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Universal AI Literacy in Chinese Higher Education: Current Landscape and Optimization Pathways

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Abstract: **Being the central impetus of the new wave of technological revolution and industrial change, artificial intelligence (AI) has made universal AI literacy a strategic concern in the reform of higher education in China, and a set of national policies have significantly broadened the scope of AI literacy education in domestic universities and created a collaborative development model that comprises national top-level design, regional characteristic innovation and diversified school-level practices. In order to fully sort out the realistic development landscape of universal AI literacy education in Chinese higher education institutions, this paper will take two research approaches, policy text analysis and multi-case comparative research. Based on systematic investigation and comparative analysis, this study finds five significant bottlenecks limiting high-quality education development: ambiguous course positioning, fragmented curriculum systems, insufficient faculty capacity, absent evaluation frameworks, and superficial university-industry collaboration. To address these challenges, this study suggests improved trajectories based on the "national guidance - local adaptation - university initiative" model.**

Keywords: AI Literacy Education; AI Literacy; Higher Education; Curriculum Reform

1. Introduction

The growing role of intelligence in economic and social development is causing unprecedented shifts in the relations of productivity and production. It has become necessary to improve the artificial intelligence (AI) literacy and skills of the whole population in order to adjust to the intelligent era, improve social development, and personal growth [1,2]. The empirical research on science education worldwide proves that AI tools have a positive impact on the learning motivation of students, but disciplinary mismatch and ethical risks limit their promotion at large scale in higher education [3]. At the same time, with the modern industrial systems developing fast, new productive forces are being created, and strategic emerging industries are formed, engineering science and technology innovation is undergoing an unprecedented burst of activity. As the principal reserve force of the future workforce, high education students' overall AI literacy has thus become an important factor in enhancing competitiveness and driving high-quality development.

AI literacy, preparing students to adapt to technological and industrial change, and improving systems for developing AI literacy in higher education are essential to reforming professional training. In response, scholars have conceptualized AI literacy as a multidimensional competency encompassing knowing and understanding, using and applying, evaluating and creating, and addressing ethical concerns [4]. Meanwhile, systematic reviews have mapped the growing applications and pressing challenges of artificial intelligence in higher education [5]. The United Nations Educational, Scientific and Cultural Organization (UNESCO) also released the first ever Competency Framework on Artificial Intelligence in September 2024 to guide students to understand the direction that they should follow in their skills acquisition in the age of artificial intelligence. It is a new concept of AI Society Citizenship which is introduced by this framework as well as it sets up the structure of four fundamental AI competencies of the students in terms of Human-centred mindset, Ethics of AI, AI techniques and applications, and AI system design [6].Teachers' professional knowledge and ethical awareness in integrating AI-based tools into instruction constitute essential institutional supports for advancing standardized AI literacy education [7].

Moreover, empirical evaluations of AI literacy courses for higher education students from diverse disciplines have shown that conceptual understanding of AI can be cultivated across disciplines, informing the design of discipline-specific curricula [8].

China gives a lot of importance to the popularization and education of AI, specifically promoting the development of AI education at all levels and in all areas of society, with an emphasis on cultivating high-quality talent constantly. This involves giving policy guidelines that can help universities and colleges to adopt AI education extensively [9]. The AI literacy training in universities and colleges as one of the key educational strategies during the digital transformation of education is vital to improving the AI literacy of students, developing general adaptability, and generating innovative thinking. It is a key tool of improving the higher education system and cultivating talent capable of adapting to the demands of the intelligent era. Therefore, this paper systematically reviews the state of the art of AI literacy education in Chinese higher institutions of learning, determines the most common practical issues in its further development, and offers suggestions and recommendations regarding the improvement of its developmental path.

The purpose is to provide information on the high-quality development of AI literacy education and suggest practical measures to Chinese higher education institutions in order to develop an all-around AI literacy education system.

2. Current Landscape

Higher education institutions are fast adopting the use of AI in Education applications to improve AI literacy education worldwide [10]. At the same time, the Chinese government and scholars circles are also actively exploring the governance of AI in education with an emphasis on actors of governance, mechanisms and goals. It aims at encouraging cooperation between different stakeholders to come up with a dynamic policy framework which results into the creation of a preliminary three-dimensional governance structure that includes policy leadership, legal regulations and ethical limitations [11].

