SALSANO INSTITUTE
Independent Research & Policy Analysis

Free Education in the Age of Artificial Intelligence

Access, Quality and Equity When Instruction Becomes Abundant

Research Report | October 2026
Salsano Institute, Programme on Education, Technology and Society

Executive Summary

For two centuries, the central question of education policy has been *who pays*. Tuition-free schooling, and later tuition-free higher education in a number of countries, expanded access dramatically, but it never solved the deeper problem of *quality*: millions of children attend school without learning the basics. Generative artificial intelligence changes the economics of that problem. The scarcest input in education, patient and personalised human attention, can now be partially supplied by software at a marginal cost approaching zero.

This report argues that AI does not make free public education obsolete; it makes it more important and changes what it must guarantee. Our principal findings are:

- **Access is no longer the main bottleneck; learning is.** Global enrolment has risen sharply, yet the World Bank estimates that roughly seven in ten ten-year-olds in low- and middle-income countries cannot read and understand a simple text.
- **Early evidence on AI tutoring is promising but conditional.** Well-designed, pedagogically constrained AI tutors have produced meaningful learning gains in controlled studies. Unrestricted access to general chatbots can produce the opposite: better homework, weaker underlying skills.
- **AI will widen inequality unless it is publicly provided.** The benefits of AI accrue first to learners with devices, connectivity, literate parents and the self-regulation to use it well. Without deliberate public provision, a 'free' AI layer will be captured by the already advantaged.
- **Teachers become more important, not less.** AI is strongest at explanation, practice and feedback; it is weakest at motivation, belonging, judgement and moral formation, which are precisely the functions that sustain learning.
- **The definition of 'free education' must expand** to include free connectivity, free access to vetted AI learning tools, and public ownership of the data and standards that govern them.

> **Core recommendation.** Governments should treat a safe, curriculum-aligned AI tutor as a public good, as they once treated textbooks and libraries: free at the point of use, publicly governed, open to independent evaluation, and deployed *through* schools and teachers rather than around them.

1. Introduction and Scope

Free education is a policy commitment with a long lineage: compulsory, tuition-free primary schooling spread across Europe and North America in the nineteenth century, was enshrined as a human right in Article 26 of the 1948 Universal Declaration of Human Rights, and became a global target through the Millennium Development Goals and Sustainable Development Goal 4, which calls for free, equitable and quality primary and secondary education for all by 2030.

Artificial intelligence, and particularly large language models capable of fluent dialogue, now intersects with that commitment in three ways. First, it offers a new instructional technology that can explain, question and give feedback. Second, it alters the labour market that education prepares people for, shifting the value of particular skills. Third, it creates new costs, dependencies and risks that public systems must manage.

This report examines the current state of free education, the emerging evidence on AI in learning, the distributional consequences of AI adoption, and the policy choices that will determine whether AI broadens or narrows educational opportunity. It focuses primarily on compulsory schooling and on tertiary education where tuition policy is contested, with attention to both high-income and low- and middle-income contexts.

1.1 Method

The analysis synthesises published research from international organisations (UNESCO, the World Bank, OECD), peer-reviewed and working-paper studies on AI-assisted learning, and documented national experiences with tuition-free policies. Where evidence is preliminary, we say so. Several of the AI studies cited are recent, small or not yet fully replicated, and readers should treat their effect sizes as indicative rather than settled.

2. The State of Free Education

2.1 The access revolution and its limits

The abolition of school fees has been one of the most reliable levers for expanding enrolment. When countries such as Malawi (1994) and Kenya (2003) eliminated primary fees, enrolment rose sharply within a single year. The same experience revealed the limits of access alone: classrooms swelled, pupil-teacher ratios deteriorated, and learning outcomes frequently stagnated or fell.

Today UNESCO estimates that roughly 250 million children and young people remain out of school, and that the world needs on the order of 44 million additional teachers to meet the 2030 goals. Yet the larger crisis lies among children who *are* enrolled. The World Bank's 'learning poverty' measure suggests that around 70 percent of ten-year-olds in low- and middle-income countries cannot read an age-appropriate text, a figure worsened by pandemic-era school closures.

> Free education has largely solved the problem of **getting children into classrooms**. It has not solved the problem of **what happens once they are there**. That is the problem AI is best placed to address, and also the one it can most easily make worse.

2.2 Tuition-free higher education

At the tertiary level, models differ widely. Several Nordic countries, Germany (which abolished state tuition fees fully by 2014) and Scotland (for domestic students) offer tuition-free public university study. Chile introduced its *gratuidad* programme in 2016 for students from lower-income households. In the United States, 'promise' programmes such as Tennessee Promise cover community-college tuition. Other systems, notably England, rely on income-contingent loans.

