

Education for Human Agency in the Age of AI

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Abstract

This conceptual article argues that artificial intelligence (AI) does not alter the fundamental purposes of K–12 education but instead heightens the importance of cultivating distinctly human forms of knowledge and agency. Drawing on classical and contemporary educational thought, we identify four enduring capacities central to schooling: disciplinary understanding, applied competence, sound judgment, and reflective wisdom. We examine how these capacities align with the enduring aims of education and consider the extent to which schools currently develop them in practice. We then analyze how AI is reshaping teaching and learning by expanding access to information, automating routine cognitive tasks, and raising new questions about judgment, authorship, equity, and human development. In response, we propose a framework of human intellectual agency in an AI-mediated world, arguing that students, teachers, and schools must learn to empower, govern, and disrupt AI in ways that serve educational purposes. We conclude that AI makes the cultivation of human knowledge, judgment, and purpose more—not less—essential in contemporary schooling.

Keywords: Human agency, artificial intelligence (AI), K-12 education, knowledge, skills, judgment

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Introduction

“The Industrial Revolution made human strength more or less irrelevant,” artificial intelligence (AI) pioneer Geoffrey Hinton remarked in a 2025 interview. “Now [the arrival of AI] is going to make human intelligence more or less irrelevant” (Hinton, 2025). It is a striking claim and one that captures a growing public narrative about AI. If taken literally, it is tempting to conclude that schools must reinvent themselves for education in the Age of AI, shifting not only their approaches to curriculum, instruction, and assessment, but reorienting the purposes of education itself. If machines can think, reason, and create faster than humans, then perhaps K-12 education should focus its attention on AI itself—teaching students how to adapt to a world in which machines increasingly perform cognitive work once reserved for humans

Respectfully, we disagree.

AI is rapidly reshaping schools and classrooms. Great disrupters to the context of schooling (e.g., the printing press, the Enlightenment, the Industrial Revolution, the Digital Age) invite us to ask: *What knowledge is most worth cultivating in K–12 schools—especially in an AI-mediated world?* For centuries, educators and philosophers have emphasized enduring forms of human knowledge that support thoughtful participation in society and a good life. These include conceptual understanding, practical competence, sound judgment, and reflection on meaning and purpose (Alvunger, 2022; Leandro, 2019). Although schools have emphasized these aspects of human agency in different ways, the core purposes of education have remained remarkably stable over time (Biesta, 2010; Reimers, 2020). What matters is not educational change itself, but the context in which it occurs. AI can be a powerful support for teaching and learning, but it is not a substitute for human thinking, teaching, or judgment (Mozer et al., 2019).

In this conceptual article, we examine the relationships among the enduring forms of knowledge cultivated through schooling, the fundamental purposes of K-12 education, and the emergence of AI. We begin by examining these forms of knowledge and how they align with the enduring purposes of education. We then consider how well schools are currently developing these capacities in practice, highlighting important gaps and tensions. Next, we examine how AI is reshaping the context of teaching and learning, clarifying what these technologies can and cannot do, and why human knowledge and judgment remain indispensable. Building on these foundations, we introduce a framework of human intellectual agency in an AI-mediated world, describing how students, teachers, and schools can empower, govern, and thoughtfully disrupt AI. Finally, we consider the implications for K–12 education, exploring how curriculum, instruction, assessment, and school leadership can better support the development of the forms of human knowledge and agency that matter most in the age of AI.

What’s Worth Knowing?

For more than two millennia, educators and philosophers across traditions have asked a central question: *What knowledge is of most worth?* The answer has remained remarkably consistent. From Aristotle’s account of the intellectual virtues in ancient Greece to Confucius’s framework of moral and practical cultivation in ancient China, from Plato’s ascent from practical skill to philosophical wisdom to Dewey’s insistence that genuine education requires reflective experience

with real problems, thinkers working independently across cultures and centuries converge on similar forms of human development (Aristotle, ca. 350 B.C.E./2009; Confucius, ca. 500 B.C.E./1979; Dewey, 1938; Plato, ca. 380 B.C.E./1992).

Drawing on these classical sources, we identify four complementary forms of knowledge essential for human flourishing: the capacity to accurately interpret the world through disciplinary understanding (*episteme*, ἐπιστήμη), to act skillfully and produce competent work in the world (*techne*, τέχνη), to exercise sound judgment in complex and uncertain situations (*phronesis*, φρόνησις), and to reflect on what is most true, most valuable, and most worth pursuing in human life (*sophia*, σοφία).

Our modern adaptation of Aristotle's framework for educational purposes resonates in contemporary education research (Biesta, 2009; Reimers, 2020). Across grade levels and subject areas, these forms of knowledge, skill, and disposition reflect the shared aims of schooling: helping students accurately perceive, carefully analyze, prudently judge, responsibly act, and critically reflect in ways that support thoughtful participation in society and the pursuit of a good life.