The incorporation of AI literacy education into the curriculum of universities is not only a technological progress, but also a major transformation in cultivating talents. Investigation of the AI education practices in China reveals the formation of a unified development model characterized by “national top-level planning, regional innovative differences and diverse institutional approaches”.

2.1 National Policy-Driven: Institutional Guarantee of High-Level Design

2.1.1 Policy stages and goal evolution

It was in the form of a national plan that AI literacy education started to be planned in China. The Chinese Minister of Education, Huai Jinpeng, has also suggested in March 2024 that the use of AI technology should not be limited to a specific level of education but rather it should be applied at all levels of education so as to attract students and introduce new methods of teaching. Then, on July 2024, Wu Yan, who is the vice minister of education, suggested that an overall curriculum system of artificial intelligence should be created to increase the number of talents in different areas. This is the official introduction of the AI literacy learning program to the country wide reform of the educational system. In the year 2025, China had already released its white paper on AI education, which required that general AI classes must be offered to students as part of their course work. It is not only a directive that implies a policy on national scale but also a step by step process with regard to the integration of technology, moral regulation and structural change that will explain how the entire education system, including primary and tertiary levels, will be transformed by AI.

Since 2012, the country has made policies to encourage AI in higher education. According to [12], China has published 46 policies on AI-related policy and each of these policies has its own type, which is related to a certain stage of the policy process (the so-called critical juncture). In particular, three stages of policy making were identified: the initial stage (the first period) when it was necessary to create the discipline system and to provide courses on artificial intelligence; the second stage (the middle period) when the system of disciplines was developed and it became necessary to make compulsory courses on artificial intelligence at universities; the third stage (the final period) when it was necessary to develop the courses on artificial intelligence as a separate subject.

2.1.2 Policy instruments and implementation pathways

Based on the analysis of the programmatic documents, it can be concluded that the state has implemented a strategy which is coordinated and consists of three types of instruments used in the policy making process: supply-side, environmental and demand-side. The policy loop would take place when the state provides hard resources to the universities, which are then transformed into the soft environment, as a result of which the demand is created (flexible demand). It is a strategic guide and assurance of the local governments and the higher education institutions [12].

The supply side tools are those that focus on the provision of resources to enable the mass implementation of AI in the learning process. This is done by curriculum design, training of the teachers and building of technological infrastructure. Some of these programs include creating special funds of national AI education to finance the development of standard curriculum modules, a national smart education system to coordinate the library of course materials in literacy education, and use of virtual teaching and research systems to encourage collaboration among faculty members and increase their capacity.

The policy regulation and the institutional innovation of environmental instruments create an ecosystem of development, which includes the policy incentives, standardization and reform of the evaluation system. One of the practices is the AI literacy education in the Ministry of Education where it was introduced as part of the New Engineering, New Medicine, New Agriculture, and New Liberal Arts. This project requires the universities to offer their students a course that will be based on the specifics of the disciplines they are studying, i.e. science and engineering, management and humanities, arts and physical education. Also, it provides ways of accreditation of courses and credit, as well as the ability of universities to incorporate the competencies of artificial intelligence in the overall quality control of the student [13].

Demand-side tools are also used to increase the motivation, by providing scenarios of demand and models like pilot demonstration, industry interaction and competition. An example is that the pilot-first model as seen in the Beijing municipal universities which have 50, 000 first-year students aims at establishing a replicable curriculum model that can be implemented nationally after it has been successfully executed [14]. The concept of integrating industry with education implies that the university and enterprise will collaborate to create an effective platform, e.g., the virtual simulation laboratory, and turn the actual needs of the industries into educational practices. Also, there is the competition incentive model, which encourages the students to become interested in the use of technology and innovation by organizing national AI discipline competitions.

2.2 Sub-National Government Coordination: a Regional Approach to Decentralization of Curriculum Resources.

At the national policy level, regional governments are working together to accelerate the implementation of artificial intelligence in higher education. This is done by using a "policy adaptation–resource integration–scenario innovation" model of curriculum implementation which produces three different models. Table 1 provides an overview of these regional implementation models and their dimensions and differences in operation.

