

# The Teacher's Role in a Changing Educational Landscape

**Damir Odobasic**

**Head of Music, ICT and Digital Integration**

**Shanghai United International School  
Hongqiao Campus**



# Speaker Introduction:

## MUSIC



- Head of music
- Music composer
- Accordion player

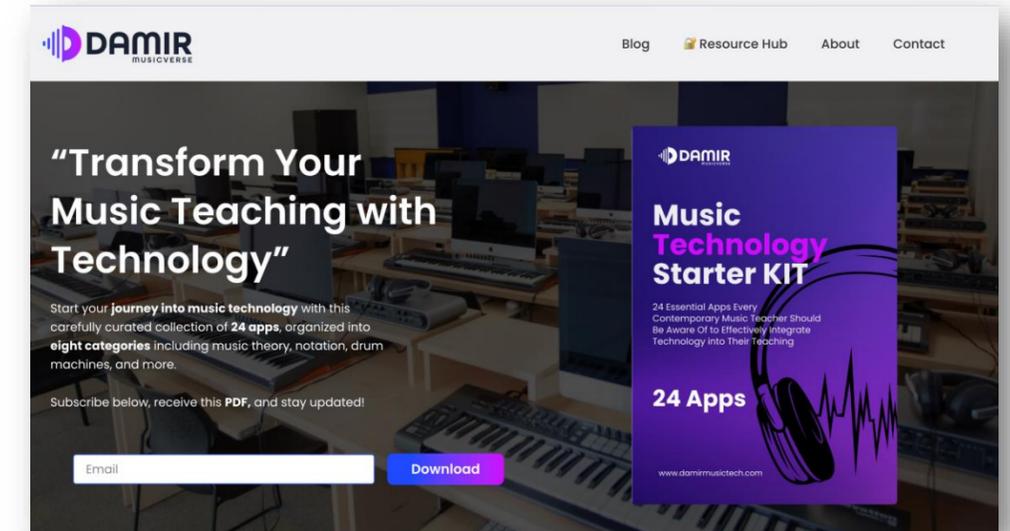
## TECHNOLOGY



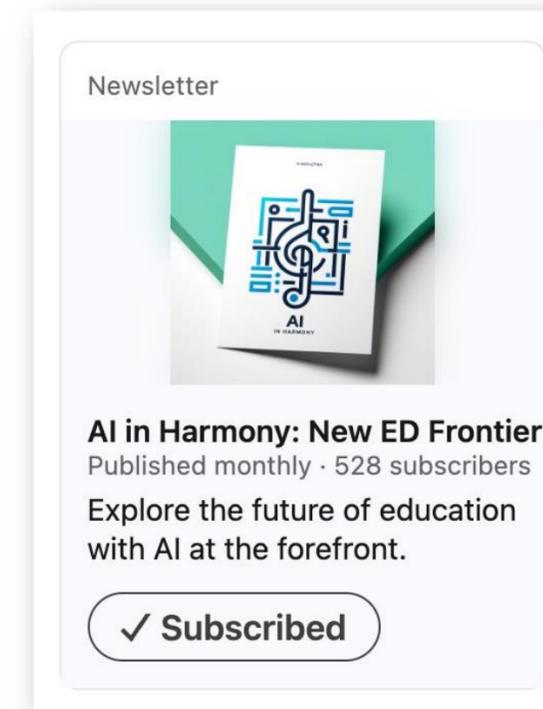
- Head of ICT
- Head of Digital Integration
- EdTech & AI advocate

**“Music & Technology merge to create my path”**

www.damirmusictech.com



LinkedIn Newsletter



## **Content:**

- **A Classroom in Transition**
- **The Cognitive Dilemma: A Rising Global Concern**
- **The Teacher's New Identity**
- **A Path Forward**

2025 AI in Action:  
The Future of K-12 Education Conference

# The Teacher's Role in a Changing Educational Landscape



**Handout**

Created By Damir Odobasic

## Presentation PDF Handout

- ✓ Presentation summary
- ✓ AI tools to explore (for teachers)
- ✓ Key research insights
- ✓ Classroom AI guidelines
- ✓ Recommended links

...and more

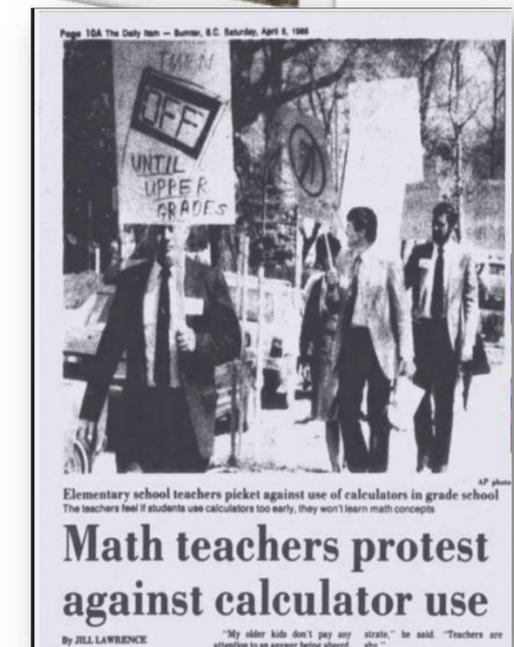
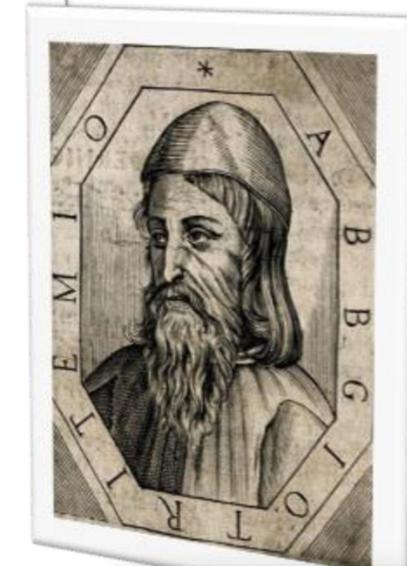
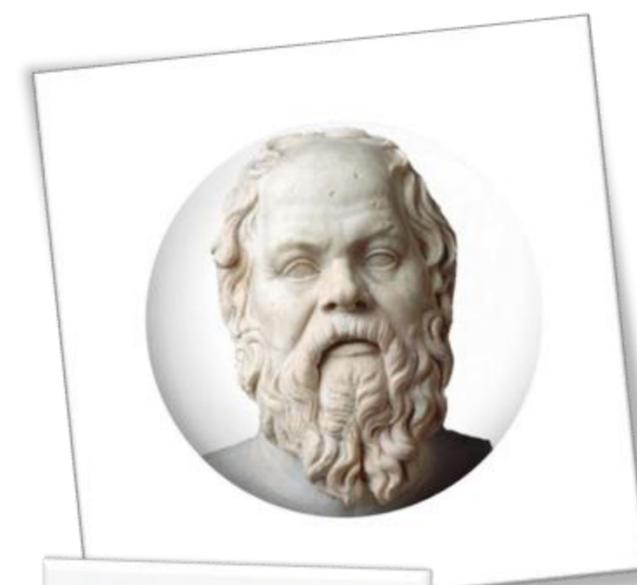


**The only constant in education is change —  
and right now, that change is exponential.**



# Technologies that affected the impact on quality of human thought.

| Technology                                                                                                  | Typical Fear                                                                                      | Historical Voice                               |
|-------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|------------------------------------------------|
| Writing (5th c. BCE)                                                                                        | People will rely on marks instead of memory and lose true wisdom.                                 | <b>Socrates</b> in <i>Phaedrus</i> (via Plato) |
| Printing press (15th c.)                                                                                    | Easy reproduction will cheapen scholarship and erode monks' disciplined study.                    | <b>Johannes Trithemius</b> , abbot & scribe    |
| Calculators (20th c.)                                                                                       | Students won't master arithmetic facts or mental math.                                            | Math classroom teachers                        |
| Internet / AI (21st c.)  | Endless information and automated answers will shorten attention spans and shallow our reasoning. | Contemporary commentators                      |



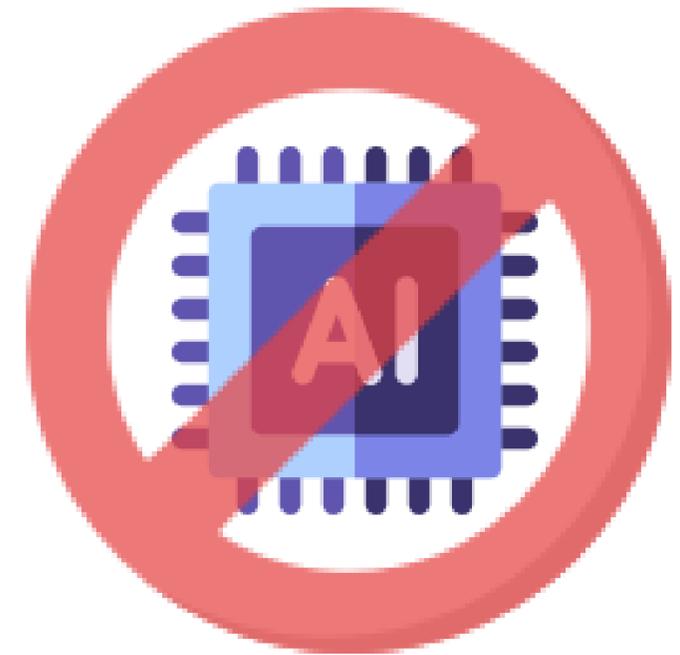
## Pair & Share

What do you consider as  
the greatest challenge  
when integrating AI into  
your work?