In classrooms, this work manifests in varied ways yet consistently serves common educational ends. A history teacher helps students interpret sources and weigh competing accounts. A science teacher guides students in designing investigations and evaluating evidence. An English teacher supports students in constructing and defending interpretations of texts. A mathematics teacher helps students apply concepts, solve problems, and justify their reasoning. At a high level of generality, teachers of all subjects are engaged in essentially the same work from different perspectives—equipping students with the knowledge, skills, and dispositions needed to understand the world and act thoughtfully within it.

The Aims of Education and Forms of Human Knowledge

What are schools for? Despite centuries of debate, the answer has remained remarkably consistent. Biesta (2010) captured this well: Schools exist to qualify students with knowledge and skills, to socialize them into cultural and civic traditions, and to support their development as independent, reflective persons. These are not competing priorities but complementary dimensions of a complete education.

Contemporary educational research suggests that schools aim to develop these enduring forms of knowledge (Biesta, 2010; Reimers, 2020), including disciplinary learning (Bransford et al., 2000), transferable skills and applied competence (Pellegrino & Hilton, 2012), moral and reflective judgment (Vermeer & van der Ven, 2002; Pasupathi et al., 2001), and purpose and meaning in human development (Damon et al., 2003; Yuen et al., 2021).

Understanding the World. Schools are society's primary institutions for initiating students into the accumulated knowledge of human inquiry—the disciplinary frameworks, cultural traditions, and shared ways of thinking that allow individuals to make sense of the natural and social world. Through mathematics, science, history, literature, and the arts, students develop the conceptual tools to interpret evidence, analyze problems, and engage ideas beyond their immediate experience

(Alvunger, 2022; Shegenova & Slambekova, 2024). Conceptual and disciplinary knowledge enable students to explore and understand the world through an educated lens.

Acting Competently in the World. Knowledge that cannot be applied is incomplete. Schools create structured opportunities for students to put what they know into action. Through writing, investigation, problem solving, and collaboration, students develop the practical competence needed to communicate effectively and act skillfully in real-world contexts (Gagnon & Sasseville, 2008). Research confirms that these capacities develop most powerfully when embedded in authentic, applied work rather than isolated skill exercises (Koukounaras-Liagkis, 2019). Practical skills and applied competence enable students to act effectively and skillfully in the world.

Participating in Civic and Social Life. An essential purpose of schooling is preparing students to participate thoughtfully in civic and social life. Democratic societies depend on individuals who can evaluate information, weigh competing perspectives, and deliberate about complex public questions (Mosher et al., 1994). More broadly, this kind of judgment is required whenever people must make decisions in situations shaped by competing values, incomplete information, and real consequences. Research suggests that such judgment develops when students engage with complex problems that require balancing values in context (Vontz, 2016). Drawing on Aristotle's concept of *phronesis* (practical wisdom), Vontz argued that sound judgment cannot be reduced to rules or abstract principles; it requires discerning what is best, right, or good in a particular situation. Judgment and practical wisdom enable students to deliberate, decide, and act responsibly in civic and social contexts.

Developing Identity, Purpose, and the Search for Meaning. Finally, schools not only shape what students know or can do, but they also help to shape who they are becoming. Through sustained engagement with literature, history, philosophy, and the arts, as well as through meaningful relationships with teachers who take their development seriously, students are invited to reflect on their values, emerging identities, and the purposes they wish to pursue (Yuen et al., 2021; Schroeder & Branco, 2020). Research suggests that this search for meaning develops over time through opportunities for reflection, goal setting, and participation in communities where students feel recognized and valued (Olkhova, 2022; Yuen et al., 2021). In this sense, schooling is not only about preparing students for future roles but about helping them consider what is worth knowing, what is worth doing, and what it means to live well. Reflective wisdom enables students to develop identity, purpose, and a meaningful orientation toward life.

Bringing These Forms of Knowledge Together. These four purposes describe what schooling is fundamentally for: helping students understand the world, act competently within it, participate responsibly in civic and social life, and live as thoughtful, purposeful human beings. The four forms of knowledge are interdependent capacities that develop over time through structured instruction, experiential learning, dialogue, and relationships (Koukounaras-Liagkis, 2019; Collinson, 1996). Understanding supports action; action strengthens judgment; and judgment, in turn, opens space for reflection on meaning and purpose. These aims also resonate beyond the academy. People consistently identify intellectual preparation, civic readiness, and personal development as central expectations for their schools (Richardson, 2016).

How Well Do Schools Achieve Their Aims?

If these four purposes describe what schooling is fundamentally for, it is worth asking how well schools are currently realizing them in practice. AI does not enter K-12 education in a vacuum; it will interact with an educational system that already achieves these aims unevenly and with persistent gaps in depth, equity, and application

Understanding the World. Schools invest the most time and attention in disciplinary understanding, yet outcomes remain uneven. The 2024 National Assessment of Educational Progress showed that only 31% of fourth graders and 33% of eighth graders read at a proficient level, while roughly one-third of eighth graders performed below basic—the highest proportion on record (NCES, 2025a). In mathematics, just 22% of twelfth graders reached proficiency (NCES, 2025b).

