Exploration of the Practical Teaching Model for Artificial Intelligence Majors in Higher Vocational Colleges

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Abstract: To enhance the comprehensive quality and employability of students majoring in artificial intelligence technology applications, this paper proposes a practical teaching model reform that integrates industry-education integration and job-course integration. This proposal is based on an analysis of the current situation of practical teaching positioning, practical teaching system, and evaluation standards for artificial intelligence majors. This paper suggests cultivating high-quality and high standard artificial intelligence professionals who meet the current industry needs through conceptual innovation, reconstruction of practical course system, and reform of multi-dimensional practical teaching evaluation system.

Keywords: Higher Vocational Education; Artificial Intelligence Major; Practice Teaching Mode; Integration of Industry and Education; Integration of Industry; Academia and Research

1. Introduction

Artificial intelligence is a strategic technology in the current technological revolution and industrial transformation. The development of artificial intelligence has significant and far-reaching impacts on the country's economic development, social progress, and the international political and economic landscape. Due to its importance, multiple ministries in China have collaborated to design top-level artificial intelligence development plans, leveraging policy advantages to release several policies promoting the development of the AI industry and AI talent cultivation. Examples include the "Notice on the Development Plan for a New Generation of Artificial Intelligence" issued in July 2017, the "Opinions on Promoting the Integration of Disciplines and Accelerating the Training of Postgraduates in the Field of Artificial Intelligence" issued by the Ministry of Education, the National Development and Reform Commission, and the Ministry of Finance in March 2020, and the "Guidance on Accelerating Scenario Innovation to Promote High-Level Applications of Artificial Intelligence for High-Quality Economic Development" issued by the Ministry of Science and Technology, the Ministry of Education, and the Ministry of Industry and Information Technology in July 2022. It is evident that with the advent of the new industrial revolution, the development of the artificial intelligence industry has entered the fast lane.

Despite the rapid development of the AI industry, the artificial intelligence major in higher vocational colleges started late. Currently, many vocational application talents for basic positions such as application development, practical skills, and operation and maintenance come from computer technology graduates who have undergone secondary training. There is a significant shortage of professionals. The main issues in China's AI field are insufficient talent reserves and inadequate key technology research and development [1]. Therefore, how to cultivate high-quality technical talents capable of engaging in AI-related application development, system integration and maintenance, product sales and consulting, and pre- and post-sales technical support is an urgent task for higher vocational AI majors.

On June 23-24, 2014, the National Vocational Education Conference emphasized the need to cultivate high-quality workers and technical skills talents. It reiterated that vocational education should adhere to the integration of industry and education, school-enterprise cooperation, and the combination of work and study, integrating knowledge and action. Practical training is a crucial part of cultivating AI technical talents and a primary means of honing AI students' professional technical

abilities [2]. Additionally, the AI major itself is highly practical and application-oriented. Students lacking innovation, thinking, and practical abilities cannot meet the demands of AI development [3].

Traditional classroom teaching often focuses on theoretical knowledge transmission, while practical teaching emphasizes actual operational abilities and the cultivation of innovative thinking. In this rapidly developing era, only students with practical skills can stand out in their future careers. As a multidisciplinary new major, the AI major requires rich and practical teaching projects, allowing students to try various methods to solve problems in simulated or real environments, accumulating rich experiences and knowledge to achieve classroom and job alignment. In this context, higher vocational education institutions should, under the guidance of national strategic planning, combine the local and school AI major's current status, orient towards enterprises and job positions, and aim to cultivate high-quality and highly skilled talents to build an AI practical teaching system [4-5].

2. Analysis of the Current Situation of Practical Teaching in Artificial Intelligence Majors in Vocational Colleges

In China, artificial intelligence majors are mainly offered in undergraduate colleges. In 2019, the Ministry of Education added majors such as artificial intelligence technology services to the original vocational education directory. Therefore, artificial intelligence related majors in higher vocational colleges are newly established majors, and their construction is still in the exploratory stage. There is not much experience to refer to in the construction of talent training models, curriculum system construction, and industry education integration. At present, there are the following problems in practical teaching of artificial intelligence in vocational colleges.

2.1 Unclear Positioning of Practical Teaching

The compatibility between the curriculum knowledge system and the industry is not high. At present, the knowledge system of AI professional courses has not yet formed a clear positioning for empowering industries or specific application scenarios. This has led to the difficulty of targeted practical teaching in cultivating students' practical operational abilities to meet industry needs.

Lack of excellent teachers and practical training platforms. Due to the lack of excellent teachers with practical experience and advanced AI training platforms, some vocational colleges find it difficult to effectively carry out practical teaching. Sometimes even outsourcing the entire AI profession to relevant IT companies may lead to uncontrollable teaching quality.

