

Research and Practice on the Training Mode of Robot Engineering Professional Talents

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Abstract. In order to explore and establish a training mode for robotic engineering professionals which not only meets the established training objectives, but also meets the requirements of the development of the times, a research on the mode of collaborative education between schools and enterprises based on the integration of industry and education is carried out. We should build a platform for collaborative education, which integrates Industry and education in depth and cooperates with schools and enterprises in the whole process. With the support of collaborative education platform, we will work with more robotic enterprises to train excellent robotic professionals. Construct a training system that adapts to the deep integration of Industry and education, and teaches people through the whole process of cooperation between schools and enterprises. To train advanced robotic engineering talents to meet the needs of modern industry, we should adopt the mode of "introducing enterprises into schools, interacting between schools and enterprises, and introducing schools into enterprises" in-depth integration of Industry and education, and collaborative education between schools and enterprises in the whole process. The integration of industry and education and the training mode of school-enterprise collaborative education are helpful to improve students' innovative and practical abilities. The robot talents trained not only meet the needs of production practice in the industry, but also have professional competitive ability.

Introduction

With the development of economy and the prosperity of industry, the scale of robotics industry is expanding rapidly, and the demand for advanced application talents of robots is increasing sharply [1]. It has become the goal for enterprises to compete for high-quality talents that meet the needs of modern enterprises. Some enterprises have begun to explore ways to recruit talents, to participate in the training of college students, and even to adopt order-based training [2].

On the other hand, the setting of talent training programs in Colleges and universities makes talent training stick to tradition. The curriculum setting of theoretical courses occupies a large space is often not suited to the training objectives, coupled with the "disconnection" between teaching process and enterprises. Many factors make it difficult for students to directly become "talents" needed by enterprises after graduation, and graduates can not "zero distance" docking with enterprises. Therefore, it is of great significance for us to carry out the topic of "Research and Practice on the Training Mode of Robot Engineering Professionals" [3].

Most of the topics about talent involve innovation, because there is a general consensus that although we have a large number of engineers, but lack of "innovation" ability, many industry people will attribute the problem to education: that universities do not cultivate talents with broad vision and innovative ability. In fact, out of Engineering practice, out of industry enterprises, we only cultivate "blank" [4]. Only through in-depth exchanges and cooperation between industry enterprises and universities, integration of industry and education, and collaborative education, can we cultivate compound applied talents adapted to the needs of modern enterprises.

Current Situation and Existing Problems of Talents Training Model

The low labor cost is the booster of the rapid development of manufacturing industry in China in the past decades. After the implementation of the new labor law in 2008, the labor cost has risen dramatically, and China is no longer a cheap manufacturing country. As shown in Fig. 1, industrial transformation and upgrading will continue to deepen, and enterprises will pay more attention to improving the level of automation production [5]. Robot replacement is imperative. Enterprises will need a large number of senior talents who master robotic technology.

Overseas countries have always attached great importance to the teaching research and reform of Engineering education, and the direction of development is to try to establish a new curriculum system and strengthen the cultivation of practical ability and innovative consciousness. For example, MIT (Massachusetts Institute of Technology) in a "made in America" report that the current industry has weakened the engineering practice and development capacity, so a new idea for change is to "strengthen the training of engineering practice under the concept of large engineering without weakening" the basic disciplines [6].

From 2001 to 2006, 50 academicians of the National Academy of Sciences, the National Academy of Engineering and the National Research Council jointly completed the project research entitled "Engineers in 2020". In 2004 and 2006, two summing-up reports, Vision for the Development of Engineering in the New Century and Engineering Education for the Adaptation of the New Century, were made respectively, in order to prepare for the future development of the United States [7].