These national figures reflect longstanding patterns. Standardized assessments consistently reveal substantial disparities in achievement by race and socioeconomic status, and these gaps have proven remarkably persistent over recent decades (Hanushek et al., 2022; Reardon, 2011). Even where overall performance appears adequate, concerns about depth persist. Many schools continue to prioritize content coverage and recall over deeper conceptual understanding and analytical reasoning (Wagner, 2008). Recent declines in reading scores (down five points for both fourth- and eighth-grade students from pre-pandemic levels (NCES, 2025a)) further suggest that substantial time spent on disciplinary knowledge does not automatically translate into genuine depth of understanding.

Acting Competently in the World. Knowledge alone is not enough—students must learn to use it skillfully in real situations. The gap between aspiration and practice is often widest here. Many schools continue to emphasize knowledge acquisition over application, even though real-world problems offer stronger opportunities to develop meaningful competence (Wagner, 2008). Much of the strongest evidence for applied learning comes from project-based or vocational contexts rather than general K–12 settings. Prianto et al. (2022) found that applied learning strengthens deeper competencies, while Brundiers et al. (2010) showed that such learning is most effective when it extends beyond the classroom into real-world contexts. The challenge is not whether schools can develop competence, but that the pedagogies that do so well, are not yet the norm.

Participating in Civic and Social Life. This aim reveals perhaps the most concerning shortfall. A systematic review by Fitzgerald et al. (2021) found that although civic education is widely recognized as essential, relatively little research addresses how to implement it effectively in K–12 settings. Other studies suggest that civic education can matter, but its effects are uneven. Gainous and Martens (2012) found that civic instruction has the greatest impact on students from less privileged backgrounds, while Levinson (2012) documented a persistent “civic empowerment gap” in which knowledge and participation are stratified by race and socioeconomic status. Although participation in civics courses is associated with increased voting (Siegel-Stechler, 2019), civic education has often been marginalized by accountability pressures focused on tested subjects. As a result, schools may prepare some students for democratic participation, but not all—and not consistently.

Developing Identity, Purpose, and the Search for Meaning. This is arguably the least explicitly developed purpose of schooling. Only recently have educational systems begun to give sustained attention to student well-being and purpose. Shirley et al. (2020) noted rising concerns about student anxiety, depression, and lack of purpose, while Brown and Shay (2021) argued that prevailing approaches to well-being focus too narrowly on individual traits rather than identity and belonging. Research further suggests that identity development is closely tied to engagement: Davies and O'Neill (2022) found that students with a stronger sense of identity are more motivated learners. School climate also plays a critical role, with Riekie et al. (2017) documenting strong relationships between supportive environments and student well-being, resilience, and moral identity. Yet despite this evidence, schools rarely treat identity and purpose as central, explicit aims of education.

Table 1

Four Aims of Education

Aim of Education	Core Focus	What Students Develop	How It Is Cultivated	Current Challenges in Practice
Understanding the World	Disciplinary and conceptual knowledge.	Ability to interpret, analyze, and make sense of the natural and social world.	Instruction in subject areas (e.g., math, science, history, literacy); engagement with disciplinary thinking.	Uneven achievement; emphasis on coverage over depth; persistent gaps; declining reading performance.
Acting Competently in the World	Application of knowledge in real contexts.	Practical skills, problem-solving, communication, and collaboration.	Authentic tasks, writing, inquiry, project-based and real-world learning experiences.	Overemphasis on knowledge acquisition; applied learning not yet the norm in K–12 settings.
Participating in Civic and Social Life	Civic reasoning and democratic participation.	Judgment, perspective-taking, deliberation, and responsible decision-making.	Engagement with complex social issues, discussion, civic learning experiences.	Limited implementation; inequitable access; civic empowerment gaps; marginalization due to testing priorities.
Developing Identity, Purpose, and Meaning	Personal development and reflective growth.	Identity formation, sense of purpose, values, and meaning making.	Reflection, relationships, engagement with humanities, supportive school environments.	Least emphasized aim; rising concerns about well-being; lack of systematic integration into schooling.

Synthesis. As synthesized in Table 1, across these four domains, schools show important strengths but also clear limitations. The pattern is consistent: disciplinary understanding receives the most deliberate attention yet remains uneven; practical competence, civic judgment, and reflective wisdom are often underdeveloped or marginalized. These gaps matter in the age of AI. The more powerful AI becomes at handling routine cognitive tasks, the more critical it is that schools strengthen precisely those human capacities they have historically struggled to fully develop. The central question, then, is not whether AI will change schooling but whether we will use it to exacerbate or remedy these longstanding challenges.

