Talent Cultivation Mode of Intelligent Manufacturing Specialty Groups in Industrial Universities with Enterprises as the Responsible Main Body

Baohui Jin *, and Shanshan Xiao

School of Economics and Management, Chengdu Technological University, Chengdu, Sichuan, 611730, China

Abstract. With the proposal of China's manufacturing power strategy, Chinese enterprises are in urgent need of a large number of compound talents in the direction of intelligent manufacturing-related specialties. China released a document in 2019 to encourage the integration of industry and education and the construction of industrial universities. On the basis of studying the development experience of industrial universities at home and abroad, the paper analyzes the current situation of talent cultivation and existing problems in the intelligent manufacturing professional group of China's industrial universities, puts forward the general requirements for talent cultivation when constructing an intelligent manufacturing professional group in an industrial university with enterprises as the responsible main body of schooling, through the construction of distinctive intelligent manufacturing professional groups, the formation of a student-centered education and training system, and the strengthening of goal-oriented education and training concepts and other measures, to adapt to the needs of intelligent manufacturing personnel training in the new era.

1. Introduction

In order to completely change the status quo of China's manufacturing industry, which is big but not strong, China released the strategic platform document "Made in China 2025" in May 2015 for a strong manufacturing country, which proposes that China's manufacturing industry should make major breakthroughs in innovation, quality and branding in order to realize the transformation and upgrading of China's manufacturing industry and make a leap forward in history. The development of advanced and intelligent manufacturing industry requires the in-depth integration of production and manufacturing technology with information technology, automatic control, etc. Therefore, there is a greater need for high-quality and complex talents with multi-disciplinary background in the intelligent manufacturing industry. However, China's manufacturing personnel training is still partial to the traditional model, the reality is that the supply of traditional workers is too large, and there is a serious shortage of high-end talents who master intelligent manufacturing technology [1].

In response to industry development and talent demand, China's State Council issued the National Implementation Plan for Vocational Education Reform in 2019, which calls for stimulating the active participation of enterprises, industry associations, and other diversified bodies in vocational education, adhering to the quality of education, and promoting the quality and upgrading of vocational education.

Based on the above development background and policy guidance, how to adapt to the demand for talent training in the era of intelligent manufacturing, and at the same time give full play to the enthusiasm of the main body of the enterprise employer, integrate the resources of enterprises, universities, associations, etc., and study the talent training mode and training system of the intelligent manufacturing professional group in the enterprise-oriented industrial university has become an urgent problem to be solved.

2. Analysis of the current development status of industrial universities

2.1. Current status of the development of industrial universities in developed countries

Industrial universities in economically developed countries developed earlier, but there are also large differences, here focus on the analysis of industrial universities in the United Kingdom, Germany, Japan and the United States, which have typical characteristics.

Industrial universities began to appear in the United Kingdom in the late 1990s. The industrial universities in the UK is a kind of educational organization formulated by the UK Department of Education and Employment, which provides open educational products and
educational services for the society. The industrial universities was initially established to build a learning society and promote lifelong learning, and it is an organization that develops and promotes open distance learning, and promotes flexible learning and continuous learning through television and the Internet [2].

Japan's industrial universities aim to train students to become practical industrialists who can meet the requirements of economic development in the new era. Japan's industrial universities emphasize the central position of enterprises in running schools, including curriculum, apprenticeship learning, school-enterprise linkage, etc., and have maintained a high employment rate because the students they cultivate meet the requirements of enterprises. The faculty is dominated by professors for basic education and external senior faculty from industry for skills education [3].

Vocational education in Germany carries out in-depth innovation in teaching practice, extensively intervenes in the science and technology industry chain and industry-university-research synergy, and implements a dual education model, whereby industrial enterprises and schools jointly carry out teaching and post-training in accordance with the needs of enterprises. One of the most typical is Berlin Steinbach University, which was founded in 1998, the Steinbach University annually customizes many technology transfer and innovation training courses for Siemens, IBM and other world-famous companies, as well as more than 10,000 small and medium-sized enterprises [4].

In order to promote the enhancement of U.S. national technological innovation capacity, as well as to incentivize the cooperation between universities and industrial sectors in technological research and development, the US federal government has introduced a large number of policies, including the New Technology Opportunities Program established by the U.S. President in 1972, and the Cooperative Research and Technology Enhancement Act passed by the U.S. Congress in 2004, and so on. At present, more than 170 universities in the U.S. have participated in the federal government's advanced technology programs [5], of which Silicon Valley in the U.S. has become a typical representative of university and enterprise cooperation.

