

Big-Data-Technology Talent Cultivation in the Application-oriented University: Practice and Prospects with a Case Study

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Abstract: Weifang is a rapidly-developing digital-economy city in China. The fast growth of local preponderant industries puts forwards massive demands on application-oriented big-data-technology talents, which can provide fundamental support to the digital production. Nevertheless, it is a challenging task to establish a cultivation system of big-data-technology talents. We are building the Data Science and Big Data Technology specialty in School of Computer Engineering, Weifang University. Our school has possessed the prerequisites of building a distinctive specialty, including excellent faculty team, high-level academic research lab and research projects, and university-enterprise joint cultivation mechanism. Based on the existing prerequisites, we propose to boost development of the specialty through the following solutions. First, we will explore further innovation of cultivation model aiming at the practical demands of local industries. Subsequently, we will improve the faculty team structure, especially increasing the percentage of “bi-qualified” faculty members that are competent in both academic research and engineering practice. Finally, we will establish more training bases that effectively bridge the gap between the talents and practical industry demands. Based on these three solutions, we have achieved some positive feedbacks and we are planning to build a distinctive provincial specialty of Data Science and Big Data Technology.

Keywords: Big Data, Talent Cultivation, Specialty Building

1. Background

The computer-related majors of Weifang University (WFU) aim at the talent requirements of industry in Shandong, focusing on Weifang—a city with highly developed science and technologies [1-2], focusing on the upgrading needs of the region’s advanced industries and support the transition to new from old economic engines. The industries served by WFU computer-related majors include software, big data, artificial intelligence, industrial manufacturing, chemical engineering, agriculture, and transportation. These majors cultivate high-level application-oriented talents with excellent professional skill and wide adaptability. In addition, the cultivated talents possess strong engineering practice and innovation ability; and they are supposed to empower the economic and social development of the local region by applying big-data technologies.

In 2020, the following five positions account for a large percentage of the total talent demand in the job market in Shandong Province: software engineers, robotics engineers, data engineers, back-end software development engineers and Java Programmers. With regards to the percentage, the aforementioned five positions rank second, third, fourth, seventh, and ninth, respectively. These five types of positions account for 22.33% of the total demand for talents. Big-data based and technologies have become an important driving force for the upgrading and transformation of various industries in Shandong Province, especially the manufacturing industry. In 2020, the growth rate of talent demand in Weifang job market ranked fifth among the 16 cities in the province. In 2021, industrial manufacturing positions and big-data-technology positions (represented by software, big data, and artificial intelligence) rank second and third in talent demand of Weifang job market. The trend that the industrial manufacturing industry drives the development of the computer-and-data industry has emerged.

Weifang University now has undergraduate majors in computer science and technology, software

engineering, network engineering, etc. Since its inception, there have been more than 5,000 application-oriented talents cultivated by WFU in the field of computer technology, and the graduates are well-employed. In 2003, "Computer Science and Technology" was approved as a university-level key disciplinary filed. The development of the disciplinary filed and majors has been focusing on the requirements of the "application-oriented distinctive university" project, and constantly innovating talent training models and application-oriented talent training mechanisms. In addition, WFU is continuously strengthening the academic research, teaching, and cultivation of engineering practice capabilities.

Nowadays industrial manufacturing is becoming the leading driving force of the software/data/artificial intelligence industry in Shandong. Rapid development of such industries is already on the horizon. As a result, demand for relevant professional talents will increase significantly. Weifang, where WFU is located, has many high-level industrial manufacturing enterprises. Moreover, training sufficient high-level computer talents is an inherent requirement for promoting the realization of "Industry 4.0" in industries. Although computer and other electronic information technologies have been widely applied in the development of the manufacturing industry in the local region, there is still dramatic room for improvement in industrial upgrading and transformation aiming at "Industry 4.0". Big-data based technologies still need to be further integrated with industrial manufacturing. However, there is temporarily no full-equipped big-data technology industry in Weifang and its surrounding areas. However, talent cultivation is the key factor restricting the development of the industry.

Weifang University is the only comprehensive provincial university in Weifang City, which undertakes the important task of cultivating high-level applied talents in electronic information technology for regional economic and social development. The computer science and technology major of Weifang University is among the national distinctive majors, and is also a first-class undergraduate major of Shandong Province. In addition, WFU has one provincial research lab: Shandong Province Intelligent Internet of Things and Big Data Engineering research institutions, and a provincial teaching base: Shandong Province Big Data Talent Training Base. Base on such high-level search and teaching platforms, WFU has achieved strong research prowess in supercomputing and complex system modeling, big data analysis and visualization, and IoT technology development and application. WFU strives to cultivate high-quality applied talents, and seeks strategic cooperation with superior enterprises. Currently, WFU has successively established stable and intensive cooperation with famous local enterprises including Weifang Software Park Development Center, Shandong Zhongchuang. Over forty companies have join in the cooperation with WFU, and thus vigorously promote the integration of production, education and research. Consequently, the commercialization of research achievements are significantly promoted, and development of the local economy is boosted.

