Original Paper

Research on Pathways for Enhancing University Students' Digital Literacy in the Era of Artificial Intelligence

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Abstract

With the continuous development of artificial intelligence (AI) technology, the landscape of higher education is undergoing significant transformation. This paper focuses on the core issue of cultivating college students' digital literacy, expounds on the value of fostering college students' digital literacy in the context of the AI era, and analyzes three major current predicaments: over-reliance on technology and dulled thinking, lack of resources and an inadequate curriculum system, and ethical misconduct and security risks. Furthermore, it systematically proposes comprehensive countermeasures, including the hierarchical restructuring of university curriculum systems, collaborative governance among multiple stakeholders, and the systematic enhancement of teachers' capabilities. The aim is to construct a multi-dimensional and full-chain ecosystem for digital literacy cultivation, thereby providing theoretical support and practical guidance for fostering college students' digital literacy.

Keywords

Artificial Intelligence, Digital Literacy, Higher Education, Collaborative Education

1. Preface

Against the backdrop of artificial intelligence (AI) technology profoundly reshaping the educational ecosystem, the cultivation of college students' digital literacy has become a key factor in advancing the high-quality development of higher education. With the rapid iteration and widespread application of intelligent technologies such as generative AI and large models, traditional educational models are facing unprecedented challenges and opportunities (Wang, 2025). Based on the development trend of in-depth integration of intelligent technologies and education, this study conducts an in-depth analysis of the value connotation and practical dilemmas in the cultivation of college students' digital literacy, and explores paths to enhance college students' digital literacy from multiple dimensions, including the renewal of educational concepts, the restructuring of curriculum systems, and the improvement of teachers' digital

literacy. It aims to provide theoretical support and practical reference for digital literacy education in colleges and universities.

2. The Value Connotation of Cultivating College Students' Digital Literacy in the AI Era

2.1 The Endogenous Driving Force for Guiding the Reform of Higher Education

The in-depth integration of artificial intelligence (AI) technology and the educational ecosystem is spawning a revolution in educational paradigms, and has become a core element driving the modernization of higher education. From the perspective of educational philosophy, the modernized transformation of digital literacy has constituted the value cornerstone and goal orientation for the modernization of the higher education system—it not only lays the ethical foundation for educational modernization, but also guides the evolutionary direction of educational development strategies (Xiao & Dan, 2025). By reshaping the paths of knowledge dissemination, innovating interactive teaching models, and reconstructing management decision-making mechanisms, intelligent technologies have achieved a structural upgrade of the higher education system.

At the level of teaching practice, AI technology has turned personalized learning from an ideal into a reality. In the field of scientific research and innovation, AI technology promotes the evolution of academic evaluation systems toward multi-dimensionality. Through algorithm models such as semantic analysis and impact tracking, intelligent review systems comprehensively assess the theoretical breakthroughs, social value, and technological transformation potential of research outcomes, breaking through the limitations of single quantitative indicators. Additionally, predictive analysis based on big data can dynamically monitor changes in regional industrial structures and talent demands, providing a scientific basis for the adjustment of university disciplines and majors, and optimizing the spatial layout of educational resources.

2.2 The Strategic Cornerstone Supporting National Digital Development

In the global landscape of digital competition, the digital literacy of college students has become a key indicator for measuring a country's digital innovation capability and future development potential. The essence of international competition in the future lies in a comprehensive contest between the reserve of digital talents and the maturity of the digital ecosystem. The digital transformation of the economy and society urgently requires enhancing college students' digital literacy to improve their adaptability and creativity in the digital environment (2024).

From the perspective of national strategy, the cultivation of digital literacy serves as a crucial fulcrum for implementing the strategy of reinvigorating the country through talents. As a highland for talent cultivation, higher education must proactively respond to the new requirements for talent quality in the digital age. In this process, individuals' digital literacy has become a core production factor in the modern industrial system, and the efficiency of its value realization is directly linked to the structural level of basic digital capabilities. As an important strategic resource for countries to participate in global digital technology competition, college students' literacy level directly affects the implementation effectiveness

of a country's digital strategy.

