

Navigating the future of AI in education and education in AI

How governments can forge more effective and equitable learning systems and develop workforces with future-ready skills



The better the question.
The better the answer.
The better the world works.



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with confidence



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A photograph of a man with a beard and a white cap, wearing a white thobe, sitting on a couch and holding a laptop. A young boy with curly hair is sitting next to him, looking at the laptop screen. The background is a bright, modern interior with large windows.

AI offers vast potential to transform teaching, learning and assessing and reduce teachers' administrative burdens.

Executive summary

Artificial intelligence (AI) is disrupting the way we live and work. The most pressing task for education departments around the world is to decide how education systems can prepare citizens to live and work safely and efficiently using AI. Additionally, they must determine how AI can improve educational equity and outcomes.

With its ability to analyze vast tracts of data, create personalized learning materials and interact with humans using natural language, AI holds vast potential for transforming teaching, learning and assessment and reducing teachers' administrative burdens. This potential encourages forward-thinking education leaders to reassess their education systems to embrace new learning methodologies.

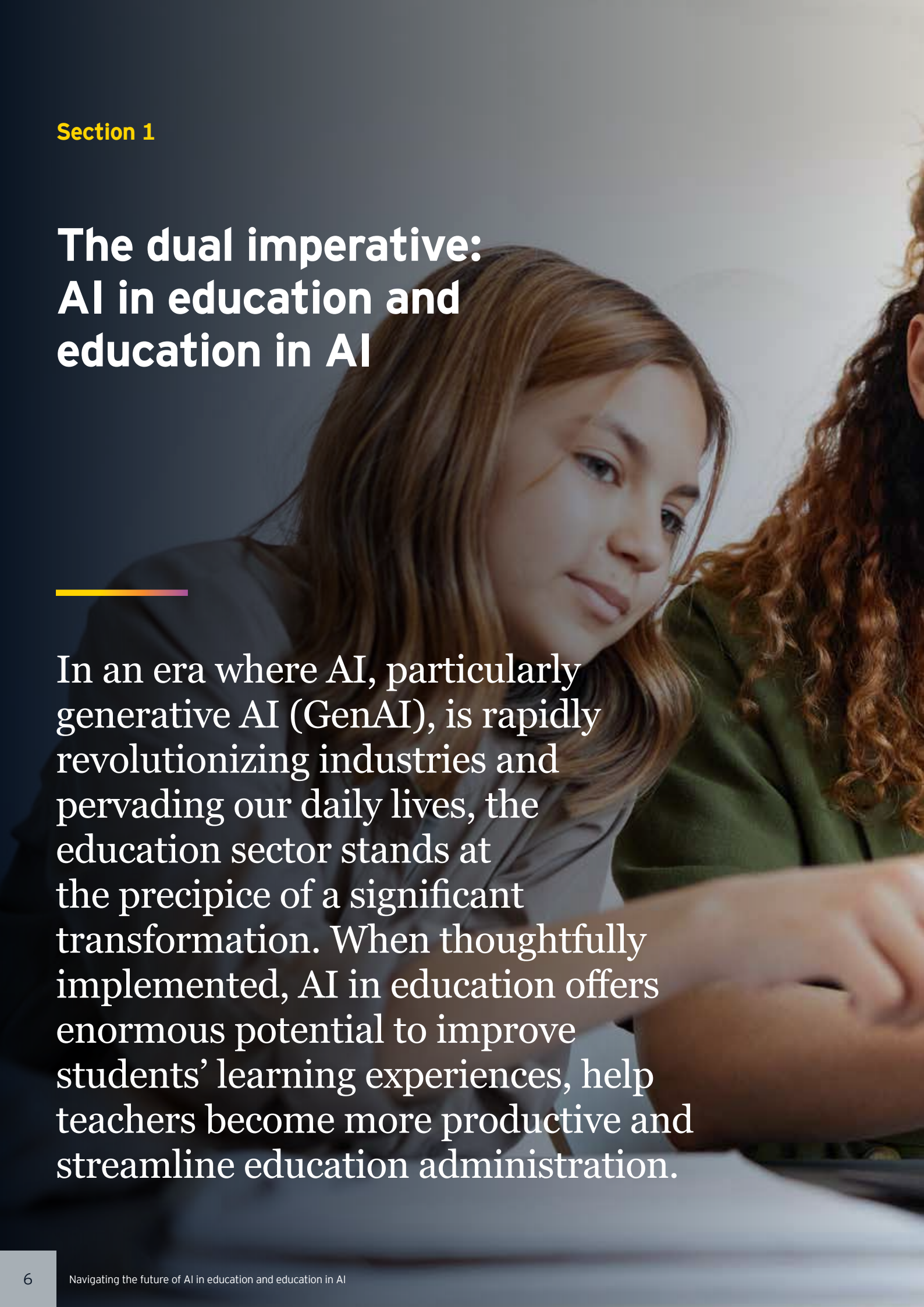
Moreover, one of the most effective ways for humans to understand the capabilities, limitations and ethical usage of AI is by regularly interacting with and applying it in an educational setting. However, while AI has the potential to significantly transform learning in the long term, there are multiple challenges that need to be addressed in the short term. Robust safeguards need to be installed before the technology can be truly effective in enhancing learning outcomes.

The rapid development and experimental adoption of AI in education presents multiple risks. These include the possibility of widening the educational divide and impacting academic integrity. There is also potential for inaccuracy, discrimination and bias as well as data privacy concerns.

Governments must be prepared to mitigate these issues while promoting the ethical development and use of AI in education. They must also focus on building a workforce capable of harnessing its transformative power. According to a nine-country study conducted by the global EY organization, more forward-thinking policymakers¹ were found to be already:

- Implementing policies that encourage the integration of technology and AI in education, providing appropriate governance and safeguards for its safe and ethical use
- Developing strategic roadmaps to guide the purposeful, effective and equitable adoption of AI in education
- Facilitating equitable access to digital devices and high-speed internet across all schools
- Implementing comprehensive AI training programs for educators
- Adjusting school and university curricula to incorporate digital skills and AI, helping students become equipped for success in the AI-enabled digital workforce
- Partnering with EdTech providers, academia and industry to support the development and adoption of AI-driven tools for students, teachers and administrators
- Allocating resources to train AI engineers to develop and implement AI-driven tools and to researchers to monitor their impact
- Providing re-skilling opportunities to learners throughout their working lives, enabling them to continuously adapt to workplaces that are being altered by AI

This paper emphasizes the crucial role of the government in shaping the ethical and transformative use of AI in education, aiming to create a system that effectively educates citizens about AI. It highlights the primary use cases for AI in education and its main areas of risk and challenge. Additionally, it suggests seven steps for policymakers to consider as they tackle the biggest transformative force that is shaping education.

A background image showing two young women with long hair, one with straight brown hair and one with curly brown hair, looking intently at a screen. The image is slightly blurred and has a soft, warm tone.

Section 1

The dual imperative: AI in education and education in AI

In an era where AI, particularly generative AI (GenAI), is rapidly revolutionizing industries and pervading our daily lives, the education sector stands at the precipice of a significant transformation. When thoughtfully implemented, AI in education offers enormous potential to improve students' learning experiences, help teachers become more productive and streamline education administration.



At the same time, the future workforce needs education in AI. Governments must facilitate conditions so that their citizens are equipped to thrive in an AI-enabled, digital world.

Just as integrating computers into schools equipped a generation with essential digital skills, such as word processing and spreadsheet management, embedding AI-powered study tools and tutors into classrooms will help nurture AI literacy among the future workforces.

Interacting with AI from an early age will help students become familiar with its capabilities, limitations and ethical considerations. As they navigate personalized learning, adaptive assessments and AI-guided problem-solving, students will learn how to interact with intelligent systems, interpret AI-driven insights and recognize potential biases. This early exposure is essential to facilitate the future workforce not only to be proficient in using AI but also to understand how to leverage AI responsibly and effectively.

A recent survey conducted among the parents of Gen Alpha and Gen Z children (i.e., born since the mid-1990s) in the US reported that 88% of parents see AI as a crucial component of their children's education. Nonetheless, a similarly high proportion of parents, 81% doubt whether AI is currently integrated into their children's curriculum.²

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As we navigate the future of AI in education, governments must harness this transformative technology to build effective and equitable learning systems. By integrating AI thoughtfully, we can empower educators, enhance learning outcomes and equip our future workforce with the skills to thrive in an AI-enabled world. Together, we can enable AI to serve as a catalyst for innovation and inclusivity in education.

