Rethinking Education in the Age of Artificial Intelligence: What and How We Teach and Learn

Harris Wang *

Posted Date: 6 May 2026

doi: 10.20944/preprints202605.0332.v1

Keywords: artificial intelligence in education; AI literacy; metacognition; ethical judgment; pedagogical transformation; human flourishing; curriculum design; generative AI; cognitive apprenticeship; 21st-century skills; AI-independent competence

 doi:10.20944/preprints202605.0332.v1

Article

Rethinking Education in the Age of Artificial Intelligence: What and How We Teach and Learn

Harris Wang

School of Computing and Information Systems, Athabasca University, Athabasca, Canada; harrisw@athabascau.ca

Abstract

The rapid advancement of generative AI and large language models challenges long-held assumptions about the purposes, content, methods, and practices of education. This paper integrates historical educational philosophy with contemporary AI capabilities to present a comprehensive framework for rethinking what and how we teach and learn. Drawing on foundational purposes—moral formation, democratic citizenship, critical emancipation, human capital development, and holistic flourishing—we analyse how AI's strengths (pattern recognition, content generation) and limitations (lack of understanding, moral agency, empathy, metacognition) reshape educational priorities. We propose a curriculum of six human-irreplaceable competencies: algorithmic literacy, ethical judgment, creative abduction, metacognition, emotional intelligence, and systems thinking. For learners, we identify five core skills: learning to learn, judge, create, relate, and be. Pedagogically, we advocate cognitive apprenticeship, problem-based learning, dialogic instruction, authentic assessment, and teacher vulnerability. A central contribution of this paper is the explicit requirement that students be prepared for two complementary workplace realities: **collaborative co-work with AI** and **independent, AI-free performance** in case AI suddenly becomes unavailable. Consequently, the curriculum and pedagogy must be redesigned to cultivate full capabilities for independent living and working in a modern society. To this end, we introduce strict ethical guardrails: students may use AI to manage their learning but must never delegate coursework to AI; human educators may use AI to create content and assess students, but only responsibly and ethically. For students, we outline practices of prompting-critiquing-synthesising, attention management, reflection, collaboration, questioning, and productive struggle. The paper concludes that the AI era demands not the abandonment of traditional educational aims but their recalibration toward uniquely human capacities, with teachers and learners becoming co-inquirers in an AI-augmented but human-centred ecosystem.

Keywords: artificial intelligence in education; AI literacy; metacognition; ethical judgment; pedagogical transformation; human flourishing; curriculum design; generative AI; cognitive apprenticeship; 21st-century skills; AI-independent competence

I. Introduction

The advent of advanced artificial intelligence—including **large language models** such as GPT-4, Claude, and Gemini; **generative systems** like DALL-E, Midjourney, and Stable Diffusion for image and video synthesis; and **autonomous decision-making tools** such as algorithmic loan approval systems, autonomous vehicle control units, and AI-driven hiring platforms—has disrupted nearly every assumption about human knowledge, skill, and value. For education, this disruption is both profound and urgent. Over the past several decades, societies have developed a rich understanding of the purposes of education: moral and civic formation, critical liberation, economic productivity, and holistic human flourishing [1–5]. Yet AI now performs many cognitive tasks—memorisation, pattern recognition, content generation—at superhuman speed and scale. This reality forces

 doi:10.20944/preprints202605.0332.v1

educators, policymakers, and learners to ask three interconnected questions: **What** should be taught? **What** should students learn? And **how** should teaching and learning occur?

This comprehensive study integrates four prior inquiries into a single framework. It begins by reaffirming the enduring purposes of education in light of AI's capabilities and limitations. It then proposes a curriculum focused on irreducibly human competencies, followed by a learner-centred set of skills for self-directed growth. A critical addition of this paper is the recognition that graduates will enter workplaces where they must **co-work with AI as routine collaborators**—delegating tasks, verifying outputs, and integrating machine suggestions into human-led decisions. Simultaneously, they must be prepared for the possibility that AI could **suddenly disappear** due to technical failure, cyberattack, regulatory change, or organisational policy shifts. Therefore, students require not only AI-augmented skills but also robust **AI-independent capabilities**: the ability to work, solve problems, and make decisions without any algorithmic assistance. This dual requirement demands a fundamental redesign of curricula and pedagogies to ensure that students can live and work independently in a modern society, whether AI is present or not. Furthermore, we establish clear ethical boundaries: students may leverage AI to manage their own learning (e.g., planning, self-testing, reflection) but must never use AI to complete coursework on their behalf. Educators may use AI to generate learning materials and support assessment, but only under principles of responsibility, transparency, and ethical oversight.

The central argument is that the AI era does not make education obsolete but rather elevates its deepest mission: to cultivate wise, creative, compassionate, and resilient human beings who can use AI as a tool without becoming its servants—and who retain their full agency when the tool is absent.

II. Related Works

The intersection of artificial intelligence and education has generated a rapidly growing body of literature. This section reviews key contributions that inform our framework, organised into three streams: (1) AI capabilities and limitations in educational contexts, (2) pedagogical models for AI-augmented learning, and (3) competency frameworks for the AI era.

AI Capabilities and Limitations. Foundational work by Bender and Koller [11] demonstrated that large language models operate on statistical correlations rather than genuine understanding, a limitation that has profound implications for using AI as a learning tool. Floridi [12] systematically analysed the absence of moral agency, metacognition, and subjective experience in contemporary AI systems, arguing that these deficits define the space of uniquely human cognitive and ethical responsibilities. Marcus and Davis [28] further documented AI's fragility in novel situations, emphasising that current systems lack robust common-sense reasoning. These analyses establish why education must prioritise capacities that AI cannot replicate.

Pedagogical Models for AI-Augmented Learning. Early work by Collins, Brown, and Newman [22] on cognitive apprenticeship provided a theoretical basis for learning as situated, guided participation—an approach that becomes even more relevant when AI handles routine tasks. Mollick and Mollick [26] offered practical methods for integrating AI chatbots into higher education, including AI as a feedback generator, a tutor, and a team member. UNESCO's guidance for policymakers [13] emphasised critical AI literacy as a cross-curricular necessity, warning against both techno-solutionism and outright rejection. Alexander's dialogic teaching framework [25] highlighted the irreplaceable role of human dialogue in developing higher-order thinking, a finding echoed by the OECD's human-flourishing agenda [10].

