

Research Article**Impact of AI-Generated Tools on Teaching Resources in Higher Education:
The Mediating Role of Instructional Innovation Skills from the Perspective
of University Teacher Preparation — A Literature Review and Future
Research Directions**Cai Jun^{1,2}, Qhamariah Binti Samu^{1,*}¹City Graduate School, City University Malaysia, Petaling Jaya, Malaysia²Zhengzhou Health College, Zhengzhou, China***Correspondence:** Qhamariah Binti Samu, dr.qhamariah@city.edu.my

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Abstract

The rapid popularization of generative artificial intelligence (AI) tools is profoundly reshaping the form and supply model of teaching resources in higher education. The instructional innovation skills and preparedness of university teachers are proposed as potentially critical mediating variables for the educational effectiveness of AI technology. From the perspective of teacher preparation, this study conducts an integrative narrative review of core literature on AI application in higher education teaching in recent years, and presents an integrated analysis of the impact paths of AI-generated tools on teaching resources, the potential mediating role of teachers' instructional innovation skills, and practical challenges. The study shows that AI-generated tools may affect the higher education teaching resource system from three dimensions: generation and expansion of resources, personalized adaptation, and evaluation optimization. Teachers' instructional innovation skills are proposed to play a key mediating role between AI tools and teaching resource quality through three potential paths: AI literacy improvement, teaching model reconstruction, and evaluation system innovation. Current research still has limitations such as insufficient authenticity of empirical scenarios, inadequate in-depth exploration of mediating mechanisms, and a lack of cross-cultural and interdisciplinary research. On this basis, this study proposes future research directions from five aspects: mechanism testing, context expansion, methodological optimization, teacher development, and ethical governance, to provide theoretical references for the construction of university teaching resources and the development of teacher capabilities.

Keywords

Generative AI tools, Higher education, Teaching resources, Teaching innovation ability, Teacher preparation, Literature review

1. Introduction

Since its public release at the end of 2022, generative artificial intelligence (AIGC) tools, represented by ChatGPT, have penetrated into all aspects of higher education at an unprecedented speed, driving the transformation of teaching resources from static and standardized to dynamic, personalized, and multimodal (Crompton & Burke, 2023).

Early research on artificial intelligence in higher education focused on the impact of tools such as adaptive learning systems and intelligent teaching assistants on student learning outcomes, viewing AI as a technological means to improve learning efficiency, and rarely explored the role of technology in reshaping the teaching resource system from the perspective of teachers (Zawacki-Richter et al., 2019).

From the perspective of teacher preparation, clarifying the impact path of AI-generated tools on teaching resources and defining the mediating role of teaching innovation capabilities not only helps to improve the theoretical system of AI education applications, but also provides practical basis for universities to formulate teacher development policies and optimize the construction of teaching resources.

Based on this, this study conducts an integrative narrative synthesis of high-quality core publications in recent years, focusing on three core research questions: First, in what dimensions have AI-generated tools impacted the construction and application of higher education teaching resources? Second, from the perspective of teacher preparation, what potential mediating role may instructional innovation skills play between AI tools and teaching resource quality? Third, what are the main limitations of existing research, and in what directions can future research be further deepened?

2. Research Methods

This study adopts an integrative narrative review approach to systematically sort out and analyze core research on AI-generated tools in higher education teaching. This approach allows for the integration of empirical studies, systematic reviews, and high-impact conceptual papers, so as to comprehensively construct the analytical framework of the relationship between AI tools, teacher competence and teaching resources.

2.1. Literature Retrieval and Screening

Literature retrieval was conducted in three core academic databases: Web of Science,

Scopus and ERIC, covering publications from 2019 to 2025. The retrieval keywords included combinations of “generative AI”, “AI-generated tools”, “ChatGPT”, “higher education”, “teaching resources”, “instructional innovation”, and “teacher preparedness”. After removing duplicates, titles and abstracts were screened according to inclusion and exclusion criteria, followed by full-text screening. Finally, 12 high-quality core publications were included for in-depth analysis.