The overlap of professional positioning and the lack of clear differentiation in employment positions. The artificial intelligence technology service major is derived from majors in computer science or electronic information, which leads to overlapping professional positioning. Therefore, in practical teaching, the distinction between talent cultivation and employment positions in the two majors is not clear, which increases the difficulty and ambiguity of practical teaching.

Integration of course certificates. Taking certain specific certificates (such as the Huawei Intelligent Computing Platform Application Development "1+X" certificate) as an example, they cover a wide range of knowledge points, including artificial intelligence, big data technology, cloud computing, and more. This interdisciplinary approach poses challenges to practical teaching as it requires balancing knowledge and skills across multiple fields, which may result in a lack of clarity and focus in the positioning of practical teaching.

2.2 Lack of Systematic Practical Teaching

Lack of diversity in practical teaching: Currently, experimental teaching in artificial intelligence technology application majors often focuses on certain specific technical fields, such as machine learning, deep learning, etc., while lacking exploration of other important areas of artificial intelligence, such as natural language processing, computer vision, etc. [6]. In addition, practical projects may place too much emphasis on basic operational training and lack innovative and diverse practical activities, which may make students feel constrained when facing diverse

challenges in the real world.

The disconnection between practical teaching and industry: Experimental teaching content usually focuses on the verification of theories and algorithms, with less involvement in practical application scenarios. This makes it difficult for students to combine their learned knowledge with practical problems and lack the ability to solve practical problems. At the same time, existing experimental teaching often focuses on confirmatory experiments, with students conducting experiments according to established steps, lacking space for innovation and exploration.

2.3 Incomplete Evaluation of Practical Teaching

At present, there are many computer programming courses in the field of artificial intelligence technology application, and the teaching evaluation focuses on the individual software programming ability of students, which cannot fully reflect their knowledge system, innovative thinking, and teamwork ability.

The evaluation criteria for students' practical operation ability, innovation ability, comprehensive quality, etc. are not clear enough, and the evaluation process is too subjective [7]. The evaluation of practical teaching is usually based solely on the completion of tasks, resulting in insufficient comprehensiveness, impartiality, and accuracy of the evaluation results, which are relatively one-sided.

3. Exploration of Industry University Research Practice Teaching Model for Artificial Intelligence Majors in Higher Vocational Education

In order to adapt to the development of the economy and society and changes in industry demands, vocational education is facing pressure to deepen reforms. Building an education system centered on the integration of industry, academia, and research has become the key to reform, which not only involves updating educational content and teaching methods, but also innovation in educational management systems and mechanisms. The promotion of the integration of industry, academia, and research requires closer cooperation between vocational colleges, enterprises, and research institutions to jointly participate in curriculum development, project implementation, and talent cultivation. The establishment and deepening of this cooperative relationship will promote the optimal allocation and effective utilization of educational resources, improve the quality and efficiency of education [8]

3.1 Concept Innovation

In constructing a deeply integrated practice teaching model of industry, academia, and research, achieving concept innovation is crucial.

With the rapid development of the economy and society, industrial structures, technological levels, and market demands are constantly changing. Traditional teaching models may no longer fully adapt to these changes. Concept innovation can help the education system better align with the new demands of economic and social development, cultivating more talents that meet the requirements of the times. Concept innovation means reflecting on and improving traditional teaching methods. By introducing new teaching concepts, such as student-centered, practice-oriented, and problem-solving approaches, we can stimulate students' interest and motivation in learning and improve teaching effectiveness. At the same time, this also helps to cultivate students' innovative thinking and practical abilities, enabling them to better adapt to and tackle various challenges in their future careers.

To achieve concept innovation, educators must not only deeply understand industrial demands but also closely integrate teaching content with actual work, emphasizing the cultivation of students' practical operational abilities and innovative thinking. Specifically, this concept innovation can be achieved through several key steps: First, redefine teaching objectives, emphasizing the organic combination of practice and theory. Focus not only on students' mastery of theoretical knowledge but also on cultivating their practical abilities and innovative thinking. Set teaching goals centered on solving real-world problems, guiding students to pay attention to the challenges and needs of the real world. Updating and improving curriculum content is an important manifestation of concept innovation. Establish close cooperation with enterprises and research institutions to jointly develop practical teaching courses and projects.

Invite industry experts to participate in teaching, providing real industry cases and practical experiences, enhancing the practicality and relevance of teaching. This way, the latest technological needs and trends of enterprises can be integrated into curriculum design, making the teaching content not only limited to theoretical knowledge but also including practical skills and case analyses closely related to the industry. Secondly, strengthening practical teaching is key to concept innovation. This includes not only the construction of training bases inside and outside the school but also the actual projects and internship arrangements in which students participate.

