

# ***Risks and Countermeasures of Generative Artificial Intelligence Empowering Professional Course Teaching***

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**Abstract:** With the rapid advancement of generative artificial intelligence (GenAI), its application in professional course teaching is profoundly reshaping the paradigm of higher education. However, this transformation is accompanied by multidimensional risks, including content hallucination, algorithmic black boxes, digital divide, and evaluation anomie. To address these challenges, the following countermeasures are recommended: developing specialized educational models and verification mechanisms to enhance technical reliability; establishing digital inclusion policies and resource compensation mechanisms to promote educational equity; constructing diversified evaluation systems and academic integrity guidelines to uphold scholarly norms; and strengthening human-AI collaboration and digital literacy to preserve educational subjectivity. By adhering to human-centered principles and the ethos of technology for good, the deep integration of GenAI into professional courses can be advanced. Multi-stakeholder collaborative governance will help achieve a dialectical unity between education and technology, thereby facilitating the modernization of higher education.

## **1. Introduction**

Generative artificial intelligence (GenAI), represented by models such as ChatGPT and DeepSeek, has achieved breakthrough progress in natural language processing and content generation. This advancement is profoundly reshaping knowledge production and dissemination, driving the transformation of higher education from traditional knowledge transmission toward intelligent, personalized, and generative teaching models <sup>[1][2]</sup>.

The academic community widely recognizes the empowering potential of GenAI, acknowledging its ability to build smart learning environments through features such as intelligent Q&A and adaptive content generation, thereby enhancing teaching efficiency <sup>[3][4]</sup>. It also facilitates the evolution of the teacher's role from knowledge transmitter to learning designer and facilitator <sup>[5]</sup>. However, the deep integration of GenAI into educational practice is accompanied by multifaceted risks. These include technical adaptation challenges, such as the lack of interpretability due to algorithmic black boxes <sup>[6]</sup>, as well as ethical concerns such as algorithmic bias undermining educational equity, the widening digital divide, and the erosion of traditional academic integrity <sup>[7]</sup>.

Therefore, it is essential to move beyond purely technical discussions and establish a value-oriented governance framework. By advancing technology refinement, policy regulation, evaluation innovation, and literacy enhancement, a deep integration of instrumental and value rationality can be achieved. This will ensure the healthy interaction and sustainable development of generative artificial intelligence within professional course teaching.

## **2. The Value of Generative AI Empowering Professional Course Teaching**

Generative Artificial Intelligence (GenAI) represents a technological paradigm capable of automatically generating multimodal content—such as text and images—based on human prompts. Its core mechanism lies in producing logically coherent new content that is not explicitly present in the training data, achieved through pre-trained models <sup>[8]</sup>. Distinct from conventional educational technologies, GenAI exhibits generative, contextual, and interactive characteristics, enabling its evolution from a mere instructional aid into a creative partner capable of directly contributing to cognitive processes.

Through systematic empowerment, GenAI restructures the roles and competencies of both teachers and students. Teachers can leverage the technology to generate personalized instructional materials and obtain diagnostic learning analytics, thereby shifting from repetitive tasks to instructional design and human–AI collaborative guidance. Students, in turn, develop autonomous learning and critical thinking through dialogic interaction, enhancing metacognitive abilities via cognitive collaboration <sup>[9]</sup>. This bidirectional empowerment establishes a tripartite synergistic system involving teachers, students, and AI.

Furthermore, GenAI facilitates a paradigm shift in education—from a "transmission–reception" model toward a "co-constructive and intelligence-enhanced" approach—enabling dynamic optimization and intelligent restructuring of the entire teaching process <sup>[10]</sup>. As teachers transform into designers of learning ecosystems and students become active knowledge creators, educational objectives and evaluation mechanisms are concomitantly reshaped, ultimately contributing to an open and adaptive educational ecology.

By empowering educational actors, evolving functional roles, and reconstructing pedagogical paradigms, GenAI significantly expands the boundaries of educational possibility. It demonstrates core value in enhancing instructional efficiency, cultivating higher-order competencies, and reshaping the educational ecosystem, thereby emerging as an indispensable force in advancing the modernization of education.

