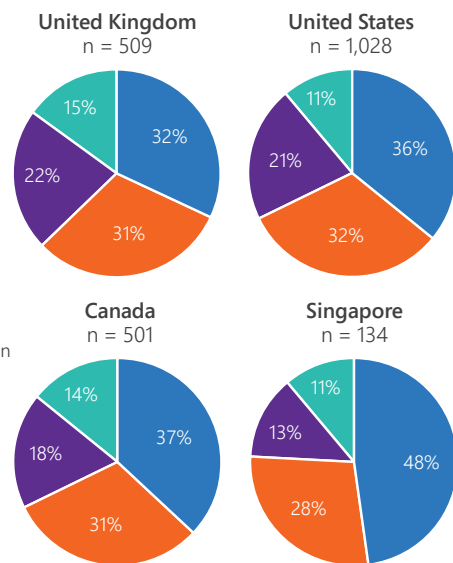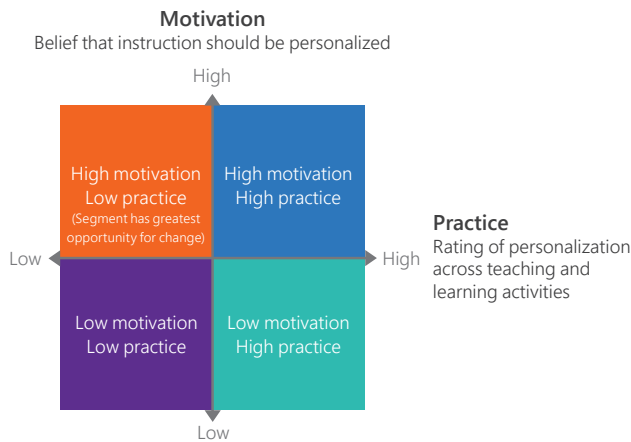
learning can be personalized for every student—irrespective of their language skills, permanent or temporary learning challenges, current reading level, or other factors. Increasingly, technology is playing a useful role in leveling the playing field for all students by providing tools that give students more control over how they learn and engage. For example, Lauren Pittman, a Special Education teacher from Holly Springs, Georgia, uses features built into OneNote to provide her diverse learners with a range of ways to engage with lessons and receive feedback through inking, typing, video, and audio.

While there is a distinction between individualized instruction and personalized learning, our survey found strong belief across geographies in the efficacy of personalization. In our survey, 67 percent of teachers agreed that learning ought to be personalized. However, only 30 percent of teachers who say they are "highly motivated" to personalize their lessons actively do so in practice, because they do not feel they have the time, curriculum and assessment resources, or the flexibility to do so.

Our survey found significant differences between countries in teachers' philosophical and practical embrace of personalized learning. In Singapore, 48 percent of teachers reported being "highly motivated" to personalize instruction and also regularly do so in practice; in the U.K., only 32 percent of teachers reported being "highly motivated" to personalize instruction and also do so in practice.

Motivation to personalize learning
Motivation vs. practice

Motivation
Belief that instruction should be personalized

High

High motivation Low practice (Segment has greatest opportunity for change)	High motivation High practice

Low ——————————————————————→ High

Practice
Rating of personalization across teaching and learning activities

Low motivation Low practice	Low motivation High practice

Low

United Kingdom
n = 509

32% · 31% · 22% · 15%

United States
n = 1,028

36% · 32% · 21% · 11%

Canada
n = 501

37% · 31% · 18% · 14%

Singapore
n = 134

48% · 28% · 13% · 11%

Exhibit 4: Approximately 30 percent of teachers across countries are motivated to personalize learning but don't yet do so in practice.[xviii]

Even if teachers and schools believe in the power of personalized learning and are motivated to individualize instruction, it is not always clear how to do so for hundreds or thousands of students. One-on-one tutoring is a highly effective way to personalize learning, for instance, but it is not a feasible model for working with large student populations. Instead, many school systems are discovering that technology-enabled, student-driven models are a powerful way to provide personalized learning at scale.

