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Construction and Research of the "Post-Course-Competition-Certificate" Teaching Ecosystem Driven by AI for Medical Majors in Higher Vocational Colleges

Xia Wang[1,2]*, Qu Peng[1,2]

[1]Ikh ZASAG University in Mongolia, Ulaanbaatar 999097, Mongolia, China
[2]Guizhou Urban Vocational College, Guiyang 550025, Guizhou, China

**Author to whom correspondence should be addressed.*

Abstract: Against the backdrop of the digital transformation of the medical and health industry and the reform of vocational education, medical majors in higher vocational colleges are in urgent need of innovation and reform to build a new teaching ecosystem. As an integrated talent training model in vocational education, the "Post-Course-Competition-Certificate" (PCCC) integration can achieve precise alignment between talent cultivation and industrial demands, fostering high-quality technical and skilled professionals. Based on this, relying on AI technology, this paper explores the construction path of an AI-driven PCCC teaching ecosystem for medical majors from two aspects: the adaptability between higher vocational medical majors and the PCCC model, and the importance of constructing the PCCC teaching ecosystem. The aim is to promote the innovation of teaching models for medical majors in higher vocational colleges and provide high-quality technical and skilled talent support for the digital development of the medical and health industry.

Keywords: AI; Higher vocational medical majors; Post-Course-Competition-Certificate; Teaching ecosystem construction

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1. Introduction

With the rapid transformation of the medical and health industry towards intelligence and precision, the industry has put forward higher requirements for the practical and innovative abilities of technical and skilled talents. Currently, due to the imperfect construction of curriculum systems and the rigid teaching concepts, the integration of "Post-Course-Competition-Certificate" mostly remains at a formal level. In this context, AI

technology, with its advantages in data processing, virtual simulation, and intelligent evaluation, provides a new path to solve the challenges of PCCC integration. Constructing an AI-driven teaching ecosystem can not only realize the dynamic matching of post demands, curriculum systems, competition content, and certificate standards but also reduce teaching costs and risks through virtual training scenarios, improve teaching accuracy, create a data-driven, collaborative, and efficient teaching ecosystem and practice, and promote the precise alignment between talent training quality and industrial needs [1].

2. Analysis on the adaptability between higher vocational medical majors and the "Post-Course-Competition-Certificate" model

2.1. Compatibility between post-competence requirements and the professional curriculum system

The core goal of higher vocational medical majors is to cultivate technical and skilled talents for frontline positions in the medical and health industry. The construction of their curriculum system must be fundamentally based on the quality and competence standards of specific posts. Specifically, medical majors themselves are highly professional, practical, and complex, while medical-related positions usually emphasize the assessment of comprehensive skills of talents, such as disease inquiry and drug recommendation, quality testing, medication guidance, inspection technology, and nurse-patient communication. These post-competence requirements do not exist in isolation but present a hierarchical structure of basic abilities, professional core abilities, and comprehensive literacy. This has a natural compatibility with the curriculum system structure of higher vocational medical majors, which includes public basic courses, professional basic courses, professional skills (core courses), and professional extension courses [2]. Therefore, the core courses of medical majors must be closely aligned with the core post competencies to accurately cover the knowledge and skill points required by the posts. Meanwhile, the clarity of post requirements provides clear guidance for the selection and optimization of course content, laying a foundation for the implementation of the "Post-Course-Competition-Certificate" model [3].

2.2. Unity between skills competition content and professional teaching objectives

The teaching objectives of higher vocational medical majors usually focus on cultivating students' medical professional skills and comprehensive literacy. The content of medical skills competitions, which centrally reflects cutting-edge industry technologies and core post skills, is highly consistent with professional teaching objectives. From the perspective of the design logic of competition content, skills competitions are usually set against the background of real medical production and service scenarios, with competition modules designed around core post tasks. These modules highly overlap with the practical teaching projects of higher vocational medical majors in terms of skill requirements and operation procedures [4]. From the perspective of the path to achieve teaching objectives, skills competitions can serve as a "catalyst" for professional teaching, promoting the updating of teaching content and the innovation of teaching methods, making teaching content more in line with industry practices, and improving teaching effectiveness.

