Google

November 2025

AI and the Future of Learning

Ben Gomes
Chief Technologist
Learning & Sustainability

Lila Ibrahim
Chief Operating Officer
Google DeepMind

Yossi Matias
VP & GM
Google Research

Christopher Phillips
VP & GM
Education

James Manyika
SVP
Research, Labs, Technology & Society

Abstract

AI opens up new possibilities for people to learn, access education, and follow their curiosity. It can also help address critical challenges, including concerning trends in learning outcomes, immense pressure on educators, and a lack of access to quality education in many communities.

Google believes that by supporting teachers and personalizing learning, AI can help unlock human potential all around the world. While human relationships will always remain central to teaching and learning, we see tremendous opportunity for AI to support Google's mission to make the world's information universally accessible and useful. At the same time, AI presents urgent challenges and unknowns that society must collectively reckon with. Our goal is to help improve learning outcomes by developing AI products that are grounded in core learning science and in close partnership with the education community — because the greatest potential of AI is helping everyone reach theirs.

Learning Matters

Learning is the bedrock of human potential and societal progress. It equips us with new skills, sparks curiosity and the exchange of fresh ideas, spurs innovative breakthroughs, and drives economic growth.

New technologies have always been a force to expand society's knowledge, as well as accelerate, challenge, and ultimately reshape how we learn and what we know. From the invention of the printing press to the vast expanse of the internet, advances in technology have helped to democratize access to information and opportunity, pushing the boundaries of human potential. Learning, while lifelong, is especially rapid in early childhood — both within and outside of formal education settings.

Curiosity and the desire to learn are human nature, and today, learning opportunities are accessible to more people than ever before.

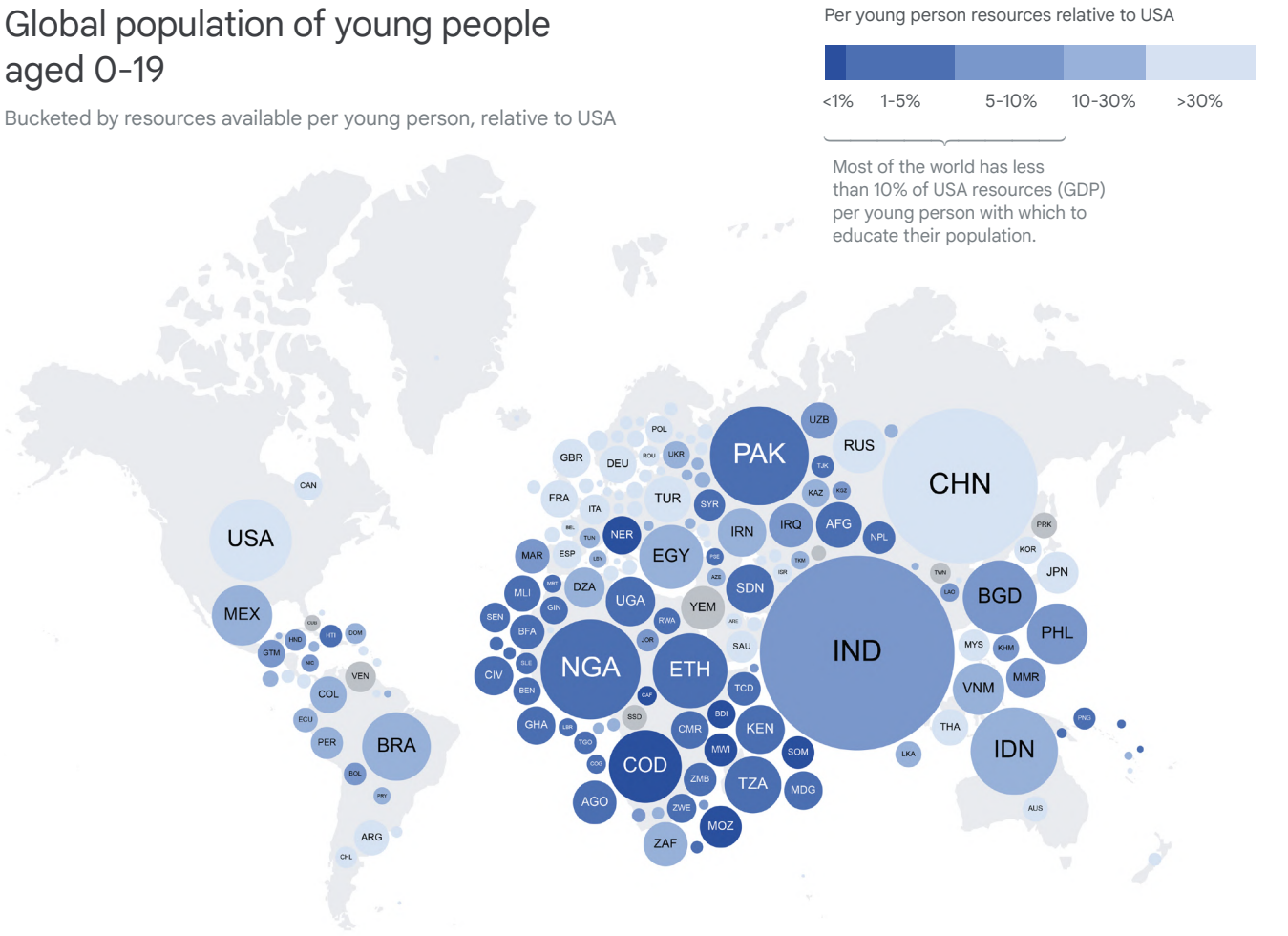
A brief history of education: Where we started, where we are

Historically, formal education was exclusive: limiting the path to opportunities to a select few. As a result, many efforts have focused on widening access, with a long arc of progress from royal tutors (effective, personalized, but inaccessible), to the industrial model of education (a powerful tool for expanding access and literacy, but not personalized), to recent education technologies that have allowed teachers to reach learners beyond their classrooms.

