Research on the Construction and Practice of Intelligent Manufacturing Specialty Group Based on Cooperative Education

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Abstract. The main part of the national economy is the manufacturing industry. The school-school cooperation and the school-enterprise cooperation are the two important ways to train talents. It is important to explore the model of cooperative education. Professional groups can adapt to the needs of local industrial development, and then integrate with the local industries according to the characteristics of local industries. The bottom collaborative type of the middle vocational and higher vocational education, the middle collaborative type of higher vocational education and the application-oriented undergraduate education, the high collaborative type of higher vocational and the research university based on Intelligent Manufacturing Specialty Group are discussed, respectively. The implementation coordination effect is also shown.

Introduction

The manufacturing sector is the main body of the national economy as well as the foundation of the powerful country. Compared with developed countries in the world, Chinese manufacturing industry is big but not strong. Therefore, cultivating high quality manufacturing talents is imperative. More and more people realize that it is needed to collaborate the Middle and higher vocational colleges, application-oriented universities and even research university education to train the highly skilled personnel. The cooperative training model of cultivating skilled personnel has been researched by many scholars, but no collaborative education model is mature enough to guide others. In addition, the training of skilled talents has obvious regional characteristics. Therefore, it is urgent to foster effective cooperation mechanism among schools and enterprises in order to cultivate excellent manufacturing talents. Advanced manufacturing group was set up in Hangzhou Polytechnic. The group combines mold design and manufacturing as its core with other two professional specialties as its support. In order to adapt to the development needs of the times, advanced manufacturing group renamed as intelligent manufacturing specialty group in 2016. Here, we take the cooperative education model of the intelligent manufacturing specialty group as an example to explore the higher vocational manufacturing specialty group construction and cooperative education mode and obtain the implementation effect.

School Cooperative Education Model

Cooperative Education between the Middle and Higher Vocational Education

The middle vocational education is to cultivate talents with mid-level technical skills. The higher vocational education is to cultivate innovative technology talents with the application of advanced technology, equipment of high technology. In 2014, the State Council made a decision on accelerating the development of modern vocational education, and pointed out promoting the co-education of the middle and higher vocational education, stressing that higher vocational education should be combined with middle vocational education.

At present, higher vocational education cooperative education model in Zhejiang Province is
mainly divided into two kinds. The first kind is the integration model of middle and higher vocational colleges, called "3+2" model. After students complete three years of education in middle vocational schools, the students can study in higher vocational colleges to obtain higher vocational college diploma for two year through the selection examination of higher vocational school organization. The second is the "3+3" cooperative education. After the students completed 3 years of vocational training objectives in the middle vocational school, the higher vocational colleges admission evaluation will be conducted for students through a separate enrollment examination form. And it will take the 3 years to obtain the diploma on the basis of the training goal of the training education. The second model is relatively independent, and the cooperation is also weak.

The Collaborative Education of Higher Vocational and Application-oriented Undergraduate

A series of documents were designed to guide the local universities to develop the higher occupation education at undergraduate level. In May 2014, the "State Council on accelerating the development of modern occupation education" was introduced. In the June 2014, the "modern occupation education system construction plan (2014-2020)" was introduced followed by the introduction of the guiding part of local colleges and universities to change the application type of guidance" in October 2015. In order to meet the economic and social development and industrial transformation and upgrading of technical talents demand, a pilot training work in higher vocational colleges and undergraduate education has launched in Jiangsu Province, Guangdong Province, Shandong province, respectively. The pilot four-year vocational undergraduate education has been carried out in Zhejiang province from 2014. So far, the local cooperative education of higher vocational and application oriented undergraduate education has done a lot of exploration work, including determining the goal of training work around the vocational undergraduate and higher vocational education, and designing the undergraduate curriculum system for higher vocational education.

The effective model of collaborative education between higher vocational education and application oriented undergraduate education is discussed in two aspects based on the practical experience of intelligent manufacturing professional group and application-oriented undergraduate cooperative education.