## **3. The Risks in Applying Generative AI to Professional Course Teaching**

While GenAI introduces innovation to professional education, its integration raises multidimensional risks spanning technical ethics, educational equity, and academic integrity. The embeddedness of technology in education is not value-neutral; inherent technical limitations, embedded social biases, and complex interactions with educational contexts may trigger risks affecting both technical reliability and educational values.

### **3.1 The Risk of Technical Unreliability: Content "Hallucination" and the Algorithmic Black Box**

Generative AI relies on statistical probability models trained on massive datasets to generate coherent outputs based on user prompts. This approach entails two fundamental technical risks: content hallucination and the algorithmic black box problem.

Content hallucination occurs when models produce plausible but factually incorrect or logically

flawed information. Lacking external fact-checking capabilities, LLMs may generate biased or fabricated content when trained on incomplete or skewed data <sup>[11]</sup>. In specialized fields such as medicine, law, or engineering, this can mislead learners who lack prior expertise, leading to entrenched misconceptions. For instance, AI might generate a chemically invalid drug formula, cite a non-existent legal precedent, or propose structurally unsound engineering designs—errors that students may accept as valid due to the authoritative tone of AI responses.

The algorithmic black box refers to the lack of explainability in AI decision-making. Complex neural networks obscure reasoning processes, preventing Generative AI from revealing logical pathways or evidence trails. This opacity conflicts with educational principles that emphasize critical thinking, verifiable reasoning, and knowledge construction. Overreliance on opaque AI outputs may discourage deep cognitive engagement, erode critical faculties, and undermine the pedagogical process of inquiry and doubt resolution. When students receive ready answers without understanding the underlying logic or assumptions, their knowledge construction shifts from an open, examinable process to passive acceptance of technical outputs, ultimately impairing the cognitive foundations of academic innovation.

### **3.2 The Risk to Educational Equity: Algorithmic Bias and the Digital Divide**

GenAI is often viewed as a tool for educational inclusion, yet unregulated use may reinforce structural inequities through algorithmic bias and the digital divide.

Algorithmic bias stems from unrepresentative training data, which can embed social stereotypes related to gender, race, culture, or class. When deployed in teaching—such as in case generation or content recommendation—GenAI may systematically exclude certain perspectives, implicitly shaping students' worldviews and hindering development of inclusive citizenship<sup>[12]</sup>. For example, in business teaching, AI-generated business leader cases might be overly concentrated in specific genders or nationalities; in social sciences, its analysis of certain social phenomena might imply presuppositions of specific ideologies, affecting students' objective understanding of complex social phenomena. Such biases are often implicit, subtly shaping students' cognitive frameworks, causing them to accept and internalize biased values and worldviews unconsciously. If educators lack critical vigilance towards algorithmic bias, it is tantamount to partially ceding the construction right of curriculum content to a technical system lacking value judgment and ethical accountability, triggering systemic educational risks.

The digital divide extends beyond access to include usage capability. Privileged institutions and students often enjoy advanced, paid AI tools, while underserved groups rely on limited free versions<sup>[13]</sup>. Moreover, students with stronger metacognitive and prompt-engineering skills benefit more from AI, whereas others may misuse it or be misled. Without universal AI literacy training and equitable resource distribution, GenAI may worsen educational inequality. Thus, educational equity is not merely a matter of access, but also of effective use. If educational institutions fail to provide universal AI literacy education and equitable technical resource support for all students, GenAI will not only fall short of promoting educational inclusivity but could also become a new catalyst exacerbating educational inequality.

### **3.3 The Risk to Academic Integrity: Evaluation Anomie and Behavioral Disorder**

The ability of GenAI to generate coherent and formally correct outputs challenges traditional academic evaluation. It complicates the distinction between original and AI-assisted work, undermining assessments meant to measure authentic understanding and creativity. For example, in humanities, students can use AI to generate a course paper with clear arguments and standard literature citations, but its internal logic may be patchwork, lacking genuine thought process and

academic insight; in computer science, code written by AI may pass basic functional tests, but its architecture design may lack optimization awareness and originality in problem-solving.