The world has made huge strides in access. 90% of primary school-aged children globally are enrolled in school and approximately 87% complete their primary education. However, challenges remain, including uneven access to education, differences in education quality, limited content availability across languages, as well as low and unequal learning outcomes.

Global population of young people aged 0-19

Bucketed by resources available per young person, relative to USA



Resources defined as 2023 GDP at PPP, from World Bank; young person defined as aged 0-19, from UN. Grey circles have no GDP data available.

Making good on the promise of education means ensuring all learners reach proficiency while supporting their potential and well-being at every level. Public education systems face significant strain as a result of inadequate funding, the continuing impact of pandemic-era learning loss, disruption from global conflicts, teacher turnover and shortages, student attendance and mental health challenges, and persistent socio-economic disparities.

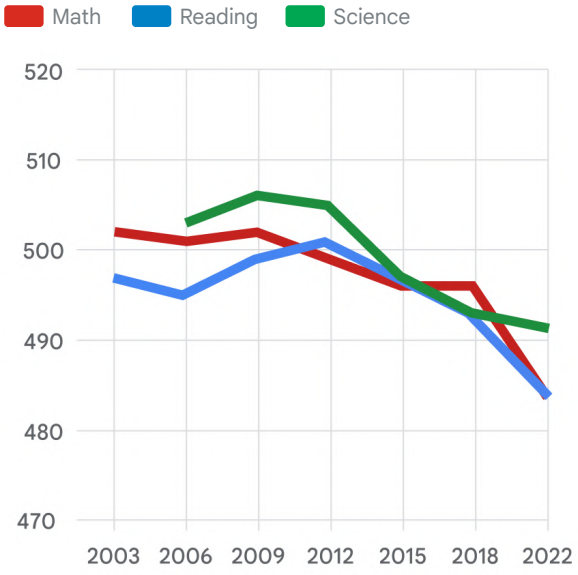
These interconnected factors are compounded by the need to constantly update curricula to prepare students for the demands of a changing world.

According to the OECD's Programme for International Student Assessment (PISA), global learning outcomes have declined over the last two decades. Results from the 2022 PISA survey, which captured data from 81 countries and economies, noted an "unprecedented performance drop" with mean performance in mathematics down by 15 points and reading down by 10 points compared to 2018. Challenges are being seen in developed and developing countries alike. And despite positive trends in enrollment, 272 million children remain out of school (11% of children in primary, 15% in lower secondary, 31% in upper secondary). As the school age population of low- and middle-income communities continues to grow, experts estimate the world will need 44 million more teachers by 2030 to provide universal primary and secondary education, including in places that already face meaningful barriers to fully supporting their existing students.

It is not easy to keep up with the accelerating demands of a rapidly changing world. Today's jobs demand not just foundational skills, but advanced problem solving, collaboration, and the ability to learn throughout life. The emergence of AI marks another period of profound transformation — the opportunity to rethink how education should adapt to both the opportunities and the challenges ahead. As educational systems grapple with the question of what it means to be well educated in a world where AI is ubiquitous, students will need a new set of skills to prepare for the future.

Trends in mathematics, reading and science performance

PISA test scores, OECD average



Source: OECD (2023), PISA 2022 Results (Volume I): The State of Learning and Equity in Education.

Learning, teaching and education are universal in human societies

Learning: The acquisition and retention of information, representing a shift in what an individual knows or can do.

Teaching: The process of helping someone else learn. This happens in both formal education and outside of that process.

Education: The bundling of teaching and learning in a structured setting alongside a relatively consistent curriculum. This often ends with a formal recognition of completion. For simplicity, we use the term teacher to indicate an educator in this type of formal setting.

Though focused on primary and secondary education, this paper's discussion of opportunities, limitations, and future exploration is relevant to all ages.

Note: AI is a broad term encompassing a wide range of technologies, including predictive models, generative AI rooted in large language models, and general intelligence. Throughout this paper, we use the term AI to talk about the category as a whole.

Opportunities: AI's Promise for Learning

Advances in AI, such as large language models, present new opportunities to equip learners with the skills they need for success. While the internet removed barriers to accessing information, AI increases our ability to understand and apply that information. This leap from passive consumption to active, deep understanding is a profound change that is revolutionary for education. AI can expand teaching and learning by modifying content to be more engaging and interactive, simplifying complex topics, and enabling deeply personalized learning at scale.

Education systems have always faced a core challenge: limited resources.

Ideally, every student would spend ample time working in their zone of proximal development– the sweet spot of "just right" learning challenges that lead to new skill growth. But because student needs vary so widely, traditional education cannot always provide this personalized support to everyone.

While AI is by no means perfect, it does have the potential to reduce barriers and allow people to learn more effectively than before. For students, AI can help create individualized learning paths and offer extra help, whether or not they have the support of an educator. For educators, AI can serve as a teaching assistant that supports their workload and enables new approaches, ultimately freeing up more time for the essential human aspects of teaching. It is critical that AI-powered learning tools are developed and supervised by experts and educators to ensure they reflect learners' needs and provide effective, evenly distributed pedagogical benefits.