On the one hand, local application-oriented universities can provide guidance for vocational school with four-year undergraduate work in personnel training setting, curriculum setting and the content difficulty. The four-year undergraduate experimental units should formulate the talent training program to achieve the high-quality application-oriented talents. The four-year undergraduate pilot unit gets well done in Zhejiang Province. For example, the curriculum system of undergraduate major of electronic information science and technology (the direction of power electronics technology) was jointly organized by Jinhua Polytechnic (Vocational College) and Zhejiang Sci-Tech University (Application oriented Undergraduate) \(^1\). The teaching management personnel, professional and responsible person, professional teachers and related industry experts have repeatedly held together to determine the pilot training program for the four-year undergraduate during the collaboration of the mold design and manufacturing specialty in Intelligent Manufacturing group (auto mould direction) in Hangzhou Polytechnic and the vehicle engineering in Zhejiang University of Science and Technology. The training program of personnel training objectives and curriculum design are determined together, which has laid a good foundation for the four year undergraduate pilot units.

On the other hand, the vocational school can take the advantages of productive training base to carry out the training courses for local application-oriented universities. Therefore, it can not only enhance the efficiency of the usage of public training base but also provides a strong support for the cultivation of the talents of applied-oriented undergraduate university. 200 application-oriented university students were trained by the intelligent manufacturing specialty group of Hangzhou polytechnic during the cooperative education process since 2012.
The Collaborative Education Model between Higher Vocational Colleges and Research Universities

During the great development of higher education in China, the construction projects of research universities, such as "211 Project" and "985 Project", have been built, which have promoted the development of a large number of high-level research universities. Higher vocational education is to train skilled personnel, while research universities is to train academic talents. They may be inconsistent. However, the cultivation of innovative talents is the main body of college teachers. As an old saying, good teachers can cultivate students with high level. The training of teacher is also in the module of cooperative education.

The development model of teachers in our country is dominated by administrative training or by individual conscious personal development. There are many ways to develop teachers’ abilities in foreign countries. For example, the United States has “teacher professional development school standard movement" and "excellent teachers' professional standards". Germany has “mentoring and excellent teacher education program”. "The government outstanding teachers plan" has been put forward the collaborative education way to improve teachers’ professional skills in Australia, and the cooperative education mode is also discussed.

The cooperative education model between higher vocational colleges and research universities is discussed from two aspects, namely, the development of university teachers and the construction of teaching resources database. On the one hand, most of the teachers in Zhejiang higher vocational colleges have the master degree, and these teachers can cooperate with the research universities to improve their professional skills in their summer and winter vacations. Research universities have good hardware conditions for scientific research. Teachers in higher vocational schools can explore their own professional ideas by utilizing library resources and laboratory conditions of research universities. The professional vision could also be expanded through the Internet related to the research team of the research universities. On the other hand, the research university teachers and students are of high IQ people. They can develop a large batch of virtual teaching software, implementation experience courses and online open courses. The development of can participate in their virtual software and teaching resources. Therefore, the development of teaching resource database could be enhanced in the higher vocational college.

The Cooperative Education Model with Three Layers

The cooperative education model with three layers, such as the bottom collaborative layer of vocational school collaboration, the middle collaborative layer of higher vocational– application oriented undergraduate and the high collaborative layer of vocational colleges-research university, is built through the analysis of the talent demand, technology and services. And the cooperative education model is shown in Fig.1.
The bottom coordination is based on the basic courses and specialized courses in teaching. It is focused on how to carry out professional groups and setting of the basic knowledge, basic skills, vocational curriculum system and teaching resources in the convergence of middle-higher vocational education. The bottom coordination lays the foundation for the training of highly skilled talents.

The middle cooperation is based on different professional occupation post of the professional group within the required skill, including the curriculum, personnel training programs, the sharing of teachers and training base, and other development aspects. It can provide a good platform for further training of personnel with high skilled, fine and sharp abilities.