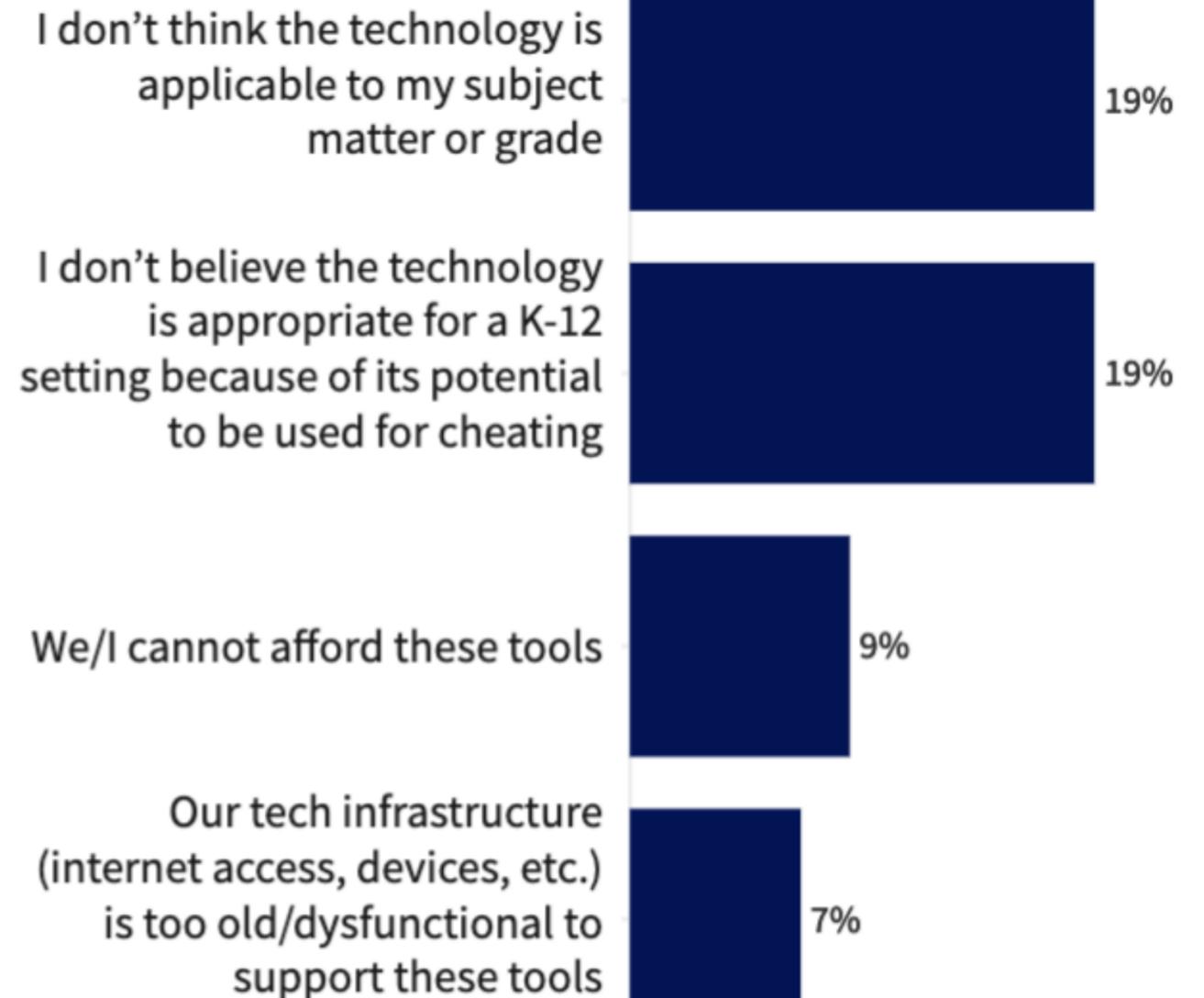
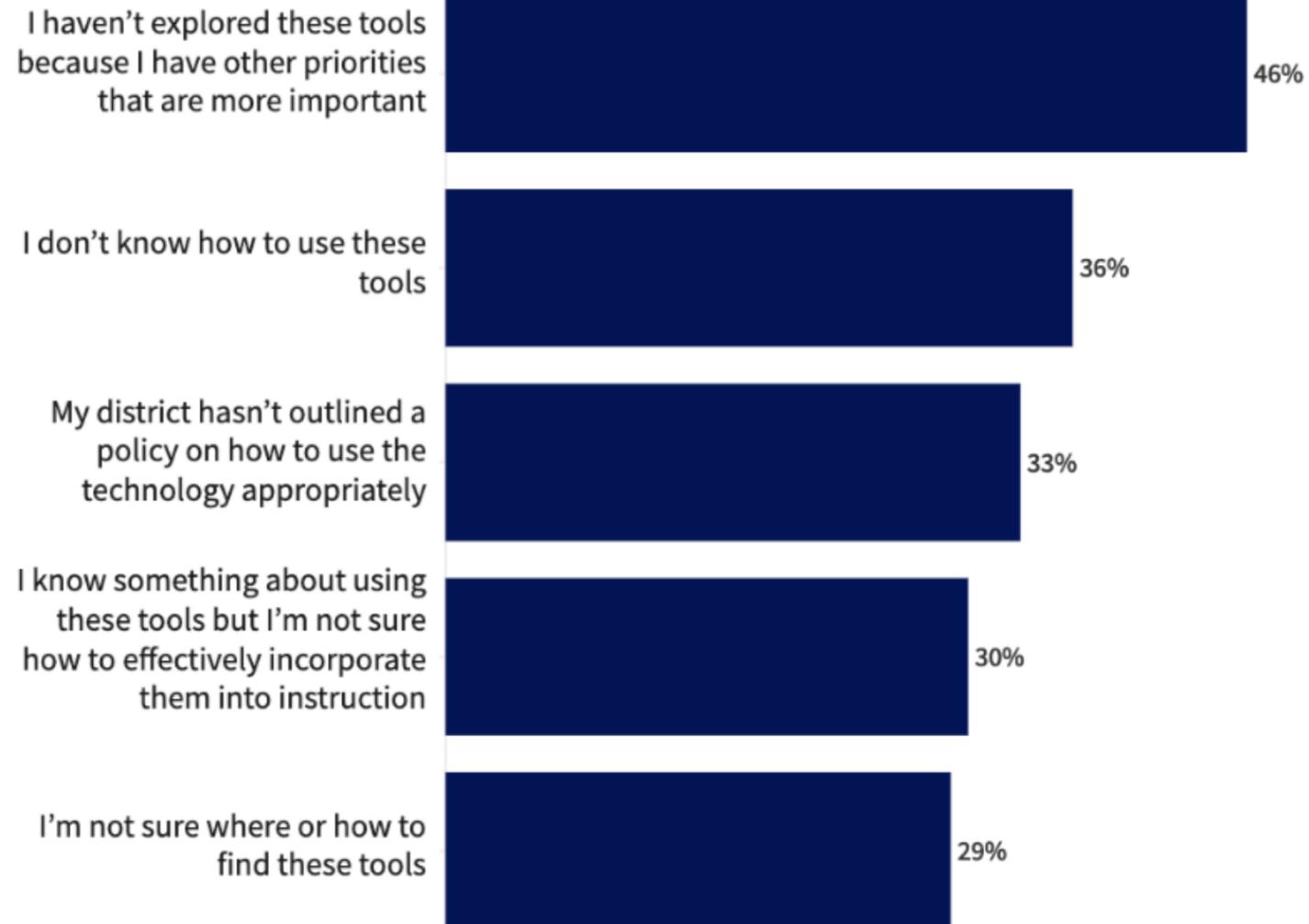


# Most common reasons why teachers (still) say **NO** to AI

- Concerns About Student Learning and Cognitive Development
- Lack of Training and Support
- Ethical and Privacy Concerns
- Fear of Diminished Human Interaction (use case share)
- Scepticism About AI's Educational Value