Through these practical activities, students can apply the knowledge they have learned in real work environments, deepening their understanding of professional skills and improving their ability to solve real problems. The construction of the teaching team is also crucial to achieving concept innovation [9]. To better meet the needs of industry-academia-research integration, higher vocational colleges focus on introducing professionals with rich industry experience as teachers. They bring the latest industry trends and provide real work experience sharing. Meanwhile, existing teachers are encouraged to participate in actual enterprise projects to enhance their understanding of the industry and the practicality of their teaching. This kind of teaching team construction helps to closely combine teaching content with industry practices, improving the adaptability and effectiveness of education. Under this guiding concept, the practice teaching model integrating industry, academia, and research can better meet students' learning needs and career development goals. By participating in real projects and internships, students can enhance their professional skills and cultivate problem-solving abilities, team collaboration spirit, and innovative thinking. The successful implementation of this educational model depends on the close cooperation and resource sharing between higher vocational colleges, enterprises, and research institutions. Through joint participation in curriculum design, project implementation, and talent cultivation, all parties can achieve mutual benefits and jointly promote the development of education and industry. Concept innovation plays a crucial role in constructing a deeply integrated practice teaching model of industry, academia, and research. By updating teaching content, strengthening practical teaching, and building a professional teaching team, higher vocational colleges can more effectively respond to industrial demands, cultivating technical and skilled talents with both solid theoretical foundations and strong practical abilities. The promotion and deepening of this educational model will further drive the reform and development of higher vocational education, cultivating more technically skilled talents with practical abilities and innovative spirits for society.

3.2 Reconstruction of the Practical Curriculum System

Reconstructing the curriculum system is a key link in achieving the integration of industry, academia, and research. It requires higher vocational colleges to closely cooperate with enterprises and research institutions to jointly develop and optimize curriculum content. This process involves integrating the latest technological needs and research results of enterprises into curriculum design and creating comprehensive curriculum projects oriented towards actual work scenarios so that students can directly apply the theoretical knowledge they have learned during their studies.

The artificial intelligence major involves both hardware and software. Therefore, reconstructing the practical curriculum system for this major needs to comprehensively consider the integration of software and hardware, as well as the close combination of theory and practice. Firstly, integrate basic theory and practical courses, add interdisciplinary basic courses, and integrate basic knowledge of computer science, data science, and electronic information to form interdisciplinary basic courses, laying a solid foundation for students' subsequent professional learning. Strengthen courses combining algorithms and hardware, such as microcontroller and embedded development courses. While explaining algorithm principles, introduce relevant content of hardware implementation, allowing students to understand the operating mechanisms and optimization methods of algorithms on hardware. Secondly, in the design and implementation of practical projects, design

comprehensive practical projects covering both software and hardware, such as smart home systems and autonomous driving cars. These projects allow students to master the development process combining software and hardware and familiarize themselves with underlying design and machine vision applications. Subsequently, introduce actual industry cases and cooperate with enterprises to use real industry problems as sources for practical projects. This helps students enhance their practical ability to combine software and hardware while solving real problems. Students are also encouraged to participate in innovation and entrepreneurship activities, providing necessary resources and guidance to cultivate their innovative consciousness and entrepreneurial abilities. Finally, integrate practical teaching resources, including integrating mentor resources by inviting more expert mentors in the field of artificial intelligence to participate in teaching, providing practical guidance and project suggestions, and promoting deep integration of industry, academia, and research. Also, integrate industry resources by establishing joint talent cultivation with large tech enterprises, using industry resources to provide practical platforms for students, and promoting student employment. The construction of laboratories and equipment should include establishing comprehensive laboratories equipped with advanced hardware, software development environments, and simulation tools to provide an all-around practical platform for students. Establish school-enterprise cooperation training bases with relevant enterprises, allowing students to conduct practical operations combining software and hardware in actual work environments.

Through the above aspects of reconstruction, a comprehensive practical curriculum system for the artificial intelligence major can be established. This system aims to cultivate professional talents with solid foundational knowledge in both software and hardware, proficient practical skills, and innovative abilities. Additionally, to maintain the timeliness and foresight of the curriculum system, regular evaluations and adjustments of the curriculum content are necessary to meet the needs of industry development and technological updates.

3.3 Innovation in Practical Teaching Methods

Innovating teaching methods is crucial in the practical teaching of artificial intelligence majors. Effective teaching methods can enhance students' problem-solving abilities and innovation skills. Innovation in teaching methods can be approached from several aspects.

Firstly, innovate the theoretical teaching mode. Adopt an integrated teaching approach, where theoretical courses not only explain software design principles but also introduce relevant hardware foundations and support environments. For example, when explaining obstacle avoidance for smart cars, start by explaining the hardware structure of smart cars, and then explain the design ideas of the functional code based on understanding the hardware circuit principles. Create dual-teacher classrooms by inviting experts from both software and hardware fields to teach together, allowing students to understand the application of artificial intelligence technology from two perspectives.