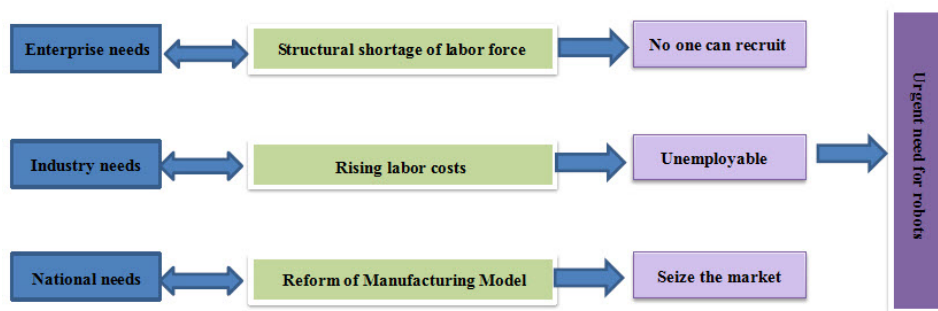


Fig. 1 Robot replacement is imperative

The report points out that there will be new demands for the quality of engineers and managers in the future. The cultivation of such qualities is different from the requirements of traditional courses, and requires a broader and more comprehensive "professional hands-on ability" while possessing technical ability. At the same time, engineering educators and industry in the United States are increasingly aware of the importance of introducing engineering activities while offering basic science and mathematics courses at the early stage of undergraduate students. Teachers and engineering technicians from schools and industrial enterprises form cooperative teams to cross-integrate courses and reconstitute a series of courses. These vertical integration series, including previous engineering and laboratory experiences, such as teamwork project design and industry service projects, enable students to recognize the essence of engineering as soon as possible [8]. Now, due to the need for technology and products beyond existing knowledge and the changing professional environment that engineers will face, the way engineering practices are required to be further changed. Engineering practice and engineering education must be considered in a global context.

Some developed countries began to study the training mode of school-enterprise cooperation talents very early, and formed a unique training mode of school-enterprise cooperation talents represented by Germany, Britain and the United States [9].

(1) German "dual" education model. It refers to the combination of students' practical skills training in enterprises and theoretical training in schools. Students have dual identities: they are students in schools and apprentices in enterprises. In recent years, there has been a new development

in the "dual system": cross-enterprise training, that is, students receive enterprise training and school education at the same time, each year to take a certain time to cross-enterprise training centers for centralized training, as a supplementary reinforcement of enterprise training.

(2) British "sandwich" model. It refers to the intersection of students' theoretical study and practice. Taking the four-year system as an example, students first learn two-year theoretical courses in school, then take part in practice from the third year to the enterprise, and then return to school in the fourth year to carry out the "theory recovery". This model is known as the "sandwich" model, which is recognized as a relatively successful model in the educational reform at home and abroad.

(3) The "Enterprise University" model in the United States. Originated in the 1920s, it is marked by the establishment of the General Motors Design and Management Institute in the United States. Enterprise universities initially take employees as training objects and are taught by senior managers and technicians. With the continuous expansion of the scale, enterprise universities have become the cradle of enterprise talents training.

Exploring and establishing an effective talent training mode to make talent training not only conform to the established training objectives, but also to the requirements of the times has always been an important issue and a difficult problem in the educational reform. The above modes are common in Higher Vocational education. It is difficult to copy and apply them to general undergraduate higher education.

In the 1980s, China began to explore the cooperation between schools and enterprises to train talents, in the form of order training, the establishment of practice bases in schools, and the provision of learning funds by enterprises. In recent years, some achievements have been made in school-enterprise cooperation. But generally speaking, there are still some deficiencies in the theoretical research of school-enterprise cooperation, which can not completely solve the problems in practice [10].

There are still some problems in Higher Engineering Education in our country. Engineering education shows some inadequacies in the training of outstanding engineering talents.

First, the concept is not suitable. At present, some problems in the field of engineering education are directly related to the lagging of engineering education concept, which is mainly manifested in the inadaptability of engineering education concept to current changes and future needs. For example, the concept of student-centered, achievement-oriented and quality-continuous improvement of engineering education certification is not fully implemented, the concept of lifelong learning and personalized learning is not fully integrated into the educational process, the concept of multi-disciplinary cross-integration needs to be strengthened, and the concept of green engineering education has not yet been firmly established.

Second, the talent structure is not suitable. The shortage of world-class engineering leaders and top-notch talents, the shortage of craftsmen in major countries, the shortage of engineering and technology talents in basic, emerging and high-end fields, the weak ability of engineering and technology talents to support the transformation and upgrading of manufacturing industry, and the relative surplus of traditional engineering talents present the coexistence of surplus and shortage of manufacturing talent structure, the "shortage of employment" of enterprises and the "difficulty of employment" of graduates.

