Exploration of the Curriculum System of Measurement and Control Technology and Instrument in Application-oriented Universities

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Abstract: The training target of application-oriented universities is to train applied talents, but the current curriculum system is unsuitable. This paper introduced the talent training objective of Measurement and Control Technology and Instrument specialty, and then given the curriculum system which is suitable for training applied talents. It has guiding significance to professional construction.

1. Introduction

Measurement and Control Technology and Instrument specialty is the only second-level discipline under the Instrument Class. The first major of Instrument Class named Precision Mechanical Instrument was set up in 1952 by Tianjin University. By the 1960s, before the beginning of “cultural revolution”, more than 10 instrument-class specialties had been established in more than 30 colleges and universities nationwide [1]. After the reform and opening up, under the guidance of the ministry of education, this kind of instrument-class specialties were integrated and been named Measurement and Control Technology and Instrument [2]. With the development of economy and the changes of social needs, this specialty had a big development, but the social requirements for the major were becoming higher and higher. So the requirements for measurement and control professionals have become higher and higher. Now the specialty which is a high-tech intensive comprehensive discipline formed by Optics, Precision Machine, Electronics, automatic control, Signal Processing, Computer and Communication is the source of Information Technology [3]. According the development status and the social demands, it is very necessary to develop a training plan that accords with the applied talents training.

2. Talent Training Objective of Measurement and Control Technology and Instrument

Chinese manufacturing industry has shifted from Made-in-China to Created-in-China, and has achieved some results. According to the report released by IFI CLAIMS Patent Services, in less than 10 years, the number of patents obtained by Chinese companies in the United States has increased by nearly 10 times. In particular, China became the top five grants of American patents and in 2007, with an increase of 28% over 2016. The USPTP issued 308,853 Utility Grant patents in 2018, this represents a 3.5% decline from 2017’s record year. Chinese companies represent only 4% of 2018 US Grants, but their total of 12,589 US patents is an increase of 12% over 2017 [4], and China is the only country with positive growth.

The development of Created-in-China needs a large number of innovative talents, so one of the talents training goals of Measurement and Control Technology and Instrument is to cultivate research talents, who have strong abilities of knowledge updating, innovation and comprehensive design. They master certain subject frontier knowledge and have good ability to engage in scientific research, and after graduation, students can study for a master’s degree or engage in scientific research in

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enterprises and institutions [5].

The other talents training goals of Measurement and Control Technology and Instrument is to cultivate applied talents, who have standard engineering quality, strong hands-on ability and skilled professional skills. Because of the Created-in-China, more and more technicians in charge of operation, maintenance, repair and sale are needed, so the most of application-oriented universities aim at cultivating applied talents.

3. Curriculum System of Measurement and Control Technology and Instrument

Application-oriented universities aim at technicians who have strong abilities of operation, sales and maintenance, so the talents training plan should reflect the training of students' practical ability, that is, the training of students' ability to apply theoretical knowledge to solve practical problems should be strengthened. So the curriculum system has been adjusted to increase the proportion of practical hours. Table 1 shows the course structure and credit proportion.

Table 1 Course structure and credit proportion

Course Platform		Course Nature	Credit	Credit proportion
General education		Compulsory courses	27.5	16.8%
Subject foundation		Compulsory courses	27.5	16.8%
Professional course		Compulsory courses	18.5	11.3%
Practical teaching		Compulsory courses	38/50.5	23.2%/30.8%
Personality Development	Unlimited Optional Courses of General Education	Optional courses	4	2.4%
	Unlimited Optional Courses of Disciplinary Basis	Optional courses	6	3.7%
	Limited Optional Courses of Specialties with Prerequisite	Optional courses	20	12.2%
	Unlimited Optional Courses of Specialties	Optional courses	14.5	8.8%
	Unlimited Optional Courses of Innovative and Venture	Optional courses	4	2.4%
	Interdisciplinary Unlimited Optional Courses of Specialties	Optional courses		
	Unlimited Optional Courses of Innovative and Outward bound Platform	Optional courses	4	2.4%
Subtotal of compulsory courses			111.5	68.0%
Subtotal of optional courses			52.5	32.0%
Subtotal of Unlimited optional courses			32.5	19.8%
Total			164	100%

Students of this major must obtain 164 credits before graduation, the unlimited optional courses credit should not exceed 4 credits, and the limited Optional Courses of Specialties with Prerequisite credit should not less than 20 credits.