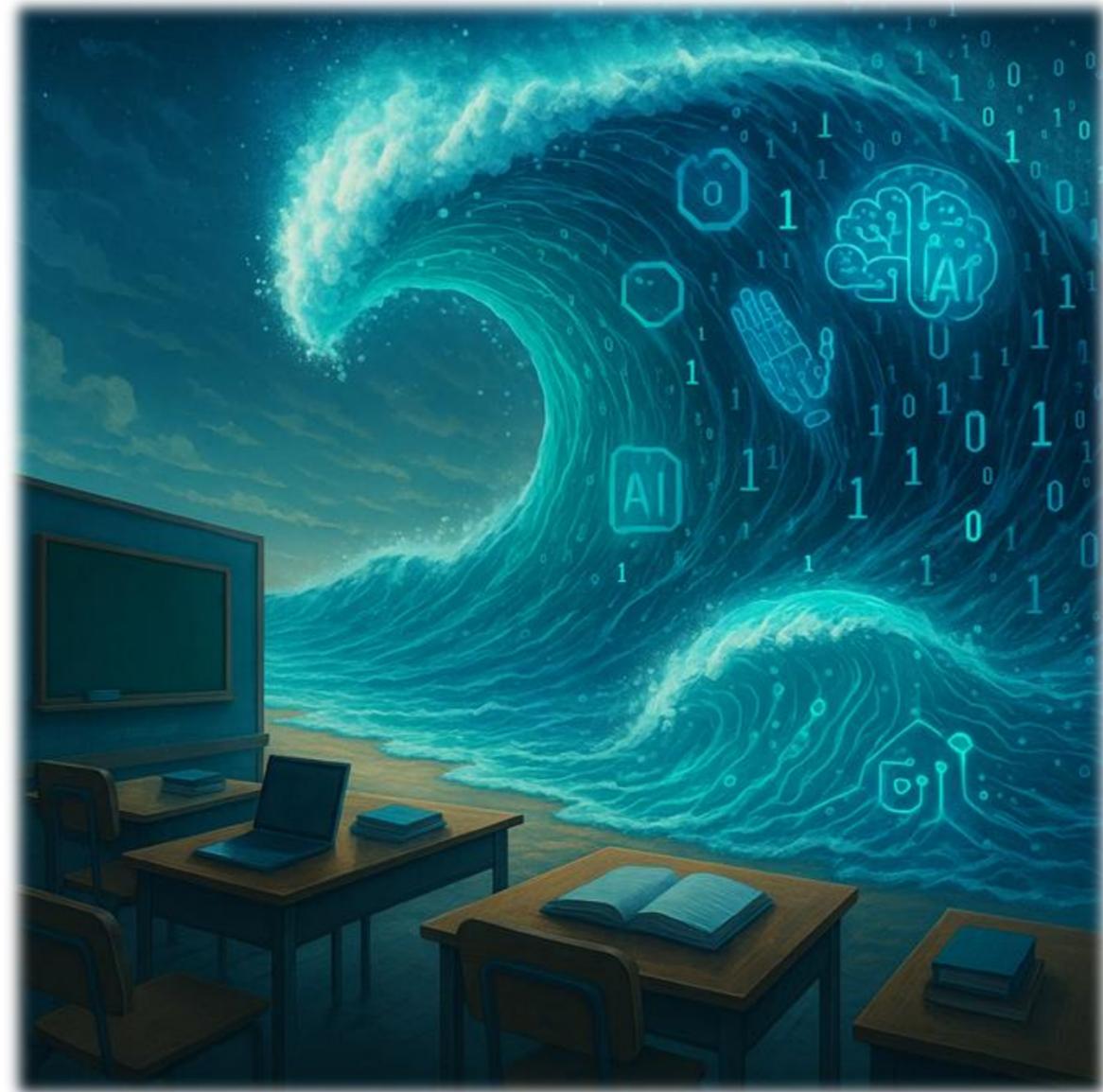
**You indicated you don't currently use artificial intelligence-driven instructional tools in your classroom. Why not? Select all that apply.**



SOURCE: Ed Week Research Centre survey, December 2023

**The wave of AIEd  
implementation is  
transforming into a  
tsunami **

**...evidence is everywhere**



China has launched a comprehensive plan to integrate artificial intelligence (AI) into its education system, aiming to transform teaching methods, curricula, and learning environments across all educational levels—from primary schools to higher education [1](#) [3](#).

### Key Aspects of China's AI Integration in Education

- **Curriculum and Teaching Reform:** AI will be embedded into school curricula and textbooks, with mandatory AI education introduced in primary and secondary schools starting in 2025. Students will be required to take at least eight hours of AI-related classes annually, with content tailored by grade level—from basic AI concepts in elementary schools to advanced AI innovation in high schools [1](#) [5](#) [6](#).
- **Skill Development Focus:** The initiative emphasizes cultivating essential skills such as independent thinking, problem-solving, communication, teamwork, and ethical awareness. AI is expected to foster these competencies by creating more dynamic, interactive, and innovative learning experiences [1](#) [6](#) [7](#).
- **Teacher Training and Digital Competency:** Educators are being trained to effectively use AI tools, enhancing their instructional capabilities and enabling them to design more challenging and creative learning experiences [4](#) [6](#).
- **Technological Infrastructure and Resources:** China is building AI-powered education platforms and model classrooms, developing large-scale AI models for education, and deploying AI assistants and applications to support smart campus development [2](#) [6](#). The Ministry of Education's Smart Education platform has become the world's largest high-quality digital education repository, with plans to expand resource sharing and public education access [4](#).
- **Alignment with National Goals:** This AI education integration supports China's broader ambitions to become a global AI and technological powerhouse by 2035, fostering innovative talent to meet the demands of the digital economy and future industries [1](#) [4](#) [6](#).
- **Ethical and Human-Centered Approach:** Guidelines have been drafted to ensure AI use in education is human-centered and ethically sound, addressing concerns such as data privacy and equitable access [6](#) [8](#).

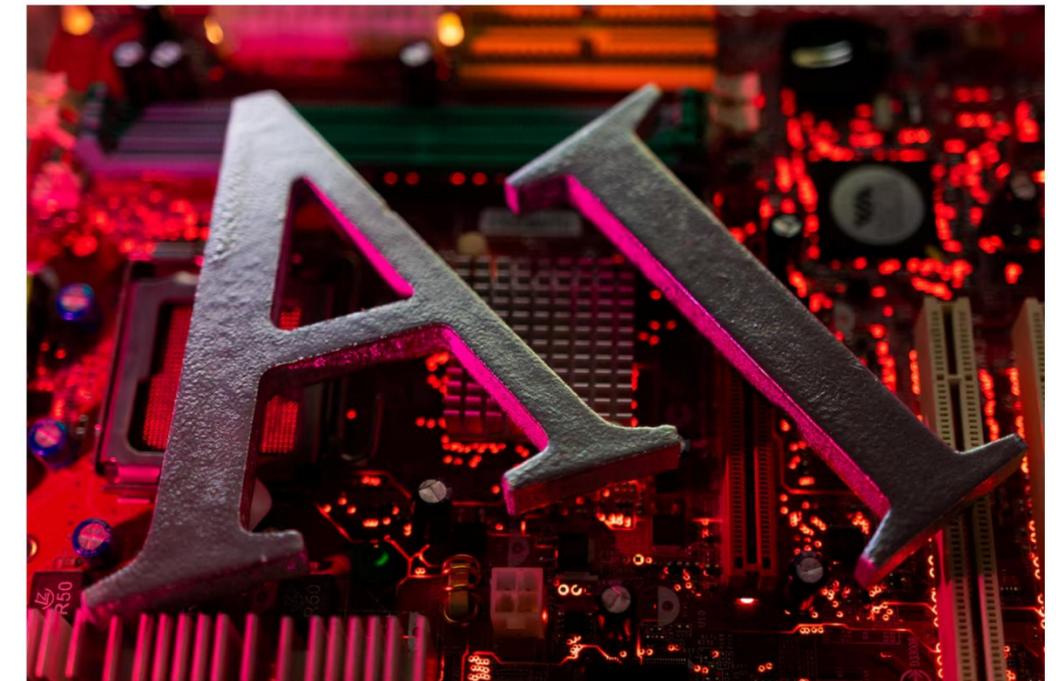
PerplexityAI



## China to rely on artificial intelligence in education reform bid

By Reuters

April 17, 2025 3:21 PM GMT+8 · Updated 10 days ago



AI (Artificial Intelligence) letters are placed on computer motherboard in this illustration taken, June 23, 2023. REUTERS/Dado Ruvic/illustration/File Photo [Purchase Licensing Rights](#)

HONG KONG, April 17 (Reuters) - China will integrate artificial intelligence (AI) applications into teaching efforts, textbooks and the school curriculum as it moves to overhaul education, authorities said in an official paper released on Wednesday.

The move targeting pupils and educators across primary, secondary and higher levels comes as the world's second-largest economy looks to boost innovation and find new sources of growth.

The Washington Post  
*Democracy Dies in Darkness*

## Draft executive order outlines plan to integrate AI into K-12 schools

A policy under consideration by the White House and seen by The Post instructs federal agencies on how to incorporate artificial intelligence into classrooms.

April 22, 2025

🔗 3 min 🔍 ↗️ 📌 🗒 248



Most Read Education



1 DHS reinstates court losses pill

The United States is actively developing a multi-faceted plan to integrate artificial intelligence (AI) into education, focusing on K-12 schools and workforce readiness through federal initiatives, guidance, and partnerships.