Model	Examples	Strengths	Weaknesses
Universal tuition-free	Germany, Norway, Finland	Simple, no debt deterrent, strong social signal	High fiscal cost; benefits partly flow to affluent families; can lead to capacity rationing
Targeted free tuition	Chile (gratuidad), US 'promise' programmes	Directs funds to lower-income students	Eligibility cliffs; administrative complexity
Income-contingent loans	England, Australia	Expands capacity; graduates pay from higher earnings	Debt aversion; political fragility of repayment terms
Free online / open provision	MOOCs, open courseware	Near-zero marginal cost, global reach	Low completion; weak credential value; favours already-educated learners

A central lesson from the open online course era is directly relevant to AI. When high-quality university courses became freely available online in the early 2010s, enrolment was enormous but completion rates were low, and participants were disproportionately people who already held degrees. **Free content did not automatically produce equitable learning.** Structure, support and motivation proved to be the binding constraints.

3. How AI Changes the Education Equation

3.1 The two-sigma problem revisited

In 1984 the educational psychologist Benjamin Bloom reported that students taught through one-to-one tutoring combined with mastery learning performed about two standard deviations better than students in conventional classrooms. Later research suggests the true average effect of tutoring is smaller, but high-dosage tutoring remains among the most effective interventions known. The obstacle has always been cost: no public system can afford a human tutor for every child.

Generative AI is the first technology that plausibly offers individualised, conversational instruction at scale. Its marginal cost per learner is small and, given trends in computing costs, likely to keep falling. Figure 1 illustrates the structural shift this implies.

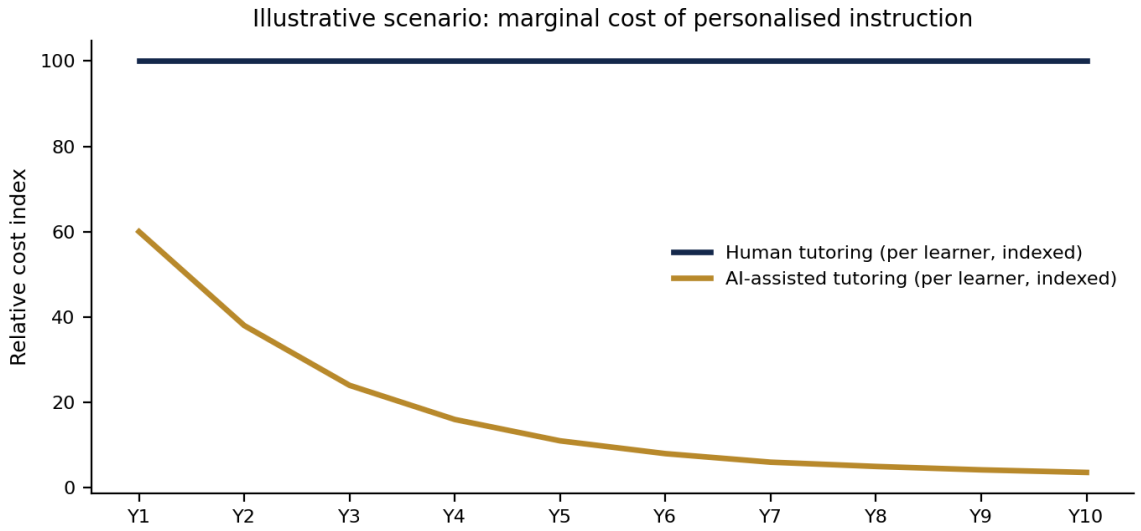


Figure 1. Illustrative scenario, not empirical data. Human tutoring costs remain roughly constant per learner; AI-assisted costs fall as infrastructure is amortised and inference becomes cheaper.

3.2 Where AI adds value

- **Personalised explanation and practice:** adapting pace, examples and difficulty to each learner, and offering unlimited worked problems with immediate feedback.
- **Language access:** instruction and materials in mother tongues and minority languages, an area where public systems have historically been weakest.
- **Teacher workload:** drafting lesson plans, differentiated exercises and formative assessments, freeing teacher time for direct interaction.
- **Accessibility:** text-to-speech, simplified reading, and adaptive interfaces for learners with disabilities.
- **Adult and lifelong learning:** retraining for workers displaced by automation, at a fraction of traditional costs.

3.3 Where AI is weak

- **Motivation and belonging:** most learners, especially children, learn within relationships. Software cannot easily replace the teacher who notices, expects and encourages.
- **Reliability:** language models still produce confident errors, which novices are least equipped to detect.
- **Cognitive offloading:** a tool that supplies answers can bypass the productive struggle through which understanding is built.
- **Values and judgement:** civic, ethical and social formation are core purposes of public education and are poorly suited to automation.

4. What the Evidence Shows So Far

Research on generative AI in education is young, and the field is moving faster than the evidence base. Nevertheless, a pattern is emerging from early controlled studies.

