Construction of the Course System of Mechanical and Electronic Specialty for Applied Undergraduate Course -- Teaching Direction of Industrial Robot

Yaping Lu, Hejian Liu
Applied Technology College of Soochow University, Suzhou215325, China
luyaping1982@126.com, 19030138@qq.com

Abstract. Under the background of “Internet + Made in China 2025” production and education integration innovation promotion plan. According to the professional uniqueness and social needs of applied undergraduate education. Take the teaching direction of industrial robots in the field of mechanical electronics as an example. The paper proposed the teaching of professional basic courses as the basis, the professional direction of curriculum teaching as the focus, professional quality and innovative entrepreneurship education curriculum as a fundamental, three training courses for the innovation of the curriculum system. All kinds of courses include in-class courses (the first class) and extra-curricular courses (the second class), the two classes with other courses, enrich the entire teaching system. And through the series of industrial robotic laboratory construction and management model innovations, it can achieve the true experience of students' corporate life and the wide range of students' second classroom activities; it can cultivate excellent applied talents.

1. Introduction
With the development of industrial robots in a deeper and more widely direction and the improvement of the level of robot intelligence, the application scope of the robot is constantly expanding. Therefore, there is an urgent need to cultivate professional talents in the field of industrial robots in order to respond to the large demand for applied technology talents driven by technological progress and industrial upgrading in China's manufacturing industry. It truly enhances the ability of local colleges and universities to serve regional economic and social development and to serve the technological advancement of industry and enterprises. We must really train and create a team of manufacturing talents with sufficient numbers, reasonable structure, and high quality and dynamic. It is of great significance and value to study the construction of an applied undergraduate course system for the direction of industrial robots. The current curriculum system has the following two problems:

①Improve students' learning autonomy and create a strong professional atmosphere: The first classroom, including experimental courses, is mainly teacher-led. There are teachers who organize and monitor the entire teaching process. This may lead students to become too dependent on teachers, lack of autonomy in learning, and consciously develop practical skills. Students choose to participate in activities that they are interested in from the second classroom, so that students have a strong academic research atmosphere after class and receive professional knowledge.

②Make full use of laboratory equipment resources to enhance the connotation of the second classroom activity: The openness of experimental teaching resources for engineering majors is not high enough, the idle rate of experimental equipment is high, and the teaching methods are still...
focused on classroom operations. There is a lack of organic integration of experimental teaching and extracurricular activities. In the second classroom activity, we will develop professional and professional literacy training modules, and carry out series of activities aimed at cultivating students’ practical hands-on skills, understanding and applying the theoretical knowledge they have learned. Extend the teaching of the first classroom.

③Improve the transformation efficiency of students' scientific and technological innovation results, make mechanical and electronic professional students can publish scientific research papers and other research learning experience, can apply for invention patents, utility model patents, software copyrights and other intellectual property rights, improve the professional students in the knowledge of the gold content. Provide a certain support material for professional evaluation.

For the “Internet + China Manufacturing 2025 Production and Education Integration Promotion Plan”, the construction of an application-oriented undergraduate curriculum system can speed up the development of applied technology talents that can adapt to the technological progress and industrial upgrading of the smart manufacturing industry. To meet the large demand for applied technology talents driven by technological progress and industrial upgrading in China's manufacturing industry, the construction of the curriculum system helps to train talents and facilitates the transformation of the company[3].

2. Curriculum system construction

Students in this major are mainly engaged in the basic theory of machinery, electronics, and automatic control, as well as certain professional knowledge, and receive basic training from modern engineers, thus possessing basic capabilities for the application and development of machinery, electronics, electromechanical integration, and related technologies of industrial robots. Master the necessary mechanical design knowledge; Electrical and electronic technology knowledge; PLC programming and application knowledge; Industrial robot technology and applied knowledge; It has preliminary capabilities in the design, manufacture, application and development of machinery, electronic products and systems, and electromechanical integration (industrial robots). According to the training objectives of the mechanical and electrical specialties, we have established three systems with Professional course, Professional practice course, Professional quality course, and integrate the second class into the three major systems[2]. As shown in Table 1.