### 2.2. Current development of industrial universities in China

The construction of industrial universities is in line with the direction of China's vocational education reform and development, which can ensure the effect of talent cultivation and has a broad space for development under the guidance of relevant policies. Most provinces in China have already issued documents to guide local undergraduate colleges and universities to develop in the direction of application-oriented, and more than 300 local undergraduate colleges and universities in China are now actively participating in the pilot reform of application-oriented, and have carried out useful explorations in the areas of university-enterprise cooperation, joint talent cultivation, and faculty construction, including the formulation of joint talent cultivation programs, and the development of joint curricula and teaching materials. In the practical exploration of industrial universities, talent cultivation models such as enterprise college system and modern apprenticeship system have emerged.

Although China's industrial universities have flourished, in general, there are still problems such as inaccurate positioning of industrial universities and unclear talent cultivation models.

### 3. Major problems in talent cultivation of intelligent manufacturing specialty groups in China's industrial universities

The main body of China's industrial universities has diversity, generally including universities, enterprises, industry associations, and local governments and other parties, which brings about a variety of types of industrial university construction, construction and training standards are not uniform, and the level of schooling is uneven, which to a certain extent restricts the development of industrial universities.

According to the survey, the following problems mainly exist in the cultivation of talents in the cluster of intelligent manufacturing majors in Chinese industrial universities.

#### 3.1. Inadequate curriculum system

Intelligent manufacturing majors are developing very fast, and in industrial universities there are often problems such as the curriculum system is not perfect, not sound, and not able to keep up with the development of the times.

#### 3.2. Disconnect between theory and practice

Intelligent manufacturing specialty groups personnel training pay more attention to the combination of theory and practice, but because of its rapid development, theory teaching is often superficial, and practical teaching is detached from the actual, students are difficult to learn to use.

#### 3.3. Formalization of internship practice

When the industrial university has become an independent school running body, some institutions in order to complete the teaching task, often make the off-campus internship practice in form, cannot ensure that students in the enterprise position to get real exercise.
4. Talent cultivation mode of intelligent manufacturing specialty groups in industrial universities with enterprises as the responsible main body

4.1. General requirements for talent cultivation

The category of talent training in industrial universities can generally be divided into academic education and general education & training (non-academic education). Regardless of the category, talent training objectives and training standards should be formulated on the basis of the goal-oriented industrial demand, and training programs, training modes and training paths should be set up on this basis. The setting of academic disciplines and specialties should reflect the participation of industry and enterprises in their deliberations, the urgent needs and shortages of the society, the market-oriented adjustment mechanism, the evaluation of employment quality and other factors.

For the industrial university with enterprises as the main running body, it is necessary to build a perfect and characteristic specialty groups in intelligent manufacturing talent cultivation, and strengthen the goal-oriented talent cultivation concept [6], in order to adapt to the requirements of the new era for the cultivation of intelligent manufacturing talents.

4.2. Constructing an intelligent manufacturing specialty groups with distinctive features

Intelligent manufacturing specialty groups generally include mechanical manufacturing and automation, intelligent manufacturing science and technology, optoelectronic information science and other directions, mainly involving the application of artificial intelligence, big data, cloud computing, virtual reality and other professional knowledge. At present, China's undergraduate majors related to intelligent manufacturing include intelligent science and technology, robotics engineering, intelligent manufacturing engineering, etc., and higher vocational majors include industrial robotics technology and intelligent control technology [7]. According to the research on enterprises, it is found that enterprises mainly need engineers in the specialties of intelligent manufacturing equipment, green intelligent manufacturing, and industrial software use and maintenance, and there is a high demand for the positions.

Since the specialty directions of intelligent manufacturing specialty groups cover a wide range and the required professional knowledge develops rapidly, its specialty construction will face challenges such as incomplete system of training programs, lack of compound teachers, and insufficient school practice resources. Therefore, the general intelligent manufacturing specialty group construction should combine the school's characteristic specialties and consider factors such as future development and talent employment to build subdivided directions under the major categories of intelligent manufacturing specialties with similar specialty bases and related positions [8].

For example, Zhongshan Institute of Vocational Technology in Guangdong, China, is oriented to the strategic emerging manufacturing industry in Zhongshan City, focusing on intelligent equipment, intelligent production lines, intelligent workshops, intelligent factories, etc., and has constructed a specialty group of intelligent manufacturing including the professional directions of molds, machinery, electromechanics and robotics with data information and control technology as the core [1].

In the practice of cultivating talents in the intelligent manufacturing specialty group of industrial universities with enterprises as the main body, a relatively complete specialty group should be formed according to the requirements of professional skills, the demand for employment, etc., as well as professional directions with core competitiveness, so as to lay a foundation for the enhancement of students' comprehensive ability and form an employment advantage [9].