Firas Qoussous

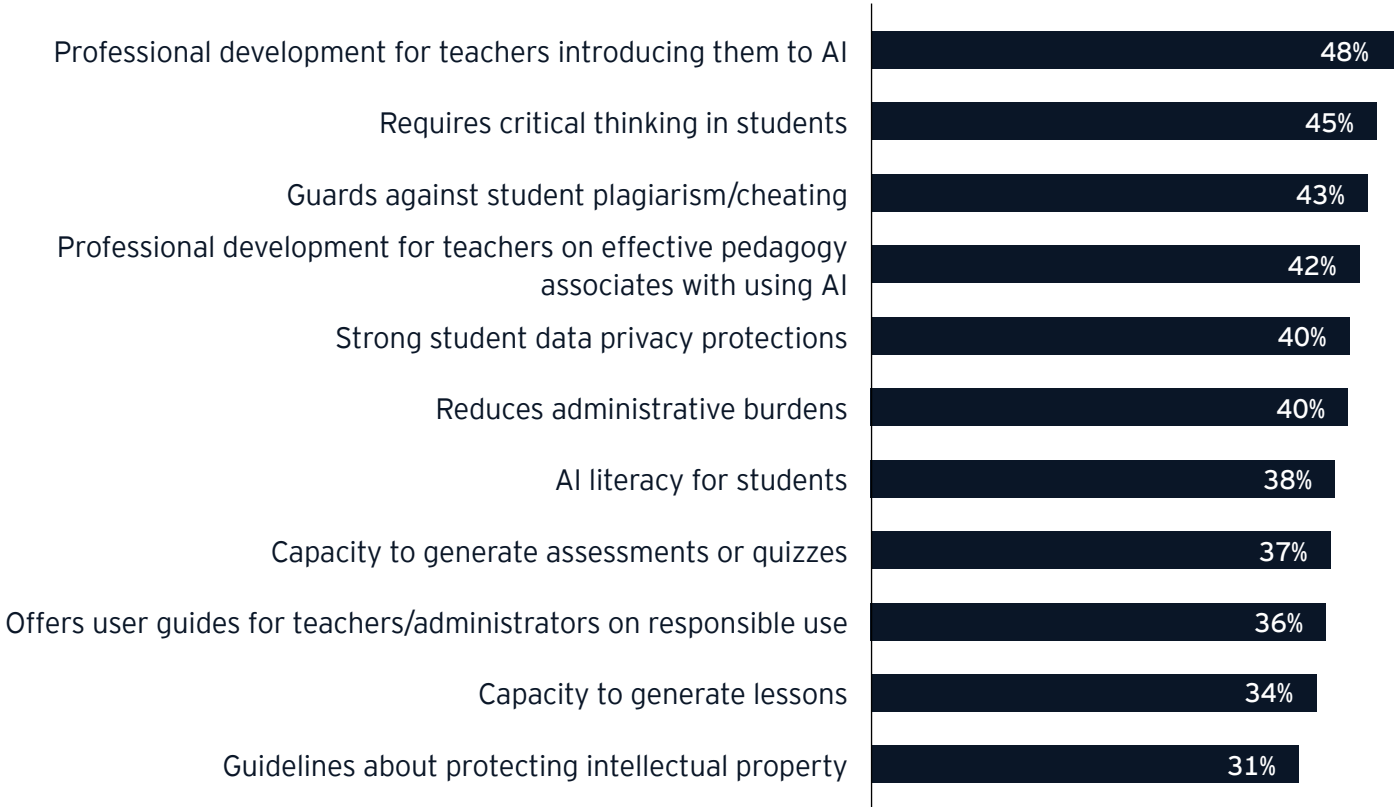
EY MENA Government & Public Sector Leader

Adoption of AI tools among students and teachers is racing ahead of policy

The massive shift to online learning during the COVID-19 pandemic opened the door for personalized, self-paced learning, continual assessment and the ability to deliver quality learning experiences to students wherever and whenever they want to learn. AI-driven tools are the logical extension of this kind of digital learning. The EdTech industry has responded rapidly to this opportunity, integrating AI and GenAI into an extensive range of teaching and learning tools that can aid student learning and classroom management. The proliferation of AI-driven digital education tools has been heralded as the “fourth educational revolution,”³ or Education 4.0 (echoing Industry 4.0).

Not surprisingly, given the plethora of AI-powered teaching tools available, education decision-makers see abundant use cases for AI in education. They believe it could transform the sector. Almost two-thirds (62%) of US teachers and 60% of UK teachers are using AI for work purposes in 2025, up from 25% and 30% in 2023 respectively.⁴ Yet, institutions are behind the curve in providing the necessary support. According to an educator survey from EdWeek Research on the desired features from AI products, 48% of school officials desire professional development for teachers to introduce them to AI, 45% want AI to require critical thinking in students and 43% seek AI tools that can prevent students from cheating. This indicates that the impetus for the adoption of AI comes from the bottom up, with students leading the way while institutions work to catch up.

Figure 1: Features valued by K-12 school officials who have indicated an interest in incorporating AI in school

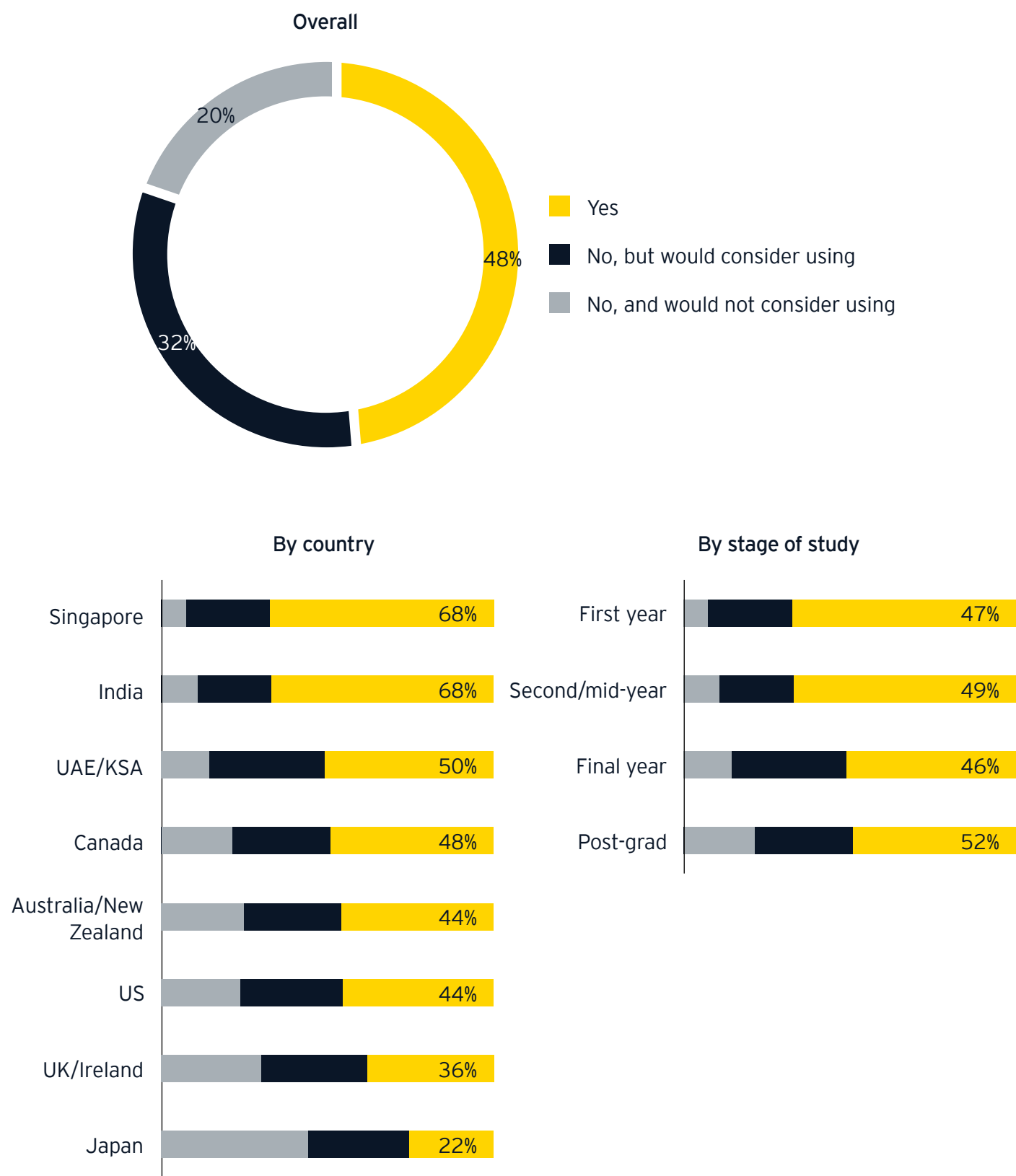


Source: 2023 EdWeek Research Center educator survey.