### Key Elements of the U.S. AI Education Plan

- **Executive Order and Federal Coordination:** In April 2025, the Trump administration signed an executive order to advance AI education for American youth. This order establishes a White House Task Force on AI Education, chaired by the Director of the Office of Science and Technology Policy, with members including the Secretaries of Education, Labor, and other key officials. The task force aims to coordinate federal efforts, foster public-private partnerships, and promote AI literacy nationwide [1](#) [6](#) [10](#).
- **AI Literacy and Curriculum Integration:** The plan emphasizes early AI training to demystify the technology and prepare students to be confident participants in an AI-assisted workforce. It encourages integrating AI concepts into K-12 curricula and providing resources for educators to use AI tools effectively in teaching [1](#) [5](#) [10](#).
- **Teacher Training and Professional Development:** Federal agencies are directed to prioritize teacher training in AI, including using discretionary grant programs to support educator proficiency with AI technologies and pedagogies [5](#) [6](#) [10](#).
- **Toolkit for Safe and Equitable AI Use:** The U.S. Department of Education released a comprehensive AI toolkit for schools, structured around mitigating risks (privacy, security, equity), building AI integration strategies, and implementing AI responsibly. The toolkit highlights the importance of compliance with federal laws, ethical use, and community engagement during AI adoption [5](#) [7](#) [9](#).
- **Workforce Preparation and Apprenticeships:** The executive order directs the Department of Labor to promote AI-related apprenticeships and use workforce funding to develop AI skills. Collaboration among Labor, Education, and NSF aims to expand AI coursework and certification opportunities for high school students, aligning education with labor market demands [10](#).
- **Research and Innovation Support:** The National Science Foundation (NSF) launched the EducateAI initiative to support high-quality, inclusive AI education across K-12 and higher education. This initiative provides professional development for educators, fosters communities of practice, and encourages proposals from diverse institutions to broaden AI educational access [8](#) [9](#).
- **State and Local Guidance:** Several states, including North Carolina, have developed AI guidance frameworks emphasizing responsible AI use, AI literacy across grade levels, and critical thinking skills. Regional commissions are working on recommendations to guide AI integration without requiring new legislation [5](#) [9](#).





上海青浦区协和双语学校  
SHANGHAI UNITED INTERNATIONAL SCHOOL  
QINGPU CAMPUS

# 2025 AI in Action: The Future of K-12 Education Conference

“In Cycle 1, students compare machines to humans, develop digital thinking skills, and explore AI applications.

In Cycle 2, students design and evaluate AI systems, learn about bias and algorithms, and focus on ethical AI use.

Cycle 3 prepares students for higher education and careers by teaching command engineering and simulating real-world scenarios.

The new AI curriculum will be seamlessly integrated within existing school schedules without requiring additional teaching hours. It will be taught by designated teachers as part of the Computing, Creative Design, and Innovation subject.”



HOME UAE WORLD BUSINESS SPORTS ARTS & CULTURE

Home / UAE

## Ministry of Education introduces AI curriculum in public schools starting from 2025-2026 academic year



<https://www.emirates247.com/uae/ministry-of-education-introduces-ai-curriculum-in-public-schools-starting-from-2025-2026-academic-year-2025-05-04-1.739067>

# The Current Ed. Landscape: New Tools, Old Goals?



Students are using Gen-AI to write, summarize, and brainstorm, **cheat...**



Learning is faster...  
but is it deeper?



Teachers use Gen-AI, and AI powered APPs like Canva, Quizizz as assistants, **grade...**

What does “teaching”  
mean in this  
environment?



## Pair & Share 2'

Which AI tool has  
significantly changed  
your work?



# AI tools that have changed my work:

| Tool Name                                                                                                        | Use case                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| Chat GPT                        | General brainstorming (SOW, Lesson Plans, Projects, Bi-lingual content, Events development, Writing Drafts (emails, articles) etc. |
| Canva for Education          | Worksheet design, Poster design, Colleague collaboration (Highly Recommended)                                                      |
| Black Box AI (VS Code Plugin)                                                                                    | Helping students with coding                                                                                                       |
| Quizizz for Education       | Assessments, Interactive videos, Content reviews (Highly Recommended)                                                              |
| Brisk AI (Chrome Extension)  | Lesson hook, Creating various content drafts from YT video (Guided notes, quiz, PPT, review materials etc.)                        |
| Perplexity                    | Getting reliable answers backed up by sources (online tools, teaching content ideas, latest news..)                                |

# Is AI Making Us Smarter... or More Dependent?

- Cognitive offloading is real (e.g., reliance on AI for most tasks)
- Studies show reduced critical thinking in AI-heavy learning environments
- Danger of shallow engagement: knowing that something is true vs. understanding why
- Teachers in a 'cognitive gap'



# Research Paper #1

## The Impact of Generative AI on Critical Thinking: Self-Reported Reductions in Cognitive Effort and Confidence Effects From a Survey of Knowledge Workers

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### Abstract

The rise of Generative AI (GenAI) in knowledge workflows raises questions about its impact on critical thinking skills and practices. We survey 319 knowledge workers to investigate 1) when and how they perceive the enactment of critical thinking when using GenAI, and 2) when and why GenAI affects their effort to do so. Participants shared 936 first-hand examples of using GenAI in work tasks. Quantitatively, when considering both task- and user-specific factors, a user's task-specific self-confidence and confidence in GenAI are predictive of whether critical thinking is enacted and the effort of doing so in GenAI-assisted tasks. Specifically, higher confidence in GenAI is associated with less critical thinking, while higher self-confidence is associated with more critical thinking. Qualitatively, GenAI shifts the nature of critical thinking toward information verification, response integration, and task stewardship. Our insights reveal new design challenges and opportunities for developing GenAI tools for knowledge work.

Confidence Effects From a Survey of Knowledge Workers. In *CHI Conference on Human Factors in Computing Systems (CHI '25)*, April 26–May 01, 2025, Yokohama, Japan. ACM, New York, NY, USA, 23 pages. <https://doi.org/10.1145/3706598.3713778>

### 1 Introduction

Generative AI (GenAI) tools, defined as any “end user tool [...] whose technical implementation includes a generative model based on deep learning”,<sup>1</sup> are the latest in a long line of technologies that raise questions about their impact on the quality of human thought, a line that includes writing (objected to by Socrates), printing (objected to by Trithemius), calculators (objected to by teachers of arithmetic), and the Internet.

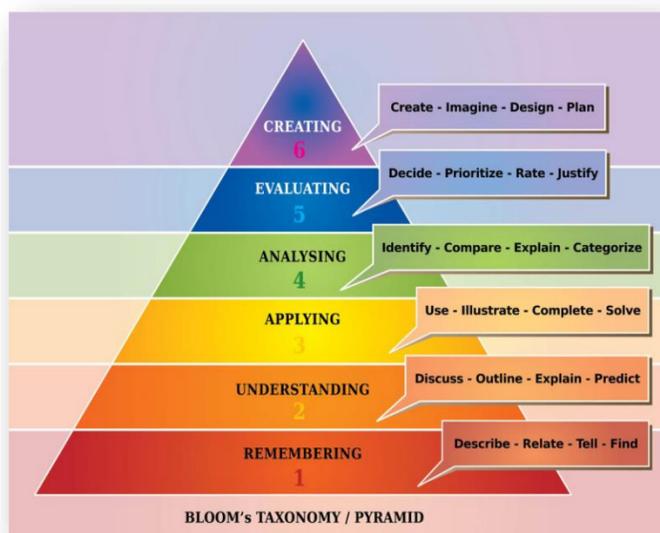
Such consternation is not unfounded. Used improperly, technologies can and do result in the deterioration of cognitive faculties that ought to be preserved. As Bainbridge [7] noted, a key irony of automation is that by mechanising routine tasks and leaving

- **319 knowledge workers · 936 - GenAI use-cases** – Creation, Information, Advice
- **60 %** of interactions included some **critical-thinking moves** (self-reported)
- **Confidence paradox**
  - Trust GenAI → critical-thinking effort ↓
  - Self-confidence → critical-thinking effort ↑
- **Cognitive shift:** from direct task execution to **oversight** (verification, integration, stewardship)

The need for new skills development:

1. Information verification
2. Response integration
3. Task stewardship

CHI '25, April 26–May 01, 2025, Yokohama, Japan



**Self-Confidence | Task Confidence | Tool (AI) Confidence**

## RESEARCH ARTICLE

## Open Access



## Embracing the future of Artificial Intelligence in the classroom: the relevance of AI literacy, prompt engineering, and critical thinking in modern education

Yoshija Walter<sup>1\*</sup>\*Correspondence:  
yoshija.walter@gmail.com;  
yoshija.walter@kalaidos-fh.ch<sup>1</sup> Kalaidos University of Applied  
Sciences, Jungholzstrasse 43,  
8050 Zurich, Switzerland**Abstract**

The present discussion examines the transformative impact of Artificial Intelligence (AI) in educational settings, focusing on the necessity for AI literacy, prompt engineering proficiency, and enhanced critical thinking skills. The introduction of AI into education marks a significant departure from conventional teaching methods, offering personalized learning and support for diverse educational requirements, including students with special needs. However, this integration presents challenges, including the need for comprehensive educator training and curriculum adaptation to align with societal structures. AI literacy is identified as crucial, encompassing an understanding of AI technologies and their broader societal impacts. Prompt engineering is highlighted as a key skill for eliciting specific responses from AI systems, thereby enriching educational experiences and promoting critical thinking. There is detailed analysis of strategies for embedding these skills within educational curricula and pedagogical practices. This is discussed through a case-study based on a Swiss university and a narrative literature review, followed by practical suggestions of how to implement AI in the classroom.