Third, the knowledge system is not suitable. In today's society, new knowledge develops exponentially, frontier disciplines and interdisciplinary disciplines are constantly emerging, and the cycle of knowledge achievement transformation is shortened. However, from the content point of view, the knowledge of engineering education curriculum is obsolete, which is out of touch with the needs of industry and society; from the structure point of view, the discipline and specialty settings are too detailed according to the hierarchical structure of the existing knowledge system; from the mechanism point of view, the flexibility of discipline and specialty adjustment settings is insufficient, lagging behind the needs of market and industry development.

Fourth, the training mode is not suitable. The development of a series of disruptive technologies, such as globalization and networking, has changed the way of education, learning and information sharing, which has resulted in the inadaptability of teaching methods and modes, teaching

environment and conditions, as well as the needs and structures of teachers. At the same time, the change of economic environment and social employers' needs requires engineering education to return from purely pursuing academic performance to relevancy with practice, and devote itself to responding, participating and resolving the emerging human social problems.

Therefore, in order to achieve students' innovative ability and practical ability, we must take a new way of integration of industry and education, school-enterprise cooperation to educate people, and train advanced robotic engineering talents to meet the needs of modern industry.

Thoughts on the Training of Robot Engineering Professional Talents

Reforming the training mode of professional talents, implementing the deep integration of Industry and education, and collaborative education between schools and enterprises are in line with the train of thought of personnel training and the direction of higher education reform and development.

Deepening the Integration of Industry and Education, Adapting to the Trend of Leading a New Round of Scientific and Technological Revolution and Industrial Change.

At present, the economic development has entered a new normal. The deep integration of industrialization and informatization has brought about vigorous development of new industries, new technologies and new models. In particular, the innovative and practical needs of the development of robotics industry are increasingly penetrating into all aspects of personnel training. It is urgent for schools to open doors, innovative education training mode, organizational form and service supply, to extend the educational content to society, and to accelerate the collaborative education between schools and enterprises.

Deepening the Integration of Industry and Education is in Line with the Direction of Higher Education Reform and Development.

Our country is in the critical period of building a modern education system. Modern vocational education is accelerating its development. Higher education is moving from popularization to popularization. Improving quality has become the central theme of educational development, which must be driven by deepening reform. Deepening the integration of industry and education means promoting the reform of separation of management from management and "releasing control clothes", speeding up the transformation of educational governance mode, introducing enterprises and other subjects to participate in running schools, actively playing the role of trade associations and the third party of society, promoting diversification of school-running subjects and modernization of governance structure, and improving the quality of education in deepening the reform of school-running system. Deepening the integration of industry and education at different levels and promoting quality improvement through structural adjustment have become the consensus of Applied Undergraduate Universities and high-level universities.

Robot engineering undergraduate specialty is a new interdisciplinary integration specialty, and it is an extremely active engineering (discipline) research field at present. In order to better adapt to the current situation that the robotics industry requires engineers with strong engineering consciousness, engineering quality and engineering practice ability, the robotics engineering specialty needs to learn from the successful experience of Higher Engineering Education in advanced countries of the world and grasp the trend of science, technology, economic and social development in the new century through close cooperation with industrial enterprises. Guided by the new educational ideas and concepts of the Ministry of Education's higher education reform. Changing the tendency of emphasizing academy over technology, knowledge over ability, specialty over quality, discipline over engineering, breaking the closed disciplinary boundaries of robotics science and engineering, taking the basic idea of "emphasizing moral character, thick foundation, wide caliber, multi-direction and strong application" as the main line, basing on Guangxi, serving regional economy and radiating the rest of the country. It is necessary to construct a training mode of special talents for Robotic Engineering Specialty Based on the deep integration of Industry and education to meet the needs of high-tech, large-scale projects, multi-cultural and intelligent economic development in the new era.

Talents Training Model of Robot Engineering Speciality Based on Deep Integration of Industry and Education

Constructing a Platform of Collaborative Education with Deep Integration of Industry and Education and Full Cooperation Between Schools and Enterprises.

The establishment of collaborative education platform enables professionals to grasp the pulse of talent training in the industry. On the one hand, the specialty can closely integrate the employment needs of robotic enterprises, and with the support of collaborative education platform, train excellent robotic professionals with more robotic enterprises. On the other hand, give full play to the guiding role of scientific and technological activities and competitions, and integrate them into the professional routine teaching to form a good interaction. In this way, the robot professionals trained by the specialty not only meet the needs of the industry's production practice, but also have professional competitive ability.