2.3 The Requirement of the Times for Promoting the All-Round Development of Individuals

Digital literacy is an essential quality for college students to achieve self-development in the intelligent era, and a fundamental guarantee for them to adapt to the digital social environment and realize their life values. At an inherent level, the growth process of college students in the digital era represents an all-round transformation of their cognitive models, learning methods, interaction patterns, and lifestyles from traditional forms to digital ones. This transformation reflects the harmonious coexistence between humans and the technological environment, and also signifies an overall improvement of college students' comprehensive quality in the digital field.

In terms of technical competence, digital literacy enables college students to skillfully use a variety of digital tools and understand the operational logic of digital technologies such as artificial intelligence and big data, thereby flexibly applying these technologies to solve problems in practical scenarios. In the dimension of cognitive development, digital literacy cultivates students' ability to identify information and integrate knowledge, allowing them to quickly and accurately evaluate the reliability and value of information amid the information flood, and transform fragmented data into a systematic knowledge framework (Guan, 2025). In the aspect of innovative practice, digital literacy equips students with the ability to develop new digital products or design innovative service models based on technology integration. By virtue of digital tools, students can create content products with unique value, demonstrating the paradigm of innovative thinking driven by technology.

3. Dilemmas in Cultivating College Students' Digital Literacy in the Age of Artificial Intelligence

3.1 Technological Dependence and Dulled Thinking

Currently, college students are confronted with a significant dilemma of technological dependence in terms of digital literacy, which is mainly reflected in the superficialization of cognition and over-reliance on applications. Although generative AI applications have become increasingly popular among students, the principles of their underlying core technologies (such as neural networks and deep learning) are often not deeply understood by users. This lack of technological cognition makes it difficult for students to effectively judge the reliability of AI-generated content and its applicable boundaries. Furthermore, in academic research, the misuse of biased information may thus affect the accuracy of research conclusions. More importantly, many students have developed a deep dependence on such intelligent tools, getting used to obtaining ready-made answers directly instead of proactively exploring the essence of problems (Deng, 2025).

Accompanying technological dependence is the potential risk of dulled thinking among college students at the cognitive level. While generative AI provides convenient answers and massive amounts of information, it also tends to trap students in a "comfort zone" of thinking, weakening the development of their critical thinking and innovative awareness. Although the "perfect" solutions offered by AI tools are efficient, they may inhibit students' motivation to explore independently and attempt new approaches.

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Especially in activities that should be full of creativity, such as writing and project design, over-reliance on AI for inspiration may instead restrict the exertion of their imagination, making it difficult for them to break through existing thinking frameworks. Eventually, this leads to a gradual decline in their ability to engage in in-depth thinking and independent innovation.

3.2 Lack of Resources and Imperfect Curriculum Development System

The lack of resources is a fundamental obstacle restricting the cultivation of college students' digital literacy. It is not only reflected in the insufficient investment in hardware facilities, but also, more profoundly, in the weak soft support required for interdisciplinary collaboration. The inherent differences in knowledge systems and research methods between disciplines (such as the paradigmatic conflict between algorithmic models and qualitative research) have made the integration of artificial intelligence and professional courses face the dilemma of "incommensurability of knowledge coding". At the same time, the resource allocation in colleges and universities has long followed the path dependence of traditional disciplinary systems, with resource distribution and talent affiliation solidified within established departmental frameworks. This seriously hinders the construction of interdisciplinary platforms and the free flow of personnel.