At Forest Lake Elementary School in Columbia, South Carolina, the student population grows more diverse by the day. Income levels, ethnicities, family structures, first languages, interests, and abilities now vary so much that a traditional teaching approach—with a uniform lesson targeted to the average student—is no longer viable. Instead, technology is used to provide multiple ways for students to access valued content and to communicate their understanding. Teachers gather and use immediate feedback on student understanding, use technology to create personal "must do" and "may do" lists, and monitor and provide support for each student's progress. This is

done discreetly and on a one-on-one basis, which helps remove the stigma many children can feel from being treated differently in the classroom.[xix]

Caliber Schools in California—public charter schools that educate students in grades K–8—gauge students' progress on a variety of competencies such as emotional intelligence, critical thinking, and student agency in daily and weekly cycles so it can tailor teacher-led instruction for each student. Caliber students are exceeding national growth in reading and math and outperforming comparable district schools.[xx]

Shireland Collegiate Academy in the United Kingdom uses a technology platform and online curricula to allow secondary school students to learn at their own pace and build self-awareness about what they know and do not know, and what they are interested in as they progress.

Several models give students more control to focus on topics that interest them, set personal goals, and motivate themselves. Student-centered instruction focuses on skills and practices that enable lifelong learning and independent problem solving, and can include inquiry-based and project-based learning.

These and other personalized learning models can provide opportunities to build social-emotional skills—notably in the areas of goal-setting and self-confidence—as students learn to make their own choices and take a proactive role in their learning.

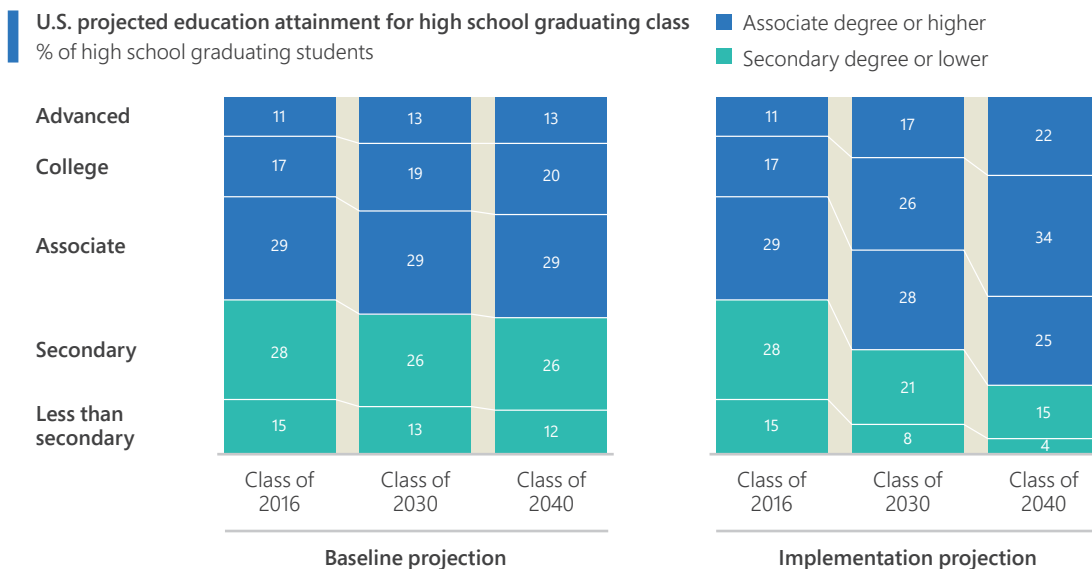With online personalized learning platforms, school systems can now efficiently develop individualized learning plans for thousands of students. But personalized learning in no way diminishes the critical role of the teacher. In a world where technology plays a more prominent role than ever before, students will need teachers to model and apply the distinctly human capabilities of critical thinking, contextual awareness, and empathy.

550,000

additional college degrees **by 2030**

Rather, personalized learning tools enable teachers to shift to more of a coaching model. As teachers come to understand their students in new ways, they can spend more time guiding and motivating them, and they can use real-time assessments and other feedback loops to monitor progress and recommend adjustments to each student as necessary. We calculated future scenarios in the United States along two assumptions: first, that teachers who currently do not explicitly teach or integrate social-emotional skills are equipped and begin to do so; and second, that teachers who believe in the importance of personalized learning but do not have the time or resources to execute it also begin to do so. Our calculations suggest that if these two groups of teachers shift their classrooms, it may be possible for the United States to raise the number of bachelor's and advanced degrees from the 2030 high school graduating class by up to 11 absolute percentage points compared with current projections, and up to 23 percentage points in 2040. That would mean an additional 550,000 expected college degrees for the class of 2030, and more than one million additional college or advanced-degree graduates in 2040, every year.