Existing representative research works are either from research universities [3,4] or vocational colleges.[5,6]. However, we focus on big-data-technology talent cultivation in application-oriented universities and use Weifang University as a case study. In this paper, we investigate on the specialty building of Data Science and Big Data Technology. We discuss our current practice and propose our solutions for open problems such as cultivation modes, faculty team building and practical-requirement driven training. Our work is still ongoing and more progresses are needed to optimize talent cultivation. The rest of this paper is organized as follows. Section 2 shows the existing foundations. Section 3 proposes our solutions. Section 4 concludes our work and points out the future work.

2. Existing Foundations

2.1 Excellent Faculty Team

There are ninety-two full-time faculty members in the School of Computer Engineering of Weifang University, including forty-five professors and associate professors, accounting for 48.9% of the total number of full-time faculty members. Among them, forty-nine teachers are under forty-five years old, accounting for 53.2%. Eighteen of them have doctoral degrees, accounting for 19.5%. Among the faculty members, many professors have honorary titles. The following are some representative titles: "Special Government Allowance of the State Council" experts, China Torch Entrepreneurship Mentors, Provincial Excellent Technological Innovation Mentors, and Municipal Top-notch Talents, Shandong Provincial Distinctive University Professor, "Weifang University Scholar" distinguished professor, selected candidates of "WFU Outstanding Youth Program", selected candidates for "WFU Excellent Doctoral Program" support program, candidates for "WFU Excellent Youth Program", WFU distinguished professors. In addition, the teaching team of computer software series courses was

selected as the “Teaching Team of Higher Educational Institutions in Shandong Province”. Teachers engaged in the teaching and research of data science and big data technology also have rich teaching experience, and can directly offer basic and professional courses of data science and big data technology, forming an academic echelon with a reasonable structure of title, education and age. The team of part-time teachers is sufficient, and it has established close cooperative relations with more than forty companies including Weifang Beida Jade Bird Huaguang Platoon Co., Ltd., Pactera Software Technology Training Co., Ltd., Weifang Software Park Development Center, Shandong Zhongchuang Software Engineering Co., Ltd., etc. A high-level off-campus part-time teacher team composed of 5 senior engineers has been formed.

2.2 Strong Research Prowess

Computer science and technology major, was rated as a distinctive major of Shandong Province in 2008. Since 2009, we have been working on construction of the school-enterprise major. In 2010, this major was rated as a national-level distinctive major. Afterwards, it was identified as the Shandong Province enterprise-school joint construction major in 2011. In 2013, it was identified as the key construction major of Shandong Province application-oriented universities, and in the same year, it was approved as the pilot major of Shandong Province “Excellent Engineer Education and Training Program”. In 2015, it was approved as the pilot major of Shandong Province general undergraduate colleges and universities for application-oriented talent training professional development support program. In 2017, the computer-specialty group with computer science and technology as the core was approved as a high-level application-oriented construction specialty group in Shandong Province. In 2019, the computer science and technology major was approved as a first-class undergraduate major in Shandong Province. The discipline of computer science and technology originated from the discipline of computer application technology established in 2003. This discipline has always been highly valued by the local society and was established as a key discipline in the year of its establishment.

The discipline has strong research prowess. Disciplinary members have completed a number of projects such as the National Natural Science Foundation of China, the Natural Science Foundation of Shandong Province, the Shandong Provincial Science and Technology Research Plan, and the National Spark Program. They have published high-level scientific research papers and have a number of intellectual property rights. In recent years, there have been fruitful research results in the fields of big data technology and application, Internet of things technology and information technology.

2.3 Training Mechanism

School of Computer Engineering has six research institutions including Shandong Province Big Data Talent Training Base, Shandong Province Intelligent Internet of Things and Big Data Engineering Laboratory, Weifang City Cloud Computing Engineering Technology Research Center, etc., and has established an on-campus internship and training base with advanced equipment. As well as a well-run off-campus practice base, the experimental training center has a total area of more than 3,000 square meters and a total equipment value of more than 20 million Chinese yuan. School of Computer Engineering has 23 professional teaching laboratories, which are first-class teaching laboratories in Shandong Province and undertake the teaching tasks of university-wide computer foundation courses and school-wide specialty courses. At present, the school has established more than 40 practice bases with well-known IT companies such as Qingdao Yinggu, Dane Technology, ZTE, Zhongchuang Software, Goertek, Neusoft, Jade Bird Huaguang, Pactera, ChinaSoft International, iSoftStone, etc. Such bases cover multiple aspects such as system design, development and application’ can well meet the needs of students' engineering practice ability training.