Forms of Knowledge, Enduring Purposes of Education, and AI

Building on the idea that schools exist to help students develop four core capacities, Biesta (2010) posited that these capacities contribute to three enduring purposes of education: qualification (developing knowledge and skills), socialization (initiating students into cultural and civic traditions), and subjectification (supporting the formation of independent, responsible persons). Drawing on both classical and contemporary perspectives, we describe these capacities as:

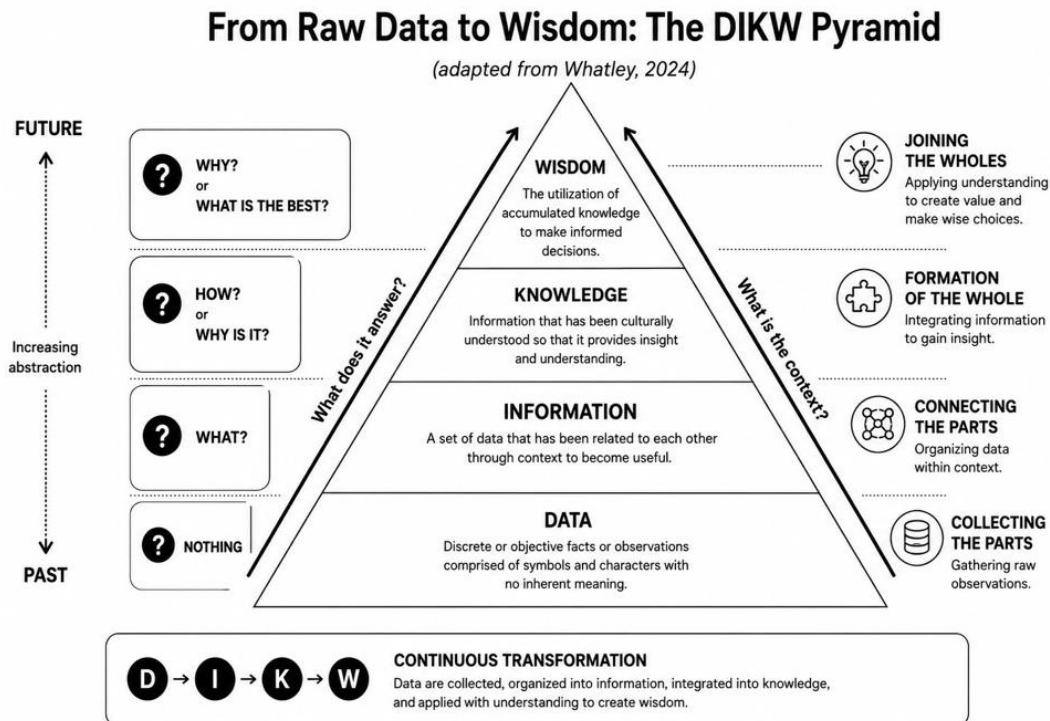
- Explore and interpret the world through organized bodies of knowledge and disciplined ways of thinking (episteme; qualification).

- Act competently in the world by applying knowledge to solve problems, communicate effectively, and perform skillfully in real situations (techne; qualification).
- Develop practical wisdom by learning to evaluate information, weigh competing considerations, and make responsible decisions in complex, uncertain contexts (phronesis; socialization and subjectification).
- Build character, meaning, and purpose by reflecting on values, identity, what it means to live well, and how to contribute meaningfully to society (sophia; subjectification).

The classic Data–Information–Knowledge–Wisdom (DIKW) hierarchy offers a useful lens for understanding how AI interacts with these purposes and forms of knowledge (Whatley, 2024). At the base are data—raw inputs and facts. When organized, data becomes information. When interpreted through human understanding, information becomes knowledge. At the highest level is wisdom: the capacity to apply knowledge with sound judgment in particular contexts (see Figure 1).

Figure 1

From Raw Data to Wisdom (adapted from Whatley, 2024)



While helpful as a heuristic, the DIKW model has limitations and can oversimplify the development of understanding. Seen alongside the four forms of human knowledge, this hierarchy helps clarify where AI is most capable and where human capacities remain essential.

Current AI systems excel at the lower levels of this hierarchy. They are extraordinarily capable at processing data and generating information—identifying patterns, summarizing sources, producing fluent responses, and creating drafts or models. They can also simulate aspects of knowledge through explanations and analyses. However, these outputs result from statistical

pattern recognition rather than genuine understanding, lived experience, moral accountability, or contextual judgment. AI does not “know” whether its responses are accurate, trustworthy, or appropriate within specific disciplinary, cultural, or ethical situations. AI connects with each purpose and its associated form of knowledge in distinct but predictable ways.

Exploring and Interpreting the World (Episteme). AI supports this purpose by generating accessible, on-demand explanations, personalized examples, and multiple representations of complex ideas across disciplines. It makes knowledge more approachable and supports self-paced exploration. However, AI outputs often appear authoritative even when they contain errors, hallucinations, or subtle biases. Without strong disciplinary knowledge, students may struggle to detect inaccuracies or contextual nuances, potentially weakening deep understanding and shifting epistemic authority from disciplines and teachers toward algorithms. This risk is especially pronounced for students from underserved backgrounds who may have fewer opportunities to build strong foundational knowledge, potentially widening rather than closing achievement gaps.

Acting Competently in the World (Techne). AI transforms this purpose by automating routine tasks, providing immediate feedback, and enabling rapid iteration on drafts, models, and solutions. This can free cognitive resources for more complex, authentic work and accelerate skilled performance in real-world contexts. A key limitation is the risk of deskilling. When AI replaces the productive struggle of drafting, revising, failing, and refining work, students may develop weaker long-term competence, resilience, and the ability to perform skillfully without technological support. Well-designed AI use, however, can mitigate this risk by deliberately preserving productive struggle (e.g., requiring students to critique, revise, or extend AI-generated work using their own knowledge and judgment).