Technologists have made similar promises about access and personalization during prior waves of education technology — and while some were met, many were not. These cycles did, however, offer valuable lessons about what works (and what doesn't) in education technology, including that technology alone cannot solve deep-rooted challenges, that it must be designed with and for the students and teachers it intends to reach, and that users must be equipped with the knowledge around how to implement new tools in meaningful ways.

AI is far more powerful than past innovations, offering truly transformative possibilities. However, turning AI's promise into reliable, everyday practice will require both time and intentional effort.

"While AI is by no means perfect, it does have the potential to reduce barriers and allow people to learn more effectively than before."

How AI can transform learning

01
Unlocking the power of learning science

AI promises to bring the very best of what we know about how people learn (learning science) into everyday teaching, and may even identify new frontiers for education research.

When designed and implemented correctly, AI systems can embody the proven principles of learning science: including sparking active participation, encouraging deep practice and review, and weaving in the benefits of spaced repetition. This can enhance learning effectiveness and efficiency, leading to more breakthrough moments for more students. AI systems that are explicitly fine tuned for these purposes can create new, scalable learning activities and assessments that were previously impossible. For educators, these tools can lighten the burden of implementation, making powerful teaching strategies more accessible and achievable in less time. For students who choose to engage, AI moves them from passive consumption to active application — becoming a catalyst for curiosity, more meaningful learning, and assessments that feel less like memorization tests and more like opportunities to demonstrate knowledge.

The potential goes even further: AI can help us deepen our understanding of learning itself. By analyzing patterns of student engagement, motivation, and "aha" moments, we can uncover new insights into how curiosity grows, how persistence takes root, and how learning flourishes across different contexts. Perhaps learning alongside AI may reveal entirely new facets of skill development and human growth potential — reminding us that learning is not just about knowledge transfer, but about expanding the boundaries of what is possible.

02
Personalizing teaching and tutoring

The goal of personalization isn't new, but AI opens up new ways to bring it to life at scale. What was once an aspiration may now be possible.

While structured education has had success in teaching large groups, it often struggles to meet the diverse needs of individual students. AI may ultimately allow every learner to take a truly individualized learning journey, realizing the promise of personalization like never before.

AI can give educators tools that can adapt lesson content to a student's specific needs and goals — providing tailored feedback and identifying knowledge gaps that hinder layered learning progress. It can also adjust based on a student's context, like whether a teacher is present, what the subject is, and what has been learned before. Educators can receive insights into student progress and learning gaps, enabling more personalized and focused support while reducing cognitive load. This can help target learners at the right level to close understanding gaps and help ensure that learning differences (including neurodivergence) do not determine one's potential for success.

Outside the classroom, lack of foundational knowledge, study skills, motivation, or means can all present barriers for studying or completing homework; as can simply finding someone to help you when you're stuck. AI can serve as an inexpensive, non-judgemental, always-available tutor. There is rigorous evidence that "high-dosage" personal human tutoring has one of the largest positive impacts on student achievement, with consistently significant effects on students from families with low incomes[1,2,3,4]. While AI tutors cannot replace the human element of great teaching or tutoring, they can be a complement or bridge when human support is unavailable. As AI tutors become more widely used, it will be important to understand how much of the benefit from tutoring comes from the opportunity to work within the proximal zone of development with a knowledgeable (potentially AI) coach versus the power of human connection (such as the natural desire to connect with someone who cares about you).

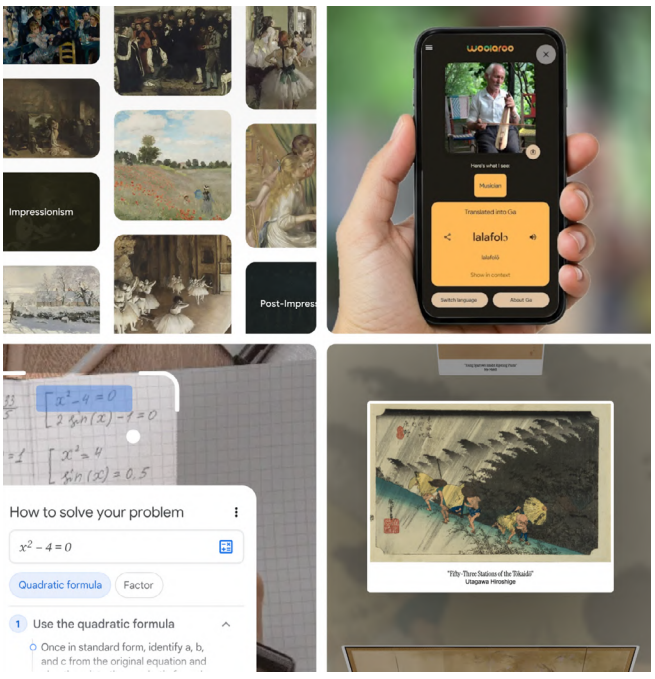
03
Make (almost) anything learnable

We live in an age of information abundance. In order to be understandable, information needs to be available and approachable.

People are most curious about things that they feel are learnable, or that they are on the verge of understanding. AI can strip away jargon and adjust explanations and delivery modes to a learner's background and preferences — helping students spend more time in their zone of proximal development.

The core school curriculum is well covered with expertly produced content, but quality options fall off rapidly when moving into more specialized subjects. AI opens up new opportunities for people to learn and retrain throughout their lives, especially for niche interests and changing job market demands.