Meanwhile, students, particularly in higher education, are already enthusiastic users of GenAI tools such as ChatGPT, Microsoft 365 Copilot, Google Bard and Dall-E. The Digital Education Council Global AI Student Survey 2024 found that 86% of university students (across 16 countries⁵) were using AI tools, of which 24% were using them daily. A study conducted by EY teams surveyed 3,030 university students across eight different regions and discovered that nearly half had utilized GenAI tools to support their studies, while an additional one-third expressed willingness to use such resources. However, at the country level, there were significant variances, with 68% of students in Singapore and India already using GenAI tools, in contrast to just 22% in Japan.⁶



Figure 2: Use of GenAI tools to support learning by country and stage of study



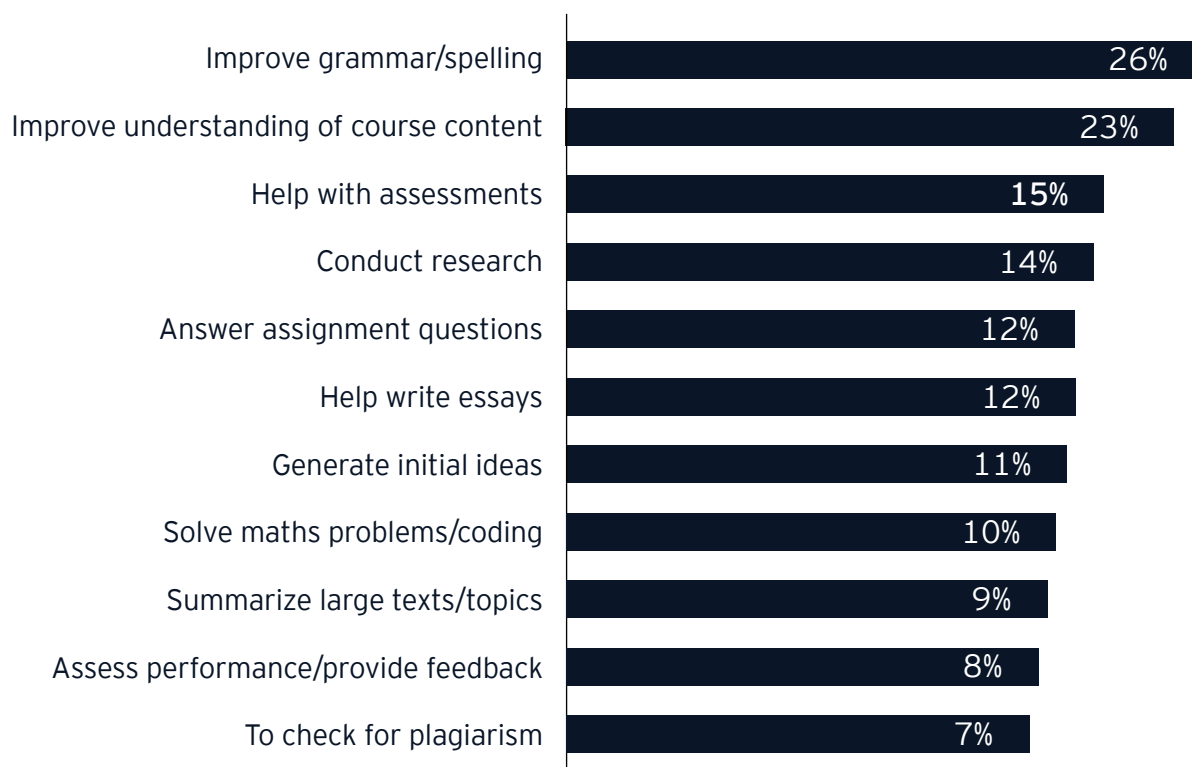
Source: EY 2023 International Student Survey on Digital Transformation in Higher Education.

These students said that they were using AI for various reasons such as improving their written output, helping them better understand their course content and assisting them with their assessments. The primary reason for not using GenAI was that students viewed it as “cheating.”

Figure 3: Use of AI tools to support learning

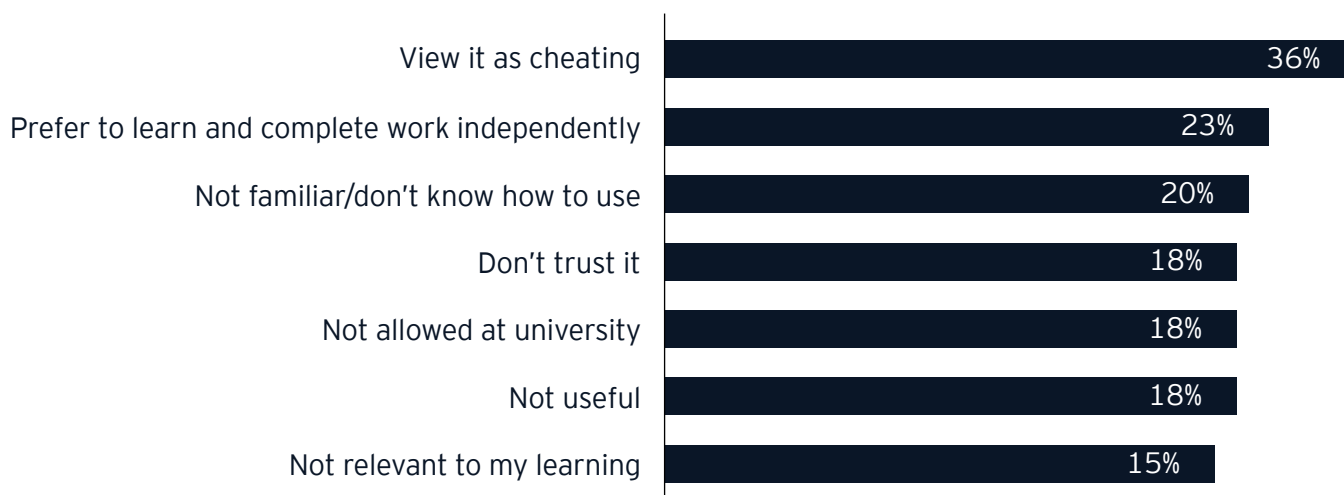
How have you used AI tools to support your learning?

(n=1,442 students who had used AI)



Why would you not use AI tools to support your learning?

(n=606 students who had not used AI)



Source: EY 2023 International Student Survey on Digital Transformation in Higher Education.

Similar student-led use cases were also highlighted in the 2024 Digital Education Council Global AI Student Survey, which found that 68% of students used AI for research and 42% used it for checking and improving their written content.

Figure 4: AI use cases among students

Information searching tops the list for AI use cases among students, followed by grammar checking?

Question: What do you usually use AI tools for (select all that apply)?



Source: Digital Education Council Global AI Student Survey 2024.

How can we ensure AI contributes to improved education outcomes for all?

AI has the potential to accelerate progress toward Sustainable Development Goal 4 (SDG 4), which aims to “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.” AI-powered tools can help address some of the critical challenges facing the world’s education systems. For example, in K-12 education, teacher shortages and issues with workload and burnout could be alleviated using tools that improve teacher workflows and reduce the administrative burden. In higher education, universities facing declining revenues and rising costs can implement new business models which are augmented by AI, to deliver remote and flexible learning to underserved communities.

However, care must be taken to facilitate the development and adoption of AI tools in a way that

truly enhances the learning experience and does not undermine the quality of learning or academic integrity.

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The use of AI in education is clearly going to transform the learning experience for students at all stages of their learning journey. It is the job of governments and education leaders to ensure that AI is designed and used in a way that improves rather than harming the quality of learning and equity of learning outcomes.

Amitabh Jinghan
EY-Parthenon and EY Global Education Leader

AI's potentially positive impact on education will not be equitable unless we can overcome the digital divide. Doing so is a matter of extreme urgency because AI has the potential to create the next digital divide.

