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Challenges and Countermeasures in the Construction of General Artificial Intelligence Courses for Postgraduates

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Abstract: Against the backdrop of the rapid development of artificial intelligence technology, the construction of general artificial intelligence (AI) courses for postgraduates is confronted with numerous challenges. This paper expounds on the background of offering general AI courses in postgraduate education in China, analyzes the key challenges in the construction of such courses, and proposes targeted development strategies from two aspects: the curriculum construction itself and the safeguard measures for its smooth implementation. The research aims to provide a reference for universities in developing general AI courses for postgraduate education.

Keywords: Postgraduate education; Artificial intelligence; General courses

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1. Background of general AI courses for postgraduates

In 2018, the Ministry of Education issued the "AI Innovation Action Plan for Higher Education Institutions," stating that "the rapid development of artificial intelligence will profoundly change human social life and the world" [1]. In 2020, the Department of Higher Education of the Ministry of Education released the "Key Work Points of the Department of Higher Education of the Ministry of Education for 2020," which clearly specified the need to "strengthen the construction of resource conditions, advance the development of engineering innovation training centers, industry-education integration innovation platforms, shared practice bases and AI teaching resources, and carry out training for deans of engineering colleges and core teachers in batches" [2]. In the same year, three ministries, including the Ministry of Education issued the "Opinions on Accelerating the Reform and Development of Postgraduate Education in the New Era," setting the clear goal of "basically building a powerful country in postgraduate education with Chinese characteristics by 2035" [3]. The "Outline for the Construction of an Education Power (2024–2035)" further emphasizes the need to "advance curriculum system reform and optimize the setup of disciplines and majors in response to the development of the digital economy and future industries, and promote AI to boost educational transformation" [4]. The "Opinions on

Accelerating the Advancement of Educational Digitalization" requires "in-depth implementation of the national strategy for educational digitalization, the launch of the AI-empowered education initiative, improvement of teachers' and students' digital literacy and skills, construction of a coherent AI literacy training system for all school stages, and development of large AI models for education" [5]. As the highest level of the national education system, postgraduate education, especially its general courses, serves as a crucial intersection of science and technology as the primary productive force, talent as the primary resource, and innovation as the primary driving force. Currently, the construction of general AI courses for postgraduates must proactively adapt to and seek changes, and accelerate the development of an educational curriculum system that meets the requirements of the intelligent era.

2. Challenges in the construction of general AI courses for postgraduates

Major developed countries worldwide have elevated the development of AI to a major strategic priority, regarding it as an important measure to safeguard national security and enhance national competitiveness. They have successively supported universities in strengthening strategic deployment in core technologies, top-tier talent cultivation, and standards and norms, aiming to seize the high ground in the new round of international competition [6]. In 2023, the number of postgraduate students in the United States exceeded 3.2 million, and the scale of postgraduate education in China has continued to expand, with 3.8829 million postgraduate students enrolled in 2023. Postgraduate education has become an important part of the global innovation system, and general AI courses, as a key component of AI postgraduate education, have gradually become a focal point of attention. The main challenges in the construction of general AI courses for postgraduates are reflected in the following aspects:

2.1. Late start and insufficient attention

A prominent feature of general education in domestic universities is its late start and insufficient attention. The general curriculum reforms of top domestic universities representing the highest level of education in China, such as Peking University, Tsinghua University, Nanjing University and Fudan University, mostly started in 2005, while the Harvard Committee released its general education reform report as early as 1945 [7]. As the birthplace and leader of intelligent disciplines in China, Peking University offers the core general AI course "Artificial Intelligence and Computational Thinking" for undergraduate students. Tsinghua University is building a distinctive AI general curriculum system with 38 AI-related general courses. However, China has a large number of universities with diverse characteristics and significant hierarchical differences. Apart from these prestigious institutions, more universities pay inadequate attention to the construction of general courses, and the development of general courses at the postgraduate level is even more deficient. Although the reform of general AI courses for postgraduates has long been listed as a key task of educational and teaching reform by universities, the awkward current situation has not been fundamentally changed in practice.

2.2. Inadequate interdisciplinary integration

AI is a highly interdisciplinary field that needs to be integrated with multiple disciplines such as mathematics, computer science, and sociology [8]. The essence of general AI courses is the interdisciplinary integration of "AI + X", whose core is to organically combine AI technology with knowledge from the humanities, social sciences, science and engineering, agriculture and medicine, etc. However, most current general AI courses for postgraduates are inadequate in interdisciplinary integration, failing to establish a comprehensive knowledge

framework system and achieve full penetration of AI concepts. Integration with the humanities and social sciences mostly remains at the application of AI technology in these disciplines, dominated by case studies. Integration with natural sciences tends to focus on technical principles and large model algorithms, lacking reflections on the boundary governance and ethical norms of AI.