The low threshold and high efficiency of generative AI can easily induce academic shortcut behaviors, even leading to "substitution dependency." Some students may use AI to complete assignments that should involve independent thinking, write initial drafts of papers, or even participate in online exams, thereby avoiding the key processes of knowledge internalization and skill training. Cognitive science indicates that learning is essentially a process of constructing knowledge through struggle, trial and error, and reflection<sup>[14]</sup>. Excessive substitution by AI keeps students only at the surface level of knowledge understanding, unable to develop higher-order thinking and complex problem-solving abilities. This not only directly leads to the loss of opportunities for deep learning but also violates the principle of academic honesty. More alarmingly, such behavior may be "normalized" due to technical convenience, forming a distorted culture of technology use that undermines the integrity norms long upheld by the academic community. If educators fail to promptly clarify the ethical boundaries of technology use and establish corresponding academic supervision mechanisms, GenAI may become an "enabler" of large-scale academic misconduct, eroding the existential value of higher education.

### **3.4 The Risk of Subjectivity Erosion: Role Alienation and Reconstruction of Pedagogical Relationships**

The deep integration of GenAI not only alters the instrumental environment of teaching but also profoundly impacts core educational subjects—teachers and students—by reshaping their role perceptions, behavioral patterns, and interpersonal dynamics.

For students, the "all-powerful assistant" image of GenAI may undermine their thinking subjectivity. When AI provides instant solutions, students tend to skip crucial thinking steps, remaining at the level of low-cognitive engagement in shallow learning<sup>[15]</sup>. Humans are gradually regulated by technological logic, alienating from subjects capable of actively mastering technology to passive recipients of technological outputs, manifesting the danger of "the enframing of technology" warned by Heidegger<sup>[16]</sup>. Consequently, education risks failing to cultivate students' capacities for "critical thinking" and "autonomous cognition." While they may acquire technical proficiency in using these tools, students ultimately risk losing their subjective agency in mastering knowledge and directing cognitive processes.

For teachers, AI's advantages in knowledge transmission efficiency may diminish their role as content authorities, reducing them to auxiliary managers of AI teaching systems. Consequently, essential human elements of teaching—such as emotional nurturing, value guidance, and inspirational mentorship—become marginalized. More alarmingly, over-reliance may lead to the degradation of teachers' professional competencies, including curriculum design capability and adaptive teaching skills.

Furthermore, the introduction of AI as a "third agent" transforms the traditional teacher-student dyad into a teacher-AI-student technological triad. This mediation may dilute direct dialogue and intellectual exchange between educators and learners<sup>[17]</sup>, exposing educational relationships to risks of "alienation" and "datafication" that endanger the most vital dimensions of pedagogy: affective interaction and personal influence.

## **4. Risk Response for Applying Generative AI to Professional Course Teaching**

The deep integration of Generative AI in education is an irreversible trend, yet the multidimensional risks it entails—particularly in technical ethics, educational equity, and the academic ecosystem within specialized course instruction—demand systematic and collaborative

responses. Educational institutions, policymakers, educators, and developers must work together to formulate proactive and feasible strategies spanning technological optimization, resource allocation, institutional design, and humanistic consideration.

#### **4.1 Develop Educational Vertical Models and Verification Mechanisms**

To address reliability challenges such as hallucination and algorithmic opacity, dedicated educational models and robust verification mechanisms must be established.

Educational models should prioritize accuracy, logical rigor, and alignment with pedagogical objectives. Unlike general-purpose LLMs, these models must be trained on high-quality, domain-specific corpora (including authoritative textbooks, peer-reviewed journals, and validated case databases) to minimize noise and bias. Integration of knowledge graphs and symbolic reasoning can enhance factual consistency and logical verification. For instance, medical education models should incorporate anatomical atlases and clinical guidelines, while engineering models ought to reference standard specifications and safety protocols. A Retrieval-Augmented Generation (RAG) framework is recommended to enable real-time citation and source annotation, improving content traceability.

Dynamic, multi-layered verification systems are critical to maintain content relevance and accuracy. Continuous updates using the latest research and practitioner input—supported by expert validation and user feedback mechanisms—can facilitate ongoing model refinement. Blockchain-based traceability systems may also be deployed to log source references and credibility metrics for key assertions, offering users greater transparency.

Furthermore, efforts to improve model interpretability through visualization, attribution analysis, and natural language explanations should be prioritized. For example, when generating legal analyses or engineering solutions, models should explicitly reference relevant statutes, precedents, or design standards. This not only aids verification but also positions AI as a "questionable partner" that encourages critical engagement.

