Research on personnel training in Higher Vocational Colleges under the background of intelligent manufacturing

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Abstract: Under the background of the decrease in demographic dividend and the rising labor cost, the state puts forward "intelligent manufacturing". This paper summarizes the impact of intelligent manufacturing on vocational education at home and abroad, and provides guidance for the training mode of Higher Vocational colleges on the basis of the current situation of the manufacturing industry and the demand for talent.

Keywords: Intelligent manufacturing, personnel training, Higher Vocational Colleges.

1. Introduction

With the improvement of automation level, the era of intelligent manufacturing is coming. Under this background, our country puts forward: "By 2020, the human resources construction pattern which is suitable for the development needs of manufacturing industry will be formed, a team of manufacturing talents with sufficient quantity, reasonable structure, excellent quality and vigor will be trained, and the talent advantages of manufacturing power will be established. In order to achieve the three step strategic goal of China's manufacturing, a solid foundation for talents will be laid. The cultivation of talents in higher vocational education is closely related to regional economic development model, industrial structure and its transformation and upgrading. The transformation of technology and industry will definitely put forward new requirements for talents training in higher vocational colleges. Vocational schools must synchronize reforms to meet the needs of intelligent manufacturing personnel."
2. The development of Vocational Education under the background of intelligent manufacturing

2.1 The impact of intelligent manufacturing on Vocational Education
In 2016, Weber E et al. [1] found that intelligent manufacturing had a dual impact on job demand. On the one hand, workers' jobs become redundant and unemployment concerns begin to emerge because of the emergence of interconnected robots; on the other hand, broad employment and innovative earnings show good prospects, and the application of robot technology eases the pressure on employees. Xu Guoqing et al. [2] studied the five fundamental effects of intelligent production system on the working mode of technical and technical personnel, and put forward specific reform measures of Vocational Education in the era of intelligent manufacturing. He suggested that vocational education should establish a consistent talent training system and a modern apprenticeship system. And the curriculum development should be carried out by the combination of "job system analysis" and "vocational ability research". In view of the orientation of higher vocational training objectives, Meng Chunqing [3] holds that there are some problems in China's higher vocational education, such as inaccurate orientation of talent training objectives, obsolete teaching contents, extremely lack of "double-qualified" teachers and the urgent need to improve the quality of students' resources. He put forward that the transition from traditional industrialized technical personnel training to information-based personnel training should be realized by formulating new personnel training objectives, reforming curriculum structure, establishing a multi-level and open modern vocational education system and increasing the content of teaching science and technology. Lu Qiguang [4] believes that we must take the initiative to adapt to the development and change of the times. Vocational education needs the transformation of ideas, development strategies and training objectives, and should realize the transformation from single skilled personnel to compound high skilled personnel. Lu Yimei [5] thinks that intelligent manufacturing makes vocational education tend to internationalize, thus impelling the transfer of vocational education thought and orientation from serving regional economy to serving the global economy and student development. He believes that the requirements of intelligent manufacturing for workers should not only be reflected in technology, but also in the ability level.