**Introduction**

In the evolving landscape of education, the integration of Artificial Intelligence (AI) represents a transformative shift, stipulating a new era in learning and teaching methodologies. This article delves into the multifaceted role of AI in the classroom, focusing particularly on the primacy of prompt engineering, AI literacy, and the cultivation of critical thinking skills.

The advent of AI in educational settings transcends mere technological advancement, reshaping the educational experience at its core. AI's role extends beyond traditional teaching methods, offering personalized learning experiences and supporting a diverse range of educational needs. It enhances educational processes, developing essential skills such as computational and critical thinking, intricately linked to machine learning and educational robotics. Furthermore, AI has shown significant

# Research Paper #2

- **Knowledge & Skills development need both for students and teachers**
  - AI Literacy
  - Prompt Engineering
  - Critical Thinking
- **Creating the 'AI Culture' approach**
  - Built on principals of Ethical use
  - Questioning and critical exploring of AI
  - Woven into all levels of institution with all stakeholders involved
  - Encouraging students led initiatives
- **Primary concern: Educators preparedness for rapidly evolving AI educational landscape**

**Table 5** Summary of AI challenges and critical thinking measures against them

| AI Challenges                                   | Description                                                                                                                                          | Critical Thinking Measures                                                                                                                                                                                                                                                                                                                                                                                    | Sources                                                                                                         |
|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Information Quality                             | Misinformation, biased information and hallucinations from AI Sources, including social problems like Deep-Fakes                                     | Implement critical media literacy programs to teach students how to identify and analyze biases and misinformation in AI-generated content                                                                                                                                                                                                                                                                    | (Alkaissi et al., 2023; Ivanov, 2023; Katarzyna et al., 2023; Theophilou et al., 2023)                          |
| AI Dependency                                   | Over-reliance on AI for problem solving, decision making, and cognitive tasks                                                                        | Foster a problem-based learning environment where students are encouraged to first use analytical reasoning before turning to AI solutions                                                                                                                                                                                                                                                                    | (Chan & Tsi, 2023; Groza & Marginean, 2023; Ivanov, 2023; Malik et al., 2023)                                   |
| AI Ethics                                       | Ethical dilemmas posed by AI, such as personal autonomy or discrimination                                                                            | Integrate ethics into the curriculum with a focus on AI-related issues, encouraging debate and discussion on ethical dilemmas                                                                                                                                                                                                                                                                                 | (Akgun & Greenhow, 2022; Ivanov, 2023; Jeyaraman et al., 2023; Nguyen et al., 2023; Rane, 2023; Williams, 2021) |
| Pace of Technology                              | Problems with keeping up-to-date with the rapid technological changes and fears concerning displacements in the job market as well as academia       | Provide workshops for career guidance that emphasize adaptability and the importance of continuous learning in an AI-evolving job landscape. Teach an agile mindset and provide sources to learn the newest developments. Emphasize non-propositional skills ("the how") over propositional knowledge ("the what"), which is more timeless. Spot latent anxiety in students and offer guidance to reduce them | (Ahmad, 2019; Fui-Hoon Nah et al., 2023; Motlagh et al., 2023; Roll & Wylie, 2016)                              |
| Social Isolation                                | Decreased human interaction due to increased absorption by AI, the digital world and time on the screen                                              | Promote activities that require teamwork and face-to-face interaction to balance the solitary nature of screen time and AI interactions                                                                                                                                                                                                                                                                       | (Ali & Smith, 2015; Baker et al., 2018; Guilherme, 2019; Jelodar et al., 2021; Locsin et al., 2021)             |
| Loss of Independent Thought and Creative Skills | Since cognitive and creative work can be handed to AI models, it may diminish students' skills in developing original thought and creative processes | Encourage projects that require out-of-the-box thinking, using AI as a tool for assistance rather than the primary source of ideas. Use a mix of tasks where sometimes students are <i>not</i> allowed to use AI and where sometimes they <i>must</i> use AI                                                                                                                                                  | (Fui-Hoon Nah et al., 2023; Ivanov, 2023; Minn, 2022; Zhan et al., 2022)                                        |
| Evolving Learning Capacities                    | AI can lead to changes in learning styles and might reduce general attention span in case of low interactivity                                       | Adapt teaching methods to cater to diverse learning styles influenced by AI and technology, including interactive and multimodal learning approaches. AI assistants and platforms can help teachers quickly adapt to new formats                                                                                                                                                                              | (Fui-Hoon Nah et al., 2023; Ivanov, 2023; Rane, 2023; Taylor & Boyer, 2020)                                     |
| Data Privacy Concerns                           | In the digital world, data is constantly gathered and AI models are trained on them                                                                  | Educate students about data privacy, including how their data is used by AI systems and ways to protect their digital footprint                                                                                                                                                                                                                                                                               | (Attai, 2019; Kouroupis & Vagianos, 2023; Serholt et al., 2017)                                                 |

## RESEARCH ARTICLE

## Open Access

**Embracing the future of Artificial Intelligence in the classroom: the relevance of AI literacy, prompt engineering, and critical thinking in modern education**Yoshija Walter<sup>1\*</sup>\*Correspondence:  
yoshija.walter@gmail.com;  
yoshija.walter@kalaidos-fh.ch<sup>1</sup> Kalaidos University of Applied  
Sciences, Jungholzstrasse 43,  
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# Room for development:

Looking towards the future, several research and development avenues present themselves as critical to advancing the integration of AI in education:

1. **Curriculum Integration:** Future research should explore effective methods for integrating AI literacy across various educational levels and disciplines.
2. **Ethical AI development:** Investigating how to develop and implement AI tools that are transparent, unbiased, and respect student privacy is essential for ethical AI integration in education.
3. **AI in Policy Making:** Understanding how AI can assist in educational policy-making and administration could streamline educational processes and offer valuable insights.
4. **Cultural Shifts in Education:** Research into how educational institutions can foster a culture of critical and ethical AI use, promoting continuous learning and adaptation, is crucial.
5. **Longitudinal Studies:** There is a need for longitudinal studies to assess the long-term impact of AI integration on learning outcomes, teacher effectiveness, and student well-being. So far, this has not been possible due to the novelty of the technology.

## Pair & Share 2'

Which strategies can we apply in order to ensure that our students are employing cognitive skills (critical thinking) in classwork and homework?



# My approach: Clear guide with frequent reinforcement.

## AI IN OUR CLASSROOM

### SMART & RESPONSIBLE USE

#### WHAT CAN AI DO FOR YOU

- GIVE YOU NEW IDEAS 💡
- HELP YOU UNDERSTAND HARD TOPICS 📖
- CHECK SPELLING AND GRAMMAR ✍️
- MAKE LEARNING MORE FUN 🎮

REMINDER: YOU ARE THE LEARNER, NOT THE AI.

#### DO'S

- ✓ USE AI TO GET NEW IDEAS.
- ✓ ASK AI TO EXPLAIN THINGS YOU DON'T UNDERSTAND.
- ✓ LET AI HELP MAKE YOUR WORK CLEARER AND MORE ORGANIZED.
- ✓ CHECK IF WHAT AI SAYS IS TRUE.
- ✓ MIX AI IDEAS WITH YOUR OWN CREATIVITY.
- ✓ REFLECT: DID AI ACTUALLY HELP YOU LEARN?

## AI IN OUR CLASSROOM

### SMART & RESPONSIBLE USE

#### DON'TS

- ✗ DON'T COPY AND PASTE AI'S ANSWERS AND CALL IT YOUR OWN WORK.
- ✗ DON'T USE AI JUST TO FINISH FASTER WITHOUT UNDERSTANDING.
- ✗ DON'T BELIEVE EVERYTHING AI SAYS — IT CAN BE WRONG!
- ✗ NEVER SHARE YOUR PERSONAL INFORMATION (NAME, ADDRESS, PHONE, ETC.) WITH AI.

#### PRO TIPS FOR USE

- AI IS LIKE A TEAMMATE, NOT THE BOSS.
- ALWAYS DOUBLE-CHECK AI'S FACTS.
- YOUR TEACHER IS YOUR BEST HELPER — ASK THEM WHEN UNSURE.
- YOUR VOICE MATTERS! AI SHOULD NEVER REPLACE YOUR OWN IDEAS.