2.3. Alignment between vocational qualifications and professional training specifications

The medical industry is a special sector related to life and health, where most positions implement a strict vocational qualification access system, such as professional certificates for licensed pharmacists, medical

laboratory technicians, and licensed nurses. The assessment standards for these certificates represent the minimum requirements of the industry for practitioners' professional knowledge, skill levels, and professional literacy, which are highly compatible with the core requirements of the training specifications of higher vocational medical majors. From the perspective of the impact of vocational certificate standards on training specifications, the knowledge system and skill requirements of vocational certificates provide clear industry-based references for higher vocational medical majors in formulating training specifications [5]. Specifically, integrating the core content of certificate assessments into the curriculum system can ensure that students have the ability to obtain relevant vocational certificates upon graduation. From the perspective of the support of training specifications for certificate acquisition, the training specifications of higher vocational medical majors not only meet the basic requirements of vocational certificates but also emphasize the cultivation of comprehensive literacy and development ability on this basis, enabling students to possess stronger post-adaptability and career development potential while obtaining vocational certificates [6].

3. Value of constructing an AI-driven "Post-Course-Competition-Certificate" teaching ecosystem for higher vocational medical majors

3.1. Conducive to improving the precision of talent cultivation

In the context of the new era, the pharmaceutical industry has undergone rapid reforms and technological updates in response to diverse patient needs. Traditional teaching models and ability training approaches struggle to keep pace with the industry's rapid iteration. Leveraging its powerful technical advantages, AI technology can construct competency maps for pharmaceutical industry positions, enabling real-time capture of industrial dynamics, job recruitment data, updates to vocational qualification standards, and other information. Through natural language processing, machine learning, and other algorithms, it conducts quantitative analysis and dynamic updates of job competency elements, accurately identifying the specific requirements of different positions for knowledge, skills, and literacy [7]. On this basis, AI can intelligently match job competency elements with curriculum knowledge points, competition assessment indicators, and certificate certification standards, forming visual ability development pathways. For students, AI can generate personalized learning profiles based on their learning behavior data, practical training records, and assessment results, precisely pinpointing ability gaps and automatically pushing tailored curriculum resources, training projects, and exam preparation materials for competitions and certifications. This enables targeted learning, thereby enhancing teaching precision.

3.2. Conducive to promoting innovation in teaching models

Supported by AI technology, higher vocational medical majors can utilize virtual simulation, digital twins, and other means to construct highly realistic medical training scenarios, such as virtual workshops for the entire pharmaceutical production process, clinical pharmacy service simulation systems, and intelligent simulation platforms for medical testing. Students can repeatedly practice core skills through immersive operations without concerns about material consumption or operational risks. Meanwhile, AI intelligent evaluation systems can track students' training operations in real-time and provide precise feedback. Using motion capture, data comparison, and other technologies, they quantitatively analyze operational standardization, process completeness, and result accuracy, promptly identifying issues and offering improvement suggestions to enhance the precision and efficiency of training guidance [8]. Additionally, AI technology breaks the temporal

and spatial limitations of practical teaching: students can participate in virtual training anytime and anywhere through online platforms, realizing a hybrid training model combining online preview and offline practice, thereby improving teaching effectiveness.

3.3. Conducive to strengthening the depth of industry-education integration in talent cultivation

Traditional industry-education integration mostly remains at superficial levels of cooperation, such as enterprises providing internships or donating equipment, with insufficient collaboration between schools and enterprises in formulating talent training standards, developing teaching resources, and driving technological innovation. An AI-driven teaching ecosystem can achieve interconnection between educational and industrial data by building a shared pharmaceutical teaching data center for schools and enterprises. Specifically, under the "Post-Course-Competition-Certificate" teaching model, vocational colleges can co-construct talent cultivation collaboration platforms with enterprises, integrating the latest production technologies, job standards, and real-case resources from enterprises into the platform and setting up learning modules. This allows students to understand enterprise development progress and dynamics while mastering basic knowledge [9]. Furthermore, an AI-empowered teaching ecosystem can attract more pharmaceutical enterprises to deeply participate in vocational education. Through joint construction of industrial colleges, co-development of courses, and co-organization of skills competitions, stable industry-education collaboration mechanisms can be formed, further promoting high-quality collaborative development between the medical and health industry and vocational education.

4. Construction and practical paths of an AI-driven "Post-Course-Competition-Certificate" teaching ecosystem for higher vocational medical majors

4.1. Develop intelligent practical training course modules to promote effective alignment of teaching systems

Under the "Post-Course-Competition-Certificate" model, to better align with job requirements, medical majors in higher vocational colleges need to develop diversified course modules based on certificate standards, competition requirements, job adaptability demands, and curriculum content, thereby achieving an effective connection between teaching content and enterprise development. Firstly, vocational colleges can rely on AI technology to construct job competency maps, decompose professional courses into several core competency modules, each corresponding to relevant competition content and key points of certificate assessments. AI technology is then used to sort out the correlations between knowledge points in each module, forming a structured knowledge network [10].

