The Impact of Artificial Intelligence Applications on Teaching Models in Higher Education

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Abstract: Artificial intelligence has been applied to higher education activities such as the generation of teaching resources, intelligent question answering, personalized learning, and assignment feedback, driving a transition from the traditional teacher–student dyadic structure toward a collaborative teaching structure involving teachers, students, and intelligent tools. Although artificial intelligence can expand the supply of educational resources and support differentiated learning, its application also raises concerns regarding inaccurate information, academic integrity, overdependence, and data security. This article analyzes the effects of artificial intelligence on teaching content, classroom organization, learning approaches, educational assessment, and teachers' roles. It proposes clarifying the boundaries of AI use, redesigning learning tasks, reforming assessment methods, and improving institutional safeguards.

Keywords: artificial intelligence; higher education teaching; teaching models; human–AI collaboration; educational assessment

Introduction

The educational applications of artificial intelligence (AI) have expanded from learning-resource recommendations, automated assignment grading, and learning behavior analysis to the generation of teaching materials, conversational question answering, coding assistance, simulation-based training, and the design of learning plans. Generative AI can produce text, images, audio, and computer code in response to instructions from teachers and students, thereby participating in lesson preparation, classroom teaching, learning, and assessment. Traditional digital teaching tools primarily store, transmit, and display resources. By contrast, generative AI can organize content in real time for specific tasks, gradually shifting educational activities from the use of existing resources toward the collaborative generation of resources by humans and AI.

In April 2025, the Ministry of Education and eight other government departments issued the Opinions on Accelerating the Digitalization of Education. The document called for improvements to knowledge graphs, the development of competency maps, the further application of large educational models, intelligent upgrading of curricula, teaching materials, and instructional systems, and the integration of AI throughout the educational process [1]. These requirements indicate that the use of AI in education is moving beyond spontaneous experimentation by individual teachers and students toward systematic development at the levels of curricula, instruction, and governance.

The rapid adoption of AI tools has also altered the conditions under which teaching takes place in higher education. Students can use intelligent tools to complete tasks involving conceptual explanations, information organization, computer programming, and general essay writing relatively quickly. If teachers continue to rely on assessment methods that focus primarily on submitted outcomes, they may find it difficult to determine students' actual levels of effort and competence. Reforming teaching models in higher education therefore requires more than introducing intelligent platforms or generative tools. Teaching objectives, learning tasks, forms of interaction, and assessment rules must also be redesigned.

1. The Fundamental Logic of Integrating Artificial Intelligence into Higher Education

1.1 Principal Forms of AI Application in Education

Educational applications of AI in higher education can be divided into resource support, learning support, learning analytics, and scenario simulation. Resource support primarily includes the generation of course outlines, teaching cases, exercises, presentation materials, and multimedia content. After teachers enter a course topic, students' level, and learning objectives, an AI tool can provide preliminary materials, which teachers must then fact-check, select, and adapt for instructional use.

Learning support mainly takes the form of intelligent question answering, content explanation, language translation, code debugging, and writing suggestions. Students can ask questions according to their individual

learning progress and request that an AI tool reformulate an explanation or provide examples at different levels of difficulty. Compared with fixed teaching resources, conversational interaction can improve the timeliness of feedback. However, students may also obtain information that exceeds course requirements and therefore need the ability to verify sources and evaluate content.

Learning analytics draws on records from online platforms to identify students' knowledge gaps, task completion, and pace of learning. Scenario simulation is particularly suitable for disciplines such as medicine, engineering, languages, management, and teacher education, in which virtual clinical cases, engineering failures, business negotiations, and classroom incidents can provide opportunities for training. The educational value of these applications depends on course objectives and task design. Technological functionality cannot directly replace instructional planning.

1.2 Mechanisms Transforming the Structure of Higher Education Teaching

Traditional university classrooms are primarily structured around teachers organizing content, explaining knowledge, and evaluating learning outcomes, while students attend classes, complete exercises, and undergo assessment according to predetermined instructional arrangements. Once AI becomes involved in educational activities, new informational relationships emerge among teachers, students, and intelligent tools. Teachers can use AI to prepare materials, design questions, and analyze feedback. Students can use it to explain concepts, retrieve information, and revise their work. Intelligent tools consequently shift from auxiliary media to active technological participants in the teaching process.