Competency Frameworks for the AI Era. Several international bodies have proposed updated competency models. The World Bank's *World Development Report 2018* [5] shifted focus from schooling to learning, advocating for adaptive competencies over content memorisation. The Delors Commission's four pillars [9] remain influential, but recent work by Nussbaum [8] on capabilities and by the OECD [10] on human flourishing has reframed outcomes toward well-being, agency, and purpose. In the specific context of AI, UNESCO [13] proposed competencies including AI ethics, data literacy, and human-centred design. However, existing frameworks often treat AI as a separate topic

 doi:10.20944/preprints202605.0332.v1

rather than an integral dimension of all teaching and learning. Our paper extends these works by integrating historical educational purposes, curriculum design, learner competencies, pedagogy, and student practices into a single unified framework.

Gaps Addressed. While prior research has examined AI ethics education [15], computational thinking [29], and the future of work [30], few studies have systematically re-anchored the entire educational enterprise—from why we educate to how students practice daily—in light of AI's fundamental limitations. Moreover, no existing framework explicitly prepares students for **both** AI-collaborative and AI-independent futures, nor does any provide clear ethical guardrails forbidding students from using AI to complete coursework on their behalf. This paper fills that gap by showing that the same historical purposes (moral, civic, critical, economic, holistic) can guide a coherent redesign of what and how we teach and learn, provided we recognise AI as a tool for augmenting rather than replacing human cognition, and provided we insist on the maintenance of full independent capability.

III. The Purposes of Education — Historical Wisdom for a New Age

Understanding what to teach, learn, and how to do so requires a clear view of why we educate at all. History offers several complementary purposes.

Moral and Virtuous Formation. From Plato and Aristotle in the West to Confucius in the East, the oldest purpose of education is the cultivation of character. Plato argued that education must shape the soul toward justice and the good [1]. As he wrote in *The Republic*, *"The direction in which education starts a man will determine his future life."* Aristotle added that practical wisdom (*phronesis*) is developed through guided experience, not mere instruction [2]. He famously stated, *"Educating the mind without educating the heart is no education at all."* Confucius emphasised lifelong self-cultivation of benevolence (*ren*) and propriety (*li*) [6]. One of his most cited sayings is, *"The superior man is modest in his speech but exceeds in his actions."* Across cultures, education was never merely about skills but about becoming a good person.

Civic and Democratic Education. With the rise of modern democracies, Horace Mann and John Dewey insisted that public schooling exists to prepare citizens for self-governance. Dewey famously declared that democracy is "a way of life" and that education's aim is "continued capacity for growth" [3]. He also proclaimed, *"Democracy has to be born anew every generation, and education is its midwife."* Mann, known as the father of American public education, asserted, *"A republic without a system of popular education is but a shadow of a republic."* Dewey believed that schools must be laboratories of democratic practice, fostering critical thinking, collaboration, and social responsibility.

Critical and Emancipatory Education. In the twentieth century, Paulo Freire exposed how traditional "banking" education domesticates learners, perpetuating oppression. He proposed problem-posing education that cultivates *conscientização*—critical consciousness of social, political, and economic contradictions [4]. His most powerful words are, *"Education either functions as an instrument to bring about conformity or as an instrument of liberation."* Later theorists like Bowles and Gintis showed how schooling reproduces class structures [7]. From this view, education's purpose is liberation: to empower the marginalised to understand and transform their world. As Freire also wrote, *"The oppressed, instead of striving for liberation, tend themselves to become oppressors"* — a warning that education must foster genuine critical awareness.

Human Capital and Economic Growth. Since World War II, international bodies like the World Bank have emphasised education as investment in human capital. According to the World Bank, each additional year of schooling raises hourly earnings by about 10% globally, and education drives innovation, poverty reduction, and institutional strength [5]. The economist and Nobel laureate Gary Becker, a pioneer of human capital theory, stated, *"The accumulation of human capital is the single most important driver of economic growth."* While powerful, this purpose is often criticised for reducing human beings to factors of production [8]. As the philosopher Martha Nussbaum countered, *"Education is not just about producing skilled workers; it is about producing capable, critical, and independent citizens."*

 doi:10.20944/preprints202605.0332.v1

Holistic and Lifelong Learning. The UNESCO Delors Commission synthesised these threads into four pillars: learning to know, learning to do, learning to live together, and learning to be [9]. The report famously declared, *"Learning is the treasure within"* — a metaphor that elevates education beyond utilitarian goals. This framework emphasises that education serves the whole person across a lifetime. More recently, the OECD has advocated "education for human flourishing," focusing on purpose, meaning, and well-being beyond employability [10]. The OECD's 2019 framework states, *"Education should enable people to lead lives they have reason to value."*

Religious Perspectives on Educational Purposes. Beyond the Western philosophical and economic frameworks discussed above, the world's major religious traditions have articulated purposes of education that transcend utilitarian and even purely rational aims. These perspectives, grounded in sacred texts and millennia of practice, converge on the view that education is ultimately about **transformation**—of the self, the community, and the individual's relationship with the sacred. Christianity holds that the chief end of education is to glorify God and to enjoy Him forever [31]. Islam grounds education in the first revealed word, *Iqra'* ("Read"—Qur'an 96:1), declaring that seeking knowledge is a sacred duty [32]. Judaism places the study of Torah at the centre of covenantal life, with the Talmud teaching that study is greater than practice because it leads to practice [33]. Hinduism distinguishes lower knowledge from higher knowledge (*parā vidyā*), defining education as the source of illumination leading to liberation [34]. Buddhism conceives of education as the progressive cultivation of ethical conduct, concentration, and wisdom, with the Dhammapada urging learners to follow the learned as the foundation of the holy life [35]. Confucianism treats education with supreme reverence, aiming to produce the *jūnzǐ* (exemplary person) who embodies humaneness and ritual propriety [36]. Daoism offers a transformative critique: the Way is gained by daily loss, not accumulation [38]. Sikhism teaches that without the Name, all learning is mere hypocrisy [37]. Across these perspectives, a common thread emerges: education is never merely about information transfer or economic productivity but about moral formation, spiritual awakening, and the cultivation of wisdom.

Eastern and Western Civilizations: Divergent Yet Converging Purposes. The Western and Eastern civilisations have historically seen the purposes of education differently—yet in the AI era, these differences are moderating and giving way to a global synthesis. The Western philosophical tradition, rooted in ancient Greece and the Enlightenment, has emphasised the cultivation of the rational, autonomous, questioning mind, with purposes ranging from democratic citizenship (Dewey) to critical emancipation (Freire) to holistic flourishing (OECD). In contrast, the dominant educational philosophy of East Asia—shaped profoundly by Confucianism, but also by Buddhism and Daoism—has placed moral self-cultivation and social harmony at the centre of learning. Confucius laid great emphasis on moral education to cultivate the *jūnzǐ* (exemplary person) whose behaviour brings harmony to family, community, and the state [6]. As Jin Li notes, "While a Western education aims to cultivate the mind and broaden one's understanding of the world, an East Asian education focuses more on moral excellence" [39].