In many emerging economies, students and schools face barriers such as limited internet access, inadequate infrastructure and a lack of digital skills. Such digital divides still exist even in prosperous economies. A survey conducted by Hart Research in August 2023 identified that one of the key barriers to AI adoption in the US was limited access to reliable internet for all students.⁷ Equally, research conducted by the UK's Higher Education Policy Institute in November 2023 found that 58% of the students from the most privileged backgrounds were using GenAI for assessments compared with 51% from the least privileged backgrounds, with male students using it more than female students.⁸

Bridging such divides, wherever they appear, requires coordinated efforts, such as investing in digital infrastructure, supporting affordable internet and device access, and empowering educators with the skills to implement AI effectively. By addressing these disparities, we can promote AI-driven

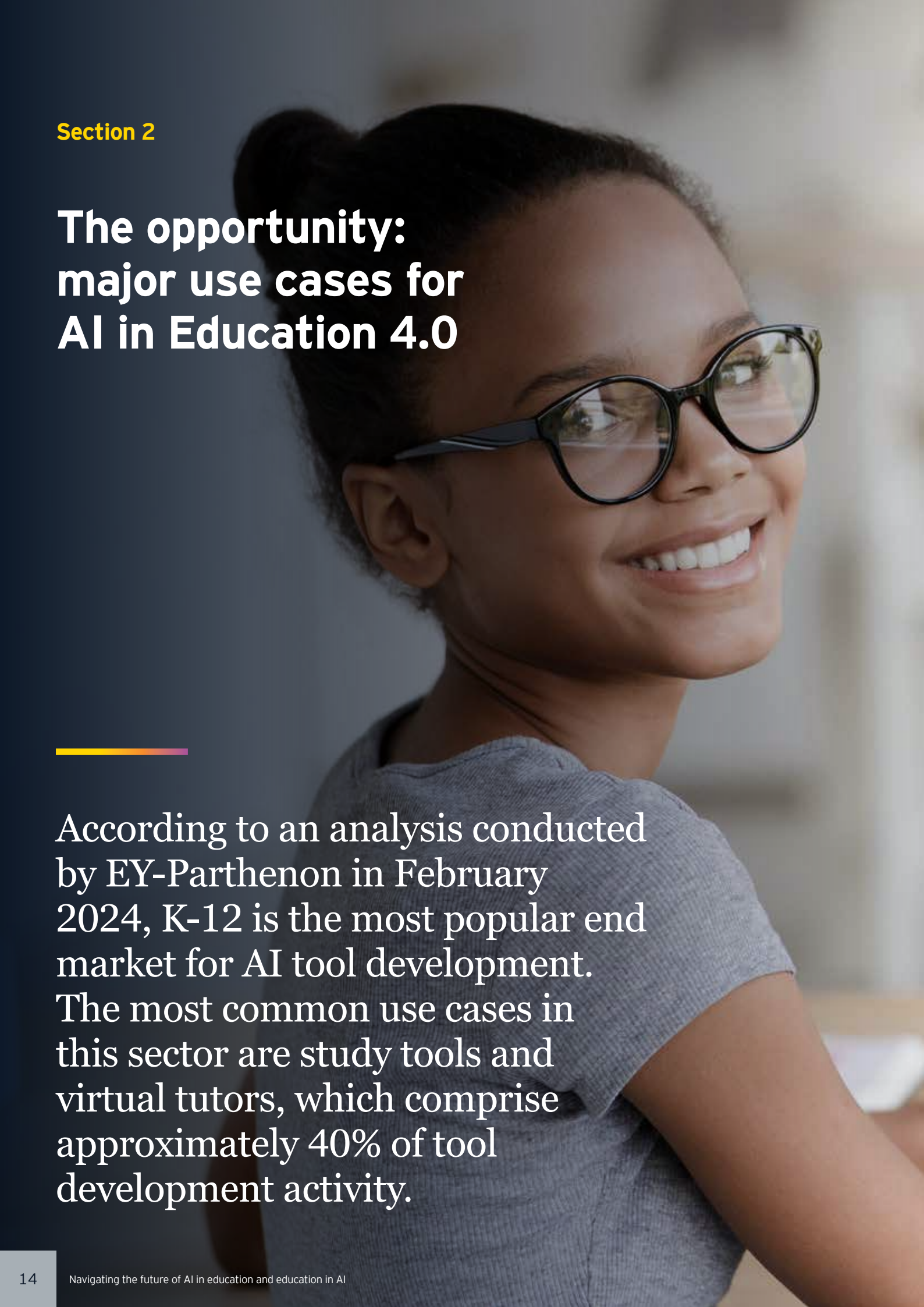
educational advancements that benefit students worldwide, creating a more equitable future where every learner has the chance to thrive.

Such initiatives require policies that promote equitable and inclusive access to digital technologies and AI. Additionally, these policies should encourage the use of AI in a way that is ethical, inclusive and serves the public good. This necessitates the establishment of comprehensive policy measures and supervision, along with the commitment of resources and the collaboration between educators, technology providers and various industries.

The UN Educational, Scientific and Cultural Organization (UNESCO) suggests that “to fully unleash the opportunities and mitigate the potential risks, system-wide responses to the following key policy questions are needed:

- How can AI be leveraged to enhance education?
- How can we ensure the ethical, inclusive and equitable use of AI in education?
- How can education prepare humans to live and work with AI?”⁹





Section 2

The opportunity: major use cases for AI in Education 4.0

According to an analysis conducted by EY-Parthenon in February 2024, K-12 is the most popular end market for AI tool development. The most common use cases in this sector are study tools and virtual tutors, which comprise approximately 40% of tool development activity.

Supporting learning

AI has the potential to dramatically change the way students learn. Well-designed AI tutors and teaching assistants can provide students with personalized learning support. They customize learning experiences to suit the needs of each individual student, adapting to different capabilities, learning styles and preferences in real time. By delivering immediate feedback and showing students their progress, AI-driven tools can encourage students to take ownership of their learning.

Well-designed AI tutors and teaching assistants can provide students with personalized learning support.

These tools use data from student interactions, such as response times, accuracy and areas of struggle, to provide additional exercises, hints or alternative explanations that are customized to each student's level of understanding. On the other hand, when a student rapidly grasps the topic, the AI tutor presents more challenging material to maintain the student's engagement. The tutor can also stimulate creativity by assisting students in brainstorming ideas, providing a

fresh perspective and introducing innovative concepts. AI can also adapt its content and tailor it for students with disabilities or for those learning in a language that is not their own.

The insights collected can also give teachers ideas about where to intervene or how to tailor their own instruction. A well-known example is Khan Academy, a nonprofit provider that uses AI to provide personalized learning experiences in mathematics and other subjects from pre-K to early college. The platform adapts its content to the learner's pace and provides practice exercises, instructional videos and a personalized learning dashboard, which can be used by both learners and teachers. More recently, Khan Academy added Khanmigo, a GPT-4-powered chatbot, which serves as a personalized tutor or teaching assistant, providing learning assistance in the subjects offered on the main platform.

According to an analysis conducted by EY-Parthenon in February 2024, K-12 is the most popular end market for AI tool development. The most common use cases in this sector are study tools and virtual tutors, which comprise approximately 40% of tool development activity.

However, as outlined in section 3, there are concerns about the potential ethical risks and practical challenges of adopting these AI-driven tools. Therefore, educators must proceed with caution.

Supporting teacher workflows

Teachers are in short supply in many countries and are struggling with increasing workloads and experiencing high levels of burnout. AI tools can enable them to do many aspects of their job better and faster, giving them more time to help students learn. For example, teachers can benefit from AI-assisted curriculum development, lesson planning and content creation. Automated grading and feedback, student performance analytics and administrative support can free up time for hands-on teaching and learning support.

An array of AI-driven learning management systems (LMS) is already available across all

education sectors. Many established LMS providers, such as Canvas, Blackboard Learn and Moodle, have incorporated AI to offer features such as personalized learning paths, automated grading of assignments and predictive analytics to track student performance.

We expect the greatest uptake in the short term, particularly in K-12, in leveraging AI to improve teacher workflows. Empowering teachers to become early adopters and experts in AI for their workflows also enables them to guide students in using AI responsibly and effectively. With the integration of student-focused applications, educators proficient in AI can foster an environment that emphasizes critical thinking and digital fluency.

Table 1: Examples of teacher workflows that can be made more efficient by AI

Teaching and learning workflows	
Accessibility	AI can assist teachers in supporting students with learning differences in various ways. It can level text to fit a student's reading level, enable speech-to-text for students with diverse abilities and personalize assignments to meet students at their current level of understanding.
Planning and content creation	GenAI can assist teachers in creating scopes, sequences, unit plans and daily lesson plans that align with standards and objectives. AI can also help teachers find supporting resources and content, suggest activities and assignments and propose methods for assessing understanding.
Assessment creation and grading	AI can generate test and quiz questions aligned with objectives. It can also assist teachers in diversifying question types to enhance the variety and depth of assessments.
Analyzing student outcomes	AI can assist teachers to identify patterns and trends in performance. It can offer real-time insights and suggestions for adapting their teaching approach to improve learning outcomes.
Marking	AI can mitigate the undermining of academic integrity brought by the shift to online learning and assessment and the availability of GenAI tools. For example, detection tools can identify plagiarism or AI-generated content. Additionally, AI tools can monitor keystrokes to verify the identity of the person completing an exam. However, these tools must be used cautiously because they are not infallible and could produce false and even discriminatory results. Teacher oversight remains essential.

Administrative workflows

Timetabling and scheduling

AI is being widely used to auto-generate optimized timetables and meeting schedules, such as for parent consultations. This technology facilitates the most efficient use of teachers' time.

Writing individual education plans

AI streamlines the documentation process for students with special education needs. It helps these plans meet educational standards while reducing the administrative burden on teachers.

Writing parent communications

AI can be used to translate parent-facing documents like newsletters, field trip forms, student information forms, etc., into any language instantly and accurately. It also enables teachers to quickly generate narrative comments for students at the end of the term.

Pastoral care

Identifying wellbeing interventions

AI can identify students who are struggling or “at risk” and suggest early interventions to staff. It can also follow up with students through text reminders or personalized support.