The high cooperation is installed on the basis of the professional teachers development in higher vocational. They can improve the level of scientific research by participating in the research group of the research university corresponding to research work through learning advanced teaching methods and research methods. They can also improve the level of teaching and build higher level virtual teaching resources. A good team of teachers for cultivating high quality talents in the high vocational colleges is build by this way.

**The School-enterprise Collaborative Education**

The school-enterprise collaborative education is the themes of higher vocational education development. The main cooperation forms are shown as follows: accepting students’ practice training, accepting teachers’ corporate learning time, selecting technical personnel and sending them to the school lectures, selected enterprises and, carrying out the professional school construction together, developing the curriculum system, building a training base, providing jobs and other forms of information [2]. We try to learn the accepted experience of cooperation experience, the establishment of practice teaching resources and the development of training base (supported by enterprises, using 7S equipment management system) and other aspects of the depth of cooperation since the establishment of intelligent manufacturing professional group. And the practical and technical talents were cultivated for manufacturing enterprises in production, construction, management and service line. The teaching team with innovation consciousness and double qualified teaching ability is established.
The Effect of Collaborative Education

Many large projects, including the Zhejiang province specialty with professional advantages, Hangzhou City special professional, the national development and reform commission projects "construction of public intelligent manufacturing training base in Jiang Dong, have been built by the intelligent manufacturing professional group since the implementation of three level collaborative education and school enterprise cooperative education in the intelligent manufacturing speciality group. The training base of intelligent manufacturing engineering technology application center was established. The intelligent manufacturing group explores the new model of collaborative education, promotes the training level of skilled talents and improves the teaching and research level of teachers.

The Skill Level and Creative Ability of the Students have been Greatly Improved

The achievements of students in all kinds of competitions at various levels have been greatly improved since the implementation of collaborative education. In 2013, the first prize and the second prize of the national mould competition have been won by the students. In 2014, the students won two second prize and one third prize of the national machinery line refers to the three-dimensional digital design and manufacturing. The students won one second and one third award of Zhejiang province college mechanical design contest, respectively. One national first prize, one national second prize and one national third prize have been won in mold the occupation college skills competition. In 2015, the first prize has been won in Zhejiang province college mechanical design contest. The first prize has also won in the CAD/CAE for injection molding and processing national skills competition for higher vocational college occupation group. In 2016, Two second prizes have been won in the national college mechanical design contest. The number and quality of Students Awards are increasing year by year.

Zhejiang province Xin Miao talents funded project has been given to the students in the intelligent manufacturing professional group every year, indicating that the students have a certain ability to innovate.

The Construction of Teaching Resource Database is Remarkable

In the aspect of teaching material construction, 4 teaching materials for the national program of Vocational Education in 12th Five-Year has been awarded. 10 books of specialized group project textbooks were published. 23 micro-class resources library constructions have been done with Zhejiang University to undertake the projects of National Open University.

The Number and Quality of Scientific Research Projects have been Improved

15 provincial and municipal projects, including one provincial soft science project, one provincial natural science foundation, eleven Zhejiang Province Education Science Projects and a Hangzhou innovative team, have been received by the intelligent manufacturing specialty group since 2012. Deep research and development cooperation have been carried out between the college and the enterprises to undertake technical research and development of enterprises since 2014. More than 2 million Yuan of the annual horizontal research projects have been done by the intelligent manufacturing specialty group. The number of granted patents annually is more than 30. And more than 20 papers are published each every year.

The Social Service is Remarkable

Two "Golden Blue" projects of Zhejiang human resources and social department have been undertaken by the intelligent manufacturing professional group. One is the training of in the mould design and manufacturing and the other is the training of industrial robots. 6 national and provincial skills competitions have been undertaken. 2 senior technician trainings of the national mold technicians have been launched. More than 10000 people have been trained at various levels since 2012.
Summary

Three levels of school cooperation combined with school enterprise cooperation have been carried out effectively to promote the development of intelligent manufacturing professional group. Therefore, good effects, including enhancing the quality of personnel training, improving the professional group of teaching level and social service level, have been shown. Finally, it can effectively promote the development of our province and our country manufacturing industry.

References