2.2 Demand for skilled talents in intelligent manufacturing
In order to cope with the industrial transformation and upgrading caused by intelligent manufacturing and industrial restructuring, Wen Yifang and others [6] put forward that the new generation of production organization mode caused by intelligent development of manufacturing industry needs talents who are sensitive to software
and have the ability of coordination and cooperation, systematic thinking and independent innovation. Ingenics [7] also investigates the abilities that workers need to master in the context of industry 4.0, and points out that lifelong learning, interdisciplinary thinking, IT skills, and machine communication skills are becoming more and more important in the era of intelligent manufacturing. Rüßmann [8] argues that intelligent manufacturing enterprises will have a greater demand for employees with software development and IT technology, such as electromechanical integration specialists with software skills. Zhou Jing [9] put forward that in the era of intelligent manufacturing, higher vocational technical and skilled personnel should have new requirements for professional ability. Higher vocational personnel training should change the concept of personnel training, break the boundaries of traditional professional settings, and cultivate interdisciplinary talents. After investigating the main application industries of robots and the scale of industrial robots, Lu Shixia and others [10] believe that machines will become the main body of intelligent manufacturing, and the demand for talents in robotics will show an increasing trend. Therefore, the goal of training industrial robot application personnel should be combined with the actual needs of factories or customers. Zhang Hongliang et al. [11] studied the change of vocational ability structure of skilled personnel in the era of intelligent manufacturing, and put forward that vocational education must construct a framework for training students' vocational ability to adapt to the development of industrial 4.0 era. By changing the concept of education, revising the vocational standard system, reconstructing the curriculum system, reforming the teaching mode and evaluation mode, innovating driving and incentive mechanism, advocating ubiquitous learning and establishing flexible learning system, we can improve our abilities in various aspects to meet the new requirements of the development of the times.

2.3 Reform of Vocational Education Curriculum under the background of intelligent manufacturing

Many scholars focus their research on vocational education curriculum. Zhou Rujun [12] takes the Electromechanical Specialty as an example to analyze, and holds that vocational education curriculum should realize the transformation to lifelong curriculum concept, compound curriculum objectives, comprehensive curriculum model, flexible curriculum standards and open curriculum implementation. Similarly, some foreign scholars have proposed that under the background of intelligent manufacturing, the concepts of key qualification, action orientation, ability orientation and learning field can be integrated into the curriculum framework of Vocational education, so as to flexibly meet the new needs of digital jobs. That is to say, the curriculum system of
vocational education needs to transform into new posts. Wermann J. et al. [13] present a professional master's program in the German University of Applied Sciences for industrial automation and engineering, which gives students ample time and space for technical exploration. Students can apply their knowledge in practice through curriculum learning.

In conclusion, the relationship between intelligent manufacturing and personnel training is very close, and the current research results have been exploring the relationship between them. Although the research is still not in-depth, intelligent manufacturing has a lot of impact on education, especially on Vocational education. The training mode of higher vocational talents must be adapted to the development trend of intelligent manufacturing. In other words, training objectives, curriculum system, school-enterprise cooperation, teaching staff and training conditions must be integrated to adapt to the reform process of intelligent society.

3. Training strategies for higher vocational manufacturing talents in the era of intelligent manufacturing

In the era of intelligent manufacturing, vocational colleges must re-examine vocational education in order to achieve sustainable development. Talents training in higher vocational colleges should begin with paying attention to the change of post ability of skilled personnel in enterprises. Reform and adjustment must be made in the aspects of curriculum system, teaching practice and educational concept, educational form and personnel training mode.

3.1 Forming a distinctive professional group of intelligent manufacturing

It is necessary to standardize students'ability to apply professional knowledge with the technical standards of enterprise posts, and reorganize the training contents of various manufacturing specialties. Some specialized courses and training courses should be merged to build a perfect practical teaching system for intelligent manufacturing specialty group, so as to realize the training goal of "enhancing ability and training compound talents".

3.1.1 Combining theory with practice

The combination of theory and practice is an effective teaching method for vocational education. In view of the current situation of talent ability demand and professional knowledge structure of intelligent manufacturing enterprises, students need to consolidate traditional skills and strengthen professional quality. At the same time, we should pay more attention to the transition between traditional technology and modern technology training, as well as the learning of new knowledge and new technology. For example, for common sense and skills such as scientific papers writing, drawing
methods, etc., can be made into micro-lessons, and sent to the students’ WeChat group for students to learn at any time. According to the development trend of transformation and upgrading of local enterprises, the integration of theory courses and practice courses should be improved, and the curriculum system of theory courses serving practice courses should be improved.