Providing wellbeing triage and support

AI-driven chatbots can provide students with a nonthreatening, safe and anonymous initial contact point for wellbeing or safeguarding concerns.



Automating business processes and improving decision-making

Education institutions are looking to deploy AI to automate and streamline business processes in areas such as admissions, finance, human resources, marketing, communications and facilities management. This approach can potentially enhance the experience of employees and students and may lead to cost savings through increased productivity. Examples include using:

- AI models to identify students with high enrolment probability to improve offer-to-enrolment rates
- An HR chatbot to provide personalized hiring and onboarding experience or to respond to routine HR queries
- Remote sensors and AI to manage heating and lighting, reducing energy consumption

An EY team assisted the University of Virginia to develop and deploy CavBot, an AI-powered virtual HR assistant. CavBot responds to common employee queries and helps new employees to complete onboarding tasks. These tasks include filling out forms, submitting documentation, applying for security passes and parking permits, and sending personalized reminders when items are due. CavBot has significantly reduced the number of enquiries that HR staff need to handle. It has improved compliance and delivered an enhanced onboarding experience for newly recruited employees.

Powering academic research

AI and GenAI has the potential to greatly advance academic research and accelerate the growth of knowledge and innovation in various disciplines.

AI can help researchers quickly scan available literature, identify relevant papers, translate or summarize key findings or pinpoint gaps for further research. It can analyze very large data sets, identifying patterns and trends that might otherwise go unnoticed. It can also create synthetic data, complex





models and simulations. AI can also reduce the manual labor involved in lab work by automating experiments, data collection and sample processing. Additionally, it is being used to reduce the administrative burden of research by automating elements of grant applications, compliance, reporting and publishing processes.

Many universities around the world are leveraging AI to power academic research across various disciplines. For example, Stanford University's AI Laboratory (SAIL) not only conducts cutting-edge research in AI, machine learning and robotics but also supports the use of AI in research projects across disciplines, including health care, environmental science and social sciences.

Enterprise and continuous learning

The innovation and adoption of AI in learning are accelerating more rapidly in enterprise learning and continuous learning environments.¹⁰ Unlike K-12 and higher education, which require high standards of quality, accuracy and security, the stakes in enterprise learning markets tend to be lower, and the content is more straightforward to create. Enterprise buyers and users are more likely to take risks and try new things when the reward could be cost savings or improvements to employee work quality or productivity.

Enterprise learning and school and university courses can be transformed using asynchronous digital learning solutions. These tools can translate an instructor's live course content into a dynamic, asynchronous digital learning experience that can be flexibly delivered to students. Guided by the course owner, the AI analyzes each content element and creates instructionally sound, engaging, self-paced digital learning elements, including reflection questions, games and quizzes. Such tools eliminate the need for instructors to prepare or format content manually. They can even recommend and populate missing instructional items. These tools can be guided to produce materials in alternative formats that are accessible to learners with different learning needs or disabilities.



Section 3

The risks and challenges in embedding AI in education systems

The rapid development of AI technology has multiple ethical and practical risks and challenges for education systems, primarily because policy and regulatory frameworks have not kept pace.

Policymakers and education leaders have a key role to play in mitigating risks and challenges. In particular, they can do so by implementing robust policy frameworks.

Risks to consider

Beyond the potential to widen the educational divide, adopting AI-driven digital tools in education can give rise to various risks. These include its impact on academic integrity, with widespread concerns around plagiarism, cheating in assessments and the loss of critical skills. Additionally, there is the potential for inaccuracy, discrimination and bias, and data privacy concerns.

Loss of human agency

AI must not be seen as a replacement for the very human experience of learning. Rather, it is a tool to aid and enhance human invention, skill and judgment. Teachers will continue to be indispensable in education, even with the introduction of AI-powered tutors.

Human learning is a complex process. Even smart, personalized digital learning will not replace the skill of teachers in motivating and guiding the learning experience. The role of the teacher is not simply to provide information and assess its absorption but to inspire students to think, question and discover for themselves. AI lacks the nuanced understanding and empathy of human educators, making it less effective in addressing complex, context-dependent learning needs. Younger students in particular rely on direct interaction with teachers to achieve meaningful learning. Hence, AI should be used to augment, not replace, human teaching.

Currency, accuracy and hallucinations

AI tools are known to have limitations regarding the recency and accuracy of the content it provides and its propensity to “hallucinate” or make up information and present it as fact. Students and teachers must learn to deal with these limitations and be taught to fact-check AI outputs. AI tutors cannot yet be entrusted with educating children too young to recognize mistakes or hallucinations. In K-12, teachers are better positioned than students to use AI safely and question its output appropriately.

Bias and discrimination

AI tools are trained on data sets, which is an issue if those data sets are incomplete, biased or unrepresentative. For example, AI tools can analyze a student’s performance or be used to support admission decisions or career recommendations. However, if the data inputs are flawed, the AI’s recommendations can be inaccurate or inequitable. This issue is especially pronounced in diverse classrooms where data on certain student demographics may be limited, potentially leading to one-size-fits-all solutions that fail to meet individual needs. For example, certain marking tools were found to discriminate against non-native speakers due to the use of nonstandard language to express the same concept.¹¹

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Biases in AI can stem from societal structures, data collection methods or inherent limitations within the AI technologies themselves. When organizations deploy AI systems in real-world scenarios, these biases may become more pronounced due to user interactions, demographic representations and misconceptions about AI neutrality. Data scientists, AI developers, educational leaders and regulators must recognize and address these biases to develop fair and effective AI tools.

Damaris Fynn

EY Americas Risk Data and AI Leader

Transparency and explainability

AI models can function as “black boxes” (i.e., a complex system, where the inner workings are hidden or not understood), making it difficult for users to understand the rationale for decisions about learning pathways, grading or student performance, with the potential for bias or errors to creep into the process.¹² Without transparency and explainability, students, parents and teachers cannot assess the fairness or accuracy of an AI-based recommendation. To enable AI to gain widespread acceptance and be used effectively in education, it is crucial to establish model development protocols. These protocols should clarify how AI recommendations are generated and validated. Building transparency and explainability into AI models is vital to building confidence.

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Providing appropriate levels of disclosure about the design, purpose and impacts of its AI systems enables stakeholders to understand, evaluate and correctly use the technology. Enhancing the explainability of AI systems ensures that users can comprehend, challenge and validate the decision-making processes and outputs. This level of clarity is vital for users who need to trust the system but who can also verify its decisions when necessary.

Damaris Fynn

EY Americas Risk Data and AI Leader

Privacy and data security

Privacy and data security are foundational for building confidence in AI-powered educational tools, promoting technology that enhances learning without compromising the safety and rights of students. In education, AI tools often rely on substantial amounts of student data to deliver personalized learning experiences, track progress or adapt to individual needs. Collecting and storing sensitive information, including academic performance and behavioral patterns, raises concerns about who has access to this data and how it can be used.



Impact on quality of learning and academic integrity

Educators fear that an over-reliance on AI tools, particularly GenAI tools, will undermine students' skills in areas like research and discovery, critical thinking and the communication of ideas. Indeed, GenAI raises concerns around academic integrity when GenAI can generate perfectly passable essays, work mathematical problems or complete test papers. Therefore, unsurprisingly, much of the attention so far has centered on ways to either prohibit the use of AI tools or identify when AI has been used to generate submissions. However, what students really need is clear guidance and policies on the ethical and effective use of AI.

In higher education especially, student use of AI has raced ahead of policymaking, raising concerns about academic integrity and assessment. While their students were quick to begin using AI tools, universities were comparatively slow to establish comprehensive AI policies due to the rapidly evolving nature of AI technology and lack of consensus on best practices. Even the earliest institutions to publish GenAI policy guidance, including Stanford and the University of Sydney, did so only in February 2023.

That same year, UNESCO found that less than 10% of schools and universities followed formal guidance on using popular AI tools like ChatGPT.

The development and proliferation of AI-driven educational tools and methods has also outpaced research into the impact on learning and on educational outcomes. As schools and universities adopt AI-driven approaches, they should be subject to the regular monitoring and evaluation of results and stakeholder feedback, with a particular eye to the equity of outcomes. Approaches can then be adjusted to increase effectiveness and eliminate gaps.

Implementation challenges

Some significant hurdles must be overcome before national education systems can fully benefit from the potential of AI. These range from inadequate digital infrastructure to a critical lack of knowledge and understanding of using AI tools safely and effectively.

Lack of digital and AI skills among staff and students

Most teachers have yet to adopt AI into their daily workflows, primarily because they do not know how. They urgently need guidance, support and resources to use AI tools to improve learning.