Secondly, strengthen the experimental teaching segment. Design comprehensive experiments that cover both software and hardware, such as using smart hardware for data collection and then processing and analyzing it through software algorithms. Organize cognitive internships lasting several days, focusing on specific software and hardware technologies or application scenarios. During this period, invite industry experts and scholars to share and discuss the software and hardware technologies of artificial intelligence, allowing students to understand the latest industry trends and technology trends. At the same time, students can deepen their understanding and mastery of relevant technologies through hands-on practice under the guidance of experts.

Next, conduct project-based learning and practice. For example, design projects that require the use of both software and hardware knowledge, such as intelligent robots and autonomous driving cars, allowing students to learn the collaborative work of software and hardware in the projects. Develop enterprise cooperation projects, introducing actual artificial intelligence application scenarios in collaboration with enterprises, allowing

students to improve their practical abilities while solving real problems.

Fourthly, innovate teaching means and tools. Utilize online collaboration platforms to enable remote team collaboration, allowing students to participate in software and hardware project development and discussions anytime and anywhere. Introduce smart hardware development tools, such as Arduino, to lower the threshold for hardware development and improve development efficiency.

Fifth, organize competitions and challenges. By organizing artificial intelligence software and hardware design competitions, students' innovative spirit and teamwork abilities can be stimulated. Competitions can revolve around actual application scenarios or problems, allowing students to learn and grow in the process of solving problems.

Additionally, cooperating with enterprises and research institutions to jointly develop actual artificial intelligence application projects can be beneficial. Students can play important roles in these projects, directly participating in the development and optimization of products. Alternatively, arrange for students to intern at relevant enterprises or research institutions, allowing them to learn and grow in real work environments. During internships, students can be exposed to the latest technologies and tools, enhancing their professional skills and literacy.

3.4 Reform of Evaluation System

The reform of the evaluation system, especially the shift towards competency oriented assessment, is one of the key links in achieving the integration of industry, academia, and research.

The evaluation system for practical teaching in artificial intelligence should be composed of the following parts: evaluation indicators, which should comprehensively reflect the performance of students in practical teaching, including but not limited to technical ability, innovation ability, team collaboration ability, problem-solving ability, etc. Specific indicators can be set according to the goals and requirements of practical teaching. Evaluation methods should be diverse, including teacher evaluation, student self-evaluation, peer evaluation, etc. Through comprehensive evaluation, gain a more comprehensive understanding of students' performance in practical teaching. The evaluation criteria should be clear, specific, and able to quantify the performance of students in various aspects. This helps to objectively and fairly evaluate the practical achievements of students.

When implementing an evaluation system, attention should be paid to the following points: combining process evaluation with outcome evaluation, focusing not only on the performance of students in the practical teaching process, but also on their practical achievements. This can comprehensively evaluate students' practical abilities and learning outcomes; Pay attention to individual differences among students, as each student has their own characteristics and advantages. The evaluation system should fully consider individual differences among students and conduct personalized evaluations; Timely feedback and adjustment, based on the evaluation results, provide timely feedback to students, help them understand their performance, and make adjustments and improvements to existing problems.

Optimization and improvement of the evaluation system. In order to continuously optimize and improve the evaluation system, the following measures can be taken: regular evaluation and adjustment of evaluation indicators, based on the development of artificial intelligence technology and changes in industry demand, regular evaluation and adjustment of evaluation indicators to ensure the timeliness and pertinence of the evaluation system. Introduce industry standards and professional qualification certification, refer to industry standards and professional qualification certification requirements, make the evaluation system more closely related to practical needs, and improve the employment competitiveness of students. Strengthen cooperation with enterprises, jointly develop a practical teaching evaluation system, and make the evaluation more practical and practical. At the same time, corporate mentor evaluations can be introduced to evaluate the practical achievements of students from an industry perspective.

Building an evaluation system for practical teaching in artificial intelligence requires comprehensive consideration of evaluation indicators, methods, and standards. By continuously optimizing and improving the evaluation system,[10] students can better

cultivate their practical abilities and innovative spirit, laying a solid foundation for their future career development.

4. Conclusion

Based on the analysis and discussion of the practical teaching mode of artificial intelligence in vocational colleges, we can see that practical teaching plays a crucial role in the education of artificial intelligence. Through innovative concepts, restructuring of practical course systems, innovative practical teaching methods, and a comprehensive practical teaching evaluation system, vocational colleges can more effectively cultivate students' practical abilities and innovative spirit, laying a solid foundation for their future development in the field of artificial intelligence.

With the continuous progress of technology and the continuous changes in industry demands, vocational colleges need to keep up with the times, continuously optimize practical teaching models, in order to adapt to and meet the social demand for artificial intelligence professionals. Only in this way can we cultivate more high-quality talents with practical operation ability, innovative thinking, and teamwork spirit, and contribute to the development of the artificial intelligence industry.

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