Developing Practical Wisdom (Phronesis). AI can multiply opportunities for developing practical wisdom by creating frequent, low-stakes moments for students to evaluate outputs, question assumptions, identify biases, weigh trade-offs, and practice contextual decision making. Well-designed tasks—such as critiquing an AI-generated policy proposal or revising flawed ethical advice—can strengthen habits of thoughtful judgment in civic, personal, and everyday contexts. However, without careful scaffolding and accountability, students may defer judgment to AI, accepting plausible-sounding responses rather than engaging with uncertainty and values themselves. Because AI lacks personal stakes and moral agency, it can simulate judgment without cultivating genuine practical wisdom. Used in this way, AI can serve as a powerful ‘practice ground’ for phronesis, but only when tasks are intentionally structured to demand human evaluation rather than passive acceptance.

Building Character, Meaning, and Purpose (Sophia and Subjectification). AI intensifies this purpose by surfacing fundamental questions about authorship, truth, value, and meaning: “Is this my work?” “What is worth knowing?” and “What does it mean to live and contribute well in an AI-augmented world?” These moments can spark deeper reflection on identity and purpose when paired with dialogue and supportive relationships. At the same time, AI can simulate reflective or wise-sounding language, leading students to substitute shallow, machine-generated responses for authentic internal reflection. Over-reliance risks weakening intrinsic motivation, sense of ownership, and the human relationships essential for developing character, empathy, and a grounded sense of purpose—core elements of Biesta’s subjectification.

AI is a powerful amplifier. When used with intentional pedagogy, it can expand access to knowledge, support skilled performance, multiply opportunities for practicing practical wisdom, and open meaningful conversations about what matters most. Without deliberate design, however, it risks deskilling students, undermining judgment, and weakening the human relationships and authentic effort that lie at the heart of a complete education. In an AI-mediated world, these dynamics do not replace the enduring purposes of education—they intensify and clarify them. As AI becomes increasingly capable of handling data, information, and routine cognitive tasks, the distinctly human capacities of deep understanding, productive struggle, ethical judgment, and reflective wisdom become even more essential. The central task for schools, then, is not whether to use AI, but how to ensure it serves without supplanting the most human dimensions of learning.

Table 2

Human Knowledge, K–12 Education, and AI

	Disciplinary Understanding (<i>Episteme</i>)	Applied Competence (<i>Techné</i>)	Sound Judgment (<i>Phronesis</i>)	Reflective Wisdom (<i>Sophia</i>)
What It Means	Understanding important concepts, explanations, and frameworks that help interpret the natural and social world.	The ability to apply knowledge effectively to solve problems and produce competent work.	The ability to interpret situations, weigh competing considerations, and make thoughtful judgments.	Reflection on values, identity, purpose, and the human condition.
Development in K–12 Schools	Structured learning in academic disciplines such as mathematics, science, history, literature, and the arts; reading, inquiry, and analysis of evidence.	Writing assignments, mathematical problem solving, scientific inquiries, artistic creations, presentations, and collaborative projects.	Classroom discussions, debates, case studies, analysis of public issues, civic simulations, and examination of ethical dilemmas.	Discussion and interpretation of literature, history, religion, philosophy and the arts; reflective writing; mentoring relationships.
Purposes of K–12 Education	Helps students understand and interpret the world through organized bodies of knowledge and disciplined ways of thinking.	Helps students apply knowledge to act competently, solve problems, and communicate effectively in real-world situations.	Helps students evaluate information, weigh competing considerations, and make responsible decisions in complex contexts.	Helps students reflect on values, identity, and purpose, and consider what it means to live well and contribute to society.
AI and Human Knowledge	AI reshapes episteme. Positively: Generates accessible, on-demand explanations. Negatively: Appears authoritative; without disciplinary knowledge, students cannot detect errors or bias.	AI transforms techné. Positively: Automates routine tasks, enabling higher-order work. Negatively: Can replace the productive struggle through which competence develops.	AI amplifies phronesis. Positively: Creates frequent opportunities to practice evaluating and questioning outputs. Negatively: Without structure, students defer judgment and accept AI responses.	AI intensifies sophia. Positively: Raises unavoidable questions about meaning, purpose, and what is worth knowing. Negatively: Simulates wisdom, risking shallow reflection in place of genuine insight.

Empowering, Governing, and Disrupting AI

If the forms of knowledge and enduring purposes of education remain stable in the Age of AI, the central question becomes how human knowledge equips students, teachers, and schools to engage AI responsibly and productively. Human knowledge enables us to engage AI in three distinct but complementary ways: by empowering it for productive learning, governing its use with ethical and educational judgment, and disrupting its outputs or applications when they fall short of human goals. Table 3 maps these capacities across students, teachers, and schools.