Scholars have identified several key dimensions of this divergence. The Western model prioritises the rational, autonomous mind, individualism, competitive achievement, and a question-oriented, critical knowledge view. The Eastern (Confucian-heritage) model prioritises moral virtue, collectivism, group harmony, and knowledge as something to be internalised and embodied. The teacher-student relationship in the West tends to be egalitarian and facilitative; in the East it is more hierarchical and reverential. However, three forces have significantly moderated these differences in the modern era. First, industrialisation, mass education, and global standardisation created universal schooling systems designed to produce disciplined workers and patriotic citizens—a convergence that transcended cultural boundaries. In East Asia, the examination-oriented system produced what Sung calls "compressed modernity": rapid industrialisation promoting competition-based education focused on measurable academic outcomes, often at the expense of moral cultivation [40]. Second, technological transformation and the rise of AI are prompting a global convergence on "21st-century skills" such as critical thinking, creativity, collaboration, and adaptability—competencies that blend

 doi:10.20944/preprints202605.0332.v1

Western critical engagement with Eastern moral and relational concerns. Third, secularisation, globalisation, and mass higher education have shifted the dominant discourse toward instrumentalism (education for economic productivity), a purpose that resonates across Shanghai, Seoul, and San Francisco. Globalisation has also produced significant cross-cultural borrowing, with Western educators embracing Eastern practices such as collaborative learning and the cultivation of perseverance, and East Asian systems incorporating Western pedagogies emphasising creativity and student-centred learning.

The lesson for the AI era is that neither tradition alone provides a complete vision. The Western emphasis on critical thinking and individual autonomy is essential for teaching students to interrogate AI outputs, detect bias, and resist algorithmic manipulation. The Eastern emphasis on moral cultivation, social harmony, and the integration of knowledge into virtuous living is equally essential for ensuring that AI serves human flourishing rather than merely optimising productivity. The most urgent task for education in the AI era is not to choose between East and West but to synthesise their insights into a **hybrid purpose**: to cultivate persons who are both critically autonomous and morally responsible; both innovative and wise; both empowered by technology and grounded in relationships.

What AI Changes and What It Does Not. Today's AI excels at pattern recognition, language generation, and optimisation within defined parameters, but it lacks genuine understanding, moral agency, emotional empathy, and metacognitive self-reflection [11,12]. Therefore, the core purposes of education remain valid, but their *instructional priorities* must shift. We no longer need to teach students to compete with machines at machine tasks; we need to teach them to excel at what machines cannot do. However, a new reality has emerged: students will enter workplaces where AI is a routine collaborator, but they may also face situations where AI is suddenly unavailable (due to outages, security breaches, regulatory bans, or employer choice). Hence, education must prepare students for **two future states**: fluent co-work with AI and fully competent independent performance without AI. This dual preparedness is not contradictory; it is the hallmark of resilient capability. As the computer scientist Fei-Fei Li has observed, *"We need to teach human qualities that AI cannot replicate: curiosity, creativity, empathy, and ethics."* To these, we add: the ability to function completely without AI when necessary. The task of education in the AI era is not to produce faster calculators but to cultivate deeper humans who remain capable and autonomous whether or not algorithms are available.

IV. What to Teach — A Curriculum for Human Irreplaceability

Given the purposes above and AI's limitations, the curriculum must pivot from knowledge transmission to the cultivation of distinctively human capacities. There are six essential domains.

1. **Algorithmic and Critical Literacy.** Students must learn to interrogate AI outputs: detect bias, identify hallucinations, cross-reference sources, and understand the limits of statistical prediction. This is not a separate subject but a lens applied to every discipline [13].

Examples: (a) In a history class, students use ChatGPT to generate a summary of the French Revolution, then compare it against two primary sources and one peer-reviewed article, documenting any factual errors or omissions. (b) In a media studies course, students analyse a set of AI-generated news headlines for subtle bias by comparing them with headlines from reputable news outlets, then rewrite the AI outputs to remove bias while preserving factual content.

2. **Ethical Judgment and Moral Reasoning.** Because AI cannot bear moral responsibility, students need guided practice in ethical analysis. Case studies of algorithmic bias (e.g., facial recognition failures), autonomous weapons, and generative AI's impact on truth and trust should be central [14,15].

Examples: (a) Students role-play a hiring committee that receives two sets of AI-filtered resumes — one known to contain gender bias. They must decide whether to override the AI, justify their decision using ethical principles (fairness, transparency, accountability), and propose changes to the algorithm's training data. (b) In a debate format, students argue for and against the use of

 doi:10.20944/preprints202605.0332.v1

autonomous drones in military operations, weighing the reduction of soldier casualties against the lack of human judgment in targeting decisions, citing real-world incidents.

3. **Creative Abductive Thinking.** AI remixes existing patterns; humans can leap to novel hypotheses that break from training data. Students must learn to ask "What if?" and "Why not?" through design thinking, improvisation, and open-ended projects [16].

Examples: (a) Students are given a common household problem (e.g., reducing water waste in showers) and asked to generate three radical solutions that no existing AI chatbot would propose — for instance, a gamified shower timer that rewards users with plant seeds. They then prototype one solution using low-cost materials. (b) In a science class, students observe an unexpected phenomenon (e.g., a plant growing faster under blue light than red light) and must generate five competing hypotheses that challenge existing botanical models, then design a simple experiment to test one of them.

4. **Metacognition and Self-Direction.** Knowing how to learn—planning, monitoring, evaluating one's own cognitive processes—is the foundational skill for lifelong adaptation [17]. Students must learn to set goals, curate information, and reflect on their biases.

Examples: (a) Students maintain a weekly "learning log" where they set three specific learning goals, record the AI tools they used, note moments of confusion, and write a brief reflection on what strategy worked best. Every two weeks, they meet with a peer to compare logs and suggest alternative strategies. (b) At the start of a project, students create a personal learning plan that includes a timeline, a list of resources (including AI tools), and criteria for success. Mid-project, they conduct a "cognitive audit" — answering questions like "What did I assume that turned out to be wrong?" and "How did I change my approach?"

5. **Emotional and Social Intelligence.** AI simulates empathy but does not feel it. Direct instruction and practice in active listening, conflict resolution, perspective-taking, and trust-building are essential [18]. Cooperative learning and service projects become core, not peripheral.

Examples: (a) In a structured "circle dialogue," students role-play a workplace conflict (e.g., a team member missing a deadline). One student speaks as the frustrated colleague, another as the apologetic team member, and a third practices active listening by paraphrasing both sides before proposing a resolution. (b) Students participate in a cross-grade mentoring programme where older students help younger ones with a non-academic challenge (e.g., adjusting to school). Mentors must document how they used empathy, patience, and non-verbal cues — skills that are then debriefed in class.