3.1.2 Combining virtual reality with reality
A variety of virtual simulation experimental facilities should be built so that students can feel the production environment of intelligent manufacturing on campus. Virtual simulation is used to enable students to experience as much knowledge as possible in a visual environment. At the same time, it can also realize the optimization of product manufacturing process plan in the form of visualization, and let students feel and master the method of digital design and manufacturing in the learning process of combining virtual with reality. For complex parts, many students can complete the design based on modules. The simulation training before the disassembly and assembly of physical objects can not only greatly improve the efficiency of practical teaching, but also lay a foundation for students to practice in factory, and cultivate students' team consciousness and innovative ability.

3.1.3 Combination of schools and enterprises
Through school enterprise cooperation, the theory and practice can be deeply integrated and deeply interacted. The training contents should be close to the needs of enterprises. Teachers can also be trained by external enterprise engineers. If problems are found in the process of cooperation with enterprises, such as some engineers are highly skilled, but the explanation is tedious, lack of teaching methods, or the technology of a certain type of work in the enterprise is monotonous, simple post practice can not achieve the real training purpose, these problems can be solved by enterprises and schools together. In this way, teachers can go deep into the enterprise, participate in the specific work of the enterprise, and integrate the new technology, new experience and new technology into the curriculum system step by step. By continuously enriching practical teaching content, it can not only promote enterprise development but also improve teaching quality.

3.2 Perfecting the modern apprenticeship education mode of "college + enterprise"
According to the current situation and trend of the development of local intelligent manufacturing enterprises, the cultivation of students'post ability should be strengthened to train high-end manufacturing technical personnel who can dock with advanced manufacturing. Enterprises and colleges should work together to form mentoring classes and jointly design job groups. The module of practice module based on production process and production maintenance development should be integrated with the enterprise. The post training instruction should be perfected according to the
post production training content, and the information of post responsibility, post ability and the time to complete the corresponding task should be listed in the instruction. It is necessary to practice the modern apprenticeship "pairing of teachers and apprentices" training mode, and to clarify the qualifications and responsibilities of teachers and apprentices, as well as the implementation methods of the pairing of teachers and apprentices. The appraisal scheme of "teacher-apprentice pairing" should be perfected, and the appraisal standards for post interns should be strictly standardized. The master should be strict with the apprentice according to the standards of the employees. The products completed during the internship should be tested strictly according to the quality standards of the enterprises. The participation of both sides of "college + enterprise" can lay a solid foundation for students to grow into employees.

3.3 Build a "double quality" teaching staff that meets the industry standard

Intelligent manufacturing enterprises put forward higher requirements for teachers' knowledge structure, ability and quality. Higher vocational colleges have also clearly pointed out that the quality of "double-qualified" teachers should be improved in the era of intelligent manufacturing. First of all, we must uphold the idea of "sending out and coming in" to enhance our teachers' abilities. Every year, teachers are sent in turn to participate directly in the production of enterprises, and teachers face-to-face exchanges with front-line personnel of enterprises. Secondly, we should employ enterprise technicians to give technical lectures and special counseling in "school factories" and "factory schools" so that teachers can have a deep understanding of the development trend of enterprises and industry standards. In this way, we can train a number of high-quality "double-qualified" teachers who have both solid professional theoretical knowledge and skilled post working ability. Thirdly, according to the production and employment needs of intelligent manufacturing enterprises, whether students have reached the assessment objectives of stage learning needs to be revised and improved. The former goal of knowledge should be transformed into the ability goal of combining knowledge with post capability. Teachers should design evaluation indicators for module knowledge of curriculum. From the microcosmic point of view, the teacher takes the product of the enterprise as the teaching example to design the teaching structure of the course, so that the students can be familiar with the product characteristics of the enterprise. On the macro level, teachers can design a good evaluation system for interns in combination with the production of enterprises, so that students can be more competent for the work of enterprises.
Acknowledgements
This study is supported by Project of Philosophy and Social Science Research in Colleges and Universities of Jiangsu Province (2018SJA1456) and The 15th Batch of "Six Talents Summit" Project in Jiangsu (SZCY-022).

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