Table 2 shows the teaching contents of the practical teaching platform.

Table 2 Teaching contents of the practical teaching platform

Classification	Course Names	Content	Place
In class practice	In class practice teaching	Use instrument correctly, test, adjust, analyze, synthesize ,design experiment plan, write report	In school
Moral and Professional Competence Module	Entrance and Graduation Education	Entrance education, graduate education	In school
	Voluntary labor	Intramural labor	
	Military Training	Military training	
	Moral Character Cultivation and Basis of Law	Social survey	Outside school
	Outline of China's Modem History	Social survey	
	Introduction to Basic Principles of Marxism	Social survey	
	Introduction to Mao Zedong Thought and the Theoretical System of Socialism with Chinese Characteristics	Social survey	
	Situation and Policy	Social survey	
Basic Skills and Practical Training Module	Metal Processing Practice C	Engineering practice	In school
	Analog Electronic Technology Course Design	Design, manufacture and debugging of analog electronic circuits	
	Digital Electronic Technology Course Design	Design, manufacture and debugging of digital electronic circuits	
Specialized Skills and Design Module	Principles and Application of Single-chip Computer Course Design	Design and realization of hardware and software for typical functions of single chip microcomputer	In school
	Sensor and Detection Technology Course Design	Design and Application of Common Sensors	
	Electrical Control and PLC Application Technology Course Design	Design and debugging of PLC control system	
	Principle and Application of Virtual Instrument Course Design	Formulate typical instrument design scheme and design panel,using LABVIEW to write debugging program	
	Machine Vision Technology and Application Course Design	Design, debugging and experiment of hardware and software of typical industrial robot system based on machine vision	
Integrated Technology and Application Module	Project Practical Training	Hardware and software design, debugging and experiment of typical control system	In / Outside school
	Graduation Practice	Working practice	Outside school
	Graduation Design (Thesis)	Automatic measurement and control system, process control, optical electromechanical integration	In/ Outside school

In Changchun Sci-Tech University, the Measurement and Control Technology and Instrument

specialty has three specialty directions, namely Process detection and control system, Information detection and instrumentation and Machine vision, different specialty directions cooperate with different companies enterprises. Students choose the specialty direction, and specialized courses and related curriculum designs are set according to the choice.

Different from cultivating research talents, in the practical teaching part, it emphasizes the cultivation of students' practical operation and debugging ability. Enterprises are introduced into the Integrated Technology and Application Module, the subject of guidance and assessment is adjusted from professional teachers in the school to engineering and technical personnel in enterprises, so that students can contact with the actual production process during school, which not only exercises students' business ability, but also helps improve students' living ability and handling ability.

Project Practical Training consists of two parts. First, students are trained by enterprise engineers in school, and then practiced in related enterprises.

4. Cooperation between School and Enterprise

An very important duty of colleges and universities is to serve local economic and social development. Although college teachers are highly educated, they have no industry background and do not know the needs of the enterprises, so they teach students what written in the teaching materials. But the teaching materials, experimental equipments lag behind the actual production technology, so when the students graduate from school, they need to take the time to learn the skills needer for the job, it takes money and practice. So Changchun Sci-Tech University develops cooperation with enterprises deeply, and it enables the school to constantly understands the talent needs of the enterprises. Fig 1 shows ten aspects of cooperation with enterprises.