U.S. projected education attainment for high school graduating class
% of high school graduating students

■ Associate degree or higher
■ Secondary degree or lower

	Baseline projection			Implementation projection		
	Class of 2016	Class of 2030	Class of 2040	Class of 2016	Class of 2030	Class of 2040
Advanced	11	13	13	11	17	22
College	17	19	20	17	26	34
Associate	29	29	29	29	28	
Secondary	28	26	26	28	21	25
Less than secondary	15	13	12	15	8	15 / 4

Exhibit 5: By 2040, the incremental impact of implementing shifts would be a 20–25 absolute percent increase in college graduates, or ~1 million additional graduates each year.[xxi]

Beyond degree attainment, increasing personalized learning and ensuring a deliberate focus on social-emotional skills could also lead to a wider set of life, health, and well-being outcomes.[xxii] Individuals with bachelor's degrees or higher are 40 percent more likely to be satisfied with their jobs and show higher levels of civic engagement and participation (for example, increased volunteering and voting rates).[xxiii] Despite all the potential benefits, teachers in the four countries we surveyed said a lack of time, tools, and resources prevent many from doing more to improve their students' social-emotional skills and increase personalized learning. This where technology solutions that already exist today can help teachers better serve their students.

The critical role of technology

From our research, we know that technology can enhance the learning process by enabling teachers to save time, providing student-specific insights, driving inclusivity, and providing immersive learning experiences—all on a massive scale.

As the World Economic Forum has noted, "Technology can personalize learning, engage the disengaged, complement what happens in the classroom, extend education outside the classroom, and provide access to learning to students who otherwise might not have sufficient educational opportunities."[xxiv]

In our study, we evaluated a wide range of technologies to determine which have the greatest near-term and long-term potential to support social-emotional skill development and personalized learning.

We predict digital collaboration platforms, artificial intelligence, and immersive, mixed reality will be powerful tools to address key teacher needs including:

- Transforming classroom time to focus on personalized learning approaches
- Gaining insights into learning
- Inclusivity, to amplify the abilities of all students
- Developing critical skills through socially embedded experiences
- Providing immersive and multi-sensory experiences that prime learners for deeper engagement

Three technologies stand out that are not only making significant, positive impacts on education today but also are transforming how learning will happen for generations to come: collaboration platforms, artificial intelligence, and immersive, mixed reality. These three technologies are increasingly prominent in the modern workplace of today, and their applications in modern learning illustrate the growing convergence of both the physical and digital worlds and how we harness technology to solve problems and work together in the classroom and in our professional lives.

Learning to thrive in collaborative environments

Collaborative activities feature prominently in teachers' learning design because they provide the social learning environment that supports the development of both cognitive and non-cognitive skills. Learning how to co-create with others is a key skill for life, and digital collaboration tools have shown promise in facilitating collaborative learning, particularly when intentionally integrated

into lesson plans. In the Fresno Unified School District, for example, student and teacher engagement in digital collaboration showed a positive and statistically significant relationship with academic outcomes and social-emotional competencies such as self-management and social awareness.[xxv]

Middle school students participating in Fresno's Personalized Learning Initiative (PLI) had over 25 percent higher odds of meeting, or exceeding, standards in language arts and math compared to students outside of the initiative.[xxvi] Students in the Fresno PLI also showed statistically significant differences in their use of technology and digital collaboration. Perhaps most importantly, observers noted PLI students taking greater ownership of their learning while participating in the initiative.

Research has shown that collaborative activities promote better learning outcomes, because collaborative interaction engages more parts of the brain.[xxvii] Collaboration platforms—software or online services that allow people in different locations to work together in real time—create opportunities for students, both inside and outside of the

classroom, to interact with others. In environments like these, students will increasingly collaborate across time zones and multilingual contexts on group projects, quickly crowdsourcing topics and potential content, co-constructing plans, establishing timelines, and rapidly iterating approaches.

Collaboration platforms also help teachers scale their work and reallocate their time by providing a way to organize large amounts of content necessary for learning plans and assignments. With advances in natural language processing and machine learning, educational content can be modified rapidly and inexpensively, allowing for highly personalized and targeted curation to suit individual student needs.

Experts call this idea the "Netflix of curriculum"— allowing teachers to find on-demand content that matches standards and is relevant to individual students. We currently see examples of collaborative social platforms outside of mandated department sites where educators engage and grow their professional communities, actively crowdsource learning plans, co-create assets, and contribute back to their peers in return. In turn, teachers' hands-on experiences with collaborative platforms enable them to recognize their benefits—and limitations— and apply them thoughtfully in their classrooms.

Applying artificial intelligence to understand students' skills and motivations

Artificial intelligence is the simulation of human intelligence processes by computer systems. These processes may include learning, reasoning, and self-correction. Applications of AI include speech recognition, vision, and thinking. Examples of AI include robotic process automation, machine learning, machine vision, natural language processing, pattern recognition, and robotics.