A report published by EdWeek Research Center in 2024 found that the main reason teachers in the US have not yet incorporated AI into their practice is a “lack of knowledge and support.” A recent Hart Research survey also revealed similar findings that, while most US K-12 teachers expect to use more AI in their teaching practices in future, approximately 80% lack confidence in their ability to use AI.¹³

According to the 2024 Digital Education Council survey, 58% of university students feel that they do not have sufficient AI knowledge and skills, and 48% of students do not feel adequately prepared for an AI-enabled workplace. Almost three-quarters (72%) of students said that their university should offer more courses on AI literacy and 59% said they expect their university to increase the use of AI in teaching and learning.

Not surprisingly, 73% of students agreed that universities should provide faculty training on the effective use of AI tools.

Lack of digital infrastructure

To access the benefits of AI in learning, all teachers and learners must have access to digital devices and high-speed internet access as well as the appropriate platforms and software to keep them safe and secure.

The lack of universal technology access will exacerbate the digital divide and inequity of education access and outcomes in an AI-powered world. This issue is particularly pertinent in underserved communities, where schools might lack consistent internet connectivity or the financial resources to provide computers for student use.

Hence, promoting equitable access to AI-enhanced education will first require a significant investment in reliable, high-speed internet connections, connected devices and, in some countries, reliable electricity supplies.

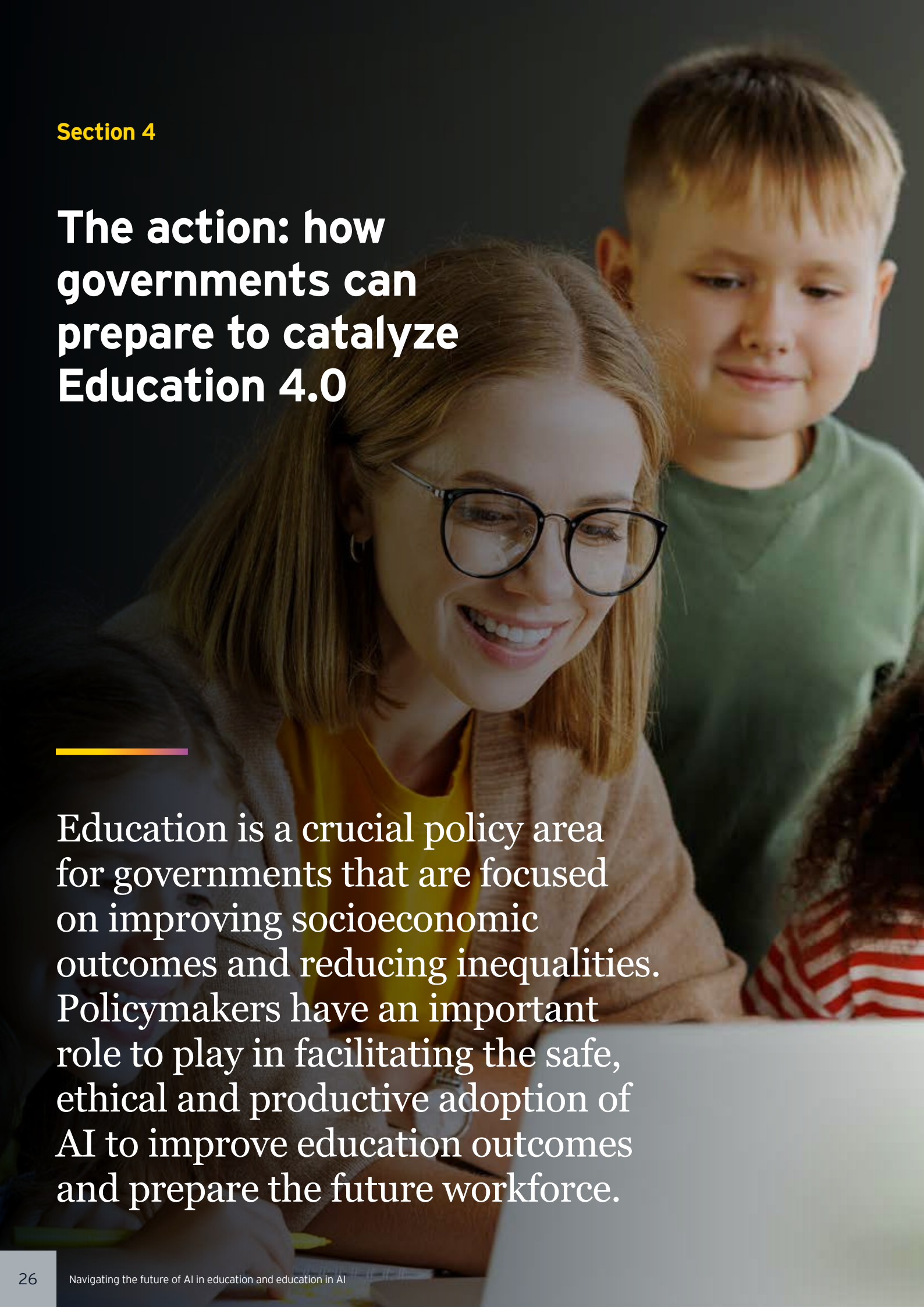
The need to invest in AI tools, data systems, data privacy and cybersecurity

AI-driven educational tools, including adaptive learning platforms, intelligent tutoring systems and data analytics software, also require substantial financial investment. This is not only for the initial setup but also for ongoing maintenance, updates and data security measures.

Implementing AI in the education system requires sophisticated data systems to gather, store and analyze large volumes of student data. These systems must comply with strict privacy and security standards, adding a layer of cost for software, data protection measures and staff training to manage them effectively.

Many schools, particularly those in underserved communities, barely have budgets for traditional teaching resources, let alone advanced technologies and the support required to keep them safe and secure.



A photograph of a woman with blonde hair and glasses, smiling while looking at a laptop. A young boy with blonde hair is standing behind her, also looking at the screen. The image is slightly blurred and has a dark overlay.

Section 4

The action: how governments can prepare to catalyze Education 4.0

Education is a crucial policy area for governments that are focused on improving socioeconomic outcomes and reducing inequalities. Policymakers have an important role to play in facilitating the safe, ethical and productive adoption of AI to improve education outcomes and prepare the future workforce.



A helpful overarching thinking framework for this task is derived from the first document to recommend how to harness AI technologies to achieve SDG 4.¹⁴ The Beijing Consensus on Artificial Intelligence and Education is the outcome document of the International Conference on Artificial Intelligence and Education held in May 2019. Its underlying thinking is that AI should be geared to improve outcomes for every student, empower teachers and strengthen learning management systems.

Based on the Beijing Consensus, UNESCO developed a set of guidelines and resources to support governments as they plan for AI in education policies, suggesting that policymakers consider providing national guidance around:

- Using AI for education management and delivery
- Using AI to empower rather than replace teaching and teachers
- Using AI for testing and assessment
- Developing skills and values necessary for life and work in the AI era
- The need for lifelong learning for all
- Promoting the equitable and inclusive use of AI in education
- The ethical and transparent use of education data for training AI
- Monitoring, evaluating and researching AI efficacy and impacts

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The growing use of novel AI technologies in education will only benefit humanity if, by design, it enhances human-centered approaches to pedagogy and respects ethical normal and standards.

AI and Education

Guidance for Policy-Makers, UNESCO, 2021



Step 1: Policy development and governance

Countries need robust AI and data governance frameworks for education, with clear guidelines on the safe, ethical and responsible development and use of AI tools in education. The objective is to facilitate AI in enhancing learning experiences without compromising safety or privacy or exacerbating inequities. Important areas for consideration include:

- Robust data governance frameworks that prioritize the safeguarding of student privacy, along with algorithmic transparency and accountability measures to mitigate accuracy, bias and discrimination
- Secure data-sharing agreements and interoperability standards to facilitate the safe exchange and use of educational data with AI tool developers
- Mechanisms for continuous monitoring of AI tools used in education to confirm that they meet defined educational objectives and ethical standards
- Channels for students, parents and educators to report concerns or adverse effects related to the usage of AI, with systems in place to address these issues transparently

Governments should adopt an inclusive approach to developing these elements. To develop robust frameworks and build public trust, consultations will likely include ethical AI experts, EdTech providers, the education community and a wider society. Given

the pace of technological change and the potential for new risks and opportunities to emerge, any AI policy frameworks will require flexibility and should be reviewed and adapted regularly.

Some countries, including Singapore, Australia and the US, have already issued guidelines on the safe and ethical development and use of AI in education. Others are still in the drafting or planning stages. Generally, national or federal governments are responsible for providing educational policies and guidelines. Canada is an exception, where this responsibility sits at the provincial level.

Examples

The US federal government's Executive Order on the Safe, Secure, and Trustworthy Development and Use of AI required the Secretary of State for Education to develop an AI toolkit for education leaders. In July 2024, the Office of Educational Technology (OET) responded with the guide "Designing for Education with Artificial Intelligence," organized around five areas of shared responsibility: Designing for Education, Providing Evidence of Rationale and Impact, Advancing Equity and Protecting Civil Rights, Ensuring Safety and Security, and Promoting Transparency and Earning Trust. The OET developed the guide with educators, policymakers, students, parents, researchers and technologists.

