Research on the Major' Construction Path of Computer Science and Technology under the Integration of Industry and Education

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Abstract: In the context of the Integration of Industry and Education (IoI&E), the construction of computer science(CS) and technology major in Chinese universities is gradually being optimized and improved. However, the application of IoI&E model in CS major still faces some problems and challenges. The purpose of this research is to investigate the construction path of the CS major under IoI&E. This study examines the conflict between conventional educational methods and the demands of current industrial development by outlining the construction of CS majors both at home and overseas. In addition, this paper elaborates on the problems existing in China's CS major from three aspects: talent cultivation, industrial demand, and school enterprise cooperation. Based on the above research, this paper explores the development direction and solutions of CS major under IoI&E from the perspectives of talent cultivation goals, curriculum system construction, practical teaching, teaching staff, industry education cooperation, and teaching quality. At the end of this paper, a summary and outlook are provided on the development of CS major.

Keywords: The Integration of Industry and Education; Computer Science and Technology; Major Construction; Personnel Training

1. Introduction

With the continuous development of social economy and technology, computer science and technology (CS) have become one of the most popular majors at present. Under the integration of industry and education (IoI&E) in CS majors, enterprises and universities jointly participate in the cultivation of computer professionals, jointly implement the formulation of cultivation goals, design and construction of curriculum systems, and practice teaching processes to make higher education more closer to industry needs and improve the quantity and quality of talent cultivation [1]. The construction of CS majors in Chinese universities is gradually being optimized and improved under IoI&E, striving to cultivate a large number of outstanding computer professionals [2]. However, the application of IoI&E in this major still faces some problems and challenges, which require continuous exploration and research in order to better leverage the advantages of IoI&E in this major and promote the development of CS in China.

2. Development Status of CS Majors at Home and Abroad

2.1 Construction of CS Major in China

IoI&E has achieved certain development in CS majors, and many universities in China are currently implementing specific plans.

2.1.1 Collaborate between universities and enterprises can cultivate high-quality computer professionals

The most typical application of IoI&E in CS majors is university-enterprise cooperation [3]. In this mode, universities and enterprises jointly develop talent cultivation plans, jointly build curriculum systems, and jointly cultivate students. Universities are responsible for theoretical teaching, while enterprises are responsible for practical teaching. Students can learn theoretical knowledge while practicing in enterprises.

For example, NanJing XiaoZhuang University and JiangSu Wisedu System Co., Ltd. adopt IoI&E, jointly offering CS majors. In this mode, the latest technologies, products, and management concepts are involved into the teaching of CS in universities. Universities adapt the educational content and methodologies to the enterprise's technical

needs, making CS talent development more directly tied to the enterprise's actual needs.

2.1.2 Integrating industry, academia, and research can enhance the scientific research capabilities of computer professionals

IoI&E can also enhance the research capabilities of CS professionals by promoting the integration of industry, academia, and research. Under IoI&E, universities and enterprises jointly carry out scientific research activities, apply for scientific research projects, publish scientific research papers, and obtain scientific research results. Under this model, universities can leverage the platforms and resources of enterprises to enhance students' research capabilities; Enterprises can obtain more scientific research results and improve their technological level through cooperation with universities.

For example, Beijing University of Posts and Telecommunications and Huawei Technologies Co., Ltd. have established a joint laboratory, adopting IoI&E model, to jointly carry out scientific research activities. In this model, universities and enterprises jointly research technological hotspots and difficulties, including cutting-edge technologies such as artificial intelligence, big data, and cloud computing, to explore the future development direction of CS.

2.1.3 Social services can promote the sustainable development of CS

IoI&E can also promote the development of CS in social services. Under the model, universities can publish their own scientific research achievements, providing theoretical, technical and talent support for enterprises; Enterprises can provide more industry background support, cooperate with universities in talent cultivation, and enhance market competitiveness.

For example, Shandong University has signed a contract with Inspur Group Co., Ltd. to jointly build the Shanda-Inspur joint laboratory, adopting IoI&E model, and jointly carrying out social service activities. In this model, universities and enterprises jointly provide technical consultation, technical support, and talent training services in the field of CS to society, promoting the development of the CS major.