The problems of an imperfect and lagging curriculum system also directly affect the effectiveness of digital literacy education. The core dilemma of the current curriculum system lies in the slow update of content, loose structure, and severe disconnection from practice (Lin & Zhang, 2025). While artificial intelligence technology is advancing by leaps and bounds, colleges and universities are constrained by the traditional teaching management system and the long cycle of textbook updates, making it difficult for curriculum content to keep up with cutting-edge technologies. Coverage of emerging fields such as generative AI is particularly limited. Moreover, the curriculum design fails to systematically integrate real industry needs and technical standards into teaching, resulting in a significant gap between what students learn and what positions require. This all-round inadequacy of the curriculum system ultimately leads to the cultivated talents being unable to meet the social expectations of the digital and intelligent era.

3.3 Ethical Anomie and Crisis in Security Assurance

The primary challenge in the application of artificial intelligence (AI) in education lies in data privacy and security governance. When interacting with intelligent tools, students often expose sensitive information due to insufficient security awareness. Such data is at risk of being collected, stored, and even misused—which not only directly infringes on personal privacy but also may lead to practical harms such as property losses. Therefore, digital literacy education must strengthen content related to data security and privacy protection, guide students to understand how data is processed and valorized, and cultivate their critical habits of using technology. This reality also requires a coordinated response from both institutional and technological perspectives: by improving data supervision frameworks and algorithm accountability mechanisms, a crucial defense line for safeguarding students' digital security can be built.

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The popularization of generative AI poses a dual impact on academic integrity and college students' mental health. Academically, it is easily used to complete schoolwork, eroding the cornerstone of academic integrity; moreover, the ambiguity regarding the copyright of its outputs exposes students to the risk of unintentional infringement. Psychologically and interpersonally, the growing trend of students seeking emotional support from AI may weaken their ability to communicate and express emotions in real-life scenarios. When this preference for "human-machine interaction" combines with the existing "virtual circle"-based social model on campus, it exacerbates alienation in real-world interactions, laying hidden risks for students' socialization process and long-term mental health. Consequently, warning education needs to strengthen guidance on humanistic care and connection with real life.

4. Paths to Enhancing College Students' Digital Literacy in the Age of Artificial Intelligence

4.1 Designing a Gradient Curriculum System

Constructing a gradient and multi-level curriculum system is a fundamental path to enhancing college students' digital literacy. This system should follow a progressive framework of "General Education Level – Professional Level – Innovation Level," achieving full-process coverage from popularization education to professional in-depth learning and further to innovative research. At the General Education Level, the focus is on basic education in algorithmic thinking and technological ethics, and core concepts of artificial intelligence are popularized among all students (Lin & Zhang, 2025). At the Professional Level, interdisciplinary courses such as "AI + Medicine" and "AI + Economics" are offered based on the characteristics of different disciplines, aiming to cultivate students' ability to analyze and solve professional problems using intelligent technologies. At the Innovation Level, through project-based learning and scientific research training, students are guided to conduct exploratory research in the field of artificial intelligence.

In terms of curriculum development, colleges and universities should implement the "AI Curriculum Group Construction Initiative". Based on the core courses of majors such as computer science and artificial intelligence, they should upgrade traditional courses, develop emerging courses for AI-empowered majors, and introduce high-quality online resources to meet the differentiated needs of students. Practices in some colleges and universities have shown that constructing a progressive curriculum system for AI literacy cultivation in a hierarchical and categorized manner can effectively adapt to the learning characteristics of students with different professional backgrounds. Many colleges and universities have offered the basic course "Introduction to Artificial Intelligence" for lower-grade students and provided online advanced courses for upper-grade students, achieving favorable teaching effects.

4.2 Building a Diversified and Collaborative Education Pattern

Improving the government-university-enterprise collaboration mechanism is a systematic solution to enhance college students' digital literacy, and a collaborative governance framework featuring "government guidance, university leadership, and enterprise participation" should be established. At the

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government level, a cross-departmental collaborative governance mechanism can be built to address the current issue of fragmented policy supply. For instance, administrative resources across departments such as education, science and technology, and industry and information technology can be integrated to set up a joint working mechanism for AI literacy cultivation, clarifying the responsibility boundaries and collaboration standards of each department. The education department takes the lead in formulating curriculum standards and conducting teacher training; the science and technology department promotes the transformation of cutting-edge technological achievements into teaching resources; and the industry and information technology department coordinates the connection of enterprise resources. Real-time information sharing among industry, academia, and research institutions is achieved through data sharing (Nanjing Tech University, 2024).