4.3. Formation of a student-centered talent training system

The construction of a student-centered talent training system should not be confined to whether it is the Japanese model or the German model, but should be based on the orientation of the school and the characteristics of the students, in accordance with the needs of the society, and seriously take the ability of the students as the goal of cultivation [10], so it is recommended to make a major change in the three aspects of the talent cultivation system, the role of teachers, and the teaching methods to truly improve the quality of education and teaching in industrial universities.

Firstly, the talent cultivation system should be transformed to the goal of ability cultivation and quality cultivation. The transformation of talent cultivation from knowledge goal to ability goal and quality goal is the inevitable trend and demand of the development of higher education. But China's current objectives, concepts, methods and systems of competence training and quality training are not specific, and most of them are still focusing on the completeness and systematicity of the curriculum system, and lack the cultivation of comprehensive competence and literacy of the majors studied. The realization path of the talent cultivation system from knowledge goals to ability goals and quality goals is shown in Fig. 1.
actively participate in various internship practices and corresponding policies and measures, guide students to strengthen the students’ job skill. 

positions and the objectives of talent training, and to curriculum system, the demand for employment demonstrate in advance the composition of the services.

equipment, to improve the sophistication of teaching introduction of enterprise advanced technology and learning through practice.

construction, strengthening practice, and promoting concept requires strengthening school-enterprise co-

Strengthening the goal-oriented talent cultivation 

4.4. Strengthening the concept of goal-oriented talent training

Secondly, the role of teachers should be changed to that of coaches. In the student-centered talent training system, the role of the teacher should be changed, and students should be allowed to become the protagonist of learning, while the teacher is only the auxiliary role of student learning, similar to the role of the coach. This will allow students to get better exercise and growth. However, the current evaluation system is teacher-centered, and the evaluation system should incorporate students’ learning outcomes and effects into the assessment to promote the transformation of the teacher's role to the role of coach.

Thirdly, the teaching method should be changed to learning-oriented. Based on the concept of student-centered talent cultivation, the teaching method should be changed to focus on student learning. In the process of learning, teachers are mainly responsible for broadening students’ horizons, guiding, supervising and helping students to learn, and students learning on their own initiative. The guiding method of teaching needs to be based on the characteristics of the knowledge to be taught, the needs and characteristics of students, and the requirements of the cultivation objectives, etc., and the appropriate teaching methods should be selected according to the local conditions, such as systematic theoretical teaching methods, problem-oriented teaching methods, typical case teaching methods, and practical training teaching methods, etc. [10].

4.4. Strengthening the concept of goal-oriented talent training

Strengthening the goal-oriented talent cultivation concept requires strengthening school-enterprise co-construction, strengthening practice, and promoting learning through practice.

Enterprise-led, school-enterprise co-construction, the introduction of enterprise advanced technology and equipment, to improve the sophistication of teaching services.

Improve the curriculum system, to investigate and demonstrate in advance the composition of the curriculum system, the demand for employment positions and the objectives of talent training, and to strengthen the students’ job skill.

Promote learning by practice, formulate corresponding policies and measures, guide students to actively participate in various internship practices and competitions, and cultivate students’ professional comprehensive application ability and cooperative spirit.

5. Conclusions and recommendations

The talent cultivation program of industrial universities should implement the essence and purpose of education, promote students’ active learning and lifelong learning, and should not be a formality, while industrial universities are the ability delivery engine that determines the future development of enterprises, which is the purpose of the establishment of industrial universities.

The cultivation of talents in industrial universities should focus on the quality of cultivation, and should meet the needs of schools, enterprises, governments, industry associations and other diversified subjects, the needs of the society for talents, and the needs of students’ learning and employment.

The construction of intelligent manufacturing specialty group is to realize the transformation and upgrading of traditional manufacturing industry, and the professional construction in industrial universities must consider the development of multidisciplinary cross-fertilization.

In the practice of training talents in industrial universities with enterprises as the main body of schooling, for the talent training system and training mode of the intelligent manufacturing specialty group, it is recommended that a specialized professional setting review committee and talent training program expert committee composed of experts from the intelligent manufacturing industry, enterprises and schools should provide guidance. In the process of construction, a dynamic adjustment mechanism for talent training programs should be established, and at the same time, the job requirements of the society and enterprises should be fully considered, and internal training courses of enterprises should be introduced as much as possible, and the resources of internal training courses should be embedded into the talent training system of the industrial university.

Acknowledgment

This paper is supported by 2019 Pilot Project of Industry-Education Integration Reform of Chengdu Technological University (grant number CG201902).

References

5. Martin J.D. ISIS 111(4) 697-716 (2020)