Table 3*Human Agency in an AI-Mediated World*

Human Agency	What It Means	K–12 Students	Teachers	Schools
Empowering AI	Using AI productively to extend human learning, teaching, and institutional capacity while remaining guided by human knowledge and purpose.	Use disciplinary knowledge to question, refine, and extend AI-generated explanations, summaries, and ideas during learning.	Use subject expertise and pedagogical knowledge to design tasks where AI supports inquiry, explanation, and feedback while keeping student thinking central.	Use AI to support tutoring, communication, scheduling, and analysis of learning data in ways aligned with educational goals rather than efficiency alone.
Governing AI	Exercising ethical and professional judgment over when and how AI should be used in light of educational and civic purposes.	Examine issues such as bias, privacy, and fairness in algorithmic systems and consider how AI influences decisions and information.	Use professional judgment to evaluate AI tools, interpret their recommendations, and ensure technology supports rather than distorts learning.	Establish policies and institutional norms governing responsible AI use, including safeguards for privacy, transparency, fairness, and accountability.
Disrupting AI	Questioning, challenging, or redirecting AI outputs when they are inaccurate, biased, shallow, or inconsistent with human goals.	Apply disciplinary understanding to critique AI explanations, identify errors or omissions, and revise conclusions.	Override AI suggestions when they conflict with sound pedagogy, contextual knowledge of students, or professional judgment.	Reject or redesign AI applications that undermine equity, valid assessment, teacher agency, or the educational mission of the school.

Empowering AI. Human knowledge empowers AI in education by enabling more productive and purposeful collaboration. It allows students and teachers to ask better questions, interpret responses critically, and iterate ideas meaningfully (Mozer et al., 2019; Xie et al., 2024; Bilstrup et al., 2025). This critical perspective helps identify hallucinations, biases, and incomplete reasoning so that AI outputs are evaluated rather than simply accepted. It also strengthens metacognition and self-regulation, helping students stay in control of their learning.

Critically, human knowledge supplies what AI cannot: emotional insight, motivation, relationships, and the practical wisdom needed to decide when and how AI should be used. When we intentionally blend human knowledge with AI, we stop treating it as a replacement for thinking and begin using it as a tool that extends thinking.

Students with strong background knowledge can engage in rich dialogue with AI. A student who understands the causes of the Great Depression, for example, can recognize what AI overlooks, ask sharper follow-up questions, and refine the output into something genuinely useful. Teachers do the same through pedagogical craft—such as generating multiple explanations of proportional reasoning and asking students to identify the most precise one or using AI-drafted thesis statements as objects for evaluation rather than final answers.

At the institutional level, empowering AI effectively requires strategic judgment. School leaders must decide which tasks AI can appropriately support (e.g., tutoring, scheduling, data analysis) and which demand close human oversight, ensuring technology serves the purposes of education rather than efficiency alone.

Governing AI. Human judgment governs AI by ensuring it serves learning rather than undermining it. It helps evaluate whether tools are fair and unbiased, decide when and how to use them, protect privacy, and hold systems accountable. Most importantly, it develops self-governance—the internal capacity to regulate one’s own use of AI responsibly, ethically, and thoughtfully. This capacity depends on practical wisdom that AI cannot provide.

This capacity is better understood as a form of judgment than as a technical skill. Judgment is precisely what schools are meant to cultivate. Students who learn to ask not only whether an AI tool is useful but also whether its use is fair, whose interests it serves, and how its outputs might shape human decisions are developing high-order civic reasoning (Olari & Romeike, 2021; Walsh et al., 2023; Velandar et al., 2024). A middle school class examining how recommendation algorithms shape beliefs is not just doing technology, it is doing citizenship education.

For teachers, governance is exercised every time they decide that AI-generated feedback suits early drafts but not the evaluation of a student's unique voice or intellectual risk-taking. At the school level, governance involves creating policies, norms, and safeguards that keep AI aligned with educational values, especially when adoption outpaces understanding (Nazaretsky et al., 2022; Avraamidou, 2024; Karan & Angadi, 2023).

Disrupting AI. Human knowledge and judgment disrupt AI by refusing to accept outputs that are flawed, shallow, or misleading. It enables spotting inaccuracies, hallucinations, and biases; challenging oversimplifications; and protecting the integrity of real learning. Disruption is not rejection—it is the active defense of human agency, and the creative reimagining of what learning can be.

Students and teachers who bring genuine knowledge to their interactions with AI are better positioned to treat it as a tool that must earn their trust rather than as an authority. A student who uses disciplinary understanding to critique an AI-generated experimental design or identify weaknesses in a literary interpretation is not resisting technology—they are doing science or close reading. Teachers disrupt AI when they override recommendations that ignore classroom context or pedagogical nuance (Holstein et al., 2019; Holstein & Aleven, 2022).

At the school level, disruption means having the institutional courage to reject or redesign AI applications that undermine equity, valid assessment, teacher agency, or the core mission of schooling. Schools do not exist to optimize efficiency. They exist to help students explore the world, act competently, develop practical wisdom, and build character, meaning, and purpose. Whenever AI pulls practice away from these aims, schools must be prepared to push back.