2.2. Inclusion and Exclusion Criteria

Inclusion criteria: (1) The research topic focuses on the application of AI-generated tools in higher education teaching, involving teaching resources, curriculum design, teacher competence, assessment and other related content; (2) The research types include peer-reviewed empirical studies, systematic reviews, meta-analyses, and high-impact conceptual papers that construct core theoretical frameworks; (3) The research objects involve university teachers, students or teaching systems, which can provide empirical or theoretical basis for analyzing the impact of AI tools on teaching resources and the role of teachers. Exclusion criteria: Short commentaries, editorials, news articles and purely opinion pieces without academic analysis were excluded.

2.3. Definition of Core Concepts

Teaching resources: In this study, teaching resources refer to various elements supporting teaching activities in higher education, mainly including generated course content, exercise materials, assessment tools, instructional design schemes, and immersive learning scenarios. This study distinguishes resource generation technology from practical teaching application effects, and does not equate technical output with educational quality.

Instructional innovation skills: This concept refers to teachers' comprehensive ability to innovate teaching models, design teaching activities and optimize assessment systems with the support of AI tools. It is different from related concepts: digital competence focuses on basic technology operation ability, AI literacy focuses on AI cognition and ethical application, and TPACK focuses on the integration of technology, pedagogy and content. Instructional innovation skills emphasize the innovative transformation and practical application of technology on the basis of the above abilities.

2.4. Research Results

First, the generation and expansion of teaching resources. Liang et al. (2025), in a systematic review of 33 articles, pointed out that AI technology can autonomously generate course content, teaching materials, and extended resources, providing technical support for

the development and updating of the curriculum system. For example, intelligent systems can generate corresponding teaching cases, exercises, and extended reading materials based on the teaching syllabus, which helps make up for the shortcomings of traditional resources such as slow update speed and single format. Zhang and Tang (2025)'s interdisciplinary comparative study further pointed out that AIGC tools can generate multimodal teaching resources such as text, images, and audio, breaking the media boundaries of traditional teaching resources and showing strong content creation potential in humanities, art design and STEM fields. Their study found that the strategic application of AIGC tools was associated with a 37% improvement in composite outcomes including collaborative problem-solving, cross-domain integration and peer evaluation in interdisciplinary learning, rather than a direct improvement in resource integration efficiency alone. Luo et al. (2025)'s systematic review of 63 articles also shows that 26 studies applied AI technology to generate and deliver multimodal learning materials, reflecting the wide application of multimodal resource generation functions; however, whether these materials can actually improve the richness and educational value of teaching resources still needs more empirical evidence from real teaching scenarios. A scoping review by Liu et al. (2025) indicates that tools such as ChatGPT can assist teachers in designing test items and drafting grading criteria, providing technical support for the development of assessment-related teaching resources.

Second, the personalized adaptation of teaching resources. The classic review by Zawacki-Richter et al. (2019) pointed out early that adaptive systems and personalization are among the core functions of artificial intelligence in higher education.

The study by Luo et al. (2025) showed that among the 63 included studies, 46 focused on the personalized feedback and recommendation functions of AI tools. Technically, AI tools can push suitable learning resources, practice questions and guidance suggestions in real time based on students' learning progress, knowledge mastery and learning preferences, showing the potential of targeted learning support; however, the large-scale and effective implementation of "teaching according to aptitude" in real teaching scenarios still needs to be verified by long-term practical research. Liang et al. (2025) also mentioned that AI technology can analyze students' learning process, performance and needs, provide timely feedback for teachers, assist teachers in carrying out adaptive teaching, and provide support for personalized assignments and learning guidance. For example, in music teaching scenarios, AI-driven learning systems can push targeted training resources according to students' practice performance, and relevant studies have reported positive effects on teaching efficiency; specific effect sizes and applicable scenarios need to be further verified against primary research evidence.