# My approach:

## AI – Use LOG

### Page 2 – AI LOG

**Instructions:**

- Record **every time** you use an AI tool while working on the project.
- Remember that copy-paste of AI generated content is **strictly not allowed**

| #  | Stage / Component (Report, Artefact 1, Postcard, etc.) | AI Tool | Purpose (idea, outline, image, grammar, etc.) | Student Edits / Fact-Checks Made | Teacher Check ✓ |
|----|--------------------------------------------------------|---------|-----------------------------------------------|----------------------------------|-----------------|
| 1  |                                                        |         |                                               |                                  |                 |
| 2  |                                                        |         |                                               |                                  |                 |
| 3  |                                                        |         |                                               |                                  |                 |
| 4  |                                                        |         |                                               |                                  |                 |
| 5  |                                                        |         |                                               |                                  |                 |
| 6  |                                                        |         |                                               |                                  |                 |
| 7  |                                                        |         |                                               |                                  |                 |
| 8  |                                                        |         |                                               |                                  |                 |
| 9  |                                                        |         |                                               |                                  |                 |
| 10 |                                                        |         |                                               |                                  |                 |
| 11 |                                                        |         |                                               |                                  |                 |
| 12 |                                                        |         |                                               |                                  |                 |
| 13 |                                                        |         |                                               |                                  |                 |
| 14 |                                                        |         |                                               |                                  |                 |
| 15 |                                                        |         |                                               |                                  |                 |

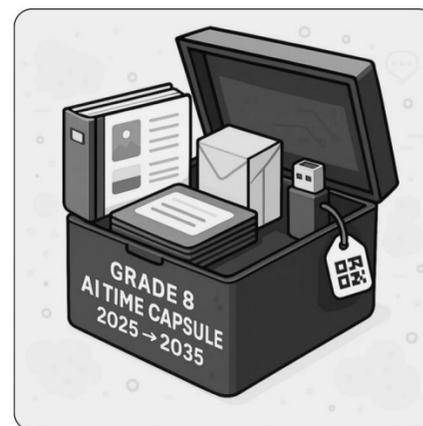
**Quick Compliance Checklist**

- ✓ AI-generated text rewritten in our own words
- ✓ Facts cross-checked with human-authored sources
- ✓ No personal data or copyrighted text pasted into prompts
- ✓ AI images clearly labelled on artefacts
- ✓ Log fully completed before Week 4 peer review

*(Attach this sheet to the front of your project envelope at final submission.)*

Grade 8 ICT - Final Unit Assessment  
Semester 2 - Foundations of Gen-AI

### "Time Capsule – 2025 2035"



"Three creations, one capsule, ten years—  
show future Grade 8s how AI shaped our  
world in 2025."

Students Names, Class:

Project Guide, Student Worksheet,  
Assessment Criteria

*Grade 8 – ICT –  
Capstone project –  
Unit: Foundations of  
Generative AI*



Computers and Education: Artificial Intelligence 2 (2021) 100025

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Computers and Education: Artificial Intelligence

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AI technologies for education: Recent research & future directions

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ARTICLE INFO

**Keywords:**  
Artificial intelligence  
AI  
AI in Education

ABSTRACT

From unique educational perspectives, this article reports a comprehensive review of selected empirical studies on artificial intelligence in education (AIEd) published in 1993–2020, as collected in the Web of Sciences database and selected AIEd-specialized journals. A total of 40 empirical studies met all selection criteria, and were fully reviewed using multiple methods, including selected bibliometrics, content analysis and categorical meta-trends analysis. This article reports the current state of AIEd research, highlights selected AIEd technologies and applications, reviews their proven and potential benefits for education, bridges the gaps between AI technological innovations and their educational applications, and generates practical examples and inspirations for both technological experts that create AIEd technologies and educators who spearhead AI innovations in education. It also provides rich discussions on practical implications and future research directions from multiple perspectives. The advancement of AIEd calls for critical initiatives to address AI ethics and privacy concerns, and requires interdisciplinary and transdisciplinary collaborations in large-scaled, longitudinal research and development efforts.

Since Alan Turing first articulated the promising vision of “thinking machines” in 1950, artificial intelligence (AI) research has been advanced in many different fields and generated an increasing body of literature (e.g., [Andriessen and Sandberg, 1999](#); [Beck et al., 1996](#); [Burlison & Lewis, 2016](#); [Glancey et al., 1979](#); [Kaplan & Haenlein, 2019](#); [Kurzweil, 1985](#); [Kurzweil & Kapur, 2002](#); [Kurzweil, 2002](#); [Legg & Hutter, 2007](#); [Simmons & Chappell, 1988](#); [Zdenek, 2003](#)). In education, emerging technologies have also been transforming ways of teaching and learning. The AI market in US Education Sector is expected to grow by 48% in 2018–2022 ([BusinessWire.com, 2018](#)). With the thrive of AI technology, its applications in education have been increasing, with promising potentials to provide customized learning, to offer dynamic assessments, and to facilitate meaningful interactions in online, mobile or blended learning experiences. More provocatively, in response to the teacher shortage in USA, for example, scholars ([Edwards & Cheok, 2018](#)) have proposed to replace some roles of teachers with robots with AI.

The increasing applications of AI in education (AIEd) demand interdisciplinary approaches, while most AI research is carried out only in STEM fields ([Zawacki-Richter, Marin, Bond & Gouverneur, 2019](#)). Consistently, a few recent literature reviews have highlighted the lack of educational perspectives in AIEd research (e.g., [Chen, Xie, Zou, &](#)

[Hwang, 2020](#); [Hinojo-Lucena, Aznar-Díaz, Cáceres-Reche, & Romero-Rodríguez, 2019](#); [Zawacki-Richter, Marin, Bond, & Gouverneur, 2019](#)). In addition, researchers have voiced concerns about the absence of educational theories and models, as found in AI-enabled e-learning research published in the past two decades ([Tang, Chang, & Hwang, 2021](#)). It is also worth noting that AIEd innovations remain at the early, experimental stage, and there is few collaboration with educational institutions in related interventions such as AI enabled adaptive systems ([Kabudi, Pappas, & Olsen, 2021](#)). As a result, there has been a critical gap between what AIEd technologies could do and how they are actually implemented in authentic educational settings ([Bates et al., 2020](#); [Kabudi et al., 2021](#)).

As an effort to further advance AI technologies for education, this article intends to help the broader AIEd community, including educators, educational researchers, AI technology creators and other stakeholders to build a deeper understanding in AIEd, including its current state, potentials, challenges and future directions. Specifically, this comprehensive review of related literature aims to achieve the following goals through multiple analysis methods:

- to map the landscape of AIEd research publications in recent decades,

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<https://doi.org/10.1016/j.caeai.2021.100025>

Received 10 December 2020; Received in revised form 3 May 2021; Accepted 30 May 2021

Available online 9 June 2021

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# Research Paper #3

- **40 empirical studies on AIEd (1993-2020)**
- **16 countries**
- **Various educational settings and subjects**

- **Lack of longitudinal studies on AIEd**

- Expansion of application requires expanded approach to research

- **Lack of educational perspectives on AIEd**

- Could be addressed by closer collaboration between researchers and educators (ed-institutions)

- **Lack of diversity in approach**

- E.g. most studies focuses on PLS (Personalized Learning System) and areas as chatbots, ML (machine learning), AR/VR and others.

**AIEd Technologies**

**Proven and Potential Benefits for Teaching and Learning**

**Chatbots**

- Stimulating conversations
- Increasing learners' interest and engagement

**Expert systems**

- Pedagogical planning
- LMS uses
- Improving quality of interactions
- Leveraging the LMS

**Intelligent tutors / agents**

- Customized and timely materials, guidance, and feedback
- Customized learning experience based on needs, preferences, and prior knowledge

**Machine learning**

- Analyzing large scale student data
- Predictive models
- Preventive and adaptive interventions

**Personalized learning systems / environments**

- Facilitating interactions
- Improving e-learning
- Customized learning materials and resources for tailored learning

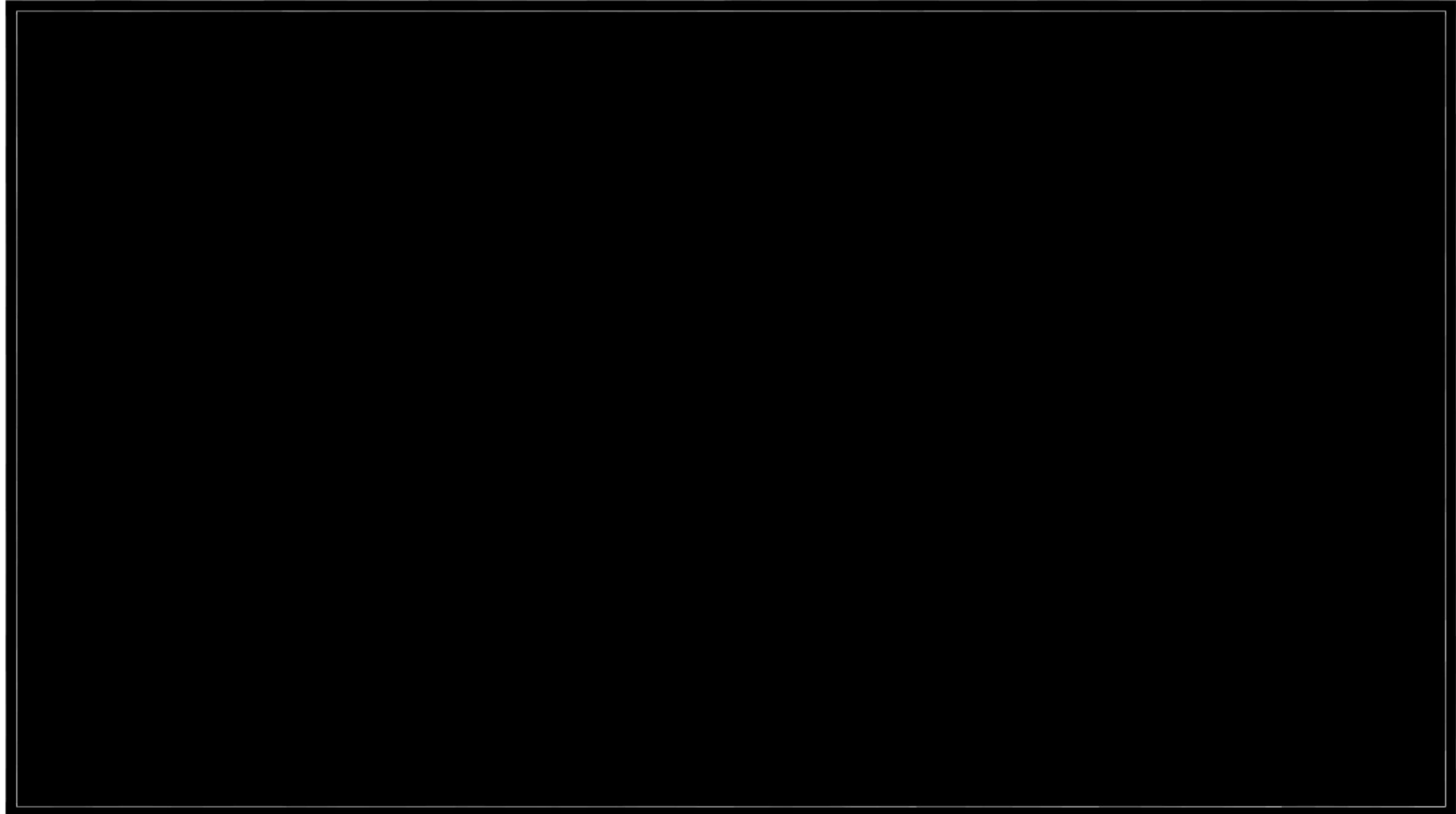
**Visualizations and virtual learning environments**