Implications for K–12 Education

The argument developed in this paper challenges many dominant narratives about AI in schools. AI does not change the fundamental purposes of education; it changes the context in which those purposes must be pursued.

Rather than forcing a choice between human knowledge and AI, schools must learn how to strengthen both. AI can extend access to information and support certain aspects of learning, but it cannot replace the disciplinary understanding, practical wisdom, perspective, and human interaction that meaningful education requires.

The central task for schools is, therefore, not to choose between human thinking and AI, but to design learning experiences in which each enhances the other. Getting AI right in K–12 education

begins with a simple but essential step: revisiting and clearly articulating what schools are fundamentally trying to accomplish.

Human Knowledge Becomes More Important in the Age of AI. A growing concern is that AI reduces the need for students to know things (Naeem, 2025; Burns & Winthrop, 2026). If AI can generate explanations, summaries, and solutions on demand, it may seem less necessary to build deep knowledge. In practice, the opposite is true. Students need strong disciplinary knowledge to use AI well. Without it, they cannot evaluate what AI produces—they can only accept or reject it on intuition. With it, they can question, refine, and improve AI-generated outputs (Mozer et al., 2019; Xie et al., 2024; Bilstrup et al., 2025). Rather than making knowledge obsolete, AI makes it more consequential. Schools should resist narrowing the curriculum in favor of training students on AI tools and instead strengthen students' understanding of core disciplines (Alvunger, 2022; Bransford et al., 2000).

At the same time, AI creates new opportunities. When used thoughtfully, it can take on routine tasks—summarizing information, generating initial drafts, retrieving and organizing content—freeing classrooms to focus more fully on the higher levels of the DIKW hierarchy (Whatley, 2024): interpreting knowledge, exercising judgment, and pursuing wisdom (see Figure 1). AI operates most powerfully at the base of that pyramid, processing data and producing information at speeds and with fluency that no human can match. What it cannot do is climb reliably to the levels that matter most—making meaning, weighing competing considerations, and deciding what ought to be done. Those capacities belong to human beings, and they are precisely what schools exist to develop. AI, used well, does not displace that work. It clears space for it—allowing schools to make greater room for the kinds of thinking they have always valued but often struggled to prioritize (Holstein et al., 2019; Holstein & Alevan, 2022; Kong & Yang, 2024).

The Teacher's Role Becomes More Visible and Consequential. Much of the current conversation about AI centers on concerns about teacher displacement (Avraamidou, 2024). These concerns often rest on an incomplete understanding of what teachers do. Teachers are not simply providers of information. They interpret student thinking, recognize when confusion reflects deeper misconceptions or emotional barriers, and make moment-to-moment decisions that shape learning. They model intellectual habits, guide inquiry, and support students as developing thinkers and individuals (Adams et al., 2022; Döğer & Göçen, 2025).

AI does not diminish a teacher's responsibilities. It brings them into sharper focus. As AI takes on more routine tasks, what remains central is the relational, interpretive, and judgment-based work of teaching. AI clarifies and elevates the role teachers have always played.

AI Use Shapes Not Just What Students Know, But Who They Are Becoming. The implications above address knowledge and institutional practice. But there is a more personal dimension that schools cannot afford to overlook. AI is designed to be responsive, fluent, and confident—producing polished answers quickly and adapting to what users seem to want. For adolescents still forming their intellectual identities, that responsiveness carries a subtle risk. Students who habitually outsource thinking to AI before developing their own voice, judgment, and capacity for reflection may find those capacities harder to build later.

Biesta (2009) referred to this as subjectification—the process through which young people become self-directed persons rather than products of the forces around them. The concern is not that students use AI, but that unreflective use—particularly before strong knowledge foundations and intellectual habits are in place—can quietly substitute for the cognitive struggle through which judgment, resilience, and intellectual identity develop (Pasupathi et al., 2001; Damon et al., 2003). Working through a difficult problem, constructing an original argument, sitting with uncertainty long enough to reason through it—these are not inefficiencies to be optimized away. They are the experiences through which students become capable, purposeful human beings.

The sequence matters. Students who first develop strong disciplinary knowledge and habits of independent reasoning are far better positioned to use AI as a genuine tool for inquiry (Burns & Winthrop, 2026). Those who encounter it before those foundations are in place are more likely to become dependent on it in ways that quietly impede their development. Schools that care about who students are becoming, and not just what they can produce, must attend carefully to that sequence.

Assessment Must Shift Toward Visible Thinking. Generative AI has made a long-standing limitation of traditional assessment impossible to ignore. Many assignments measure the production of outputs—essays, summaries, or problem solutions—rather than the thinking that produces them. When AI can generate a competent response in seconds, relying on these products as evidence of learning becomes increasingly problematic (Azzam & Charles, 2024; Tang, 2024).

This moment creates an opportunity to focus more directly on what matters. Tasks that require students to explain their reasoning, compare interpretations, revise their thinking, and defend their conclusions provide stronger evidence of understanding. These approaches to assessment are not new, but AI makes their importance much harder to ignore and their absence much harder to justify (Pellegrino & Hilton, 2012).