At the university level, universities should take the initiative to break down organizational barriers and deepen substantive cooperation with enterprises. Through joint construction of carriers such as laboratories and industrial colleges, they can transform enterprises' needs for technological research and development into teaching project resources. At the enterprise level, enterprises should go beyond the superficial model of traditional university-enterprise cooperation and build strategic partnerships for talent cultivation. Technology enterprises and institutions of higher education can jointly establish industrial colleges, develop a technology resource sharing mechanism supported by agreements, and convert enterprises' real R&D scenarios into teaching resources.

4.3 Enhancing Teachers' Digital Competence

University teachers play a core role in the intelligent education ecosystem, and their level of AI literacy directly determines the quality and effectiveness of digital literacy education. To enhance the intelligent literacy of university teachers, it is necessary to build a hierarchical and progressive training system. For teachers in the basic cognitive stage, general AI training can be carried out. For teachers in the professional development stage, discipline-specific AI-integrated curriculum packages can be customized based on the nature of their disciplines. Meanwhile, a dynamically updated AI teaching case library should be established to provide references for teachers' teaching innovation. The practice of some universities in improving teachers' AI teaching capabilities through systematic training is worth promoting; through multiple sessions of online and offline training, these universities have effectively enhanced teachers' ability to apply intelligent technologies.

4.4 Improving the Teacher Evaluation Mechanism

Reform of the evaluation mechanism is an institutional guarantee for stimulating teachers' enthusiasm. Colleges and universities should formulate special policies and establish incentive measures, incorporating teachers' teaching achievements, research projects, and innovative applications in the field of AI education into the important reference indicators for professional title evaluation and performance assessment, so as to fully mobilize teachers' initiative and creativity. They should develop standards for university teachers' AI literacy, integrate these standards into professional title review and performance assessment, and dynamically monitor the progress of literacy improvement. Meanwhile, it is necessary

to improve the guarantee and incentive mechanisms, and provide appropriate recognition and rewards to teachers who have made outstanding achievements in the field of AI education.

5. Conclusion

The cultivation of college students' digital literacy is not only an inevitable requirement to adapt to technological changes, but also a crucial measure to promote higher education reform and serve national strategies. In the future, colleges and universities need to continuously deepen the government-university-enterprise collaborative education mechanism, build a dynamically adjustable curriculum system and teaching model, and constantly improve the digital literacy education ecosystem while balancing technological innovation and ethical requirements. This will enable college students to achieve the transformation from the use of technical tools to the internalization of digital literacy, and boost higher education to realize connotative development and quality improvement in the digital age.

References

(2024). Research on digital media literacy education for college students in the era of artificial intelligence. *China Adult Education*, (13).

Deng, H. Y. (2025). Cultivation of college students' digital literacy under the background of generative artificial intelligence: Opportunities, challenges and optimization strategies. *Advances in Education*, *15*(6), 486-493.

Guan, J. (2025). How to improve college students' digital literacy in the intelligent era. *China Education Daily*, (4).

Lin, J., & Zhang, B. (2025). Connecting "government-university-enterprise" to create a combined strategy for AI literacy cultivation. *Guangming Daily*.

Nanjing Tech University. (2024). *Actively promoting the foundation-building program for undergraduates' AI literacy*. Website of Jiangsu Provincial Department of Education.

Wang, H. M. (2025). Optimizing the cultivation ecosystem for college students' digital and intelligent literacy. *Guangming Daily*, (14).

Xiao, M., & Dan, W. G. (2025). Cultivation and reconstruction of college students' digital literacy. *China Social Sciences Daily*.