In November 2023, Australia's Department of Education released its Australian Framework for Generative Artificial Intelligence (AI) in Schools. The framework is based on six principles and 25 guiding statements around teaching, human wellbeing, transparency, fairness, accountability and privacy. Education ministers have committed to reviewing the framework every 12 months to respond to rapid developments in GenAI.

Step 2: Strategic roadmap development

To date, AI in education has been implemented in a piecemeal, experimental fashion, often without a clear strategy or vision at the institutional level, and less so at the jurisdictional level. This has led to inconsistency and inefficiency in how AI is adopted, most crucially resulting in unequal access, with well-funded or more experimental institutions benefiting from advanced AI tools ahead of under-funded or disadvantaged schools.

Education authorities have a key role to play in guiding AI adoption in a more purposeful and deliberate way. They can do this by developing a strategic roadmap with a clear vision, educational objectives, targets, timelines, available resources and responsibilities and accountabilities. Such a roadmap would help align stakeholders around common goals and facilitate AI initiatives targeted toward improving educational outcomes, equity and inclusion and mitigating ethical and practical risks. It would also help to target scarce financial, technological and human resources toward priority areas. A holistic plan requires that investment in AI innovation be matched with investment in capacity building, equipping teachers and students to take advantage of AI in a safe, ethical and equitable way.

Examples

The UAE aims to be the leading country innovating in AI-enabled education, preparing its young people to have the necessary skills for an AI-infused future. As far back as 2018, the UAE launched a comprehensive National AI Strategy driven by a dedicated ministry-level Artificial Intelligence Office focusing heavily on AI in education. The strategy aims to integrate AI into the education system, develop AI-driven educational tools and promote AI literacy among students and teachers. The UAE is also investing in AI research and development in education and fostering a fertile ecosystem for AI in the country.





Universities will require funding to invest in cutting-edge digital tools and equipment so that they can fully utilize the power of data and AI in their research.

Step 3: Infrastructure investment

To promote equitable access to the benefits of AI, governments will need to invest in providing digital tools and reliable, high-speed internet across all schools and in universities. Particular attention should be paid to underserved communities. Some countries have already made significant progress in rolling out basic connectivity and devices for schools and for students in need, to close the digital divide, spurred by the pivot to remote online learning during the COVID-19 pandemic. However, many still have work to do.

Education systems must also invest in purchasing or subscribing to AI software and platforms. Additionally, robust and secure data storage and management systems are necessary to support the safe collection and processing of large volumes of learning data to power the tools.

Universities will require funding to invest in cutting-edge digital tools and equipment so that they can fully utilize the power of data and AI in their research.

Achieving this will require not just substantial financial resources but also cohesive strategizing and cooperative efforts. Understanding where the need is and finding the most cost-effective ways to build, maintain and upgrade the infrastructure are essential. Governments should explore opportunities to leverage support from international development

partners, like the Edison Alliance, and global technology providers, many of whom are committed to helping bridge the digital divide. Collaborating with such partners can help share the financial burden of infrastructure development, provide access to greater capabilities, leading-edge technology, and bring in best practices to support educator training and capacity-building. These partners can also help countries to scale their digital and AI education initiatives, benefiting more students in a shorter timeframe.

Emerging economies have an important opportunity to bypass traditional, linear educational development models and move directly to modern, AI-enhanced systems that offer higher efficiency and better outcomes. Once their schools have connectivity and devices, these countries can implement the latest educational innovations from the beginning, avoiding outdated methods and benefiting from global best practices in AI-driven education.

Examples

In the US, the Bipartisan Infrastructure Law allocated US\$42.5b for states to roll out high-speed internet access in communities and institutions, including schools and universities.¹⁵ The Digital Learning Infrastructure and IT Modernization Pilot Program is also providing grants to eligible minority-serving educational institutions to support IT modernization.¹⁶

In Japan, under its Global and Innovation Gateway for All (GIGA) school program, the government has already delivered on its commitment to equip all schools with high-speed connectivity and every school-going child with a computer, at a total cost of JPY460b (approximately US\$3b).¹⁷

In India, only 24% of government schools had internet access in 2022. The Department of School Education & Literacy issued an advisory that directed all states and union territories to enter into a memorandum of understanding (MoU) or agreement with network provider BSNL and provide high-speed internet connections to all government schools equipped with computers.¹⁸

Step 4: Pedagogy and curriculum reform

Education departments will need to take the necessary but difficult step of adjusting school pedagogy and curricula. This adjustment is required not only to teach students about AI but also to teach with AI and impart the necessary skills to succeed in an AI-infused world. Moreover, this will not be a one-and-done exercise; curricula will need to be continually reviewed and updated to keep pace with advancements in AI.

■ Teach about AI

Incorporate AI literacy into the national curriculum, giving students a foundational understanding that will be critical in almost every workplace. The AI literacy curriculum should include the ethical and effective use of AI, helping students understand AI's role, potential and limitations. It should also allow students to experiment with AI tools in a controlled environment. This hands-on experience will help to demystify AI and enable students to understand its real-world applications.



■ Teach with AI

Embed the use of AI in teaching practices across the curriculum, including AI-powered tutoring tools that provide personalized instruction. These tools help students engage deeply with content, avoiding crutches that undermine learning, such as basic tools that merely give students the answers. The key is to prevent AI tools from becoming shortcuts. Basic AI applications that only provide answers discourage critical thinking and problem-solving. These skills are foundational for deep understanding and long-term knowledge retention. To avoid this, AI tools should be designed to prompt students to reflect, analyze and attempt solutions independently before offering hints or guidance. AI can also help students develop metacognitive skills by encouraging them to consider why they arrived at specific answers or how they might approach similar problems in the future.

■ Teach for an AI world

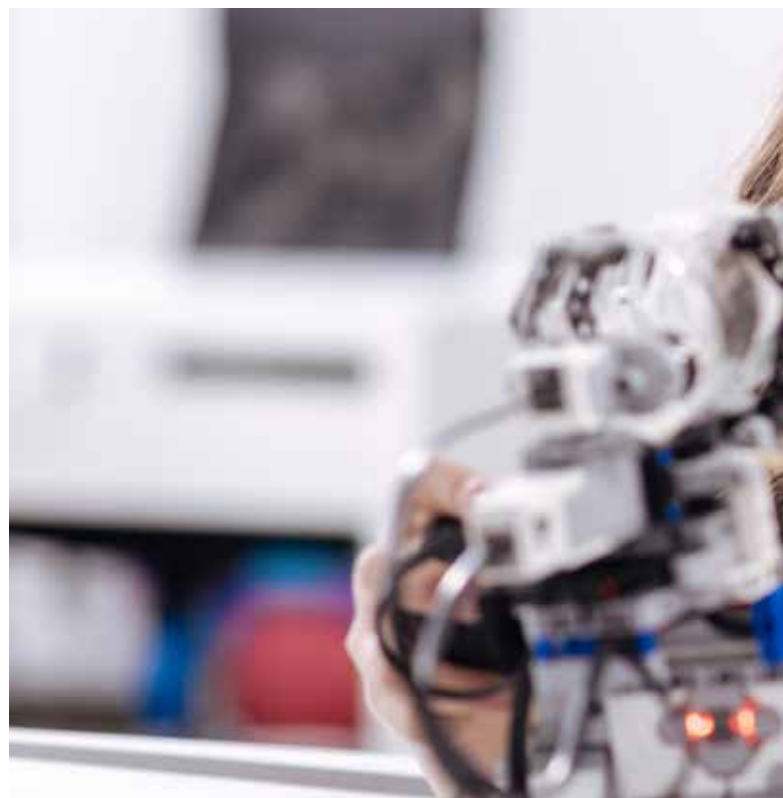
Fundamentally, it is important to rethink which knowledge and skills are necessary and what to assess students on, especially when simple recall or fact-finding is less important. Reinforce the development of complementary skills for the AI-infused digital workforce, especially those that AI cannot replace, such as critical thinking, creativity, teamwork and real-world problem solving.

As Paul LeBlanc, former President of Southern New Hampshire University, told the global EY organization in 2023: “GenAI tools are raising the question, if all knowledge is just one prompt away, do we need to test your ability to retrieve knowledge? Should we not instead focus on what can you actually do? This is fundamental and means that a good part of universities’ curricula is out of date, and the universities don’t even know it.”

The higher education sector would also benefit from national guidance on adapting to changes in the skills needed for the future of work. The World Economic Forum (WEF) estimates that 42% of current business activities could be automated by 2027, affecting millions of workers worldwide, mainly white-collar, middle-income workers.¹⁹

For example, do we need to teach coding when GenAI can write code? Or do we need to teach students how to prompt AI effectively to generate code and then assess the accuracy of the code and fix any errors? Similarly, with law degrees, students need less emphasis on memorizing case law or manual research and document-review techniques. Greater emphasis should be placed on how to use AI tools to automate manual tasks and on developing higher order skills such as interpreting and applying law or making moral and ethical judgments.