Thirdly, there is the evaluation and reverse optimization of teaching resources. Among the three paradigms of AI education applications proposed by Ouyang and Jiao (2021), the learner-led paradigm empowered by AI includes intelligent evaluation of the learning process and resources. Liang et al. (2025) specifically pointed out that AI tools can use word embedding technology to evaluate the reading difficulty of teaching and assessment materials, ensuring the difficulty matching between assessment and teaching resources, and providing an objective basis for optimizing teaching resources. This evaluation not only covers textual resources but can also extend to judging the rationality of the overall course design, assisting teachers in reflecting on course design. Luo et al. (2025) also confirmed that evaluation and assessment are one of the core roles of AI in higher education, with 45 studies using AI tools to conduct learning assessments, analyzing students' learning performance to diagnose deficiencies in teaching resources and promote dynamic optimization of resources.

Based on the synthesis of existing literature, three potential paths for teachers' instructional innovation skills to play a mediating role are proposed as follows: The first path is the enhancement of AI literacy and the awakening of innovative awareness. Research by Liu et al. (2025) shows that teachers' perception and acceptance of ChatGPT directly affect their level of application in teaching. Teachers with higher AI literacy are more willing to try integrating AI tools into teaching resource construction and are better able to identify the advantages and limitations of AI-generated content. Research by Chu et al. (2022) also points out that teachers' technological awareness and teaching philosophy are important prerequisites for AI teaching applications. When teachers possess innovative awareness, they will proactively transform AI tools from "auxiliary tools" into "resource co-creation partners." Liang et al. (2025) further mention that the popularization of AI requires teachers to shift their role from knowledge transmitters to learning guides and facilitators. This role transformation itself is a manifestation of teaching innovation ability and directly determines the design logic and presentation method of teaching resources.

The second path is the innovative reconstruction of teaching models. Kasneci et al. (2023) pointed out that generative AI provides technical support for the implementation of new teaching methods, while teachers' teaching innovation ability is the key to transforming technological possibilities into real teaching scenarios. A review by Liang et al. (2025) shows that AI technology can create immersive learning environments and new teaching models, supporting students to conduct trial-and-error exercises and skills training in simulated scenarios. However, the implementation of such innovative teaching resources is highly dependent on teachers' instructional design capabilities. Only when teachers have the ability to innovate teaching models can they integrate the scattered resources generated by AI into a

complete immersive teaching plan. The interdisciplinary research of Zhang and Tang (2025) also confirms this point. Their research found that, under the innovative design of teachers, AIGC tools can serve as a carrier for interdisciplinary collaboration, breaking down disciplinary barriers and constructing new interdisciplinary teaching resources.

The third path is the reform of the assessment system. Cotton et al. (2023) pointed out that the widespread use of AI tools has brought huge challenges to the traditional academic integrity and assessment system, and the core of addressing this challenge lies in teachers' assessment innovation capabilities. Liang et al. (2025) mentioned that in the face of the academic integrity risks brought by AI, teachers need to redesign assessment methods, shifting from outcome-oriented assessment to process-oriented assessment, and developing new assessment resources such as oral examinations, project-based assessments, and process-based assessments; this reform of the assessment system is essentially a reflection of teachers' teaching innovation capabilities in the evaluation dimension. The research of Liu et al. (2025) also shows that existing research has begun to explore the use of AI tools to assist in assessment design, developing assessment tasks that are more realistic and better able to examine higher-order abilities, and the depth and quality of such explorations depend entirely on teachers' assessment innovation capabilities.

First, teachers' AI teaching and innovation capabilities are generally insufficient. Bond et al.'s (2024) metasystems review points out that the application of AI in higher education currently suffers from a general lag in teacher capacity building. Most teachers lack systematic AI literacy training and have insufficient understanding of the technical logic, teaching application scenarios, and risk prevention of generative AI. Liang et al. (2025) also confirm that AI poses new challenges to teachers' teaching abilities, including how to cultivate students' ability to critically use AI texts, how to use AI tools ethically, and how to cultivate digital citizenship literacy, etc., and most teachers are not yet prepared to address these challenges. Liu et al.'s (2025) research further points out that current teachers' understanding of AI is mostly limited to the tool level, lacking the innovative ability to deeply integrate AI with subject teaching, and making it difficult to fully explore the teaching value of AI tools.