Yang et al. argue that generative AI is transforming the structure of education from a teacher–student dyad into a teacher–AI tool–student triad, with corresponding changes in content production, learning spaces, and assessment methods [3]. This triadic structure does not diminish teachers' responsibilities. Intelligent tools can provide content and feedback, but they cannot independently determine educational objectives or assume responsibility for value formation, emotional communication, and educational accountability.

Changes in teaching structure are also reflected in the weakening of boundaries between learning inside and outside the classroom. Students can use AI to familiarize themselves with concepts before class, analyze problems during class, and obtain supplementary explanations afterward. Teachers must organize these stages into a coherent learning process so that students do not merely perform fragmented operations across multiple tools without developing a stable knowledge structure.

2. The Impact of Artificial Intelligence on the Teaching Process

2.1 Changes in the Production of Teaching Content

AI reduces the time required to produce preliminary teaching materials. Teachers can generate cases, exercises, and discussion questions according to learning objectives and adjust the difficulty of the language for different disciplines or levels of prior knowledge. In courses where knowledge develops rapidly, intelligent tools can also assist in identifying emerging concepts and areas of application. Because AI-generated results are based on training data and probabilistic calculations, however, they may contain factual errors, fabricated references, or conceptual confusion. They should not be used as formal teaching content without review.

The production of educational resources is shifting from independent work by teachers toward teacher-led human–AI collaboration. Teachers' work is correspondingly moving away from routine information organization and toward knowledge verification, content selection, curricular alignment, and learning activity design. Chen et al. propose combining generative AI with the organization of knowledge components so that structural constraints can improve the relevance of generated content in educational settings [4]. Only when AI output is embedded within the knowledge system of a course can fragmented content and uncontrolled difficulty be reduced.

Students can also participate in generating teaching content. During classroom discussions, students may formulate prompts, compare several AI-generated responses, and evaluate their validity against textbooks and academic literature. Such activities transform intelligent tools from providers of answers into objects of analysis, thereby developing students' awareness of evidence and their critical judgment.

2.2 Reconstructing Classroom Organization and Teacher–Student Interaction

AI can provide some explanations of foundational

knowledge and answer repetitive questions, allowing more classroom time to be devoted to case analysis, experiments, group discussions, and problem-solving. Teachers do not need to repeat all basic content, but they must assess the quality of students' pre-class learning. If pre-class tasks require students only to read AI-generated summaries, students may bypass textbooks and primary materials and consequently develop a partial understanding.

Classroom interaction can expand from the linear pattern of teachers asking questions and students responding to multidirectional interaction in which teachers organize activities, students discuss problems, and intelligent tools supply supplementary information. Teachers may require students to compare differences among AI-generated answers, locate supporting evidence, and correct errors. Medical courses can analyze virtual clinical cases, law courses can compare alternative arguments, and engineering courses can diagnose simulated failures. Intelligent tools supply materials, whereas teachers control the difficulty of problems and the direction of discussion.

AI may also weaken genuine interaction between teachers and students. Once students become accustomed to directing questions immediately to a tool, they may engage less frequently in discussion with teachers and peers. Higher education institutions should preserve face-to-face communication, teamwork, and classroom questioning and guide students in understanding the value judgments and relationships of responsibility involved in complex problems.

2.3 The Development of Personalized Learning

AI can provide explanations at different levels according to the questions students ask. Students with weaker foundations can receive concept breakdowns and supplementary examples, while faster learners can investigate more advanced questions. In language learning, students can repeatedly practice conversations. In computer programming, intelligent tools can explain the causes of errors. Personalized support is therefore no longer entirely dependent on one-to-one guidance from teachers.

Li et al. surveyed 1,190 undergraduates at Zhejiang University and found that generative AI had already been widely adopted in coursework and research activities. Among the respondents, 72.77% were familiar with generative AI, 71.76% used it occasionally, and 21.51% used it frequently [2].