One idea for adapting higher education curricula is teaching future skills via interdisciplinary programs in existing faculties. For example, these courses might combine technical skills with humanities or social sciences, such as psychology with AI or ethics with data science. This can help in preparing students to manage AI responsibly in their chosen field.



■ Create a national taskforce to support these efforts

Pedagogy and curriculum reform is one of the least developed AI-in-education policy areas. Most of the focus to date has been on controlling the use of GenAI tools among students, with some piecemeal teaching about the safe and effective use of GenAI tools. Educators need the frameworks, training and resources to be able to adapt their curricula, teaching content and methods for an AI-infused world.

A central government task force on AI in education can help to expedite this critical step. The role of the task force is to facilitate collaboration and partnership between educators, industry and EdTech providers to create curricula, facilities and digital tools that leverage AI and provide learning relevant to future industry demands. The task force could also support research and development (R&D) and innovation to advance AI in education pedagogy, curriculum and administration.

Many governments have already set up national AI-related task forces, often to support a national AI strategy or to work on a whole-of-government application of AI. In some cases, these task forces have included representatives from academia,

industry and government to focus on the need to develop AI skills in society. However, few national task forces are specific to AI in education. In some countries, national digital education or eLearning task forces are now focusing on the use of AI in education.

Examples

South Korea has implemented AI-based systems to adapt homework and assignments based on students' educational levels and "tendencies and learning behaviors." Each child will have a personalized AI tutor and access to an online learning platform. By 2025, the country aims to have AI coursework in its national curriculum across all grade levels, starting with high school.²⁰

In March 2023, Australian education ministers established a National AI Schools Taskforce to promote the advancement of AI in education, including a draft framework for using AI in schools. The task force has representatives from all states and territories across the federal government and education leadership in the Australian government, as well as various education bodies and education research institutions.



Step 5: Professional development

All teachers across the education system (not just computer science teachers) urgently need training and support to develop AI literacy before they can benefit from AI-driven tools or adapt their teaching approaches in response to AI. The teaching profession urgently needs guidance and training on how to safely and effectively incorporate AI into learning.

In the UK Department for Education's call for evidence in 2023 on the use of GenAI in education, almost all respondents emphasized the need for some form of training for teachers and other users of GenAI in educational settings. The most requested training topics were basic digital literacy, AI literacy, safe and ethical GenAI use, alignment of GenAI with sound pedagogical practice and how to prepare for GenAI's impact on the skills students will need as they enter an AI-enabled workforce.²¹

Comprehensive training programs are essential for all educators to equip them with the necessary skills to teach students about the safe and ethical use of AI. Additionally, these trainings will help educators to integrate digital technology and AI into their teaching and working practices. Governments can partner with the private sector to develop AI-focused teacher training programs, materials and qualifications.

Examples

The South Korean Ministry of Education's Keris unit is designing and piloting extensive teacher development around AI and other technologies. The ministry's Future of Education Center provides model classrooms where visitors can experience the use of advanced technologies in education.

Luxembourg has been incorporating AI topics into teacher training courses since 2023. The National Education Training Institute has consistently expanded its offerings, including:

- Massive open online courses on demystifying AI, AI ethics and using GenAI for teacher preparation
- Tailored training courses in the use of AI for specific subjects, such as art and language
- On-the-job support from digital skills trainers²²





Step 6: EdTech ecosystem development

The EdTech sector is already developing and proliferating AI-driven tools for education. Governments have an essential role in shaping the EdTech sector to support national education outcomes. This involves establishing clear regulations and guidelines for the development and use of AI tools for education, as described in Step 1. They need to confirm that the tools developed are safe and ethical, demonstrably improve learning outcomes and promote equality and productivity.

Governments can also shape the sector by supporting innovation and commercialization and providing funding for research and development in EdTech and AI. Encouraging collaboration and partnerships between educational institutions, technology companies and industries is essential to drive purposeful innovation.

Governments should consider providing developers with strictly controlled access to their extensive learning data to train AI models. Innovation can also be fostered and directed by running competitions, supporting experiments and pilots from educators, tech providers or students, and creating regulatory sandboxes. Governments must continuously monitor the educational and societal impacts of the new technologies to determine their effectiveness and maintain public trust.

Examples

The Australian government has partnered with EdTech sector leaders and the University of Technology Sydney to launch the Australian Network for Quality Digital Education. The Network aims to leverage the potential of digital technology and AI to transform learning outcomes, particularly for students experiencing disadvantages.

The UK government is investing £4m to create a centralized repository of government documents to train AI tools. A key feature will be a “content store” that contains educational documents such as curriculum guidance, lesson plans and anonymized pupil assessments. These assets will be made available to AI companies to train their tools, ensuring they generate accurate, high-quality content and tools for use in schools.

Step 7: Training and re-skilling workers

Learners at every level and stage in their working lives will need training in digital skills and AI to enable them to adapt to workplaces being altered by AI. An investment in digital and AI skills will promote productivity and socioeconomic equality.

In addition, countries will need a pipeline of AI engineers trained in advanced mathematics, statistics and other data sciences to promote the development and application of AI-driven tools. Funding will also be necessary for researchers to conduct empirical studies on the impact of AI on educational outcomes and equity in their societies.

Examples

Singapore's National AI Strategy has identified talent and education as key enablers for AI innovation and adoption. Its multiple initiatives to uplift AI skills include the:

- AI Apprenticeship Program to identify and train AI talent and to make these skills available to industry. Apprentices are offered a three-month intensive, deep-skilling training course followed by a six-month real-world AI project.
- TechSkills Accelerator to support ICT and non-ICT professionals to upgrade and acquire new skills for the digital economy.
- Lifelong learning program, SkillsFuture, which partners with major technology companies to include AI content in its SkillsFuture for Digital Workplace program.

The Australian government is investing AUD\$44m in the three years to 2025 to establish four 'AI and Digital Capability Centres' that will connect small and medium-sized enterprises (SMEs) with AI equipment and tools, provide services and training and link them to AI skills and expertise.





A photograph of two young students, a Black boy and a white girl, looking at a tablet together. The boy is on the left, pointing at the screen, and the girl is on the right, looking down at the tablet. They are both wearing white shirts. The background is blurred, showing other students in a classroom setting.

This paper highlights the critical role of governments in leading educational transformation toward a future where technology and AI are integral to teaching and learning while enhancing, rather than replacing, human experience.

Conclusion

By embracing the strategic recommendations provided in section 4, countries across the world can help their young populations not only to be prepared to navigate the challenges of an AI-infused digital future but also to be poised to lead innovation and drive economic growth and development.

To fully harness the benefits of AI for education while minimizing its risks, governments are urged to adopt a multifaceted approach that encompasses policy innovation, infrastructure development, curriculum reform and professional development for educators. These recommendations can be summarized as follows:

1 Policy development and governance

Develop forward-thinking policies that encourage the integration of technology and AI in education. Provide appropriate AI and data governance frameworks and safeguards to promote the safe and ethical use of AI-powered tools to support national education outcomes.

2 Strategic roadmap development

Develop a roadmap for introducing AI into the education system in a deliberate and systematic way, with a focus on equitable outcomes. This will provide a clear vision, help manage complexity and reduce risks, allocate resources more efficiently, and enhance capacity-building and uptake among educators, students and parents.

3 Infrastructure investment

Facilitate equitable access to digital devices, reliable, high-speed internet and secure data platforms across all schools, eliminating the digital divide and laying the foundations for an inclusive learning environment. Consider partnering with international development partners or technology companies.

4 Teachers' professional development:

Implement comprehensive training programs for educators so that they are equipped with the necessary skills to integrate technology and AI safely and effectively into their teaching practices, while fostering continuous learning and innovation.

5 Curriculum reform

Review and adjust school and university curricula to incorporate digital skills and AI to help students become equipped for the AI-enabled digital workforce by:

- Improving digital literacy by teaching the ethical and effective use of AI
- Incorporating digital skills and the use of AI in teaching across the curriculum
- Fundamentally reassessing the knowledge and skills that will be required in an AI-powered digital workforce and how best to develop and assess those skills

6 EdTech ecosystem development

Partner with EdTech providers, academia and industry to support the development and adoption of AI-driven student-facing, teacher-assisting and administrative tools that can have a positive impact on learning outcomes, educational efficiency and learners' and teachers' wellbeing.

7 Training and re-skilling workers

Invest in training a pipeline of AI engineers to develop and implement AI-driven tools and researchers to monitor their impact. Provide re-skilling opportunities to learners throughout their working lives to enable them to continuously adapt to workplaces being altered by AI.

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