Study / setting	Design	Reported finding	Interpretation
Harvard University introductory physics (Kestin et al., 2024–25)	Randomised crossover; custom AI tutor vs. in-class active learning	Students using the structured AI tutor learned more, in less time, than in active-learning sessions	Pedagogically scaffolded AI can match or exceed strong human-led instruction for some content
Secondary schools, Edo State, Nigeria (World Bank pilot, 2024)	After-school programme using a GPT-4-based tutor with teacher guidance	Substantial gains in English over roughly six weeks, reported as among the more cost-effective interventions evaluated	Promising in low-resource settings when embedded in a supervised programme
High-school mathematics, Turkey (Bastani et al., 2024)	Field experiment comparing unrestricted chatbot, guardrailed tutor and control	Unrestricted chatbot improved practice scores but lowered later unassisted exam performance; guardrailed tutor largely avoided this harm	Design matters: answer-giving tools can harm learning

> **The emerging consensus:** AI improves learning when it behaves like a good tutor (asking questions, withholding answers, prompting effort) and when it operates inside a structure supervised by teachers. It can damage learning when it behaves like an answer engine.

These findings carry a direct implication for free education policy. The question is not whether learners have access to *some* AI (most with a smartphone already do) but whether they have access to *pedagogically designed* AI. Commercial general-purpose chatbots are optimised for helpfulness and user satisfaction, which is not the same objective as learning. This creates a strong case for public specification and provision.

5. Equity: Will AI Narrow or Widen the Gap?

Every previous wave of educational technology, from television to laptops to online courses, has been predicted to democratise learning. In practice, gains have tended to concentrate among learners who already had advantages. There are good reasons to expect the same with AI unless policy intervenes.

5.1 The new digital divide

The International Telecommunication Union estimates that roughly a third of the world's population, around 2.6 billion people, remained offline in 2024. Even where connectivity exists, a phone shared among a family is a very different learning environment from a personal device with reliable broadband. AI tools that require consistent connectivity therefore risk becoming another resource distributed according to household income.

5.2 The 'Matthew effect' in AI use

Using AI well requires prior knowledge (to judge outputs), literacy (to formulate questions) and self-regulation (to resist simply copying answers). These are the very capacities that are unequally distributed by family background. Without guidance, the advantaged student uses AI as a sparring partner while the disadvantaged student uses it as a shortcut, compounding existing gaps.

5.3 Private premium versus public baseline

A plausible future is a two-tier system: affluent families combine human tutors, elite schools and premium AI services, while public systems receive generic or advertising-supported tools. The historical function of free public education has been to guarantee a common baseline of quality. In an AI era, that baseline must include high-quality AI learning support, or the guarantee becomes hollow.

Risk	Mechanism	Mitigation
Connectivity gap	Learners without devices or data cannot use AI tools	Zero-rated educational traffic; offline-capable models; school-based access
Skill gap in AI use	Prior knowledge determines benefit	Teach AI literacy explicitly; guardrailed tutors by default
Commercial capture	Tools optimise for engagement or data extraction	Public procurement standards; ban on advertising and data resale for minors
Language bias	Models perform worse in low-resource languages	Public investment in local-language datasets and evaluation
Credential inflation	AI-assisted work erodes trust in grades	Shift toward supervised, oral and project-based assessment

6. The Economics of Free Education After AI

6.1 Lower marginal costs, new fixed costs

AI reduces the marginal cost of instruction but introduces new fixed and recurring costs: infrastructure, devices, connectivity, model licensing or development, safety evaluation, data protection and, crucially, teacher training. Experience with past technology programmes suggests that hardware purchased without investment in pedagogy and training yields little. Ministries should budget for the full system, not the software alone.

6.2 The labour-market argument

If AI automates a growing share of routine cognitive tasks, the returns to narrow, credential-based education may fall while the returns to adaptable, foundational capability rise: deep literacy and numeracy, scientific reasoning, communication, collaboration and the capacity to learn continuously. This strengthens the case for free foundational education and for publicly funded lifelong learning entitlements, because workers will need to retrain repeatedly over longer careers.

6.3 Why elite universities still matter: the network effect

AI can make high-quality *instruction* nearly free, but it cannot make *social capital* free. Ivy League and other highly selective universities offer something that course content alone does not: dense networks of peers, alumni, faculty and employers that shape careers for decades. These networks open doors to internships, leading firms, graduate programmes, investors and public office, often through introductions and trust rather than formal qualifications.

Research by Chetty, Deming and Friedman (2023) finds that, among comparable applicants, attending an Ivy-Plus college substantially raises the likelihood of reaching the top 1 percent of the

income distribution, of attending an elite graduate school and of working at a prestigious firm. The advantage appears to come less from better teaching than from access, signalling and connections.