6. **Interdisciplinary Systems Thinking.** Wicked problems like climate change and pandemics require integrating insights from data science, ethics, history, and ecology. Students must learn to see feedback loops, emergent phenomena, and the interplay of technology, society, and nature [19].

Examples: (a) Students model the impact of a proposed urban policy (e.g., congestion pricing) using a simplified system dynamics tool. They must include at least three feedback loops (e.g., reduced traffic → faster transit → more riders → less revenue from fares) and present how a change in one sector (transportation) affects others (air quality, retail sales, public health). (b) In a history-science combined unit, students investigate the 1918 influenza pandemic. They create a causal loop diagram linking troop movements (history), viral mutation (biology), public communication (media studies), and healthcare capacity (economics), then compare it to the COVID-19 response, identifying which feedback loops were similar and which differed.

Preparing for Both AI-Collaborative and AI-Independent Workplaces. The curriculum described above naturally cultivates human-irreplaceable capacities. However, we must go further by designing learning experiences that explicitly alternate between **AI-augmented** and **AI-free** conditions. Students should practice complex tasks (research, writing, data analysis, ethical deliberation) twice: first with AI as a collaborative partner, then without any AI tools. Comparative reflection on these two experiences builds metacognitive awareness of when AI adds value and when

 doi:10.20944/preprints202605.0332.v1

it becomes a crutch. Furthermore, students must be trained to maintain full capabilities for independent living and working in a modern society. This means that foundational skills—critical reading, mathematical reasoning, clear writing, face-to-face collaboration—must be mastered without AI before AI is introduced as an accelerator. The curriculum should therefore specify **AI-free zones** and **AI-required zones** in every subject, ensuring that no student becomes incapable of performing essential tasks when AI is absent.

Examples of dual-preparation activities: (a) In a writing class, students first write a persuasive essay with access to AI for brainstorming and drafting, then write a second essay on a different topic with no AI at all. They compare the processes, noting where AI helped and where their own skills were sufficient or better. (b) In a data science module, students analyse a dataset using AI to generate code and visualisations; then, one week later, they analyse a different dataset using only spreadsheets and manual calculation. The debrief focuses on what would happen if AI stopped working during a critical deadline.

The table below summarises the six domains, their alignment with classical purposes, and example activities.

Domain to Teach	**Traditional Purpose**	**AI Limitation Addressed**	**Example Activity**
Algorithmic & critical literacy	Democratic citizenship [3]	Hallucination, bias	Evaluate ChatGPT's historical summary using primary sources
Ethical judgment	Moral formation [2]	No moral responsibility	Debate an AI-generated loan recommendation
Creative abduction	Holistic flourishing [9]	Derivative, pattern-based output	Solve a local problem with no existing template
Metacognition	Lifelong growth [3]	No self-reflection	Maintain a learning journal; plan personal project
Emotional intelligence	Learning to live together [9]	No genuine empathy	Role-play conflict resolution
Systems thinking	Capabilities for complexity [8]	Narrow domain optimisation	Model climate policy trade-offs

V. What to Learn — Student Competencies for Flourishing

While the curriculum defines what is taught, students must actively appropriate these domains as personal competencies. From the learner's perspective, six interconnected skills are paramount.

1. **Learning to Learn (Metacognition).** Students must become skilled at planning their own learning, monitoring comprehension, and adjusting strategies. They should keep AI use logs, documenting prompts, critiques, and revisions, and use these logs for reflection [20].

Examples: (a) After completing a research assignment using ChatGPT, a student fills out an AI use log with columns: "What I asked the AI," "What the AI gave me," "What I changed or rejected,"

 doi:10.20944/preprints202605.0332.v1

and "What I learned about my own thinking." Every two weeks, the student reviews past logs to identify recurring mistakes (e.g., accepting vague citations) and sets one improvement goal. (b) Before a major exam, a student creates a two-week study plan that allocates time for concept mapping, self-testing, and AI-assisted quizzing. Each evening, the student spends five minutes rating their understanding of each topic (1–5) and adjusts the next day's plan accordingly, documenting the changes in a learning journal.

2. **Learning to Judge (Ethical Discernment).** Every use of AI requires a moral check. Students learn to ask: What data was used? Who might be disadvantaged? How would I justify this decision? This practical wisdom is developed through repeated, scaffolded practice [2].

Examples: (a) When an AI chatbot recommends a medical treatment plan for a case study, a student writes a one-page ethical audit answering: "What patient populations might be underrepresented in the training data?" "What would happen if the AI's recommendation was followed without human review?" and "Whose consent is needed?" (b) In a group project, students receive two AI-generated candidate solutions to a school policy issue (e.g., cafeteria food waste). The group must choose one solution, but before voting, each member writes a "stakeholder impact statement" identifying three groups that could be harmed or helped, then debates the trade-offs with peers.

3. **Learning to Create (Abductive and Divergent Thinking).** Students need experience with ill-defined problems that have no single correct answer. They should learn to generate multiple hypotheses, tolerate ambiguity, and embrace productive failure [21].

Examples: (a) Given a vague challenge — "How might we reduce loneliness in our neighbourhood?" — a student brainstorms ten wildly different ideas without judging feasibility, including one that deliberately breaks a common assumption (e.g., "Replace all benches with seesaws"). The student then selects the most surprising idea and builds a simple prototype from cardboard, documenting what failed and why. (b) In a science class, a student is shown a puzzling result: a chemical reaction that worked yesterday fails today. Instead of looking up the answer, the student writes five possible explanations (e.g., temperature change, contaminated beaker, expired reagent) and designs a single experiment that could rule out three of them at once, accepting that the process might lead to more confusion before clarity.

4. **Learning to Relate (Collaborative Intelligence).** This includes working with diverse human peers and with AI as a team member. Students learn to delegate routine subtasks to AI, verify its outputs, and integrate them into a human-led vision [10].

Examples: (a) In a team project to design a community garden, one student is assigned as "AI lead": they prompt ChatGPT to generate a planting schedule, check the AI's recommendations against local climate data (correcting errors), and present the revised schedule to the team. Another student serves as "human liaison" who ensures the team's values (e.g., using native plants) are reflected in the final plan. (b) During a debate preparation, two students collaborate with an AI summariser: one student feeds the AI the opposing team's arguments and asks for counter-arguments; the second student then critically evaluates the AI's counter-arguments for logical fallacies, and together they decide which two counter-arguments to use and which to discard, documenting their reasoning.