In education settings, AI can automate grading, giving educators more time to invest in the type of personalized engagement we know is a priority. AI can also assess students and adapt to their needs, helping them work at their own pace. And AI tutors can provide additional support to students, ensuring they stay on track.

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AI-powered analytics

With AI, predictive models can analyze an incredible volume of real-time information, identify patterns, and recommend actions based on algorithms.

The Tacoma Public School District utilized AI-powered analytics and improved its student graduation rates from 55 percent to 82.6 percent over the course of six years.[xxviii] This was not, however, an exercise in technology in isolation. Instead, the school set out to "measure the whole child," with an intentional social-emotional skill agenda based on four goals:

- Helping students achieve academic excellence
- Creating partnerships between parents, community, and staff in educating children
- Focusing on early assessment and intervention to ensure academic success
- Creating and maintaining safe learning environments

By pooling all available institutional data on the students securely in the Azure cloud, along with accessing additional data from government departments and even social media, the Tacoma Public School District was able to use machine learning and AI to gain deep insights into its students and identify, in real time, any "at risk" students who required immediate intervention and support.

AI-powered enablers of inclusion

AI can be harnessed to increase the inclusiveness of classrooms in innovative ways. Machine language translation involves the use of software to translate text or speech from one language to another, a need we know is increasingly important in today's diverse classrooms and societies. Real-time translators enable students to engage in cross-language conversation by translating spoken languages and text languages.

In another example, AI-powered robotics currently support students who experience long-term medical absences from their classrooms. Avatarion is a Swiss company which builds robot avatars that provide absent children a physical presence in class, with full video and audio connections to their hospital or home so they can continue to participate in their learning. The child uses a tablet to control the robot's movements and speech, to send images to classmates, and to answer questions by raising the robot's hand and speaking through a connected microphone and speaker. Cloud-based AI monitors the robot's performance at all times, sending valuable information back to the developers to ensure it performs securely and consistently as it represents the absent child in the classroom.

These are just a few examples of how AI can be applied for educational purposes. There are innumerable other opportunities to apply the power

of machine learning and massive computing power to educational diagnostics, real-world problem solving in the classroom, and hands-on curricula. Either way, incorporating the technology skills of tomorrow into the classrooms of today will help bridge the knowledge gap for future employability.

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Exploring virtual reality to observe and practice social-emotional skills

Mixed reality blends the physical world and virtual reality. It can also include augmented reality and holds promise for its ability to support experiential learning.

One especially effective teaching method is to provide students with opportunities to observe social-emotional skills and then practice those skills.[xxix] Blends of multisensory stimuli—sight, sound, touch, smell, and taste—can better approximate natural settings, creating higher impact experiences for the brain to develop, learn, and operate.[xxx] Immersive and mixed reality technologies can provide these stimuli for students and help them see the world from others' point of view. Gaining such new perspective can help students develop empathy—a crucial skill—and discover, practice, and apply that skill.

These technologies are becoming increasingly accessible, putting them within reach of many school systems. For instance, students might "visit" Egypt to understand what it is like to be an archeologist or travel back in time 2,000 years and

cast a vote in the Roman Assembly. Or they might sign in to a communication platform like Skype to visit a classroom on the other side of the world, to better understand what it is like to be a student in another culture. Such experiences can help raise awareness of bias and improve skills, such as empathy and collaboration, among other benefits.

Interactive learning can also empower students to create content. We expect technology solutions, such as virtual and mixed reality, to create immersive simulations that elevate student engagement and improve focus. For example, Lifeliqe offers a K–12 science curriculum that includes more than 1,100 3D and augmented reality models, more than 20 virtual reality experiences, and 700 lesson plans, enabling learners to see, hear, and interact with science rather than just read about concepts.

Technology already plays a pivotal role in fostering social and emotional skills and personalized learning, and we expect this trend to accelerate. We anticipate collaborative platforms, AI, and immersive mixed-reality tools will become new norms in classroom tools. The class of 2030 will work together on interactive, visually rich experiences that build skills and deepen understanding while leveraging social-emotional skills as they collaborate, develop presentations, and test and refine their thinking, all while engaging with technologies they can expect to use in the workplace.

Actions educators and leaders can take

Many teachers, school leaders, and education systems are eager to make changes, but they don't know where to start. In fact, there are many big and small ways that everyone involved in education can begin today to make changes that will benefit the class of 2030.