Second, ethical risks and academic integrity challenges increase the pressure on teachers. Kasneci et al. (2023) systematically sorted out the risks of ChatGPT in educational applications, including misinformation generation, algorithmic bias and academic misconduct. Cotton et al. (2023) specifically pointed out that AI-generated text is difficult to be identified by traditional detection tools, which poses a serious challenge to academic integrity and assessment fairness. Liang et al. (2025) also showed that misinformation, data privacy,

algorithmic bias and students' cheating risk are the main ethical concerns faced by teachers in AI application.

In addition to the above risks, the ethical governance of AI teaching application also involves multiple dimensions: the ownership of intellectual property rights of AI-generated resources, the disclosure obligation of AI-assisted content, data security and governance norms in the process of resource generation, accessibility inequality caused by paid AI tools, dependence on commercial AI service providers, and the environmental and labor costs behind large model operation. These issues will directly affect the quality and sustainable application of AI-generated teaching resources, and need to be paid attention to in subsequent research and practice.

Third, the lack of technical support and institutional safeguards restricts teachers' innovative practices. Liang et al. (2025) found that most universities lack a comprehensive technical support system and AI teaching training, leading to technical barriers for teachers when using AI tools and hindering their access to timely guidance and assistance. Furthermore, some universities' teaching management systems even restrict the application of AI tools in teaching, suppressing teachers' enthusiasm for innovation. Liu et al. (2025)'s policy-themed research also shows that most universities' current academic integrity policies have not clearly defined the use of AI tools and lack a systematic AI teaching governance framework. Zhang and Tang (2025) further point out that a sound governance framework, a teacher co-design mechanism, and an interdisciplinary practice community are key to ensuring the effective implementation of AI tools, and most universities are currently severely inadequate in these areas.

The above three paths are theoretical frameworks constructed based on existing research findings, and the actual mediating effect and action mechanism need to be further tested by empirical research.

3. Discussion

A synthesis of existing research reveals that the impact of AI-generated tools on higher education teaching resources follows a logic of "technology supply—capacity transformation—resource upgrading," with teachers' innovative teaching capabilities playing an indispensable mediating role. This logic echoes and expands upon the three paradigms of AI education applications proposed by Ouyang and Jiao (2021): AI does not directly replace teachers as experts in teaching, but rather indirectly promotes the upgrading of teaching resources and the transformation of teaching models by empowering teachers' innovative capabilities.

This logic also corrects the tendency of “technology centrism” in earlier studies and reaffirms the central role of teachers in the application of educational technology (Zawacki-Richter et al., 2019).

Existing research has formed several core common understandings: First, generative AI tools have important technical potential for the construction of higher education teaching resources, and their advantages in improving resource generation efficiency, supporting personalized adaptation and assisting assessment optimization have been shown in multiple studies (Crompton & Burke, 2023; Luo et al., 2025). Second, teachers are the core subjects of AI teaching application, and their ability and preparedness are key factors affecting the effect of AI application; most studies from the teacher perspective support this view. Third, the application of AI in teaching involves ethical, integrity, fairness and other related risks, which require prudent response; this is also a widely recognized view in existing research.

Meanwhile, there are also obvious disagreements in existing research, and the reasons for the differences are related to multiple contextual factors. First, the impact of AI tools on the development of higher-order abilities is controversial: some studies believe that AI tools can promote students’ creativity, critical thinking and other higher-order abilities (Zhang & Tang, 2025), while others point out that over-reliance on AI may weaken students’ independent thinking and in-depth thinking ability (Luo et al., 2025). Such differences may be related to factors such as the type of AI tools used, the design of teaching activities, the duration of intervention, and the method of ability assessment. A meta-analysis by Deng et al. (2025) also shows that AI has significantly different effects on different types of learning outcomes, with a better effect on knowledge memory than on higher-order thinking outcomes. Second, there are disagreements on the direction of teacher role transformation: some studies emphasize that teachers should transform into “guides” and “facilitators” and weaken the knowledge transmission function; while other studies believe that teachers’ professional subject knowledge is irreplaceable, and AI can only be used as an auxiliary tool, and the transformation needs to maintain reasonable boundaries. Such disagreements are affected by disciplinary attributes, school running concepts and teacher ability levels, and cannot be simply attributed to the tension between technology and the essence of education.