2.3. Inadequate AI literacy of teachers

Teachers are the primary responsible persons and key guides in the construction of general AI courses for postgraduates, and their AI literacy directly affects the quality of curriculum construction and educational effectiveness. According to the 2024 Global AI Student Survey by the Digital Education Council, 86% of higher education students worldwide have integrated AI tools into their daily learning scenarios, but less than 25% of teachers believe that AI has practical value in improving teaching quality [9]. The stark contrast in the acceptance of AI between students and teachers not only weakens teachers' motivation for teaching but also poses a systematic challenge to the construction of general AI courses for postgraduates.

3. Strategies for the construction of general AI courses for postgraduates

Postgraduates must possess a solid theoretical foundation in their disciplines, which is the cornerstone of their future career development. Curriculum teaching is the main channel for postgraduates to master theoretical knowledge of their disciplines [10]. Therefore, the construction of general AI courses for postgraduates is necessary and highly challenging. It requires inculcating AI thinking in students from different professional departments with diverse knowledge backgrounds to inspire them. This not only demands a high-quality and complete general AI curriculum for postgraduates, but also comprehensive support at the university level to ensure the effective implementation and practical results of the curriculum.

3.1. Construction of general AI courses for postgraduates

The core of curriculum construction is "what kind of talents to cultivate". A scientific and reasonable curriculum design decomposes educational goals into specific and executable modules, ensuring that each module aligns with the curriculum construction objectives. A high-quality teaching team is the key support for achieving the educational goals of general AI courses for postgraduates.

3.1.1. Curriculum construction objectives

In response to the challenges of general AI courses, such as extensive knowledge coverage, wide span and high comprehension difficulty for students [11], the course aims to achieve the following three teaching objectives through instruction: First, help students better understand the working principles of AI technology, update their knowledge structure, and cultivate algorithmic thinking, data analysis and problem-solving abilities; Second, enable students to fully adapt to the rapidly changing digital technology environment, understand industry frontiers, and develop key algorithm skills; Third, assist students in realizing the application of "AI +" in their study, work and daily life.

3.1.2. Curriculum design

The course establishes and improves the knowledge system of general AI courses for postgraduates through four modules: History and Scenarios, Basic Knowledge, Practical Application, and Industry Frontiers.

(1) The History and Scenarios module introduces the development history of AI technology. The origin of AI can be traced back to 1956, when more than 30 scholars gathered at Dartmouth College to attend an AI summer seminar that lasted about 8 weeks, marking the official emergence of AI in human history [12]. In the more than six decades since then, AI has experienced several ups and downs, until the proposal of the deep learning neural network model in 2012, which achieved a major breakthrough in the field of image recognition. Since then, key AI technologies have made breakthroughs, triggering disruptive changes in multiple industries and becoming an important driving force in the digital age.

(2) The Basic Knowledge module aims to lay a theoretical foundation of AI for students and help them understand the underlying logical framework of its applications. The content covers the core methods and basic principles of AI, such as machine learning, deep learning, natural language processing, and knowledge representation and reasoning; it also introduces typical AI application technologies, including computer vision, speech recognition, and robotics. Through systematic teaching and case introduction, the module helps students comprehensively understand the basic concepts and applications of AI, laying a foundation for further in-depth learning and practical exploration.

(3) The Practical Application module focuses on the typical practical applications of AI in multidisciplinary fields through case analysis and thematic explanations, promoting interdisciplinary integration. For example, it guides students to understand how AI drives decision-making processes, market research and intelligent analysis in the era of AIGC (Artificial Intelligence Generated Content), and the combination of machine learning and economics. In addition, the module covers a series of ethical and psychological issues triggered by the rapid development of AI, as well as relevant governance, policies and regulations, providing students with a multi-dimensional understanding framework and a basis for critical thinking.

(4) The Industry Frontiers module is intended to broaden students' horizons and enable them to understand the latest developments and future trends in the field of AI. It mainly invites experts from academia, policy circles and industry to deliver special lectures and conduct thematic dialogues, helping students gain an in-depth understanding of the current application progress and cutting-edge research of AI technology in various industries. It also provides students with opportunities to interact with industry experts, stimulating their thinking and exploration on the future development of AI.

3.1.3. Improving teachers' literacy

Strengthening AI learning is the core of improving teachers' literacy. The gap between teachers' digital literacy and the demands of AI education has become a key bottleneck for reform [13]. In traditional classrooms, teachers face textbooks and students, while in the general AI courses for postgraduates, teachers need to face both students with professional foundations and AI technology. This means that teachers must not only be able to use AI, but also understand and guide students to apply it effectively.