Whether it's connecting academic concepts to real-world applications or bridging the gap between new information and prior knowledge, AI tools can help make learning more exciting – fostering intrinsic motivation and sparking curiosity and exploration.



From left to right, top to bottom: Explore the Musée d'Orsay, Paris with Google AI, Woolaroo, Google Lens, Moving paintings.

04
Removing barriers to learning

Everyone deserves access to quality learning experiences and the skills and tools needed to build the future they envision for themselves.

For the majority of human history, access to knowledge and information was a critical barrier to learning. While the printing press and internet have improved access in recent history, information is still not universally available. Some of this remains an infrastructure challenge, but barriers exist even for those with internet access: a scarcity of content and learning opportunities in one's native language, content format limitations, and content unsuitable for different learning levels. AI has the power to help in all of these respects by transforming content into new, more accessible forms, and delivering content at the right level to close learning gaps.

Millions of learners still lack access to formal education or sufficient time with a teacher, or face challenges from physical or learning disabilities. AI has the potential to deliver quality learning experiences — making the world's information more suitable to individuals' needs.

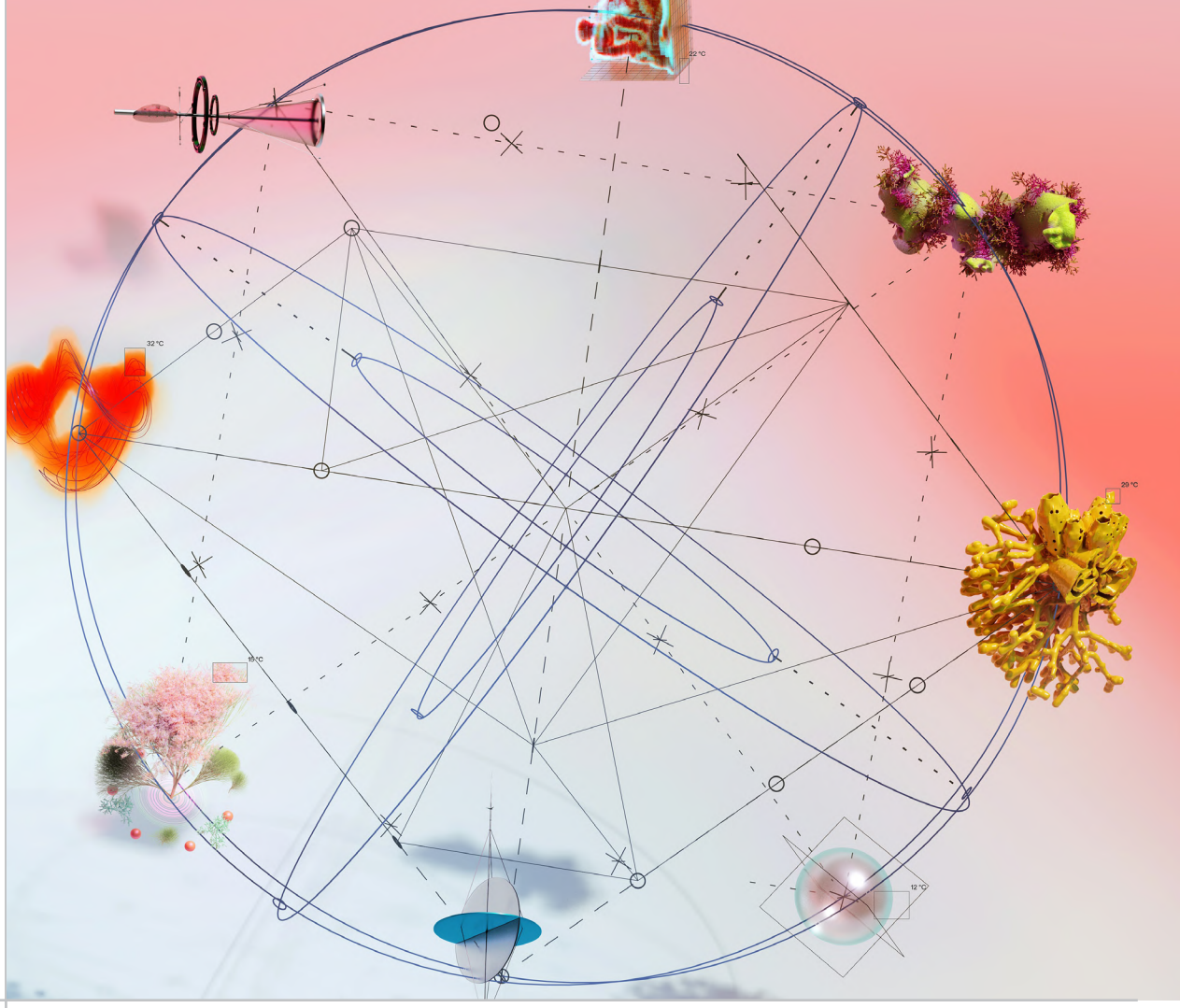
AI may not only raise the ceiling for those who have educational support today, it will also significantly raise the floor for learners across the globe.

05
A helping hand for busy educators

AI can become a powerful teaching assistant, freeing up precious time for teachers to focus on meaningful human and social interaction with students.

AI can assist busy teachers across a range of areas, spanning from deep research and content creation, to activity planning and administrative tasks. Separately, AI can also assist by enabling new forms of instruction or assessment. This can include AI-led group breakouts that drive active student learning, adaptive real-time feedback for multiple students at once, or open-ended debates that evaluate arguments and push the frontier of a student's understanding.