2.2 Majors Construction of CS under IoI&E in Foreign Countries

Building a CS major in IoI&E has drawn attention from a number of nations due to the ongoing growth of the global economy and information technology advancements.

The higher education system in the United States has always been characterized by IoI&E. For CS majors, universities and enterprises in the United States have a close cooperative relationship to jointly carry out research and talent cultivation. For example, MIT collaborates with companies such as IBM and Microsoft to build laboratories, providing students with internship and employment opportunities.

The integration model of industry and education in Germany is characterized by a dual education system, where universities and enterprises jointly cultivate talents. In the field of CS, German universities and enterprises jointly develop training plans, and some students spend more than half of their free time on internships.

The integration model of industry and education in India is led by the software outsourcing industry, and the construction of CS major is mainly aimed at the software outsourcing industry. Close cooperation between universities and enterprises in India has cultivated a large number of software talents, making significant contributions to the software development industry in India.

3. Existing Problems in CS Majors

In IoI&E in China, education of computer major and the industry come apart. As a highly practical discipline, the development of CS cannot be separated from the support of industry, and development of industrial also requires a large number of high-quality talents. However, under IoI&E model, there is a certain disconnect between higher education and industrial needs in CS majors, which affects the quality and quantity of talents and limits the industry's ability to develop sustainably.

Firstly, from the perspective of talent cultivation, current CS education still focuses on theoretical teaching, with weak practical teaching. In terms of curriculum design, the situation of emphasizing theory over practice is relatively serious, and many universities lack practical operation and practical links in the curriculum design of computer majors. IoI&E model requires university teachers to have rich

experience in enterprises and industries, in order to better guide students and cultivate computer professionals. However, in reality, some teachers lack practical work experience, making it difficult to accurately grasp the actual needs of enterprises, which affects the quality of education. On the other hand, there is a common situation of emphasizing scientific research over teaching in the teaching staff, which also makes it difficult for teachers to fully play their role in IoI&E. In the actual operation process, due to limitations in hardware facilities and practical teaching resources in universities, it is difficult for students to obtain sufficient practical opportunities. This makes it difficult for students to accumulate sufficient practical experience during their school years, which affects the employment competitiveness of graduates.

Secondly, from the perspective of industrial demand, China's CS industry is developing rapidly, especially with the rapid development of artificial intelligence internationally, which continuously increases the demand for high-quality computer professionals [4]. However, under the existing integration model of industry and education, there is an imbalance between the cultivation of professional talents by universities and the needs of industrial development. There is information asymmetry between the talent cultivation plans of universities and the needs of industrial development, resulting in a certain degree of mismatch between the types of talents cultivated by universities and the needs of enterprises. This makes it difficult for students to find jobs that match their majors, and also affects the industry's long-term development.

Furthermore, from the perspective of university-enterprise cooperation, the current level of cooperation between universities and enterprises in China has not been fully popularized, and the cooperation mode is single [5]. Many universities still remain in the traditional mode of university-enterprise cooperation. The cooperation between enterprises and universities is limited to internship, practical training, and other links, lacking deep cooperation. Although some universities implement a joint curriculum development model between enterprises and universities in IoI&E, to ensure that the curriculum content is consistent with the actual needs of enterprises. However, due to deficiencies in information communication and resource sharing between enterprises and universities, it is challenging for the curriculum to adequately address the actual needs of businesses. In addition, the computer industry is experiencing rapid technological updates, and course offerings often require some time to adjust, resulting in a gap between course offerings and actual job requirements. This makes it difficult for universities to fully understand the development trends and needs of the industry when cultivating computer talents.

4. The Development Path of CS Major

This paper explores the development direction and solutions of CS majors under the integrated of industry education mode from the perspectives of talent cultivation goals, curriculum system construction, practical teaching, teaching staff, industry education cooperation, and teaching quality assurance.