3. Proposed Solutions

3.1 Innovation of Cultivation Model

Our work replies on the computer science and technology specialty group. In accordance with the construction requirements of “new engineering”[7], we adopt “university-enterprise integration” as the main line, to realize the sharing of “talent training, scientific research platform. In this manner, we promote the specialty, courses, platforms, and faculty, forming a new cooperative education mechanism for industry-university-research collaboration shared by local universities and regional industries. All majors have achieved high social reputation in school-enterprise cooperation, school running

conditions, faculty, talent training mode, teaching content, curriculum system, teaching methods, teaching management, talent training quality, etc. We are planning to achieve one or two provincial-level high-quality online courses by 2023, and form a continuous improvement mechanism for the quality of talent training.

3.2 Improving the Faculty Team Structure

We will make full use of the system and mechanism advantages of professional group construction, and create a high-level bi-qualified teacher and teaching team. Strengthen teachers' advanced studies, long-term training and temporary training, improve teachers' own practical ability and practical teaching level [8], and take part-time internal and external studies to improve teachers' professional ability. We continuously increase school-enterprise cooperation, integrate full-time and part-time teacher resources of various majors in the professional group. Also, we absorb outstanding talents from industry enterprises to be full-time teachers and part-time teachers. In this way, we enhance full-time teachers' social practice exercises. We launched five projects: talent import, educational qualifications, talent echelon, Part-time teachers and bi-qualified teacher quality. We try to establish a team with full-time and part-time professional group leaders as the guidance. And the full-time and part-time backbone teachers in various majors are the core of the group. This group will possess advanced teaching concept, and reasonable bi-qualified structure. We will make efforts to import more than five PhDs in big data and other related fields, and finally establish a team of teachers with strong scientific research and practical abilities with a reasonable age structure, gender structure, academic structure, title structure, and an optimized ability structure.

3.3 Construction of Training Bases

We will increase the investment in specialty building, and improve experimental conditions as well as teaching equipment. Besides, we will strengthen the training of talents' practical ability in big data technology, and plan to build a big data training base. Relying on the Shandong Province Intelligent Internet of Things and Big Data Engineering Laboratory and the Shandong Province Big Data Talent Training Base, we will create an excellent innovation practice environment through the "project tutor", "student innovation club" and other methods. We will open up a second classroom for students, and investigate on in-depth development of a new management model combining academic tutors and project tutors. This mechanism will encourage students to participate in various types of discipline competitions across the country and the province, and provide students with support in policies, funds, equipment, venues, and teachers. In this way, we will introduce innovation education into entire flow of engineering practice teaching, and create all conditions to create a platform for students. On this platform, students will perform innovative activities both inside and outside class[9,10].

4. Conclusion

The specialty building is still ongoing. Figure 1 shows the total funding amounts of high-level academic research projects (approved to School of Computer Engineering, in the field of big data) in recent years. Obviously the research proress is constantly growing.

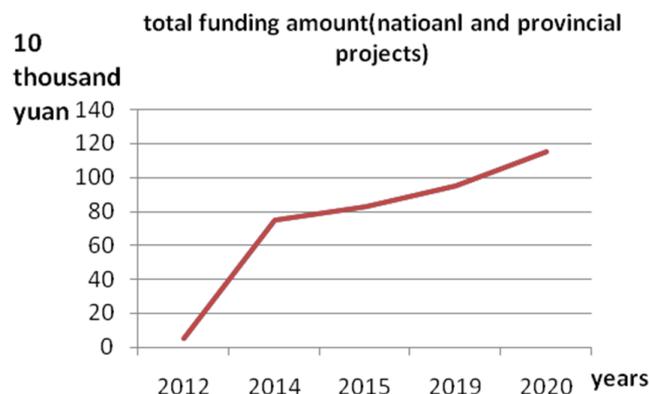


Figure 1: Total funding amounts of high-level academic research projects (approved to School of Computer Engineering, in the field of big data)

4.1 The Current Shortcomings Mainly Exist in the Following Aspects

There is still significant room for improvement in the total number of high-level scientific research projects, though two national-level scientific research projects have been approved in the past five years. However, constrained by factors such as scientific research foundation, the total number of high-level projects is still insufficient. The future work will cover two aspects. Internally, we will further condense the characteristics of disciplines, guide and encourage existing full-time teachers to further combine the requirements of the industry, and try to achieve landmark research fruits in applied research work. Externally, we will strive to import high-level faculty that can promote the scientific research level of this university.

4.2 There is Still Room for Improvement in the Influence of Existing Industry Mentors in the Industry

Due to the lack of leading companies in the software/big data/artificial intelligence fields in Weifang, the technical literacy and social influence of industry mentors are obviously insufficient. In the future, we will strive to achieve normalized exchanges and cooperation with high-level enterprises, research institutes, and universities in other cities in the province and even outside the province. Also, it is still a choice to hire higher-level industry mentors.

Based on Weifang and serving Shandong, we will further strengthen cooperation with enterprises to contribute to the development of the regional big data industry. In short, after years of development, a deep foundation has been brewed in terms of curriculum construction, faculty team, platform construction, practice bases, etc. It is promising to open the new major of data science and big data technology.

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