#### **4.2 Establish Digital Inclusion Policies and Resource Compensation Mechanisms**

Public policies and institutional systems should proactively promote digital inclusion through equitable resource access and skill development to mitigate potential educational inequalities exacerbated by generative AI.

Education authorities should lead efforts to universalize publicly accessible AI educational resources. Governments could provide collective licensing for advanced GenAI tools to public institutions through targeted subsidies or corporate partnerships, ensuring all students have equitable access to core AI educational functions. Simultaneously, lightweight, low-threshold localized AI teaching tools should be encouraged to reduce dependencies on network infrastructure and hardware capabilities, safeguarding basic usage rights for educators and students in underserved regions.

AI literacy education must be systematically integrated into curricula, particularly in digitally disadvantaged areas. Such education should encompass technical skills, prompt engineering, critical evaluation of information, ethical considerations, and responsible use. Schools ought to provide structured workshops, online tutorials, and ongoing support—especially for students with limited digital proficiency. For instance, compulsory modules on "AI-assisted Learning Methods" and dedicated "AI Learning Tutors" could help students develop metacognitive strategies and critical integration skills. Teacher training programs must likewise strengthen AI literacy components to enhance pedagogical guidance in the ethical and effective use of AI.

### 4.3 Construct Diverse Evaluation Systems and Academic Norm Guidelines

In response to GenAI's disruptive impact on traditional assessment, a shift toward process-oriented and competency-based evaluation is essential.

Assessment should emphasize cognitive processes, exploratory learning, and knowledge internalization over final outputs<sup>[18]</sup>. Incorporating oral defenses, reflective journals, peer reviews, and multi-stage project work can diversify evaluation approaches. For research assignments, requiring annotated bibliographies, proposal drafts, and revision memos makes visible the evolution of student thinking. In technical subjects, live code reviews and design rationales help assess genuine understanding.

Concurrently, clear institutional policies on AI use disclosure and academic integrity must be established. These should delineate permissible versus prohibited applications of AI assistance, supplemented—where appropriate—by detection tools and oral verification. Through orientation programs and academic integrity modules, students should be guided to recognize that the core of scholarship lies not in avoiding plagiarism, but in engaging authentically with knowledge creation.

### 4.4 Strengthen Human-AI Collaborative Teaching and Digital Literacy Cultivation

To address technology's potential challenge to educational agency, it is essential to enhance digital literacy among educators and students, maintain human primacy, and build effective human-AI teaching collaboration. This ensures AI serves educational goals within appropriate boundaries<sup>[19]</sup>.

First, develop teachers' AI-integrated instructional capabilities. Professional development should include "AI in Education" as a key component, enabling teachers to comprehend AI's educational value and limitations, and effectively integrate it into curriculum design, teaching interactions, and assessment. Teachers need to become "designers" of AI-supported learning—designing tasks that leverage human-AI complementarity, using AI-generated solutions for critical refinement, applying analytics for personalized guidance while providing essential human mentorship, and demonstrating critical engagement with AI outputs. Teacher learning communities should be established to share best practices and sustain professional agency.

Second, cultivate students' critical AI engagement. Critical digital literacy must be embedded in curriculum design. Students should learn to treat AI as a supportive tool rather than an authority, and to examine its outputs through the lens of disciplinary knowledge. Through activities like "AI Error Detection," "Prompt Design Workshops," and "Human-AI Dialogues," students can develop prudent usage habits, critical questioning skills, and independent judgment. The objective is to foster discerning technology users who expand their cognitive capacities with AI while maintaining cognitive autonomy and avoiding overreliance.

## 5. Conclusion

Generative AI (GenAI) is transforming professional education through enhanced teaching efficiency and personalized learning. By empowering educators and optimizing instructional processes, it creates new pathways for cultivating innovative talent. However, these advances entail multidimensional risks—from technical issues like algorithmic bias and opacity to challenges in educational equity and academic integrity.

A multi-level governance framework is essential. This includes developing education-specific models with verification mechanisms, promoting digital inclusion policies, diversifying evaluation systems, and strengthening digital literacy for human-AI collaboration.

Critically, education must preserve human subjectivity. GenAI integration should reinforce—not replace—the essential human elements of teaching: teachers' mentorship and students' critical



thinking. By maintaining this human-centered approach, we can build an educational ecology of human-AI collaboration that ensures sustainable integration of technology and education.

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