- Collaborative learning, engagement, and visual feedback
- Visualization of information
- Immersive learning environments

**Challenges to be addressed:**  
**Costs & Scalability**  
**Ethics & Privacy**  
**Lack of AI expertise among educators**  
**Lack of actionable guidelines for educators**

# ALPHA SCHOOL

- Innovative Approach
- Teachers -> Guides
- Is this the concept of the Future Ed where AI is at the forefront?



# Comparing traditional with AI tutors

| Feature/Outcome           | AI-Powered Tutors                                                   | Traditional Tutors                                                  |
|---------------------------|---------------------------------------------------------------------|---------------------------------------------------------------------|
| Learning Speed            | Students learn up to 2x faster <sup>6</sup> .                       | Slower, depends on tutor availability                               |
| Test Score Gains          | 15-20% higher scores <sup>8</sup> ; 4-9% gains in math <sup>3</sup> | Varies, often strong in complex subjects <sup>3</sup>               |
| Personalization           | Highly adaptive, data-driven <sup>5</sup><br><sup>7</sup>           | Personalized, based on human intuition <sup>7</sup>                 |
| Feedback                  | Instant, 24/7 <sup>3</sup> <sup>5</sup> <sup>7</sup>                | Immediate during sessions, but limited by availability <sup>7</sup> |
| Cost                      | \$20-\$60/month <sup>3</sup>                                        | \$50-\$150/hour <sup>3</sup>                                        |
| Emotional Support         | Limited (68% accuracy) <sup>3</sup>                                 | Strong (92% accuracy) <sup>3</sup>                                  |
| Complex/Creative Subjects | Less effective                                                      | More effective <sup>3</sup>                                         |
| Scalability               | Can tutor hundreds at once <sup>3</sup>                             | Limited to 20-30 students weekly <sup>3</sup>                       |
| Student Engagement        | 14% higher engagement <sup>3</sup> <sup>6</sup> <sup>8</sup>        | High, especially with strong rapport                                |

**Is the hybrid approach a solution?**



## HUMAN TUTOR

Human tutors consistently outperform AI tutors in **emotional intelligence**. They provide **empathy**, **encouragement**, and **moral support**, which are crucial for building trust, **motivating students**, and fostering a **positive learning environment**.

## AI TUTOR

AI tutors significantly enhance **academic performance** through personalized. AI lacks the ability to intuitively understand student emotions, respond to subtle cues, or inspire passion for learning in the same way as a human tutor.



# Inverted Bloom's Taxonomy for AI Education

Flipping the framework to lead in a world of constant change

Traditional learning models climb from memorization to creation, but AI demands a different approach.

Starting with creation ignites curiosity and drives learners to question, analyze, and apply knowledge, embedding foundational skills through action.

Foundational knowledge is embedded at every stage, from understanding algorithms and data structures to addressing ethics and bias. Learners apply and deepen these principles as they create, evaluate, analyze, apply and adapt AI solutions.

Dr. M. Workmon Larsen  
ASU Learning Experiences Design

|                   |                                                                                                                                |                                                                                                             |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| <b>CREATE</b>     | Build new solutions, innovate processes and experiment with original ideas. Creation sparks curiosity and drives discovery.    | <i>How did I create something unique, and what new possibilities did this uncover?</i>                      |
| <b>EVALUATE</b>   | Justify decisions, appraise results, and critically reflect on outcomes. Evaluation reveals what worked, what did not and why. | <i>What aspects of this process were successful, and where could it improve?</i>                            |
| <b>ANALYZE</b>    | Draw connections, identify patterns and explore relationships within processes, data and systems.                              | <i>What patterns or insights did I uncover, and how will they inform future actions?</i>                    |
| <b>APPLY</b>      | Use knowledge to solve problems, adapt tools and implement methods in diverse situations.                                      | <i>How did I adapt and implement methods to address a contextual challenge?</i>                             |
| <b>UNDERSTAND</b> | Explain ideas, connect concepts and place learning in broader contexts. Understanding builds relevance and depth.              | <i>How do these ideas connect to larger systems, and what do they reveal about AI's role?</i>               |
| <b>REMEMBER</b>   | Recall and consolidate key facts, processes and concepts to prepare for future challenges.                                     | <i>What key insights will I retain and how can I use them to inform future challenges or opportunities?</i> |

## Possible foundation for the HYBRID approach

\* Included in the Handout



# The Evolution of the Expert Teacher in the AI Era

## Today's Expert Teacher:

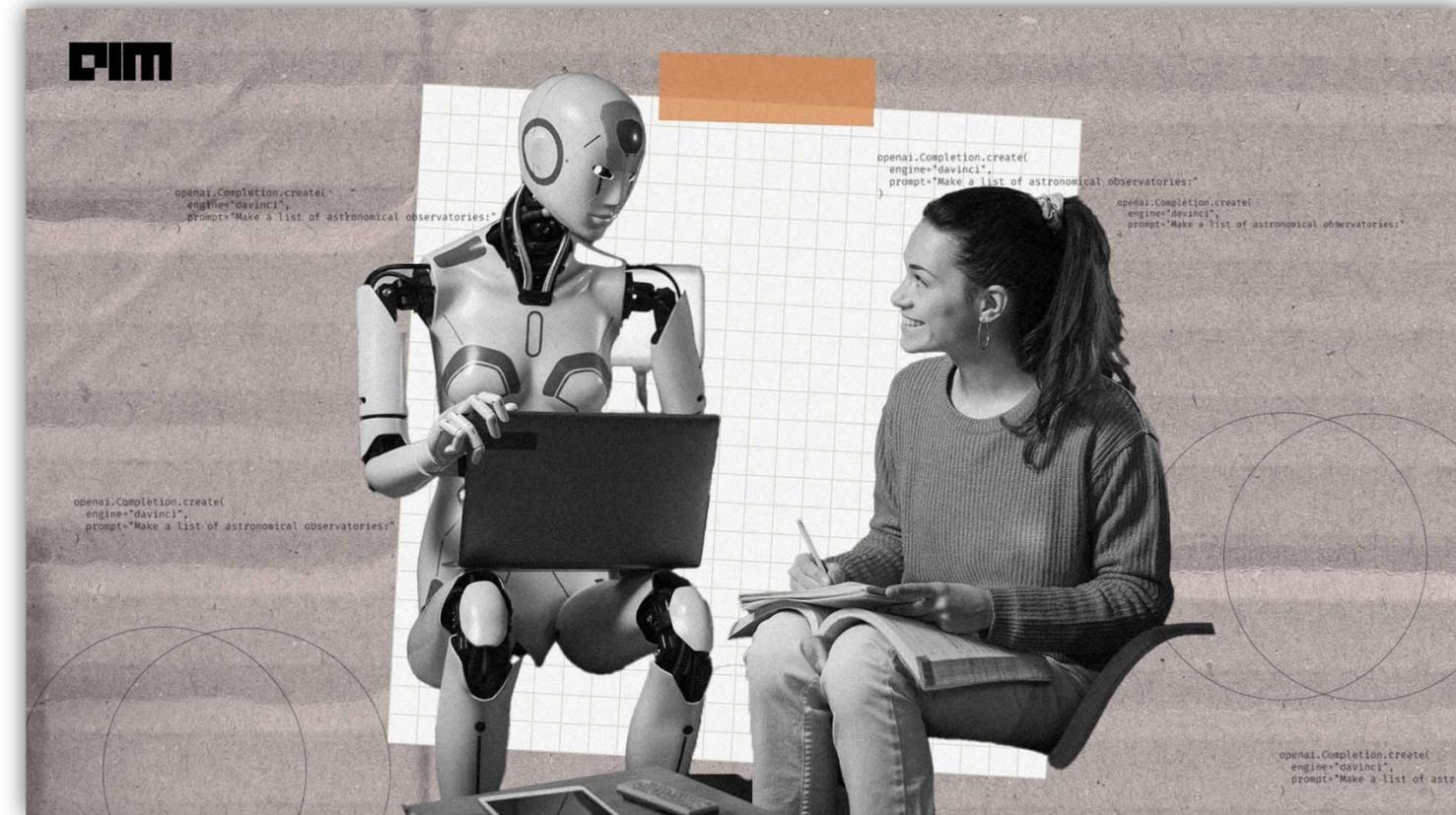
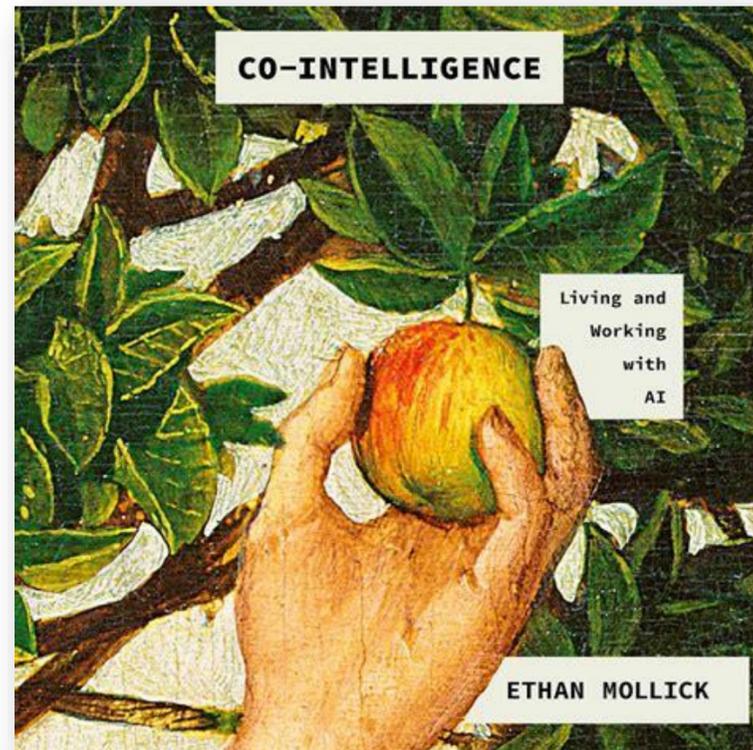
- **Content Specialist:** Possesses deep knowledge in specific subject areas.
- **Instructional Designer:** Creates engaging and effective lesson plans.
- **Mentor and Counsellor:** Provides guidance and support for students' personal and academic growth.