This matters for the AI era for two reasons. First, as instruction becomes abundant, scarce goods such as networks, reputation and mentorship may become *more* valuable, not less. Second, a free AI tutor can close part of the knowledge gap while leaving the network gap untouched. Free education policy should therefore also address access to elite institutions themselves, through need-blind admission, tuition-free study for lower- and middle-income families (an approach several leading universities have recently expanded), transfer pathways from community colleges, and public mentoring and alumni programmes that extend networks beyond the campus.

> **Knowledge is becoming cheap; connections are not.** A complete agenda for free education must widen access both to learning and to the networks that turn learning into opportunity.

6.4 Rethinking what 'free' must cover

Historically, 'free education' meant the absence of tuition. In the AI era we propose an expanded definition that also guarantees:

- free or zero-rated connectivity for educational use;
- free access to at least one publicly vetted, curriculum-aligned AI tutor;
- free teacher training in the pedagogical use of AI;
- protection of learners' data as a public trust rather than a commercial asset.

7. Scenarios to 2035

To clarify the policy stakes, we sketch three stylised scenarios. They are not forecasts but tools for reasoning about choices.

Scenario	Description	Likely outcome
A. Laissez-faire	AI enters education through consumer products; public systems react slowly	Rapid uptake among advantaged learners; widening achievement gaps; assessment crises; commercial capture of student data
B. Substitution	Governments use AI to cut costs, replacing teachers and enlarging classes	Short-term savings; declining motivation and attendance among vulnerable learners; loss of teaching profession
C. Public augmentation	AI tutors provided as a public good through schools; teachers redeployed toward mentoring and small-group work	Highest potential for both quality and equity; requires sustained investment and strong governance

The Salsano Institute's assessment is that Scenario A is the default trajectory in most countries, that Scenario B is a real temptation for fiscally constrained governments, and that Scenario C is achievable but only through deliberate policy.

8. Policy Recommendations

For national governments

- **Declare AI learning support a public good.** Fund and procure curriculum-aligned AI tutors that are free at the point of use, ad-free and independently evaluated.
- **Augment, do not substitute.** Tie any AI investment to maintained or improved staffing ratios; use efficiency gains to expand tutoring time and teacher contact, not to cut posts.
- **Close the connectivity gap** through zero-rating of educational services, school-based access points and support for offline-capable tools.
- **Invest in language equity** by funding datasets, evaluation and models for national and minority languages.
- **Widen access to elite networks** by supporting need-blind admission, tuition-free study for lower- and middle-income students at selective universities, and community-college transfer pathways.
- **Create lifelong learning entitlements** so adults displaced by automation can retrain without tuition barriers.

For education systems and schools

- Adopt 'tutor, not answer engine' design standards: AI tools for learners should default to questioning, hinting and requiring effort.
- Make AI literacy, including verification, critical evaluation and ethical use, part of the core curriculum.
- Reform assessment toward supervised, oral, practical and portfolio-based formats that remain meaningful when AI is ubiquitous.
- Provide sustained professional development rather than one-off training.

For the research community and funders

- Fund large, pre-registered randomised trials in diverse settings, with long-term follow-up on retention and transfer, not only short-term scores.
- Measure effects by subgroup (income, gender, language, disability) so that equity effects are visible.
- Establish independent public benchmarks for the pedagogical quality and safety of educational AI.

For AI developers

- Offer education-specific models with pedagogical guardrails and strong protections for minors.
- Support open evaluation and provide affordable or free access for public education systems.
- Reject advertising and behavioural profiling in tools used by children.

9. Conclusion

Free education was built on a simple moral premise: that a child's opportunity to learn should not depend on the wealth of their parents. For most of history, the binding constraint on that promise was money for buildings, books and teachers. Artificial intelligence lowers one of those constraints

dramatically, offering, for the first time, something resembling a patient tutor for every learner.

But cheaper instruction does not automatically mean fairer learning. The evidence to date suggests that AI helps most when it is carefully designed, embedded in schools and guided by teachers, and that it can quietly harm learning when it simply supplies answers. Left to markets, AI is likely to amplify existing advantages. Governed as a public good, it could help close the learning gap that free access alone never closed.

> The question for the next decade is therefore not whether education will be transformed by AI, but **whether that transformation will be publicly shaped**. The promise of free education should be renewed for this era: not only free to enter, but free to learn, with the best available tools, for everyone.

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Note on evidence: Several AI-in-education studies cited are recent and some remain working papers; figures from international organisations are estimates and are periodically revised. Readers should consult the original sources for current values.

About the Salsano Institute

The Salsano Institute is an independent think tank advancing research in health and education, with a focus on chronic disease and free access to education. Co-founded by Sandro Salsano and a group of scientists and PhD researchers, it is supported by an initial pledge from the Salsano family and has offices in Washington, D.C. and London.