Secondly, integrate the competitive requirements of skill competitions into practical training modules, set up practical training projects in a competition mode, and allow students to complete the entire competition process in virtual scenarios in accordance with competition requirements. This not only strengthens their practical skills but also cultivates their competitive thinking and teamwork abilities. Finally, higher vocational colleges can use AI virtual simulation and digital twin technologies to build immersive practical training scenarios, where students can complete full-process operations using VR equipment [11]. At the same time, AI intelligent evaluation functions are embedded to conduct real-time data collection and analysis of students' practical training operations, conduct quantitative scoring from dimensions such as operational standardization,

process completeness, and result accuracy, and generate detailed improvement reports. This realizes the organic integration of "Post-Course-Competition-Certificate" teaching content and the innovative upgrading of teaching forms, enhancing students' professional skills and comprehensive literacy.

4.2. Build teaching data platforms to achieve dynamic collaboration of teaching resources

As an education model directly connected to jobs, the "Post-Course-Competition-Certificate" teaching model can effectively provide more authoritative and advanced teaching resources and job standards for professional teaching, offering solid guarantees for students' professional development and future employment. In traditional teaching models, medical majors in higher vocational colleges usually struggle to achieve effective and in-depth connections with the four dimensions of pharmaceutical industry jobs, professional courses, skill competitions, and vocational certificates. However, relying on AI technology, higher vocational colleges can build a pharmaceutical AI teaching data platform to break down data barriers between various elements of "Post-Course-Competition-Certificate" and realize the integration, analysis, and dynamic collaboration of teaching resources [12]. Specifically, at the job data level, it can directly connect to pharmaceutical industry associations, human resource systems of leading enterprises, and recruitment platforms, capture real-time information such as competency requirements, technical standards, and qualification criteria for different jobs, and form dynamically updated job competency maps.

At the curriculum data level, integrate teaching resources such as professional course syllabuses, knowledge point distributions, teaching videos, and assessment question banks to establish a structured curriculum knowledge database. At the competition data level, collect contents such as competition regulations, assessment indicators, and award-winning cases of various pharmaceutical skill competitions to build a competition competency element database. At the certificate data level, synchronize information such as examination syllabuses, certification standards, and past real questions of vocational qualification certificates to form a certificate assessment standard database [13]. On this basis, AI technology is used to deeply match these resources with teaching content, intuitively present the matching degree and collaboration of "Post-Course-Competition-Certificate", provide data support for teaching decisions, and ensure the timeliness and accuracy of "Post-Course-Competition-Certificate" collaboration.

4.3. Innovate teaching models and construct a "Post-Course-Competition-Certificate" collaborative education paradigm

To efficiently cultivate high-quality professional and skilled talents for the pharmaceutical industry, higher vocational colleges need to adopt a series of practical measures to improve the effectiveness of curriculum reform, and the innovation of teaching models is the core link in realizing the implementation of the "Post-Course-Competition-Certificate" teaching ecosystem. Based on this, supported by AI technology, it is possible to break the temporal and spatial limitations of traditional teaching and the pattern of one-way knowledge transmission, and construct an education model featuring the integration of virtual and real scenarios and collaborative interaction. On the one hand, teachers can implement a blended teaching method. For the online part, teachers can build a digital learning space relying on intelligent teaching platforms, integrating AI question-answering robots, micro-lecture videos, virtual simulation resources, etc. Students can complete a preview of knowledge points, after-class review, and extended learning at their own pace. In this process, teachers can use AI systems to analyze students' online learning behavior data, accurately identify their weak

knowledge points, and automatically push targeted learning resources and exercises to achieve precise learning guidance [14]. For the offline part, teachers integrate contents such as pharmaceutical industry jobs, professional courses, skill competitions, and vocational certificates with the help of AI interactive teaching terminals to form complete practical projects, and let students complete practical activities through group cooperation, so as to transform online learning achievements into practical application abilities.

On the other hand, teachers can design virtual teaching scenarios, use virtual simulation and digital twin technologies to build highly realistic pharmaceutical practice scenarios, such as virtual workshops for the entire pharmaceutical production process and simulated consulting rooms for clinical pharmacy services. Students can participate in immersive practical training using VR/AR equipment to strengthen their practical skills, help them understand the real working environment and job standards, and achieve an effective connection.

5. Conclusion

In summary, the construction of an AI-driven "Post-Course-Competition-Certificate" teaching ecosystem for medical majors in higher vocational colleges is a key measure to respond to the digital transformation of the pharmaceutical industry and the reform of vocational education. By developing intelligent practical training course modules, building teaching data platforms, and constructing a "Post-Course-Competition-Certificate" collaborative education paradigm, it can effectively solve problems such as resource constraints and insufficient collaboration in traditional training models, and realize the precise connection between talent training and industrial needs.

Disclosure statement

The author declares no conflict of interest.

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