Table 1. Selected Survey Findings on University Students' Use of Generative AI

Survey item	Percentage	Implications for teaching
Familiar with generative AI	72.77%	Students had already developed a certain level of awareness of AI tools
Used generative AI occasionally	71.76%	AI had entered routine learning activities
Used generative AI frequently	21.51%	Some students had developed relatively stable patterns of use
Used AI to consult course content	74.6%	Methods of obtaining information had changed
Used AI to assist with coursework	68.1%	The authenticity of conventional assignments faced challenges
Used AI to assist in selecting research questions	72.5%	AI had begun to participate in research preparation
Used AI to assist with writing	67.4%	New standards were required for the writing process
Had never studied relevant knowledge or skills	39.24%	A gap existed between tool use and systematic learning

Personalized learning should not be reduced to the continuous provision of answers by AI. Students must first formulate questions, evaluate answers, and reflect on the learning process. Without self-monitoring skills, convenient feedback may create dependence. Teachers should require students to explain their reasoning, demonstrate their working processes, and verify sources, thereby guiding them from merely obtaining results toward understanding those results.

3. The Impact of Artificial Intelligence on Educational Assessment and Teachers' Roles

3.1 Adjusting the Objects and Methods of Assessment

Generative AI can complete general question-answering tasks, organize information, translate languages, and produce preliminary drafts. Conventional take-home assignments therefore have limited ability to demonstrate students' competence independently. If assessment remains focused primarily on submitted outcomes, teachers may find it difficult to distinguish among work completed independently, work completed with AI assistance, and content generated directly by AI. Assessment must therefore pay greater attention to problem formulation, source selection, analytical processes, and the rationale for revisions.

Process-based assessment can require students to retain their task designs, AI-use records, initial drafts, and revised drafts and to explain the stages at which AI was involved. Oral defenses, on-site practical tasks, and timed analyses can help determine students' genuine understanding. Research papers can incorporate topic justification, literature verification, and staged presentations, thereby reducing the information loss associated with the one-time submission of a finished product.

Assessment content should also extend beyond knowledge recall to encompass problem-solving, critical judgment, creative expression, and collaboration. AI is proficient at generating conventional answers; higher education must therefore place greater emphasis on whether students can identify constraints, detect errors, and propose professionally grounded solutions.

3.2 Transforming Teachers' Responsibilities and Professional Competencies

The use of AI is shifting teachers' roles from transmitters of knowledge toward designers of learning, facilitators of learning processes, and reviewers of quality. Teachers must determine which content may appropriately be supported by AI and which tasks students must complete independently. They must also explain the limitations of AI tools and guide students in verifying facts, references, and data.

Teachers' digital competence cannot be limited to operating tools. Teachers must understand the basic characteristics of generated content, the risks associated with data use, and relevant professional ethics. They must also be able to design human–AI collaborative activities according to disciplinary characteristics. Teachers in science and engineering must consider the authenticity of code, calculations, and experimental data. Teachers in the humanities and social sciences must address the sources of arguments, AI-generated writing, and fabricated references. Teachers in arts disciplines must manage questions of originality and ownership in generated content.

Once AI reduces some repetitive work, teachers can devote more time to individualized guidance and educational research. If universities use technology merely to reduce teaching staff or increase workloads, however, the benefits of technology will be transformed into new teaching burdens. The transformation of teachers' roles therefore requires training, time, and institutional support.

4. Risks Associated with the Educational Application of Artificial Intelligence

4.1 Inaccurate Information and Distortions in Knowledge Acquisition

Generative AI produces answers on the basis of statistical relationships in data and does not guarantee the accuracy of every claim. Models may fabricate references, confuse concepts, or overlook the conditions of a problem. Students who lack disciplinary foundations may be unable to identify these errors promptly. Because erroneous content can nevertheless be linguistically coherent and well organized, it may be mistaken for reliable knowledge.

University courses should establish clear requirements for content verification. Information concerning concepts, data, policies, and academic literature should be checked against textbooks, academic databases, and authoritative sources. Teachers can deliberately select flawed AI-generated answers and ask students to identify and analyze their problems. Verification should become a fundamental learning competency in AI-enhanced educational environments.