Table 1. Comparison of Three Representative Local-Government-Led Models of AI Literacy Education in China

Mode name	Core features	Practical path	Typical cases	Achievements and Challenges
The "stratified and classified" model oriented towards policy adaptation	With differentiated policy design as the core, formulate stratified and classified plans based on the discipline layout,	1. Subject characteristic adaptation: Design the curriculum framework based on subject types. 2. Stratification of industrial demands: Match educational priorities according to regional leading	The Beijing Municipal Education Commission has designed three general versions: the science and engineering version, the management version, and the art and sports version, forming a characteristic brand of "AI + major" with "one school, one brand".	Effectiveness: Enhanced the adaptability of policies to local demands; It has reduced the cost of repetitive construction in colleges and universities. Challenge: Uneven distribution of resources across levels

	industrial foundation and resource endowment of universities	industries. 3. Resource endowment classification: Allocate policy support intensity according to the level of universities	Shanghai Institute of Technology has established the School of Intelligent Technology and developed a curriculum system of "AI+ Advanced Manufacturing"	(such as lagging policy implementation in underdeveloped regions); The dynamic adjustment mechanism is not perfect
The "industry-education symbiosis" model driven by resource integration	Achieve resource integration through the collaboration of the government, enterprises and schools, and build a symbiotic ecosystem of education and industry	1.Government-enterprise-school Joint Laboratory: Enterprises provide equipment and case libraries. 2. Dual-appointment system of industry mentors: Enterprise experts participate in teaching. 3. Credit recognition mechanism: School-enterprise joint development of practical courses	Suzhou City has taken relevant measures and actions to promote "artificial intelligence + manufacturing" and built related platforms. Shenzhen University's Tencent Cloud Artificial Intelligence Specialized Class and Tencent AI Elite Class jointly carry out talent cultivation in the field of client development	Achievement: Improved resource utilization rate; Narrow the gap between supply and demand of talents. Challenge: The absence of a mechanism for coordinating the interests of schools and enterprises; Disputes over the ownership of intellectual property rights.
The "digital and intelligent integration " model led by scene innovation	Reconstruct teaching scenarios through technological innovation to boost the digital transformation of education	1. Virtual simulation platform construction: Developing VR/AR teaching scenarios. 2. Intelligent evaluation system: Applying learning behavior analysis technology. 3. Adaptive learning path: Personalized Recommendation Based on Big Data	Colleges and universities in Hangzhou have connected with the resources of the Hangzhou "City Brain" platform to carry out characteristic teaching activities. Fudan University's exploration and practice of "AI+ Medicine" immersive teaching allow students to experience AI diagnosis in real scenarios	Achievements: Improved teaching efficiency; Break through the limitations of time and space. Challenge: The cost of technological iteration is high; There is a significant difference in digital literacy between teachers and students.

Source: Compiled by the author from policy documents and representative regional cases

2.3 The Innovation Implementation in Universities and Colleges: Various Explorations of Curriculum Systems

The higher education systems are also important in the implementation of AI literacy curriculum system. The diversity in the process of the introduction of AI literacy education is also significant in the case of the higher educational institutions in China. There are a few elite schools that have been experimenting with the development of the general structure of their curricula, which involves the integration of various disciplines and the use of technology. These new models can be used to build an interdisciplinary synergy and talent building. Table 2 provides information on the different approaches of the institution to the implementation of the general course structures.

Table 2. Representative Models of AI Literacy Education Curriculum Systems in Chinese Universities and Colleges

Mode name	"Pattern meaning"	Implementation path	Typical Case
Stratified and oriented curriculum	Based on the positioning of the university, the characteristics of the	1. Classify course versions by major disciplines (such as science and engineering,	Nanjing University: Building a "1+X+Y" system (1 compulsory course +X quality course +Y interdisciplinary course). Peking University: Science students