5. **Learning to Work with and Without AI (Dual Readiness).** Students must develop the meta-skill of switching fluently between AI-collaborative and AI-independent modes. This requires deliberate practice in delegating to AI, verifying its outputs, and integrating them—but also practice in performing the same tasks entirely alone, rebuilding confidence in unaided cognition. Students learn to diagnose when AI is genuinely helpful versus when it weakens their own capabilities.

Examples: (a) In a project to forecast local election results, students complete phase one with full AI access (data collection, analysis, report drafting). Then, without warning, the instructor announces that AI tools are unavailable for phase two (presentation and Q&A). Students must rely on their own

 doi:10.20944/preprints202605.0332.v1

understanding and printed notes. Afterward, they reflect on what they remembered and what they had outsourced to AI. (b) A student maintains a "readiness diary" tracking two types of tasks: those performed with AI and those performed without. Each month, the student sets a goal to reduce AI dependence on one specific skill (e.g., summarising articles) by practising it manually for one week, then documents the improvement in speed and accuracy.

6. **Learning to Be (Purpose and Resilience).** Finally, students must explore existential questions: What kind of life is worth living? In an era of rapid change, developing a sense of purpose, identity, and resilience is not a luxury but a core educational outcome [8].

Examples: (a) At the start of a semester, a student writes a one-page "personal mission statement" answering: "What matters most to me?" and "What kind of person do I want to become?" Every six weeks, they revisit the statement, note any changes, and write a brief reflection on how their daily actions (including use of AI) align or conflict with their stated purpose. (b) After experiencing a setback — e.g., an AI-assisted project receives a low grade because the student over-relied on generated content — the student completes a structured resilience worksheet: "What did I learn about my limits?" "What will I do differently next time?" and "Who or what helped me get back on track?" The worksheet is shared with a peer mentor for feedback, turning failure into a deliberate learning event.

VI. How to Teach — Pedagogical Principles for the AI Era

Effective teaching in the AI era transforms the teacher's role from information dispenser to designer of cognitive apprenticeships. Seven principles guide this transformation.

1. **Design Cognitive Apprenticeships.** Teachers model expert thinking processes (e.g., critiquing an AI-generated essay aloud), coach students as they practice, and then fade support [22]. This mirrors Dewey's learning by doing [23].

Examples: (a) In a writing class, the teacher projects a ChatGPT-generated paragraph on climate policy, then thinks aloud while critiquing it: "I notice the AI uses a vague statistic — I should check the original source. The argument also assumes a false dichotomy between jobs and the environment. Watch how I rewrite this sentence to acknowledge trade-offs." Students then repeat the process in pairs with a second AI paragraph. (b) In a mathematics lesson, the teacher models how to use an AI tutor to check a solution: "I'll ask the AI to solve this equation, then I'll compare step-by-step. The AI's second step uses a formula we haven't learned — I'll ask it to explain that step. Now you try with a different problem, and I'll circulate to coach."

2. **Use Problem- and Project-Based Learning.** Students confront complex, real-world problems without predetermined solutions. The teacher scaffolds inquiry, asks probing questions, and facilitates reflection on process [24]. This aligns with Freire's problem-posing education [4].

Examples: (a) The teacher presents a local issue: "Our school's recycling bin is frequently contaminated with trash. Design a solution that reduces contamination by 50% in one month." The teacher provides no step-by-step instructions but asks scaffolding questions: "What data do you need? How might AI help you analyse waste patterns? Who are the stakeholders?" (b) During a unit on water quality, the teacher gives students a map of local water testing sites and the prompt: "Some sites show high nitrate levels, but the source is unknown." Groups decide their own investigative approach — sampling strategies, data analysis, community interviews — and the teacher periodically asks: "What assumptions are you making? What have you ruled out? How will you present your findings to the city council?"

3. **Teach Critical AI Literacy Across Disciplines.** AI literacy is not a separate computer science course but a lens applied everywhere. In history, verify AI timelines; in biology, detect hallucinated citations; in literature, compare AI and human poems [13].

Examples: (a) In a history class, the teacher asks students to use an AI chatbot to generate a timeline of the Cold War, then to verify at least three dates using two different primary or secondary

 doi:10.20944/preprints202605.0332.v1

sources. Students present a "hallucination report" listing any fabricated events and speculate on why the AI might have invented them. (b) In an English literature class, the teacher provides an AI-generated sonnet in the style of Shakespeare and a genuine Shakespeare sonnet. Students work in small groups to identify three features that distinguish the human poem (e.g., consistent meter, original metaphor, emotional ambiguity) and then write a paragraph explaining why those features are difficult for AI to replicate.

4. **Teach for Dual Readiness Through Alternating Conditions.** Effective pedagogy must systematically alternate between AI-available and AI-unavailable learning environments. Teachers design sequences where students first struggle with a problem without AI (to build foundational competence), then use AI to extend or refine their work (to learn collaboration), and finally perform a transfer task without AI to consolidate independent mastery. This alternation prevents over-reliance and ensures that students retain full capability for independent living and working.

Examples: (a) In a mathematics unit, the teacher gives a problem set: "Solve the first three problems without any AI. Then use an AI tutor to check your answers and learn from your mistakes. Finally, solve two new problems without AI—and you may not refer to the AI's solutions from the middle step." (b) In a history class, students analyse a primary source without AI, writing their own interpretation. Then they use AI to generate an alternative interpretation and critique it. Finally, they write a synthesis essay without AI access, citing both their original analysis and the AI's perspective from memory.

5. **Prioritise Dialogue and Socratic Questioning.** AI generates answers but cannot engage in the messy, empathetic, turn-taking dialogue that drives deep learning. Teachers should facilitate discussions, debates, and one-on-one conferences [25].

Examples: (a) After students use AI to research a controversial topic (e.g., school uniform policies), the teacher runs a Socratic seminar where students must cite both human-sourced evidence and AI-generated claims. The teacher asks follow-up questions: "You said the AI claimed uniforms reduce bullying — did you check the original study it cited? What if the study was from a different cultural context?" (b) In one-on-one conferences, a teacher sits with a student who has over-relied on AI for a draft. Instead of lecturing, the teacher asks: "Which sentence in your essay required the most thinking? Which part felt hardest? Let's look at the AI's contribution — what would you change if you had to write without it?"

6. **Redesign Assessment to Be Process-Oriented and Authentic.** Traditional exams and take-home essays are now easily solvable by AI. Instead, use oral exams, portfolios with reflection notes, collaborative projects with peer evaluation, and in-class performance tasks where students must justify their reasoning [26].

Examples: (a) For a final project, students submit a portfolio containing: an AI-generated first draft, a marked-up version showing their edits, a one-page reflection on what they changed and why, and a recording of a three-minute oral explanation of their key argument. The teacher grades the portfolio based on the quality of revision and reflection, not the polished final product alone. (b) In a science class, the teacher gives an in-class performance task: "Using any AI tool you wish, solve this real-world data problem. But you must also write a 'justification log' — after every major step, record why you chose that approach, what the AI suggested, and whether you accepted or rejected it." The teacher assesses the log for metacognitive depth.