4.2 Academic Integrity and the Weakening of Students' Capabilities

The use of AI to produce assignments, essays, and computer code blurs the boundary between independent work and technological assistance. A complete prohibition would fail to reflect actual patterns of use, whereas unrestricted use could undermine the fairness of assessment. Courses should therefore specify the stages at which AI use is permitted, restricted, or prohibited. For example, AI may be used for information retrieval and language revision if its use is disclosed, whereas core arguments, experimental data,

and personal reflections should be completed independently by students.

Long-term dependence on AI may also weaken reading, writing, calculation, and analytical skills. When students receive structurally complete answers without undergoing the processes of understanding knowledge and repeatedly revising their work, apparent learning efficiency may improve while core capabilities remain undeveloped. Foundational courses and stages devoted to developing essential competencies should therefore retain tool-free tasks and independent practice.

4.3 Data Security and Algorithmic Fairness

When teachers and students upload assignments, personal information, experimental data, and unpublished research materials to public AI platforms, they may create risks involving privacy and intellectual property. Information concerning personal identity, grades, health, or confidential research should not be entered directly into platforms that have not undergone institutional security assessment.

AI output may also reflect biases in training data, resulting in uneven representations of particular regions, social groups, and academic perspectives. Students also differ in their access to devices, network environments, and paid AI services. When universities introduce institution-wide AI platforms, they must provide basic conditions for equitable access and prevent disparities in technological resources from widening existing educational inequalities.

5. Pathways for Reforming Teaching Models in Higher Education

5.1 Establishing Human–AI Collaborative Teaching Processes

Higher education institutions should define the scope of AI use according to course objectives. Before class, AI may be used to generate preparatory questions and provide foundational explanations. During class, it may support case comparisons, scenario simulations, and immediate feedback. After class, it may provide personalized exercises and facilitate learning reflection. These three stages must form a coherent sequence of tasks rather than involving isolated uses of tools.

Learning tasks should be designed to increase process transparency. Teachers can require students to submit their questioning strategies, generated results, fact-checking records, human revisions, and final outputs and to explain why particular content was retained or removed. AI should not directly replace the learning task; rather, it should become an auxiliary object through which students analyze, verify, and improve their work.

Courses can also include units on AI literacy, covering effective prompting, output verification, disclosure and citation, data security, and ethical responsibility. Requirements should be adapted to individual disciplines rather than applying one uniform standard to every course.

5.2 Improving Institutional Rules and Support Systems

Higher education institutions need differentiated and multilevel rules for AI use. Institution-wide policies should establish basic requirements concerning data security, academic integrity, and ethics. Academic departments should develop more specific rules based on disciplinary characteristics, and instructors should explain the applicable boundaries at the beginning of each course. When students use AI to complete assignments or research tasks, they should disclose the name of the tool, the stages at which it was used, and the revisions they made.

Teaching administration departments can develop internally managed platforms that have undergone security assessments and provide course knowledge bases, access controls, and usage records. Faculty development centers should offer continuing training and organize the exchange of teaching cases across disciplines. The evaluation of AI-assisted teaching should not be limited to frequency of use. It should also examine the achievement of learning objectives, changes in students' capabilities, and teachers' actual workloads.

Universities must also adjust course assessment and quality assurance systems. Teaching reviews should examine the design of human–AI collaborative tasks, the development of students' independent capabilities, and the control of risks. Effective practices that have been verified can be converted into course guidelines and resource templates and gradually extended to a broader range of courses.

Conclusion

Artificial intelligence is changing the production of teaching content, classroom organization, learning support, educational assessment, and teachers' responsibilities in higher education. Intelligent tools can provide immediate feedback and differentiated resources while reducing the

cost of producing general teaching materials. Students already use generative AI extensively to consult course content, complete assignments, and support research. Consequently, established teaching models centered on knowledge transmission and the submission of finished products require adjustment.

Teaching reform in higher education must preserve the fundamental relationship of teacher leadership, active student participation, and technological support. Learning tasks should emphasize problem analysis, evidence verification, and the revision of outputs. Assessment should incorporate process records, on-site presentation, and independent practical work. Only by clearly defining the boundaries of AI use, improving standards for academic integrity, data security, and algorithmic fairness, and strengthening the AI literacy of teachers and students can technological applications be translated into genuine improvements in teaching quality.

References

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