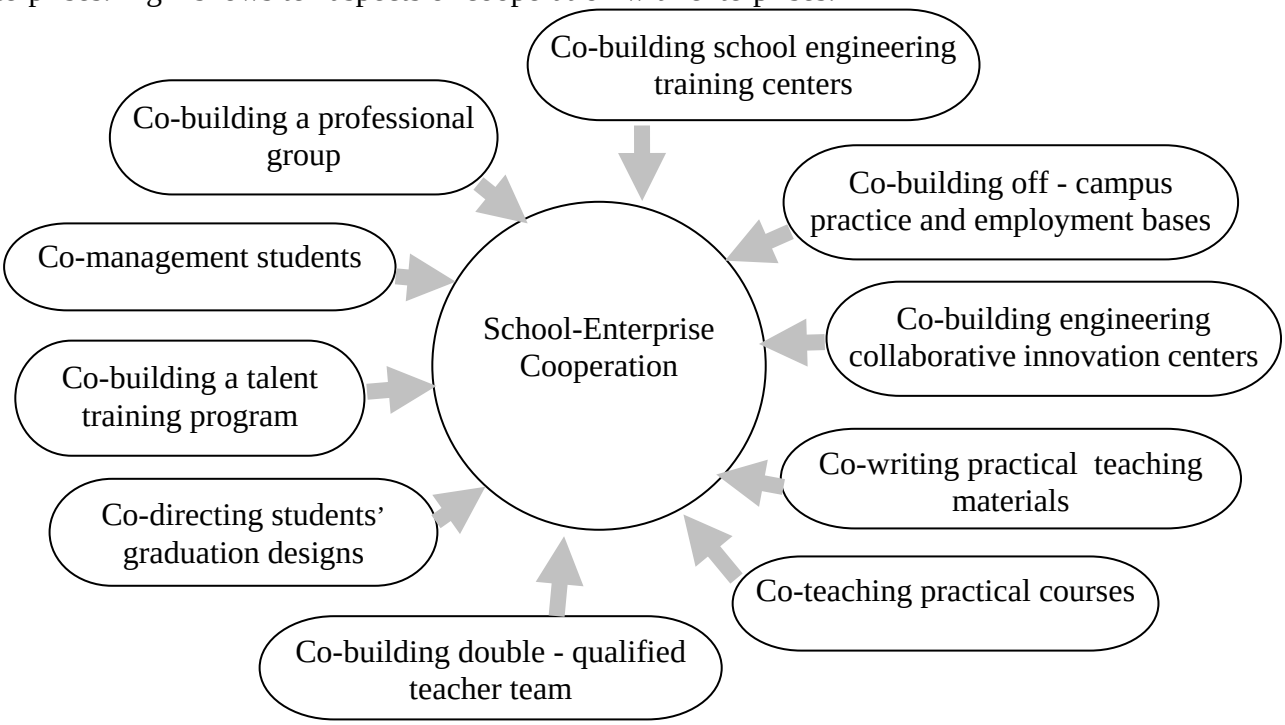

Figure 1. The measures for integration of production and education

Changchun Sci-Tech University has cooperated with enterprises for many years, for example, Measurement and Control Technology and Instrument specialty has cooperated with Suzhou DECHUANG Measurement and Control Technology Co., Ltd. for three years, and the "Suzhou DECHUANG Machine Vision Intramural Practical Training Center" and the "DECHUANG and Sci-Tech Machine Vision Collaborative Innovation Center" were established. In the intramural practical training center, enterprise engineers teach students about knowledge and detecting technologies of machine vision, and evaluate the learning effect of students. In addition, engineers are also hired as graduation design tutors, so the graduation designs come from engineering practice. At

the same time as inviting the enterprise engineers to teach in school, send teachers to the enterprise to attend training. So the double - qualified teachers who possess the quality of theoretical teaching and practical teaching are more and more.

Cooperation with companies is the best method to make up for the lack of universities, it can improve the practical conditions without paying too much. After the training of enterprises, the students have some understanding of the production process and master certain techniques, when they enter the society, they can quickly adapt to their jobs.

5. Summary

With the development of economy and society, the demand for applied talents is increasing. Application-oriented universities should establish a curriculum system which is suitable for training applied talents. Changchun Sci-Tech University has adjusted the curriculum system to strengthen the training of practical ability, cooperated with enterprises to increase practice opportunities. These three years, students' practical ability has been enhanced, and the employment in the industry has increased significantly.

Acknowledgements

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