7. **Model Vulnerability and Co-Learning.** No teacher can be the sole expert. Effective teachers say, "I'm not sure—let's research this together." This models intellectual humility and builds a democratic community of inquiry [3].

Examples: (a) A teacher asks an AI chatbot a complex historical question in front of the class, receives an answer that seems plausible, then says: "I actually don't know if this is accurate. Let's open a library database together. I'll show you how I would check this source — and if I'm wrong, we'll learn something new." The teacher then documents the verification process on a shared screen.

 doi:10.20944/preprints202605.0332.v1

(b) After a student points out a factual error in the teacher's own lecture, the teacher says: "Thank you — I missed that. Let's ask the AI to explain the correct fact, then let's both verify it using the textbook. I'll add a correction note to our class website." The teacher then invites students to submit "teacher error reports" for extra credit, normalising that everyone — including teachers and AI — makes mistakes.

VII. How to Learn — Student Practices for Self-Directed Growth

Students are not passive recipients; they must adopt new study habits and ethical routines. Seven practices are presented here.

1. **Prompt, Critique, Synthesise.** For any AI-generated output, students learn to prompt effectively, critique for accuracy and bias, and synthesise with other sources into a new understanding. This turns AI into a sparring partner.

Examples: (a) When researching a biology topic, a student prompts ChatGPT: "Explain photosynthesis in three paragraphs suitable for a 10th grader." Then the student critiques the output by checking two statements against a textbook and flagging a misleading metaphor. Finally, the student rewrites the explanation, combining the AI's structure with their own corrected facts and a hand-drawn diagram. (b) For a history essay on the causes of World War I, the student prompts the AI to list five causes. They critique the list by cross-referencing with a primary source (a 1914 diplomatic telegram) and identify one cause that the AI overstated. The student then synthesises by writing a thesis that acknowledges the AI's four correct causes but adds a fifth from their own reading.

2. **Manage Attention and Cognitive Load.** Students learn techniques like the Pomodoro method, digital minimalism, and regular "analog hours" to protect deep focus. They also learn when *not* to use AI—e.g., for foundational memorisation that must become automatic [21].

Examples: (a) A student preparing for a foreign language vocabulary test sets a timer for 25 minutes of "no-AI study" using physical flashcards, then takes a 5-minute break away from screens. After four Pomodoros, they use an AI pronunciation tool for only 10 minutes to check difficult words, then return to analog review. (b) Before a calculus exam, a student deliberately practises differentiation problems by hand without any AI help, even though ChatGPT could solve them instantly. The student notes: "I need to internalise the chain rule so I can recognise it quickly during the test." Only after mastering the basics does the student use AI to generate additional practice problems with varying difficulty.

3. **Document and Reflect on AI Use.** Keeping an AI use log (tool, prompt, evaluation, changes made, lessons learned) builds metacognition and makes AI use transparent and accountable [20].

Examples: (a) A student maintains a spreadsheet with columns: "Date," "AI Tool," "Exact Prompt," "AI Output Summary," "What I Changed," and "Lesson Learned." After a week, the student reviews the log and notices they accepted AI-generated citations without verification three times. The student sets a new rule: always verify at least two citations per assignment. (b) For a group project, each student submits their individual AI use log alongside the final report. One student's log entry reads: "I asked Claude to outline three counter-arguments to our proposal. The AI gave one weak point; I rejected it. But the second point was good — I added it to our presentation. Lesson: AI can help find blind spots, but I must judge quality."

4. **Collaborate with Humans and AI.** Students practice delegating to AI, checking its work, and integrating it into human-led teams. Simultaneously, they learn to collaborate with peers who may use AI differently or reject it.

Examples: (a) In a four-person team designing a mobile app for campus navigation, one student is assigned "AI operator" — they prompt the AI to generate user story templates and code snippets. A second student is "AI auditor" — they verify the snippets for security flaws. The remaining two are "human leads" — they integrate the AI outputs with their own interviews of real students and

 doi:10.20944/preprints202605.0332.v1

make final decisions. The team holds a weekly "AI accountability meeting" to discuss what to accept, reject, or modify. (b) During a debate preparation, one student refuses to use any AI tools, preferring library research. Another student uses AI to generate statistical evidence. They agree to a collaboration rule: the AI user must cite the original source of every statistic (by asking the AI for the source and then verifying it), and the non-AI user checks the logic of the argument. Together, they produce a combined evidence sheet that respects both approaches.

5. **Ask Better Questions.** Since AI can answer any factual question, the scarce skill is question formulation. Students practice generating deep, open-ended, ethically charged questions using techniques like the Question Formulation Technique [27].

Examples: (a) Before a unit on climate change, a student uses the Question Formulation Technique: they start with a prompt "The role of AI in climate modelling" and generate at least 15 questions without judging them. Then they categorise questions as closed vs. open, and select one open question that cannot be answered by a simple fact: "How should society balance the energy cost of training large AI models against their potential benefit for climate prediction?" The student then researches this question for a class presentation. (b) After reading a news article about facial recognition in public spaces, a student writes a series of "ethical depth" questions: instead of "Is facial recognition accurate?" (factual), they ask "Under what conditions, if any, would the benefits of facial recognition outweigh the privacy costs?" and "Who should be held accountable when an AI misidentification leads to a false arrest?" The student then uses AI only to find legal precedents, not to answer the ethical core.

6. **Practice Deliberate AI-Free Routines.** Students must intentionally build and maintain skills that they could perform entirely without AI. This includes memorising key facts, writing without autocomplete, calculating without a solver, and navigating unfamiliar information through human-only methods. These routines are not nostalgic relics but essential insurance against AI unavailability and foundational for genuine understanding.

Examples: (a) A student sets aside one hour per week as "analog hour": no screens, no AI, just paper, pencil, and books. During this hour, they practise a skill that AI normally does for them—e.g., writing a one-page summary, solving algebra problems, or drawing a diagram from memory. (b) Before using AI to generate flashcards or quizzes, a student first creates a set of manual flashcards and tests themselves without any digital tool. Only after achieving 80% accuracy do they use AI to generate additional practice items. (c) A student preparing for a group presentation practices delivering their portion without slides, without notes, and without any AI-generated script, relying solely on their own understanding. They record themselves, identify gaps, and then use AI only to research those specific gaps.

7. **Embrace Productive Struggle and Ambiguity.** Students must deliberately choose tasks just beyond their current ability, persist through confusion, and tolerate contradictory AI outputs. This intellectual resilience is the modern form of practical wisdom [2].