Overall, current research on AI tools and teaching resources is still in its early stages of rapid development and has three obvious limitations.

First, the research methods and scenarios lack realism. Liang et al. (2025) pointed out that existing studies mostly use simulation experiments or model building methods, with a serious lack of long-term empirical research conducted in real classroom scenarios; most studies focus on short-term intervention effects, lacking follow-up studies on the long-term quality of

teaching resources and the development of students' abilities (Luo et al., 2025). This results in limited practical applicability of existing research conclusions and makes it difficult to reflect the complex impact of AI tools in real teaching scenarios.

Second, the representativeness of research contexts is insufficient. Existing studies are mainly concentrated in regions with relatively abundant educational resources, including Europe, North America and China. Studies from European and North American contexts are mostly situated in WEIRD societies, while Chinese studies present distinct educational systems and cultural characteristics that cannot be simply classified under the WEIRD framework. Research from developing countries and under-resourced institutions is still very scarce, and the influence of institutional conditions, economic level, digital infrastructure and educational policies on AI application in teaching has not been fully discussed. In addition, the disciplinary distribution is uneven: there are more studies in language learning and medical education, while relatively few in humanities, social sciences and arts (Luo et al., 2025), making it difficult to fully reflect the differentiated application effects of teaching resources in different disciplines. Third, there is a lack of systematic research on the mediating mechanisms. While existing research sporadically mentions the importance of teacher competence, very few studies specifically explore the mediating role of teaching innovation ability, and there is a lack of systematic construction and empirical testing of the pathway of "AI tools—teaching innovation ability—quality of teaching resources ." Most studies mention teacher competence as an influencing factor or a barrier factor, without deeply analyzing its internal mechanisms and pathways, resulting in an incomplete theoretical framework.

4. Conclusion

Focusing on the perspective of teacher preparation, this study conducted an integrative narrative review of core literature on AI application in higher education teaching, and discussed the impact of AI-generated tools on teaching resources and the potential mediating role of teachers' instructional innovation skills. The main conclusions are as follows: First, AI-generated tools may reshape the supply mode and structural form of higher education teaching resources from three dimensions: generation and expansion of teaching resources, personalized adaptation, and evaluation optimization, bringing efficiency improvement space for teaching resource construction. Second, teachers' instructional innovation skills are a potential key mechanism linking AI technology and teaching resource quality. Through three paths—improving AI literacy, reconstructing teaching models, and innovating evaluation systems—the technical functions of AI may be transformed into practical teaching resource value, and the level of teacher preparation will affect the actual effect of AI empowerment.

Third, current research in this field is still in the early stage of development, with limitations such as insufficient authenticity of empirical scenarios, inadequate exploration of mediating mechanisms, and limited coverage of research contexts. The universality and practical guiding value of relevant conclusions still need to be further improved. Given the limitations of existing research, future studies can be deepened and expanded in five directions: First, deepen mechanism research, construct and empirically test the mediating role model of “AI generation tools - teachers’ teaching innovation ability - teaching resource quality”, and clarify the quantitative relationships and action paths among various variables. Second, expand research contexts, focusing on the application of AI in teaching in developing countries, local universities, and weak disciplines, and conduct cross-cultural and interdisciplinary comparative studies to enhance the universality of research conclusions. Third, optimize research design, conduct long-term follow-up studies in real teaching scenarios, and adopt mixed research methods combining quantitative data and qualitative insights to enhance the rigor and practical value of the research. Fourth, focus on teacher development, deeply explore the constituent dimensions and improvement paths of university teachers’ AI teaching innovation ability, and construct a teacher preparation support system for the AI era. Fifth, improve ethical governance, conduct research on ethical norms and academic integrity protection mechanisms for AI teaching applications, explore implementable risk prevention and control solutions, and provide institutional guarantees for the healthy development of AI teaching.

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Data availability

This study is a literature review, and all analyzed data are from published academic literature, which can be obtained through the corresponding references.

Declarations

Conflict of interest



The authors declare that there is no conflict of interest.

Ethics approval

Not applicable.

Consent to participate

Not applicable.

Consent for publication

All authors have given their consent.

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