This assistance can both help students fill gaps in their learning and enable teachers to spend more time with students. Most importantly, AI can help teachers get back to doing the job they signed up for, focusing on the important human aspects of teaching: helping their students learn how to learn, inspiring their interests, fostering connections, and developing them as curious and well-rounded individuals.



Challenges: Important Areas to Address

Like all major technological shifts, AI introduces new challenges. Some are familiar, such as protecting privacy and preventing exposure to inappropriate content, while others are specific to AI's capabilities. While these challenges vary tremendously across global settings, and manifest differently across primary, secondary and higher education levels, they must be confronted head-on. Questions of this nature - and magnitude - are best answered together, and help us make progress as a society.

01 Accuracy and objectivity

A primary concern is that AI models can "hallucinate" and produce false or misleading information, similar to human confabulation.

While hallucination rates have fallen sharply in the past two years as models are trained to use trusted sources and verify the outputs, a harder challenge remains: determining which sources are trustworthy and how to handle subjective questions. This is particularly challenging given the biases in global data.

AI also needs the right tone and must avoid confirming incorrect assertions and providing excessive praise. It should challenge a student's misconceptions and correct inaccurate statements, not simply act as an uncritical mirror that reinforces them. This is important both in ensuring accuracy, but also in maintaining educational motivation and self-regulation.

This is an area of deep importance to Google, and while no system is perfect, we have made meaningful progress with each new model release, and continue driving the industry forward with new benchmarks. By carefully and responsibly building and deploying AI models, we aim to manage these risks as we have for our other businesses, like Search, since our earliest days.

02 Safety

Safety is a major concern for users of all ages, but there is a heightened responsibility to protect younger users. Key risks focus on content or interactions which may pose physical or psychological harms.

A layered safety strategy, including age-appropriate AI literacy and content filters is essential, but will need to evolve as fast as the technology does.

Google's commitment to safety is underpinned by extensive testing and continuous expert consultation. We conduct rigorous user and adversarial testing, including "Red Teaming" exercises and child safety-focused sprints, specifically designed to identify vulnerabilities and build strong safeguards against harmful content. Our comprehensive policies and safeguards were developed by Google's dedicated in-house specialists, with continuous guidance from third-party child development experts.

Educational institutions tasked with keeping student information secure must also be good data stewards – for example, by omitting personally identifiable information from prompts when using AI to help build a personalized student plan. Google has implemented specific privacy protections tailored to the under-18 demographic, recognizing their vulnerability and higher propensity to share highly personal information.

03 Critical thinking

A common discussion centers on whether students might "offload" too much thinking to AI, leading to "metacognitive laziness," and causing them to lose the ability to engage in deep learning.

The real opportunity, therefore, is to design AI that promotes — not replaces — deep thinking, such as through question-led tutoring that prompts reflections or asks for explanations.

As educational psychologist John Sweller's Cognitive Load Theory reminds us, the goal is not to maximize struggle, it's to focus effort on the mental work that matters. Unproductive struggle, like no struggle at all, isn't always good for learning. In some situations, AI can help by reducing unproductive loads, such as the "split-attention" and "modality" effects, by making sense of fragmented or overwhelming text and images. A student's energy can then instead be channeled into higher-order reasoning and problem-solving.

The key question becomes: How do we ensure AI tools are used to expand curiosity, creativity, and analysis, rather than shortcut them? Much of the answer lies in human relationships. Motivation to pursue difficult thinking often depends on the encouragement, challenge, and social dynamics of teachers and peers — something no AI can fully replicate.

With intentional design and use, AI could help free more teacher time for these essential relationships, while also scaffolding learners to engage in complex reasoning on their own. At Google, the aspiration is to build tools that not only support teachers in this way, but also give learners agency in their learning, while guiding them into learning journeys that demand perseverance, reflection, and critical thought.

04
Cheating and learning loss

Surveys suggest that some students use AI in ways that many would consider to be cheating[5,6]. However, there is also little consensus on where exactly to draw the line between effective tool use and cheating[7,8], not least because educators have differing views on where AI use should be encouraged versus prohibited and because the appropriate use of the technology is still being determined.

As a result, there are mixed perspectives on whether the *overall* rates of cheating are higher than in the pre-LLM era. As with all new tools it will take time for new norms to be established in response to this new reality. Within this debate, it is also important not to frame cheating solely as "individual bad decisions" that require policing; but also to recognize it as a collective action problem that comes down to how we design institutions and assessment processes so that students are encouraged to learn, and to help them realize when they are actually learning, versus merely feeling like they are learning.

Redesigning assessments for an AI-enabled world could include a shift toward forms of evaluation that AI cannot easily replicate, such as in-class debates, portfolio projects, and oral examinations. We see educators starting to do this today, often starting from a desire to make previous assignments "AI-proof", but resulting in something new and exciting. As educational institutions grapple with this topic, Google is exploring tools that can support schools as they adjust their curricula and assessments. We hope our experimentation in these areas, such as developing AI tools that can help scale oral assessments or enable students to show their work, can be beneficial.

05
Equal access

Ensuring that the benefits of AI are widely distributed requires tools that are accessible, affordable, and culturally and linguistically relevant.

As noted by Mary Burns in her research for UNESCO, traditionally the introduction of new digital technology into education often creates a stratification where the wealthiest students might gain access to newer forms of online learning, while poorer students often continue to rely on older technologies, like radio or TV, or nothing at all.