system	discipline or the students' foundation, courses are designed in a stratified manner to achieve differentiated training goals.	management and literature, art and physical education). 2. Set up a gradient course module of "compulsory + elective + advanced". 3. Provide a cross-level course selection and credit recognition mechanism	must take "AI Fundamentals", while liberal arts students can take "AI and Society" as an elective course. Tsinghua University: Set up a three-stage curriculum of "Cognition-Skills-Innovation". Zhejiang University: Based on the core course "Introduction to Artificial Intelligence" of the Ministry of Education's 101 Plan, it has launched the "Fundamentals of Artificial Intelligence" series of literacy education courses A, B, and C, which are respectively targeted at students of different disciplines.
Problem-oriented curriculum system	Taking the resolution of real industrial or scientific research problems as the entry point, project-based teaching is used to drive the cultivation of AI technology application capabilities.	1. Jointly develop an industrial case library with enterprises. 2. Build a virtual simulation laboratory/practice platform. 3 Implement an integrated teaching model of "courses + competitions + projects"	Beijing University of Civil Engineering and Architecture: Embedding industry cases of "Intelligent Construction" in literacy education courses. Capital University of Physical Education and Sports: Building an "AI for Sports" Virtual Simulation Laboratory. Zhejiang University: Offers project-based courses on "AI for Healthcare".
Cultural immersion curriculum system	Integrate local culture, disciplinary traditions and AI technology to cultivate compound talents with cultural inheritance awareness.	1. Develop digital teaching resources for regional culture. 2. Offer characteristic courses on "AI+ Intangible Cultural Heritage Protection" and "AI+ Digital Humanities". 3. Establish a practice base for the integration of culture and technology	Fudan University: Launched 61 AI-BEST series courses, exploring the integration of AI with various liberal arts majors in teaching. Nanjing University: Offers a case course on "AI and Digital Humanities" to study the intelligent restoration of ancient books. Sun Yat-sen University: Establishes an "AI Innovation Workshop for Lingnan Culture".

Source: Compiled by the author from representative cases.

3. Dilemmas and Challenges

The Chinese university system is not the only one that has experienced a structural contradiction in the AI literacy education process. Even though there are already successful examples of leading universities and some other universities have achieved remarkable results, the AI literacy teaching in the colleges is not well developed yet, which leads to the fact that students in different types of higher education institutions differ greatly in their level of AI literacy [15]. It was found out that the majority of students do not feel satisfied with the course on AI literacy at college. The above challenges can be divided into three major problems:

3.1 Unclear Objectives and Uneven Supply of Teaching Content

AI literacy education aims at all students, teaching them basic AI knowledge, current development status, trend analysis, and prompting them to think about the social changes brought by AI. It aims to cultivate humanitarian feelings and missions, combining knowledge, humanistic thinking, and practical application [16]. Nevertheless, many universities have not formed stable, clear, and systematic curriculum design framework, leading to ambiguity in basic questions like “why to teach, for whom to teach, and what to teach”, thus the contents provided may be irrelevant to the students.

The educational goals are not clear enough, and the boundary between literacy education and specialized disciplines is blurred. The course content is split into two levels: “highly in-depth”

and "superficial". Some colleges consider AI literacy education courses as "simplified versions of computer science specialized courses". Non-science and non-engineering students are likely to feel frustrated because of the depth of the major and the difficulty in understanding it. On the other hand, some colleges, in their efforts to lower the threshold, have reduced teaching to "software usage training" courses or practical skills operation courses empowered by artificial intelligence. The teaching content has been simplified to operation training like generating images, copywriting, and PPTS with artificial intelligence, which seems too simple to satisfy the demands of deep learning. It is especially disadvantageous for the majority of higher education students outside computer science to build a global mindset for intelligent systems.

The gap between the same courses and different demands of the students is structural. Even though all students are supposed to take AI literacy education, there are huge differences in the basic knowledge of the students, the working environment, the goals of learning as well as the needs of the students that belong to different fields of study, which can be very diverse. However, the majority of colleges do not have a course stratification and categorization approach where the student population is divided according to general areas of disciplines or prior experience or competence. In addition, the combination of AI material with particular major cases of learning is still poor. The courses themselves are irrelevant to the professional growth of the students, cannot see the connection between AI and industrial control system or intelligent communication systems. This is because the students would consider these classes as an extra credit point instead of taking them as a tool of increasing their professional education and overall literacy. Such a perception leads to a significant absence of proactive involvement and reduced sense of achievement.

3.2 Rough Implementation of Instruction and Absence of Criteria of Evaluation

The problem of the AI literacy education is that there are no clear standards and quality control in the key aspects of the subject, such as the way to teach and the way to assess. This leads to the fact that the teaching and assessment processes can be very shallow, simplistic, and mechanical in nature, and this is not good enough for the entire educational system.