4.1 Determination of Talent Training Objectives

The purpose of the CS major is to cultivate high-quality talents with a solid foundation in CS, proficient application skills, and innovative awareness. Through IoI&E, universities strengthen cooperation with the industry, develop computer abilities' practical operation and problem-solving skills, and make them more suitable for industry needs.

4.2 Construction of Curriculum System

Regarding the layout of curriculum, universities should pay attention to the combination of theory and practice, offering courses covering CS, information technology, software development, database management, front-end and back-end development technology, network engineering, and other fields, so that students can master the basic theory and practical skills of CS [6]. In the interim, universities should pay attention to industry trends, update course content in a timely manner, introduce the latest technologies and application cases, and make the courses more practical and forward-looking [7].

4.3 Strengthening Practical Teaching

The practical teaching under IoI&E mode is an important component of CS majors. Strengthening practical teaching can enhance students' capacity for practical application and problem-solving. Specific measures include:

Establishing laboratories: Universities should establish professional laboratories and provide necessary hardware and software facilities to meet students' experimental needs.

Carry out practical activities: Universities should actively encourage and organize students to participate in various practical activities, such as technology competitions, innovation and entrepreneurship activities, computer related social practices, etc., to improve students' practical abilities and comprehensive qualities.

Encouraging collaboration between universities and businesses: Universities should actively collaborate with businesses that deal with computers, carry out practical training exercises, establish agreements with businesses, allow students to work as interns and receive training, and improve students' practical operation skills.

4.4 Strengthening the Construction of Teaching Staff

Regarding the development of the teaching staff, universities should focus on cultivating teachers' practical abilities and professional qualities. Specific measures include:

Strengthen training: Universities should encourage teachers to participate in various enterprise and industry technology training courses, learn the latest teaching methods and technological means, and improve their teaching level.

Introducing excellent talents: Universities should introduce excellent talents with rich practical experience and industry background to enrich their teaching staff.

Establish a mentor system: Universities should arrange professional mentors for each student to guide their academic research and practical activities, and improve their quality.

4.5 Strengthening Industry-Education Cooperation

Under IoI&E model, universities should strengthen cooperation with relevant enterprises to achieve resource sharing. Specific measures include:

Joint participation in curriculum development: Universities should collaborate with enterprises to develop practical and forward-looking courses to improve teaching quality.

Sharing laboratory resources: Enterprises and universities should deeply share resources to improve students' practical and innovative abilities.

Joint research projects: Universities should collaborate with enterprises to carry out research projects in the field of CS, promoting industrial development and innovation.

Establishing employment channels: Universities should cooperate with enterprises to establish internship and employment channels, providing more employment opportunities for students.

4.6 Establish a Mechanism for Ensuring Teaching Quality

In order to ensure teaching quality, universities should establish a teaching quality assurance mechanism, and specific measures include:

Establishing a teaching management mechanism: Universities should comprehensively manage and supervise the quality of teaching.

Creating a method for teaching evaluation: Universities should assess and comment on the efficacy of students' learning and the quality of teachers' instruction. They should also compile experiences to further improve and create a closed-loop system.

Strengthening the management of teaching archives: Universities should strengthen the management of teaching portfolio, record the teaching situation of teachers, and provide a basis for teaching management and evaluation.

5. Conclusion and Future Works

In order to properly educate computer professionals who can meet the demands of modern industrial development, the traditional computer education paradigm must be reformed because it is no longer able to meet those needs. IoI&E model is crucial to the development of CS majors. In the meanwhile, with the rapid development of technology and the optimization and adjustment of industrial structure, CS majors have shown broad development prospects under IoI&E model in China.

In the modern day, where open AI is developing quickly, Chinese universities

should focus on cultivating the innovative ability of computer professionals. Universities should create a good innovation environment, encourage students to participate in various scientific research and innovation activities and competitions, and cultivate students' creative ability and practical abilities. At the same time, universities should strengthen cooperation with internationally universities, introduce world-class educational resources and concepts, improve the international level of talent cultivation, broaden students' international perspectives, and improve their cross-cultural communication skills.

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