Examples: (a) A student working on a complex physics problem gets two different answers from two different AI solvers. Instead of immediately accepting the majority vote, the student spends 30 minutes working through the problem by hand, comparing each step of both AI solutions. The student discovers that one AI misapplied a formula. The student writes a "struggle log" describing the confusion, the resolution, and the feeling of breakthrough — then shares it with the class. (b) For a creative writing assignment, a student deliberately avoids using AI for the first draft, writing a messy, imperfect story. After finishing, the student uses AI to generate three alternative endings — all of which feel generic. The student rejects all of them and revises their original ending, saying: "My ending is rough, but it's mine. The AI's endings were polished but meaningless." The student then writes a reflection on why human-generated imperfection can be more valuable than AI-generated fluency.

VIII. Ethical Guardrails: Student and Educator Responsibilities

 doi:10.20944/preprints202605.0332.v1

While AI offers powerful capabilities for learning and teaching, its misuse undermines the very purposes of education. We therefore establish two complementary ethical guardrails.

For Students: Use AI to Manage Learning, Never to Do Coursework. Students may use AI as a learning companion: to generate practice questions, explain concepts in different ways, check their reasoning, organise study schedules, or provide feedback on drafts. However, students must never submit AI-generated content as their own work, nor use AI to complete assignments, answer exam questions, or write papers on their behalf. The boundary is defined by **cognitive agency**: if the AI performs a task that the student is meant to learn, the student has violated this guardrail. Institutions should require students to sign an "AI Use Declaration" for each major assignment, specifying which tools were used and how, and affirming that all submitted work represents their own intellectual effort. Violations are treated with the same seriousness as plagiarism, with progressive consequences that emphasise restoration and relearning.

Examples of acceptable use: (a) A student asks ChatGPT to explain a confusing physics concept in three different ways, then writes their own summary in their own words. (b) A student uses an AI tutor to generate additional practice problems of a specific difficulty level, solves them by hand, and asks the AI to check only the final answers. (c) A student uses AI to create a weekly study calendar based on their syllabus, then follows it manually.

Examples of unacceptable use: (a) A student copies and pastes an AI-generated paragraph into an essay without substantial rewriting. (b) A student asks AI to solve a math problem and submits the solution without attempting it themselves. (c) A student uses AI to paraphrase a source to avoid citation or to create the illusion of original analysis.

For Educators: Responsible and Ethical Use of AI for Content Creation and Assessment. Human educators may use AI to enhance their teaching, but only under principles of transparency, validation, and human oversight. AI can generate draft lesson plans, create illustrative examples, design quiz questions, or provide first-pass feedback on student work. However, educators must: (1) always review and revise AI-generated content for accuracy, bias, and appropriateness before using it with students; (2) never rely solely on AI for high-stakes summative assessment (e.g., final grades) without human moderation; (3) disclose to students when AI has been used to generate materials or provide feedback; and (4) ensure that AI-assisted assessment does not disadvantage any group of students (e.g., by failing to account for non-standard writing styles or cultural expressions). Educators remain fully accountable for all decisions made with AI assistance.

Examples of responsible educator use: (a) A teacher asks an AI to generate ten multiple-choice questions for a low-stakes practice quiz, then edits three questions that are ambiguous or factually incorrect, and adds a note to students: "This quiz was generated with AI and human-reviewed." (b) A professor uses AI to provide initial feedback on student drafts (e.g., flagging unclear sentences), but the professor writes the final comments and assigns the grade. (c) A curriculum designer uses AI to suggest real-world case studies for a business ethics course, then independently verifies each source and adapts the cases to local contexts.

Examples of irresponsible use: (a) An educator uses an AI grader to assign final exam grades without any human verification. (b) A teacher uses AI-generated lesson plans that contain factual errors or cultural stereotypes, without review. (c) An instructor feeds student essays into an AI without obtaining consent or anonymising the data, violating privacy norms.

IX. A Unified Framework: Integrating Purposes, Curriculum, Pedagogy, and Learning

The table below synthesises the entire study, showing how purposes, what to teach, what to learn, how to teach, and how to learn align, including the new elements of dual readiness and ethical guardrails.

 doi:10.20944/preprints202605.0332.v1

Purpose of Education	**What to Teach (Curriculum)**	**What to Learn (Student Competency)**	**How to Teach (Pedagogy)**	**How to Learn (Student Practice)**
Moral formation [2,6]	Ethical judgment	Ethical discernment	Case-based dialogue; model moral reasoning	Document and reflect on ethical choices
Democratic citizenship [3]	Critical & algorithmic literacy	Learning to judge	Socratic questioning; problem-based learning	Prompt, critique, synthesise; ask better questions
Critical liberation [4]	Systems thinking; creative abduction	Learning to create	Project-based learning; co-learning	Embrace productive struggle; tolerate ambiguity
Human capital [5]	Metacognition; self-direction	Learning to learn	Cognitive apprenticeship	Manage attention; document AI use
Holistic flourishing [9,10]	Emotional intelligence	Learning to relate	Dialogic instruction; collaborative projects	Collaborate with humans and AI
Human flourishing [8]	Interdisciplinary systems thinking	Learning to be	Authentic, process-oriented assessment	Ask existential questions; build resilience
Dual workplace readiness (new)	Alternating AI-collaborative & AI-free task performance	Learning to work with and without AI	Alternating conditions (AI-available / AI-unavailable)	Practice deliberate AI-free routines

 doi:10.20944/preprints202605.0332.v1

Purpose of Education	What to Teach (Curriculum)	What to Learn (Student Competency)	How to Teach (Pedagogy)	How to Learn (Student Practice)
Ethical integrity (new)	Boundaries of AI use; cognitive agency	Responsible AI use as a learner	Model ethical AI use; enforce AI use declarations	Sign AI use declarations; distinguish management vs. delegation

X. Conclusion: The Great Transition

The AI era is not the end of education but its most profound renewal. When machines can answer questions, the purpose of education shifts to asking better ones. When AI can generate plausible text, the purpose shifts to discerning truth from falsehood and beauty from mere pattern. When algorithms can optimise, the purpose shifts to choosing *which* ends are worth pursuing. This study has shown that the historical purposes of education—moral, civic, critical, economic, holistic—remain our compass. But they require new answers to the three core questions: **what to teach** (human-irreplaceable competencies), **what to learn** (metacognitive, ethical, creative, collaborative, existential, and dual-readiness skills), **how to teach** (cognitive apprenticeship, problem-based learning, dialogue, authentic assessment, and alternation between AI-available and AI-free conditions), and **how to learn** (active critique, attention management, reflection, collaboration, questioning, resilience, and deliberate AI-free practice).