There is a single model of teaching and the practical part that does not contribute to the learning process. In terms of university-level courses, there are still many courses that have been offered at large scale in universities where they only use PowerPoint lectures and listening. This method fails to take into account the best ways of teaching which are active discussion, case studies, project work and cross-curricular activities. The teachers face the problem of dealing with the high numbers of students and their varying levels of education and this makes it difficult to introduce the quality instruction and interaction in the classroom. To be more practical-oriented, some lessons are designed to provide an excessive amount of homework created by the AI-generated content (AIGC). Nevertheless, there is no direction on the procedure and conceptual scaffolding so as to enable students to do these tasks without any effort and instead of exploring, reflecting and thinking critically about them. And thus undermines learning outcomes and does not provide higher education students with AI practical training related to industrial settings.

The absence of quality standards results in low student satisfaction with the courses on average. The students tend to view course evaluations as being too simplistic, usually based on a single end-of-term report or essay. This method does not provide ongoing evaluation and specific feedback and thus plays a role in the Low quality of courses [17]. As a result, this condition creates inadequate investment in instruction, weak process control, and relaxed assessment standards which ultimately reduces the perceived value and recognition among students and does not achieve the desired educational potential of AI literacy education.

3.3 Poor Pedagogical Support and Lack of Industry-Education Integration

The system of AI literacy education should be well-supported, which means that the faculty has to be supported with the necessary resources and platforms, as well as the institution. The lack of support structures, inefficient resource distribution, and lack of supportive policies are some of the challenges faced by higher learning institutions in developing courses on artificial intelligence today.

The quality of the education is not provided as

there are not enough instructors and teachers who have the required level of qualification. The lack of interdisciplinary professionals who combine specialized disciplinary expertise with a general knowledge of AI pedagogy cannot be used to fulfill the requirements of course delivery. There is no shortage of faculty digital and artificial intelligence skills, which has been identified as one of the global constraints on the popularization of AI literacy courses among the universities [18].

There are many instructors who are not competent in some critical aspects like AI ethics, interdisciplinary integration and effective literacy education teaching approaches. The need to keep the educators up-to-date with the developments in technology and at the same time educate students of various academic backgrounds imposes heavy preparation loads and limits pedagogical translation abilities which eventually undermines course quality.

There is a lack of the practical environment and teaching conditions and the process of combining the industry with the education. The existence of AI learning environments, computers, databases, case studies, and tools that are available to all students are not enough to support the inquiry-based or project-based learning strategies. This absence of good communication between the educational system and the industry, and other sectors as well, is preventing the adoption of high technologies and the needs of the industry into the curriculum. Moreover, the fact that there is no contextual material which can be used in interdisciplinary teaching, including the case study of the AI industry, limits the possibility of the students to learn about the AI in real-life situations.

4. Development Paths and Recommendations

At present, over 400 universities and colleges in China have established undergraduate programs in artificial intelligence (AI). In these programs, AI literacy education courses have moved from the question of whether to offer to the more complex issue of how to deliver effectively. To promote the high-quality development of AI literacy education in higher education, the following suggestions are put forward based on a collaborative framework of "national guidance—regional adaptation—institutional innovation."

4.1 At the National Level: Develop Overall Plans to Construct AI Literacy Education Curriculum System and Issue Quality Standards

4.1.1 Establish a curriculum system for literacy education in artificial intelligence

The country should develop the general artificial intelligence (AI) course framework at the top-level design stage. The direction of colleges and universities to establish a curriculum system that incorporates both general and specialized education, thus addressing major issues like content imbalance and misaligned demands. Regarding construction dimensions, it is necessary to use dual strategy of general popularization and specialized empowerment. On the one hand, basic general AI courses are required to be offered to all students and they should be oriented towards developing intelligent literacy, ethical judgment and critical thinking skills. Conversely, interdisciplinary approaches of incorporating AI concepts, methodologies and tools in the talent development processes of different disciplines should be promoted through the integration of AI for Specialty, which will create a synergy between general and specialty education [19,20]. Project-based learning (PBL) has been widely adopted as an effective instructional intervention in AI literacy education; however, its outcomes and transferability across disciplinary contextsrequire further systematic evaluation [21]. The curriculum design is hierarchical, with the three levels of the courses being "the foundational courses-specialty extension courses-advanced elective courses". There should be stratified teaching and categorized provision of students with different backgrounds such as humanities, sciences, engineering, management, and arts. In particular, it is necessary to create an additional course in the form of an AI extension that will help meet the differentiated learning requirements of the engineers and make the course more flexible and appealing to the students. At the same time, there is need to have a system of control over the development of the curriculum and its dynamic implementation where the country can use the standardized, systematic, and sustainable approach to the process of implementing the curriculum system.