Equity Depends on Strong Knowledge Foundations. AI is often described as a tool that can expand access and support all learners. While this potential is real, it is not guaranteed. Students need knowledge to use AI effectively. Those with stronger disciplinary understanding are better positioned to question and refine AI outputs. Those without it are more likely to accept responses at face value, even when they are incomplete or misleading (Olari & Romeike, 2021; Velandar et al., 2024; Avraamidou, 2024).

Without careful attention, AI has the potential to widen existing gaps rather than close them. This suggests that equity efforts must focus not only on access to tools but on ensuring that all students develop the knowledge and capacities needed to use them well. This requires teachers trained in AI literacy—including the ability to critically evaluate outputs, recognize bias and limitations, and design meaningful learning experiences with AI—to guide students in using these tools responsibly and reflectively. It also raises important questions for schools about tool selection, data use, and whose interests are being served. Leveling the playing field with AI requires more than access. It requires human knowledge to use it well.

Schools Need a Clear Educational Philosophy, Not Just Policies. Many schools have responded to AI by developing policies—guidelines for acceptable use, academic integrity, and tool adoption.

These are necessary. They are not sufficient. Policies can define what is allowed, but they cannot determine what matters. Without a clear understanding of the purposes of education, schools lack a basis for deciding how AI should be used—or when it should not be used (Nazaretsky et al., 2022; Karan & Angadi, 2023).

A clearly articulated educational philosophy provides that foundation. Schools grounded in a shared understanding of what they aim to develop—knowledge, competence, judgment, and wisdom—are better positioned to make thoughtful, context-sensitive decisions about AI. Policy provides boundaries. Philosophy provides direction. Both are necessary, but the latter must come first (Avraamidou, 2024; Döğ̈er & Göç̈en, 2025). Realizing this vision will require sustained investment in teacher preparation, instructional time, and institutional capacity.

Students Need to Understand AI Itself; Not Just How to Use It. The implications above emphasize the importance of disciplinary knowledge, judgment, and character. All remain essential. But students also need a complementary form of knowledge—one that is specific to AI itself. To engage with AI as informed, critical agents rather than passive users, students must develop at least a foundational understanding of how these systems work.

This does not mean turning every student into a computer scientist. It means developing AI conceptual literacy: understanding that AI systems generate outputs by recognizing statistical patterns in training data rather than by reasoning or understanding in the human sense (Long & Magerko, 2020; Touretzky et al., 2019). Students who understand this are better equipped to recognize why AI produces confident-sounding responses that are sometimes wrong, why its outputs can reflect the biases embedded in the data it was trained on, and why fluency is not the same as accuracy. Without this understanding, students lack the conceptual tools to question what AI produces—even when their disciplinary knowledge tells them something is off.

AI conceptual literacy also includes understanding the ethical and practical dimensions of AI use—questions of bias, privacy, fairness, transparency, and accountability (Casal-Otero et al., 2023). A student who understands that AI systems can reproduce and amplify societal biases is better positioned to ask whose interests a tool serves and whose may be harmed. A student who understands how AI-generated content is produced is better positioned to take genuine intellectual responsibility for AI-assisted work. Disciplinary knowledge tells students what to think about. AI conceptual literacy tells them what they are thinking with.

AI Literacy Must Be Integrated Across the Curriculum. A common institutional response to AI has been to introduce standalone courses focused on how AI works or how to use it effectively. While these efforts have value, they are not sufficient on their own (Yim & Su, 2024). Genuine AI literacy is inseparable from disciplinary learning. Students learn to engage AI critically by bringing knowledge from history, science, mathematics, literature, and other fields to bear on what AI produces. A student with strong historical understanding can evaluate AI-generated narratives. A student with mathematical reasoning can interrogate AI-generated solutions. A student with experience in ethical and civic reasoning can evaluate the appropriate use of AI in consequential decisions (Martin et al., 2023; Azzam & Charles, 2024; Casal-Otero et al., 2023).

AI literacy is not an additional subject but a dimension of good teaching across subjects. It emerges when students use their knowledge to question, refine, and sometimes reject what AI produces. The most important investment schools can make is not in AI tools or standalone courses but in a curriculum that develops the forms of human knowledge that make meaningful, critical, and responsible AI engagement possible. That work points toward a human-centered framework for AI literacy grounded in the enduring purposes of education and durable forms of knowledge.

Human Intelligence Is Irreplaceable

In the end, Geoffrey Hinton's (2025) warning points to a deeper truth. The Industrial Revolution did not render human strength irrelevant; it made the thoughtful and skilled use of machines essential. In the same way, the Age of AI will not make human intelligence obsolete; it will make thoughtful, knowledgeable, and purposeful human intelligence more necessary than ever.

Schools that commit to cultivating these enduring forms of knowledge will help students learn to empower, govern, and disrupt AI—to engage an AI-mediated world with greater competence, judgment, and wisdom. Teachers who nurture disciplinary understanding, practical competence, sound judgment, and reflective wisdom are not becoming obsolete; they are becoming indispensable. And the students who leave their classrooms with real knowledge, clear judgment, and a strong sense of purpose will be the ones to direct AI rather than be directed.

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