## Tomorrow's Expert Teacher:

- **AI Collaborator:** Works alongside AI tools to enhance personalized learning experiences.
- **Data Interpreter:** Utilizes data analytics to inform instruction and identify student needs.
- **Ethical Overseer:** Ensures the responsible use of AI, addressing biases and promoting equity.
- **Lifelong Learner:** Continuously updates skills to keep pace with technological advancements.
- **Vibe Coder:** Using AI-powered coding tools to create tailored Apps

# The Teacher's New Identity

- **Learning Designer** – crafts experiences, not just lessons
- **Ethical Guide** – discusses bias, fairness, and misuse
- **Curator of Humanity** – models empathy, SEL, and social nuance
- **Lifelong Learner** – adapts, reflects, evolves



“We will still need expert humans—just not the same kind of experts we needed before.” —  
Ethan Mollick, *Co-Intelligence*

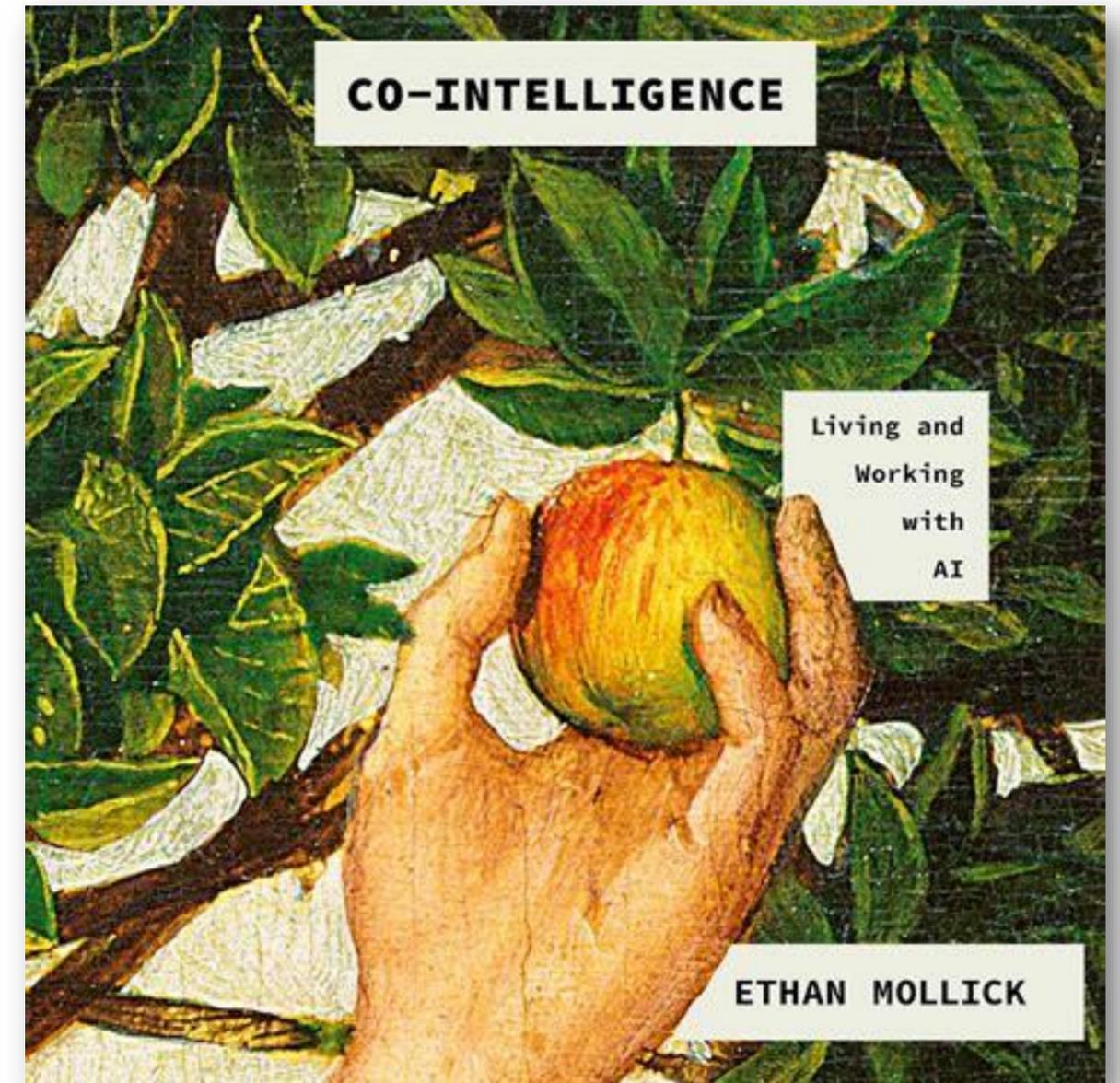
# Mollick's Four Principles

**Always Invite AI to the Table:** Integrate AI into various tasks to understand its capabilities and limitations.

**Be the Human in the Loop:** Actively supervise and verify AI outputs, ensuring accuracy and relevance.

**Treat AI Like a Person (But Tell It What Kind of Person It Is):** Provide context and define roles when interacting with AI to achieve desired outcomes.

**Assume This Is the Worst AI You Will Ever Use:** Recognize that AI is rapidly evolving; today's limitations may be overcome tomorrow.



\*book summary included in the Handout PDF

## Crafting the Path Forward as an Educator:

- **Start Small, Start Now** – pilot *one* AI task next unit (e.g., draft-feedback loop) and share results with peers.
- **Stay Human-in-the-Loop** – always verify AI output aloud so students see critical-thinking in action.
- **Design for Cognitive Stretch** – set prompts that AI *can't* finish alone: justification, reflection, multi-step synthesis.
- **Teach AI Literacy & Ethics** – devote explicit time to bias, data privacy, and responsible prompt craft.
- **Use Data, Not Hype** – track engagement and learning evidence to decide what scales and what scraps.
- **Cultivate New Skills** – sharpen roles as Learning Designer, Ethical Guide, and AI Collaborator through PD and collegial coaching.
- **Champion Equity** – advocate for access, safeguards, and inclusive policies so every learner benefits.



***“Technology changes the tools; teachers change the lives.”***

2025 AI in Action:  
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# The Teacher's Role in a Changing Educational Landscape



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**Thank You!**



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