We have added two indispensable pillars. First, students must be prepared for workplaces where AI is both a routine collaborator and a potential absence; therefore, curricula and pedagogies must cultivate full capabilities for independent living and working in a modern society, whether AI is present or not. Second, ethical guardrails are non-negotiable: students may use AI to manage their learning but never to do their coursework; educators may use AI to create and assess but only responsibly and transparently.

The ultimate message is one of empowerment, not fear. Students who master these competencies will not be replaced by AI; they will be augmented by it—and they will remain capable when it is gone. Teachers who embrace these pedagogical principles will not become obsolete; they will become more essential as guides, coaches, and models of humanity. And societies that invest in this integrated vision will cultivate citizens who can navigate uncertainty, challenge injustice, and build a flourishing future. As the Delors Commission wrote, "Learning is the treasure within" [9]. In the new AI era, that treasure is more precious—and more human—than ever.

References

1. Plato, *Republic*, G. M. A. Grube and C. D. C. Reeve, Trans. Indianapolis, IN, USA: Hackett Publishing, 1992 (original work published ca. 380 B.C.E.).
2. Aristotle, *The Complete Works of Aristotle*, J. Barnes, Ed. Princeton, NJ, USA: Princeton University Press, 1984 (original work published ca. 350 B.C.E.).
3. J. Dewey, Democracy and Education: An Introduction to the Philosophy of Education. New York, NY, USA: Macmillan, 1916.
4. P. Freire, *Pedagogy of the Oppressed*. New York, NY, USA: Continuum, 1970.
5. World Bank, World Development Report 2018: Learning to Realize Education's Promise. Washington, DC, USA: World Bank Publications, 2018.

 doi:10.20944/preprints202605.0332.v1

6. Confucius, *The Analects*, D. C. Lau, Trans. London, U.K.: Penguin Classics, 2006 (original work published ca. 500 B.C.E.).
7. S. Bowles and H. Gintis, Schooling in Capitalist America: Educational Reform and the Contradictions of Economic Life, 2nd ed. Chicago, IL, USA: Haymarket Books, 2011.
8. M. C. Nussbaum, *Creating Capabilities: The Human Development Approach*. Cambridge, MA, USA: Harvard University Press, 2011.
9. J. Delors et al., *Learning: The Treasure Within*. Paris, France: UNESCO Publishing, 1996.
10. OECD, Education for Human Flourishing: A New Framework for the Future of Learning. Paris, France: OECD Publishing, 2019.
11. E. M. Bender and A. Koller, "Climbing towards NLU: On meaning, form, and understanding in the age of data," in *Proc. 58th Annu. Meeting Assoc. Comput. Linguistics (ACL)*, 2020, pp. 5185–5198.
12. 1212 L. Floridi, The Ethics of Artificial Intelligence: Principles, Challenges, and Opportunities. Oxford, U.K.: Oxford University Press, 2023.
13. UNESCO, *AI and Education: Guidance for Policy-Makers*. Paris, France: UNESCO Publishing, 2021.
14. S. U. Noble, *Algorithms of Oppression: How Search Engines Reinforce Racism*. New York, NY, USA: New York University Press, 2018.
15. L. Floridi and J. Cowls, "A unified framework of five principles for AI in society," *Harvard Data Science Review*, vol. 1, no. 1, 2019.
16. M. A. Boden, *AI: Its Nature and Future*. Oxford, U.K.: Oxford University Press, 2016.
17. J. H. Flavell, "Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry," *American Psychologist*, vol. 34, no. 10, pp. 906–911, 1979.
18. D. C. Dennett, *From Bacteria to Bach and Back: The Evolution of Minds*. New York, NY, USA: W. W. Norton, 2019.
19. D. H. Meadows, *Thinking in Systems: A Primer*. White River Junction, VT, USA: Chelsea Green Publishing, 2008.
20. B. J. Zimmerman, "Becoming a self-regulated learner: An overview," *Theory Into Practice*, vol. 41, no. 2, pp. 64–70, 2002.
21. B. Oakley, A Mind for Numbers: How to Excel at Math and Science (Even if You Flunked Algebra). New York, NY, USA: TarcherPerigee, 2014.
22. Collins, J. S. Brown, and S. E. Newman, "Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics," in *Knowing, Learning, and Instruction: Essays in Honor of Robert Glaser*, L. B. Resnick, Ed. Hillsdale, NJ, USA: Lawrence Erlbaum, 1989, pp. 453–494.
23. J. Dewey, *Experience and Education*. New York, NY, USA: Kappa Delta Pi, 1938.
24. S. M. Barnett and S. J. Ceci, "When and where do we apply what we learn? A taxonomy for far transfer," *Psychological Bulletin*, vol. 128, no. 4, pp. 612–637, 2002.
25. R. Alexander, *A Dialogic Teaching Companion*. London, U.K.: Routledge, 2020.
26. E. R. Mollick and L. Mollick, "New modes of learning enabled by AI chatbots: Three methods and assignments," *SSRN Electronic Journal*, 2022, doi: 10.2139/ssrn.4308633.
27. D. Rothstein and L. Santana, *Make Just One Change: Teach Students to Ask Their Own Questions*. Cambridge, MA, USA: Harvard Education Press, 2011.
28. G. Marcus and E. Davis, *Rebooting AI: Building Artificial Intelligence We Can Trust*. New York, NY, USA: Pantheon, 2019.
29. J. Wing, "Computational thinking," *Communications of the ACM*, vol. 49, no. 3, pp. 33–35, 2006.
30. D. H. Autor, "Why are there still so many jobs? The history and future of workplace automation," *Journal of Economic Perspectives*, vol. 29, no. 3, pp. 3–30, 2015.
31. Westminster Assembly, *The Shorter Catechism*, 1647, Q. 1.
32. Prophet Muhammad, as recorded in *Sunan Ibn Mājah*, Book of Sunnah, hadith no. 224.
33. Babylonian Talmud, *Kiddushin* 40b.
34. *Rigveda*, as cited in Jaypee Digital, "Education in Ancient India," 2020.
35. *Dhammapada*, Sutavagga (Learning), vv. 1–3.
36. Confucius, *Analects*, 1.1, trans. D. C. Lau (Penguin Classics, 2006).

 doi:10.20944/preprints202605.0332.v1

37. *Guru Granth Sahib*, p. 467, trans. Dr. Sant Singh Khalsa.
38. *Dao De Jing*, chapter 48, trans. S. Mitchell.
39. J. Li, *Cultural Foundations of Learning: East and West*. Cambridge, MA, USA: Harvard University Press, 2012.
40. Y.-K. Sung, "The learning community writ large: Towards a new direction in the East Asian style of education," Kyoto University OpenCourseWare, 2020.