As we've outlined, our research indicates that students, communities, and society at large have much to gain if we can help the class of 2030 broaden their social-emotional skills and deepen their cognitive skills. Our research further reveals that personalized learning that leverages technology can be an effective way to make learning more student-centric and enhance students' social-emotional skills.

Many teachers, school leaders, and education system are eager to make changes but don't know where to start. In fact, there are many big and small ways that everyone involved in education can begin today to make changes that will benefit the class of 2030.

Teachers can collaborate with other educators to create or pilot programs that explicitly address social-emotional skills. Additionally, teachers play a critical role in leveraging or creating "teachable moments" to develop or reinforce social-emotional skills. For example, collaborative learning platforms enable students to work together respectfully and to negotiate as they co-create. Challenges that arise regarding shared contributions, effort, fair access, and conflict resolution are ideal real-world contexts to develop self and social awareness. Teachers can leverage digital environments to provide students safe rehearsal spaces to explore identity and learn to make responsible decisions. For example, by having students learn how to accommodate the needs of others when creating worlds in Minecraft, teachers can find opportunities to develop deeper emotional literacy and introduce strategies to resolve challenges or understand perspectives.

School leaders are pivotal as they create the "cultural climate" for their school and set vision and direction. Including staff in personalized learning experiences and identifying social-emotional skills they want teachers to model in their classrooms are two ways school leaders can set the stage. For example, Brett Webster, Headmaster of Ormiston College in Australia, plans to have his teaching staff engage in hands-on, collaborative STEM activities to better understand and influence their learning design, develop empathy, and raise awareness around the challenges and opportunities socially embedded tasks provide.

Introducing and supporting all staff to engage in online communities of practice is a powerful way to build an understanding of the platforms, purpose, and, importantly, the social context within which learning occurs. With the advocacy and involvement of school leaders, teachers will develop greater confidence with both the tools and the socially embedded nature of online collaboration.

School leaders can also enhance teachers' professional development by providing personalized learning approaches that allow teachers to individualize the pace, entry points, credentialing, and learning mode of their training, including flipped and blended learning. Silvia Scuracchio, Education Director from Escola Bosque, Brazil, uses Microsoft Teams as a space to organize content and support collaboration between students and teachers to create a social learning culture that drives improvement. These types of approaches enable teachers to experience first-hand how technology can be thoughtfully used to motivate, manage, and promote autonomous learning.

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Additionally, school leaders promote innovation in teaching and learning by providing time, resources, and the opportunity to explore.

Education system leaders will need to prioritize social-emotional skills and personalized learning approaches high on their agendas, clarify standards and expectations, and determine how to measure their benefits. The promise of these approaches to build social capital and meet the needs of a dynamic workforce are critical to the function of schooling.

In order to scale success, system leaders must provide opportunities for school leaders and their teachers to explore current and emerging technologies and the role they play in developing social-emotional skills and personalized learning.

System leaders can identify schools within their systems that are already successfully piloting programs to deepen social-emotional skills and personalized learning or that provide promising opportunities to implement new courses, training, or technology. With the right metrics of success and tracking methods in place, deeper analytics can then be applied to project the impact of different approaches on the broader system.

System leaders can better understand the impact of interventions, spot trends, and scale best practices when they are able to visualize rich data sets. For example, the Catholic Education Western Australia (CEWA) is connecting previously disparate rich data sets, including student well-being, and applying algorithms to drive predictive analytics. These approaches are providing a system-wide view of the impact of interventions and will help identify patterns of success that can be replicated.

The World Economic Forum notes that the way forward will require "a multifaceted ecosystem of stakeholders" to collaborate and devise solutions that foster social-emotional skills and learning approaches such as personalized learning.[xxxi]

We know there will be continued changes in the world of work driven by technology, globalization, shifting demographics, and other factors. How we socialize, collaborate, and engage in personal and civic life will be transformed and bring new challenges and opportunities. And while we can anticipate, model, and make predictions about the probable social and work opportunities for the graduating class of 2030, the reality is, these students will shape the future.

The skills and attitudes young people develop across their schooling will impact their mindset, skill set, and capacity to learn, unlearn, and relearn.

The young people who contributed to this landmark study were clear: they had high aspirations for their future learning in order to engage in impactful work; they valued creativity, problem solving, and the use of technology; and they wanted more time spent developing the social and emotional skills that will help them navigate a future which will be profoundly social.

We believe that when all stakeholders agree on the problems to solve and set this agenda as a critical priority, we can help young people develop the skills and mindset they need to succeed and thrive in work and life.

The class of 2030 is ready to learn.

Endnotes

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