These inequities could also play out for AI use, which requires, in the first instance, that students can access a device. More formal plans to adopt AI in schools also require qualified educators with the training, time, and support to implement them.

However, the picture is nuanced. The overall rates of AI use are remarkably high in certain middle-income countries and some education researchers are prioritizing low-income countries to study the effects of AI tutors, with some cautiously positive early results.

AI models are disproportionately trained on content from a small number of languages, but they can also translate English-language content very effectively, including across sign languages and other forms of augmentative and alternative communication.

Irrespective of income, region, or language, the primary challenge may be the "5% problem" — the possibility that the students who most productively engage with AI will be those that are already highly motivated students. In evaluation studies, such students are also more likely to use AI tools "as intended" and may form the basis of the studies' results, creating a biased view of what the tools can do for the broader population of students. Everyone should have support to use AI meaningfully and safely for educational purposes, and an understanding of when and how to responsibly use AI.

Google's mission to make information universally accessible has always relied on global partnerships to elevate quality content and bring connectivity worldwide. That commitment remains critical with AI. We are investing to ensure our models are trained on varied and global sources from the ground up, helping reflect many cultures and contexts. An AI that truly learns from the world provides a better, more helpful offering for everyone.

Underpinning all challenges: How will learning evolve in a largely unpredictable future?

As we explore how AI can augment existing educational processes, we are also cognizant that both the technology and its impacts on education are changing fast, and that this is likely to continue.

Education serves many purposes, from expanding personal agency to fostering shared culture, but in practice it is often judged by how well it prepares people for work. When new technologies affected employment in the past, they typically led to an increase in aggregate employment, albeit not always immediately. How AI will affect employment remains highly uncertain. However, as with past technologies, the effects are unlikely to be uniform. Those with certain skills are likely to do better than others, for example, in terms of job opportunities, promotion prospects, and wage growth.

These shifts, and the broader uncertainty, make planning difficult for educators who must look beyond today's labor market to anticipate the skills tomorrow's economy will demand. This is further aggravated by the challenge of an increasingly specialized economy, where many skills are not easily transferable. Today's learners need critical thinking skills coupled with domain knowledge, thereby building both expertise and adaptability as the careers of tomorrow continue to change. Educators and policymakers, meanwhile, should prioritize building systems to support a resilient labor force that can evolve as jobs do. While AI presents challenges, it also presents new opportunities for acquisition and instruction of new skills throughout life.

In the face of these opportunities and challenges, this inflection point in technology is a moment to recognize some fundamental questions about learning and education that we must collectively reckon with.

Google is talking to researchers and practitioners across the world in education, nonprofits, and government to share our perspective, receive feedback, and hear from others. While none of these questions can be solved by a single company, country, or solution, we remain optimistic about the possibilities, and hope to continue partnering with experts across the ecosystem as we work together to cross this unpredictable terrain.

There are many questions underlying how learning will evolve

- Will AI change what we need to learn or even what it means to learn?
- How might the success criteria for individual and collective learning shift?
- How might historical forms of evaluations and assessments change due to AI?
- How will the nature of teaching evolve?
- How effective can AI be for learners without the full context that a teacher or parent has?
- How can AI facilitate new types of learning previously not possible?

Societal evolution and continuous technological improvement

As advanced and prevalent as AI has already become, it is still in relatively early stages. The technology will continue to improve rapidly, becoming more generally capable and useful. As this happens, the biggest AI breakthroughs won't necessarily be technical, but societal — less about the technology itself, and more about the interaction between AI and the people who use it.

When AI becomes more present and useful in our daily lives, we will start to pivot from awe and anxiety about the technology happening to us to understanding how society can shape and steer its development so that it can help us. Crucially, the process must be collaborative, involving experts, users, and researchers early on to ensure AI is created in a way that is aligned with human interests and goals.

Our Work on AI in Learning

At Google, our mission has always been about organizing the world's information to make it universally accessible and useful — and supporting learning is a fundamental way we do that. For two decades, we've had the privilege of working with educators to develop helpful tools. Today, we're continuing our close partnership with education experts, teachers, parents, and student communities as we explore how AI can best support learning while mitigating new challenges.