Industry-education integration and school-enterprise cooperation mode are rising in recent years. The aim is to let students enter the work scene ahead of time through cooperation between schools and enterprises, to guide students to develop advanced thinking, and to conduct more authentic learning in accordance with the requirements of the employment market. The mode of cooperation is to integrate students' learning and daily production of enterprises into the unified norms by means of the combination of schools and enterprises. On the one hand, it guides factories with the advanced concepts of students in the front line of learning and teaching, and carries out fruitful production reform. At the same time, it also transfers some experiences and lessons from the daily production of factories to students through practical training. During the period of study, students have already understood and mastered the relevant operation mode and daily work mode of enterprises, so that students can prepare for their future work life psychologically and materially.

In October 2017, our school and Guangxi Huali Group Co., Ltd. jointly built Liuzhou's first demonstration base for intelligent upgrade of manufacturing, and built a production line for intelligent manufacturing of robots, which will serve as a shared training base for the integration of production and education of robotics Engineering Specialty in our school and for the collaboration of schools and enterprises in educating people, as shown in Fig. 2.



Fig. 2 Shared training base built by colleges and enterprises

Constructing a Training System Adapting to the Deep Integration of Industry and Education and the Whole Process of Collaborative Education between Schools and Enterprises.

According to the training system of robotics engineering professionals, the pattern of "introducing enterprises into schools, interaction between schools and enterprises, and introducing schools into enterprises" is constructed. "Introducing enterprises into schools" refers to the first or fourth semester of university, which is combined with the opening of robotics professional courses, and employs senior engineers and technicians of robotics industry to participate in the course teaching and course design guidance; "School-enterprise interaction" refers to the fifth or seventh semester, which combines the teaching of specialized courses with the relevant experimental and practical links, and adopts enterprises, in-school enterprise tutors and in-school teachers according to the characteristics of teaching links. Interactive integration with needs. "Introducing schools into enterprises" refers to

the eighth semester, requiring professional teachers and students to concentrate on in-depth enterprise learning and practice, adopting employment-oriented enterprise internship, graduation thesis or graduation design based on the actual project of enterprises. Really combine theory with practice, cultivate students' ability to analyze and solve problems, and improve students' innovative consciousness, so as to promote the development of students' employment ability in an all-round way.

Implementing the Double-mentor System and Improving the Double-mentor Team.

With the dual mode of "introducing part-time teachers from enterprises" and "school teachers' studying in enterprises", a "double-qualified" teaching team with full-time teachers in schools as the main part and engineering technicians outside schools as the supplement should be established. On the one hand, from the cooperative enterprise to the school part-time teaching, arrange teachers to the cooperative enterprise for practice and technical advisory services, solve problems through real situations, improve skills; regularly select teachers to study and train in famous universities at home and abroad, in order to understand the frontier trends of robotics disciplines and learning at home and abroad. On the other hand, senior engineers of enterprises are employed as out-of-school tutors to implement the "double tutorial system", that is, school tutors and enterprise tutors jointly guide students to complete the core courses of study and graduation design, so that the enterprise tutors can guide students' internship in the whole process and improve students' practical ability.

Conclusion

The fundamental purpose of "integration of industry and education" is to cultivate talents. Taking talent training as the goal of "integration of industry and education" and "integration of industry and education" into the whole process of talent training, we will build a system of collaborative education between local universities and industry. Our school takes the software and hardware of robot control and intelligent algorithm, the integration of robot system and the application of robot engineering as the characteristics of personnel training. Establish a school-enterprise joint robot engineering professional steering committee, establish off-campus training and practice bases, and strengthen the main role of enterprises. School-enterprise cooperation consists of school teachers and backbone experts of robotics industry to form professional committees and jointly formulate training programs for school-enterprise cooperation. Aiming at the robotics engineering specialty, this paper explores how to improve the curriculum, teaching links and teaching methods.

School-enterprise entity cooperation mode. Signing school-enterprise cooperation agreements with multi-party enterprises, students can enter enterprises for practical training. Enterprises can provide a certain amount of teaching resources, teaching materials, teaching aids, teaching equipment, etc. according to their own conditions; school specialties cooperate with enterprises and participate in enterprise production practice.

Enterprise staff enrollment mode. Robot enterprises can send employees to schools, on the one hand, for continuing education, to improve the overall quality of employees; on the other hand, schools can hire key experts or senior engineers to teach in schools, guide experiments and design, make schools and enterprises more closely linked, so that students' professional quality is constantly improved.

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