Enhancing risk awareness is the guarantee for improving teachers' literacy. In the AI era, it is imperative to strengthen the cognition and standardization of technological ethics and morality in higher education [14]. Teachers should fully recognize the limitations of AI technology, especially the potential threats to academic integrity posed by the widespread application of generative AI, which cannot be ignored. It is urgent to establish the teaching principle of "embracing technology and adhering to the bottom line", uphold educational ethics and academic norms, and realize the sustainable development of postgraduate education empowered by AI.

Maintaining a high level of experiential openness is the key to improving teachers' literacy. With the rapid development of AI technology, teachers must be willing to accept new ideas and dare to try new methods.

They should establish a digital teaching philosophy, understand the profound connotation of human-machine collaboration, digital-intelligent integration and intelligent generation, and actively develop new digital teaching resources [15]. Only in this way can the innovation and vitality of general AI courses for postgraduates be sustained, teaching quality improved, and the new requirements for educational talent cultivation met.

3.2. Comprehensive safeguard measures from four dimensions

To ensure the efficient implementation and sustainable development of general AI courses for postgraduates, it is necessary to strengthen top-level design and resource guarantee, set up a special safeguard team to coordinate curriculum construction and resource allocation, and attach great importance to the guidance of teachers' concepts and the improvement of their literacy. In addition, teaching methods are particularly crucial; traditional lectures can be combined with case analysis and expert lectures to comprehensively improve students' theoretical foundation and application abilities. Finally, an interactive "dual-subject" evaluation system should be established to form a dynamic mechanism for optimizing curriculum content and continuous improvement, enhancing teaching quality and curriculum effectiveness.

3.2.1. Strengthening top-level design and resource guarantee

To ensure the efficient implementation and sustainable development of general AI courses for postgraduates, it is necessary to strengthen top-level design and clarify the strategic planning of curriculum construction. It is suggested that the university's competent departments of scientific research and teaching take the lead in setting up a special safeguard team for general AI courses for postgraduates to coordinate curriculum construction and resource allocation. The team should ensure the provision of sufficient teaching resources, experimental resources and practice platforms, conduct in-depth research on students' needs, and expand the range of general AI course options for postgraduates.

3.2.2. Strengthening the guidance of teachers' concepts and the improvement of their literacy

In the construction of general AI courses for postgraduates, teachers, as the primary responsible persons for curriculum construction, their teaching concepts are the key to the successful development of the courses. To help teachers transform their concepts smoothly, special training, collective lesson preparation, seminar exchanges and on-site visits to enterprises can be organized to guide teachers to deeply understand the teaching needs of the AI era and encourage them to take the initiative to embrace changes.

3.2.3. Adopting diversified teaching methods

In the teaching process of general AI courses for postgraduates, adopting diversified teaching methods can effectively improve teaching effectiveness and help students comprehensively understand the basic concepts and practical applications of AI. Traditional lecture methods can be used to teach the historical background, development process and basic knowledge of AI. Group research on AI application cases in different fields can be organized to promote students' understanding of AI applications in real life. Inviting industry experts and scholars to deliver special lectures can narrow the gap between universities and enterprises, which not only helps students understand industry trends but also stimulates their interest and thinking in the future development of AI.

3.2.4. Constructing an interactive "dual-subject" evaluation system

In the construction of general AI courses for postgraduates, an interactive "dual-subject" evaluation system

should be constructed to ensure the forward-looking and effectiveness of curriculum content. By organizing industry experts to participate in the collection of opinions on curriculum construction, the close connection between curriculum content and industrial practice is ensured. Students' learning experience and demands are fully adopted to enhance the pertinence and attractiveness of the courses. The effective transformation of evaluation results is realized, and a feedback mechanism of evaluation results on curriculum construction is established. This not only helps the iterative update of curriculum content, but also contributes to the construction of a teaching quality guarantee system that promotes development and reform through evaluation.

4. Conclusion

With the rapid development of AI, the construction of general AI courses for postgraduates is facing various challenges. The above-mentioned curriculum construction strategies, oriented by curriculum construction objectives, design the curriculum content into four modules with different focuses, and point out that teachers are an important guarantee for the quality of curriculum construction. In addition, four safeguard suggestions are specially put forward to ensure the sustainable development of the courses, helping universities successfully grasp the "golden key" of AI and open the intelligent future of postgraduate education.

Disclosure statement

The author declares no conflict of interest.

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