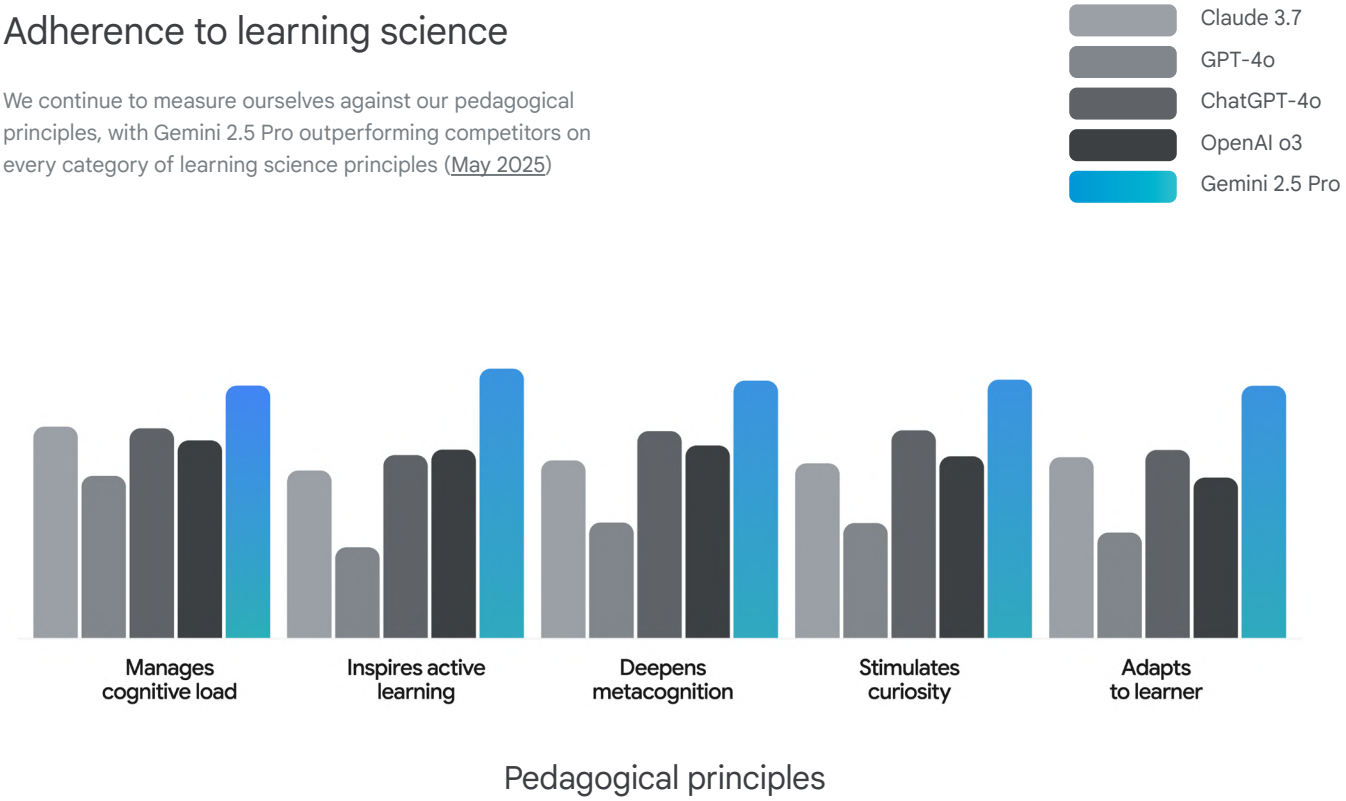
AI that is grounded in the science of learning

We are developing AI models like Gemini specifically for learning, grounded in pedagogical principles. This philosophy is at the heart of our LearnLM efforts, which are now infused directly into all our Gemini models — making Gemini 2.5 Pro the world's leading model for learning. This work is guided by our collaboration with experts in education, including institutions like Columbia Teachers College, Arizona State University, NYU Tisch, and Khan Academy, and reflects years of partnership to research and improve how AI can support effective learning practices.

We believe that more access to technology isn't the same as more learning. Our focus is on making sure all of our models are designed to enable true learning, not shortcuts. While our products can provide answers when requested, we strive to offer pathways for exploration, help people identify knowledge gaps and expose any important holes in their foundation, and spark their curiosity and motivation to learn more.

Adherence to learning science

We continue to measure ourselves against our pedagogical principles, with Gemini 2.5 Pro outperforming competitors on every category of learning science principles (May 2025)



New possibilities for personalized learning

Since true understanding goes deeper than a single answer, we see opportunities for AI to support new kinds of learning experiences.

We are exploring ways to further personalize learning across many Google platforms, including Search, YouTube, and Gemini, as well as standalone learning tools like Classroom.

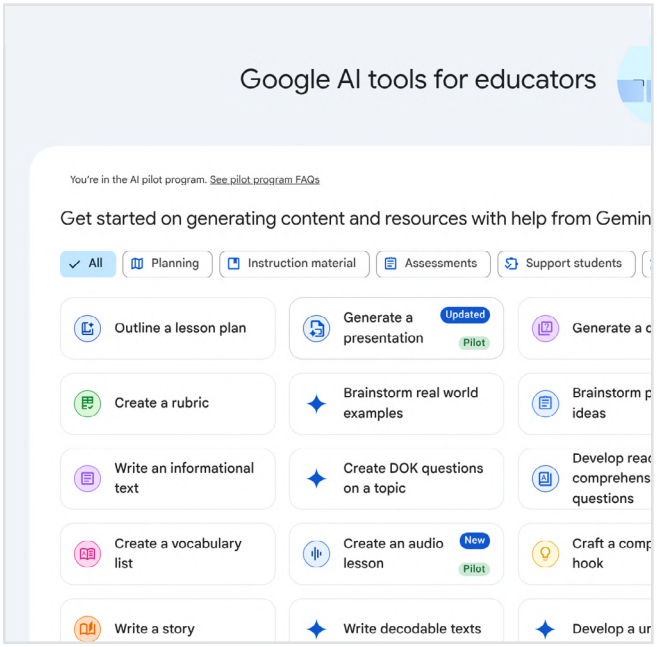
We also want to give learners the choice between receiving an immediate answer or being tutored in a more guided way. With features like Guided Learning, we've seen that learners often choose a more intellectually challenging, but also more enriching, conversational path.

To help learners go deeper, AI can act as a partner for conversation, explaining concepts, untangling complex problems, or checking work. On YouTube, for example, students can ask clarifying questions while watching academic videos. For synthesis, tools like NotebookLM can help learners find connections between study materials and their own notes. To foster exploration and personalization, we are experimenting with tools like Learn About that allow students to dive deeper into any topic they're curious about, and Learn Your Way which transform educational materials into a more personalized, effective, and engaging learning experience.For creativity and creation, Gemini Canvas enables students to build their own apps and platforms with no code. For personalized help, Exam Prep on Search and Gemini can customize practice questions to a student or educator's curriculum or content — and offer follow-up questions based on performance.