4.1.2 Develop and publish quality assessment criteria on literacy education in artificial intelligence

The policy and quality control is necessary in the

process of improving the overall artificial intelligence education. The state must make a step to establish and publish the standards of general artificial intelligence education of the higher educational institution. These standards are to be set in such a way that they will clearly outline the basic indicators, which include the objectives of curriculum, content requirements, teaching rules, assessment, and learning outcomes. These courses should have good quality, which would be incorporated into other important systems like undergraduate studies and teacher evaluation, high level professional training, and ideological and political course studies. This approach will help in making standards lead development and testing as well as this will help in enhancing the quality.

4.2 At Local Government Level: Create a Society of the Integration of Industry and Education

4.2.1 Create a system of the industry and education combination.

The industry and academic community is to be a joint venture in which the U (University)-G (Government)-B (Business)-S (School) mechanism should be implemented as a means of making the AI literacy education successful. There is a need that every region has an AI literacy education Industry-Academia Collaboration Alliance, this would make it easier to communicate and work together with the universities and companies. The alliance must be fully developed with the combination of university resources, enterprise resources, research organizations, and business associations to create a faculty of high quality, new forms of teaching and organization, and the development of generalist talents in collaboration between the academia, the industry, the research, and the application. Moreover, enterprises from relevant industries should be engaged in the co-development of the resources of AI literacy education.

4.2.2 Creation of a long-term cooperation mechanism

Create inter-university cooperation. It is important to create the system of the inter-university collaboration and the universities must be supported by the local authorities in this process, which involves a joint curriculum design, staff exchanges, and student exchange programs as an example of AI literacy education. This will bring about complementary benefits and resource sharing. Industry-university collaboration models should be improved. Besides the traditional type of cooperation that may include the students internships or the hiring of the industry experts to work with the university, it would also be necessary to encourage the enterprises to actively participate in the development of the AI literacy education program, the creation of the talent development plan and the implementation of the teaching practice within the institutions of higher learning.

4.3 At Institutional Level: Maximize Resource Building and Improve Course Quality

4.3.1. Innovation of teaching model and optimization of curriculum design

In the field of talent training, the higher education must make full use of information technology to reform the teaching mode, which is a new type of blended learning and online learning as well as MOOCs (Massive Open Online Courses) and flipped classroom in addition to the traditional face-to-face classes. The literacy course on AI should be developed with great care so that it can have a more structured and interactive and practical content. It will be necessary to start by providing basic knowledge, and then proceed with more advanced ones; at first, one would introduce the basics of AI, and later, the examples of the application of AI in real life and its development.

4.3.2 Supply the teachers with good quality of teaching resources and improve their training.

The AI literacy education curriculum is created by the teachers, enterprise technical staff and educational publishing companies in a high-quality general course textbook. The preparation of such books should be very close to the recent progress of the artificial intelligence technology and its application on the market as well as on the basis of the university teaching system. Furthermore, it is necessary to constantly improve the theoretical models and examples of real life in order to keep them both future-oriented and useful. To add highly qualified people who have an extensive experience of practical and didactic work in the field of artificial intelligence to the team of teachers [22,23]. At the same time, the teacher training programme will also be conducted, academic exchanges and other activities like working together on scientific research projects, etc., which can help to enhance the quality of the professional and pedagogical skills of the

teachers in artificial intelligence.

5. Conclusion

The inclusion of AI literacy education in the higher education curriculum has significant implications for cultivating students' talent. It encourages a collective systems thinking mindset amongst students and helps match their capabilities with workforce needs in emerging sectors. To develop AI literacy education in higher education, we propose a collaborative framework of "national guidance, regional adaptation and institutional innovation". In terms of national guidance, top-level design is needed to chart the course for curriculum development. For regional adaptation, regions should leverage local industry and education resources to take tailored actions. For institutional innovation, universities and colleges should unify disciplines and faculty to promote the integration of AI and professional education via curriculum reform. Enterprises may play a role in facilitating industry-academia-research collaboration to deliver real-life scenarios and insights driven by industrial demand. Such a multi-stakeholder synergy is essential to comprehensively develop the intelligent literacy. This is a research that will be based on the analysis of policy documents and comparison of cases. The future studies may involve quasi-experimental or large-scale empirical surveys to support the suggested framework in quantitative terms.

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