Table 1. Curriculum System Planning

| General education courses | Professional basic course |
|--------------------------|----------------------------|
| Professional course      | The First classroom (Industrial robot enterprise courses) |
|                          | The Second classroom (Professional skills certificate) |
| Professional practice course | The First classroom (Three creative courses) |
|                          | The Second classroom (Student competition, project) |
| Professional quality courses | The First classroom (Professional quality courses) |
|                          | The Second classroom (Enterprise practice, laboratory management) |

The first course group construction of the three major systems is shown in Table 2. Industrial Robot Enterprise Courses highlights the professional direction. In the mechanical and electrical engineering field, it combines enterprise projects to open multiple corporate courses in the direction of industrial robots, and cultivate students' professional orientation in industrial robots. Three creative courses focus on cultivating students' innovative and entrepreneurial skills. Professional quality courses cultivate students with good professional ethics, positive professional attitude and correct professional values; having good teamwork spirit, establishing correct professional awareness and correct professional behavior habits[3].
Table 2. First Class Curriculum Group

| Industrial Courses | Robot Enterprise | Three Creative Courses | Professional Quality Courses |
|--------------------|------------------|------------------------|------------------------------|
| Theory and Application of Robotics | Mechanical Innovation Design | Career Planning Guide | |
| Industrial Robot Comprehensive Technology | Robot Innovation Training (Robot contest) | Quasi Occupation Guidance Training I | |
| Programming and Operation of Industrial Robots | Electronic Product Design and Production | Quasi Occupation Guidance Training II | |
| Basic Operation and Programming Training of Industrial Robots | APP application development project | Occupation Orientation and Development I | |
| Installation and Debugging of Industrial Robot Workstation | Web development project | Occupation Orientation and Development II | |
| Industrial Robots Off-line Programming and Simulation | | Innovation Entrepreneurship Practice | |
| Practical Application Training of Industrial Robots | | Job Search Skills Upgrading Training | |

Through the second class of the industrial robot enterprise courses, the multi-certificate teaching and training model for students is realized, and on the basis of the academic degree certificate, on the basis of obtaining academic qualifications and degree certificates, through the training of the second class of industrial robots, professional qualification certificates for "robot operation" or industrial robot certificates (ABB, FANUC certificates) are obtained, thereby encouraging students to actively carry out professional courses[4]. As shown in fig 1.

Through the second classroom of the three creative courses, it can enrich student's three creation courses. In combination with students' three-creation courses, the second-class classroom was developed step by step, and the practical teaching system of mechanical electronics was enriched from interest groups, professional competitions, and etc. As shown in fig 2.

Through the second classroom of professional quality courses, it’s improving students' professional quality. The quality courses develop students' professional qualities, and the professional qualities of applied undergraduate college students are the most missing part at present. How to let students plan their own life blueprint in the university for four years, guide students to innovation and entrepreneurship, professional quality courses play an important role. The enterprise practice can exercise the students' physical and mental accomplishment well. The self-management of the
laboratory can improve the utilization rate of the laboratory and the experimental teaching quality while cultivating the students' self-consciousness\cite{5}. As shown in fig 3.

![Diagram](image)

**Fig. 3** the second class of the professional quality courses

3. **Summary**

The construction of the application-oriented mechanical and electrical specialty curriculum system focuses on highlighting professional orientation, cultivating students' innovative and entrepreneurial abilities as innovations, and cultivating students’ professional qualities as the fundamentals. At the same time, the curriculum system aims at cultivating application-oriented talents, and builds the second class of students in combination with business requirements, student professional competitions, and local economic development. The system cultivates students with pertinence and specific characteristics, which ensures that the training of talents meets the needs of the country, society and enterprises. The curriculum system puts forward professionalism and strengthens the spirit of chemical smiths. The curriculum system proposes a double-certificate system and strengthens professional skills. The curriculum system proposes three innovative courses to strengthen student science and technology innovation\cite{6}.

**Acknowledgement**

This research was financially supported by Jiangsu University Philosophy and Social Science Research Fund Project(Grant NO. 2017SJB2224) and the paper was funded by the “Blue Project” of Jiangsu Universities in 2017(Grant NO. QLGC201701).

**References**

[1] DS Chen, Research on Training Model of Based on International Engineering Conception for Undergraduate Education in Engineering, Springer Berlin Heidelberg, pp. 291-295, 2012.

[2] N Wang, TS Chen and YC Liu, Exploration on the GIS Major Training Mode in Applied Undergraduate University Based on CDIO Mode, Journal of Anhui Agricultural Sciences, pp. 208, 2016.

[3] Tang XiaoLu and Lu Yaping, The design of regional environmental monitoring system based on labview, Environment, Energy and Applied Technology, CRC Press Taylor&Francis Group publisher, pp. 83~86, 2015.

[4] Lu Yaping and HJ Liu, Research and Exploration on the Training Mode of Applied Undergraduate Course—the Direction of Industrial Robot, DEStech Transactions on Engineering and Technology Research, DEStech Publications, Inc, pp. 432-437, 2017.

[5] Lu Yaping and Song Tianlin, Study on practical teaching of applied undergraduate mechanical and electrical speciality[J]. Vocational Education Research,2012(9):115-116.

[6] Jianqiang Ding and Xiao Ren and Yaping Lu:Computer Control Technology and Application (Second Edition),qinghua university press 2017.