Supporting educators

We aim to support busy educators by providing no-cost AI tools through Gemini for Education and Google Classroom. These tools are designed to help with lesson planning and other classroom workflows, freeing up time for what matters most to teachers: building meaningful relationships, offering targeted support, and inspiring students' innate curiosity. Together, we are exploring how AI can be used to rethink traditional homework assignments and formative and summative assessment.

Beyond the classroom, we are committed to building capacity and supporting the broader ecosystem. In an AI era, this includes building on our longstanding history of philanthropy and training, offering a range of no-cost offerings for students and educators, ensuring our tools are available in over 100 languages; and supporting different modalities of learning that are accessible and helpful, whether through text, picture, video, or interactive experiences.



Example of no-cost Classroom AI tools for educators to discover starter ideas to create and transform content with Gemini, specifically designed for learning use cases

A commitment to collaboration

We believe the promise of AI can only be achieved through active collaboration with the entire education community, and we're proud of our long history of working with a wide range of partners, from school districts and universities to policymakers, students, parents, tech providers, and nonprofits.

Our products are designed to support learners and educators in setting their own goals and maintaining ownership over their learning. This means involving practitioners and taking responsibility for how these tools are used, especially where AI can be used to bypass traditional instruction.

We must also carefully consider the appropriate age and context for students to learn about and use AI, as a "one size fits all" approach is unlikely to work across different settings.

We are committed to a research- and evidence-based approach, using pilot studies, randomized controlled trials, and partner-led evaluations to understand AI's impact on teaching and learning. We will continue to build, learn, and iterate together, shaping our technology with input from trusted experts to advance learning in positive ways.

Conclusion

At Google, our work in learning and education is driven by a respect for both the art of teaching and the science of learning.

We have a desire not to replace instruction, but to help human curiosity reach new heights. We see this as a continuation of our work over the last two decades. For learning and education, the greatest potential of AI is helping everyone reach theirs.

Contributions and Acknowledgements

Authors: Ben Gomes, Lila Ibrahim, Yossi Matias, Christopher Phillips, James Manyika

Google Contributors: Mike Fleming, Amira Fouad, Brigitte Hoyer Gosselink, Conor Griffin, Yael Haramaty, Maureen Heymans, Stacy Karol, Andrew Kim, Jason Mothersill, Matthew Richardson, Miriam Schneider, Maggie Shiels, Julia Wilkowski

External collaborators: We appreciate the insights from those who read and offered feedback on early drafts of this paper, including Shabnam Aggarwal, Senior AI and Edtech Advisor at Gates Foundation; John Bailey, Nonresident Fellow, AEI; Isabelle Hau, Executive Director, Stanford Accelerator for Learning; Jeremy Roschelle, Co-Executive Director, Learning Sciences Research at Digital Promise; Clay Shirky, Vice Provost for AI and Technology in Education, New York University; Pia Rebello Britto, Global Director Education & Adolescent Development, UNICEF; Whiteboard Advisors

End notes

1 Luke Kohlmoos and Matthew P. Steinberg. "Contextualizing the Impact of Tutoring on Student Learning: Efficiency, Cost Effectiveness, and the Known Unknowns," Accelerate, https://accelerate.us/wp-content/uploads/2024/05/Accelerate-Research-Report-Efficiency-and-Cost-Effectiveness-1.pdf, May 2024.

2 Roland G. Fryer, Jr. "The Production of Human Capital in Developed Countries: Evidence from 196 Randomized Field Experiments," NBER Working Paper 22130, https://www.nber.org/system/files/working_papers/w22130/w22130.pdf, March 2016.

3 Allie Pearce and Paige Shoemaker DeMio. "Scaling Up High-Dosage Tutoring Is Crucial to Students' Academic Success," Center for American Progress, https://www.americanprogress.org/article/scaling-up-high-dosage-tutoring-is-crucial-to-students-academic-success/, January 18, 2024.

4 Andre Nickow, Philip Oreopoulos & Vincent Quan. "The Impressive Effects of Tutoring on PreK-12 Learning: A Systematic Review and Meta-Analysis of the Experimental Evidence," NBER Working Paper 27476, https://www.nber.org/papers/w27476, July 2020.

5 Colleen Flaherty. "Survey: College students' views on AI," Inside Higher Ed, https://www.insidehighered.com/news/students/academics/2025/08/29/survey-college-students-views-ai, August 29, 2025.

6 C. Edward Watson, Lee Rainie, AAC&U, and Elon University's Imagining the Digital Future Center. "Leading Through Disruption: Higher Education Executives Assess AI's Impacts on Teaching and Learning," AAC&U / Elon University, https://imaginingthedigitalfuture.org/collaborations/ai%20higher%20ed%20survey%20jan2025/, January 2025.

7 Justin Reich. "What past education technology failures can teach us about the future of AI in schools," The Conversation, https://theconversation.com/what-past-education-technology-failures-can-teach-us-about-the-future-of-ai-in-schools-265172, October 3, 2025.

8 Alyson Klein. "Schools Are Taking Too Long to Craft AI Policy. Why That's a Problem," Education Week, https://www.edweek.org/technology/schools-are-taking-too-long-to-craft-ai-policy-why-thats-a-problem/2024/02, February 19, 2024.


Google