

# Research and Exploration of Industrial Robot Discipline in Higher Vocational Colleges

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## **Abstract:**

At present, there are some problems in robotics courses of local higher vocational colleges, such as insufficient equipment, insufficient professional awareness, lack of effective classroom evaluation system, and insufficient innovation and entrepreneurship practice. This paper puts forward that the system of robotics specialty should be jointly built with enterprises in ways of talent alliance and room; Adopt informatization, integration of science and practice, and set up interdisciplinary teams should be set up by adoption of informatization and integration of science and practice. The evaluation system should adopt the joint evaluation mode by enterprise technicians and college teachers, and actively encourage personnel to participate in various skills competition to improve their skills. Through this model, the professional ability and professional quality of relevant majors in higher vocational colleges can be improved.

**Keywords:** Robot, Interdisciplinary, Innovation and entrepreneurship.

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## I. INTRODUCTION

Industrial demand is the driving force of the reform of talent training mode in higher vocational colleges. In the past 10 years, the industrial structure of China's manufacturing industry has been deeply adjusted, and the demand for applied technical talents of industrial robots has soared [1-2]. However, the shortage of talents and the large gap in the application of industrial robots and high-end technical talents have begun to restrict the progress of relevant technical fields and become a constraint for the industrial development. This has brought opportunities and challenges to our vocational education, requiring our vocational education to clarify the development orientation of industrial robot technology, focus on curriculum construction, and cultivate applicable, application-oriented, innovative and high-quality skilled personnel [3-5]. So as to solve the contradiction between the rapid growth of industrial robot industry and the serious shortage of professional talents, improve the level and number of applied talents of industrial robot technology, and realize the use of talents on the job. Under the current background of intelligent manufacturing, talents related to industrial robots should have analytical ability to solve problems, innovation consciousness and innovation ability, interdisciplinary professional knowledge, application and transformation ability, lifelong learning ability, solid professional knowledge ability, craftsmanship spirit

and team spirit [6].

## II. IDEAS ON INNOVATION AND ENTREPRENEURSHIP EDUCATION FOR THE MAJOR OF ROBOTICS

In order to cultivate interdisciplinary innovation and entrepreneurship talents oriented to new technologies and industries, Dongguan Polytechnic has become a cross-school and cross-major innovation and entrepreneurship talent training institution -- Innovation and Entrepreneurship College under the support of various parties. At present, the college has made sufficient preliminary preparations in platform construction, training programs, practical training system and other aspects:

### 2.1 Development of Training Program

The Innovation and Entrepreneurship College aims at cultivating multi-disciplinary innovative talents, and establishes students' innovative design team through the mode of multi-disciplinary professional combination on the basis of fulfilling the graduation requirements of the original major. Under the guidance of the multi-disciplinary teacher guidance team, the practice link of "curriculum practice - discipline competition - exploration and research - graduation project and entrepreneurship" is carried out, and the multi-disciplinary personnel training is implemented. The robotics talent training program of the Innovation and Entrepreneurship College is shown in TABLE I.

**TABLE I. Training Plan for robotics professionals**

Course	Description
Liberal education course	School curriculum, all majors are required
Core course	School curriculum, all majors are required, including advanced mathematics, linear algebra, College English, electrical and electronics
Core courses and specialized courses	The required basic and core courses
Major Courses (offered by the Innovation and Entrepreneurship College)	Robot drive and control system, robot perception and machine learning, intelligent robot and application system
Practical Teaching (offered by The Robotics Institute)	Introduction to robot design, basic robot competition, robot competition, machine graduation design
Public elective course	cultural quality course (elective)

## 2.2 Construction of Multidisciplinary Teaching Staff

The innovation and entrepreneurship college has an efficient management team responsible for daily management affairs. Teachers are mainly recruited from various colleges according to the needs of the school. At present, the core teaching staff has been employed, mainly from the School of Electronics, School of Mechanical and Electrical Engineering, Computer Department, Art and Design department, etc.

In personnel training, the college pays attention to international training and humanistic quality training, employs professional professors from Hong Kong University of Science and Technology, Huazhong University of Science and Technology and other enterprises as part-time professors to guide students' innovation and entrepreneurship through lectures, and integrates non-technical ability training into course teaching and practice [7].

## 2.3 Teaching Resource Construction

In terms of curriculum system and teaching resources, in accordance with the goal of cultivating engineering innovative talents, four multi-disciplinary core courses are set up. At the same time, the college pays attention to cultivate students' ability of independent study and independent innovation design in practice, so as to realize the goal of cultivating students' quality and ability of independent innovation and entrepreneurship.

## 2.4 Selection and Cultivation of Students

The robotics major students of the Innovation and Entrepreneurship College are selected from the first semester of the second academic year, and a group of future students are committed to entrepreneurship in the robotics industry. The teaching characteristics of the Innovation and Entrepreneurship College are that it does not directly recruit new college students, does not target specific majors, and serves for multi-disciplinary innovation and entrepreneurship talent cultivation. The college has established a student selection mechanism.

According to the principle of interdisciplinary exchange and complementing each other's advantages, students will be selected to study robotics in groups, including group research, curriculum practice, discipline competition and research and development. The college provides a team of instructors for each group, which is composed of teachers from different disciplines and specialized staff from relevant research institutes, enterprises and industries.

# III. RESEARCH ON ROBOT COURSE TEACHING

## 3.1 Informatization of Teaching Means

With the rapid development and popularization of information technology and network technology, the traditional teaching mode provides a good opportunity for information teaching, so that students can learn

teaching tasks and related learning video by making full use of computers and mobile phones. Based on the teaching concept of online-offline virtuality-reality combination, we adopt task-driven teaching method, take industrial robot material sorting workstation as the task, and design the class into three stages: self-study before class, in-class guidance and after-class expansion. The robot material sorting process is not easy to understand, the programming is prone to error, and there are safety risks in the operation exercises. Therefore, the teaching team made micro videos and programming animations, which allow students to learn before class and watch repeatedly. Moreover, the teaching team produced the MOOCs course of industrial robot operation and simulation, so that students can log on the learning platform and watch the video. By referring to relevant materials, online and offline independent learning is realized. Virtual simulation software and VR technology are adopted to move the workshop into the classroom, so that the links between teaching and production, between classroom and workshop, and between specialty and occupation are constructed.

### 3.2 Integration of Theory and Reality in Class

In order to give full play to students' strong hands-on ability and break through the disconnection between theory and practice in the past, we adopt the teaching method of integrating theory with practice. After the teacher explains the theoretical knowledge, students can use robot simulation software programming in the computer; when students cannot solve the related problem, students can discuss with each other and ask the teacher for answers; after completing the programming and optimization work, teacher will check their work and the students can immediately verify the relevant programs on the robot experimental platform in class. At the end of the task, there will be a summary and evaluation stage of the teaching task. The group members will complete the self-evaluation and improvement plan, and the teacher will also comment on the tasks of the students. Then, the teachers of school-enterprise cooperation are invited to comment and score the tasks completed by the students. Through these means, students' enthusiasm can be fully mobilized, and the technicians from the enterprise can comment on the students' technology, so as to cultivate students' engineering practice ability.

### 3.3 Students are Encouraged to Participate in Skills Competitions

In order to fully motivate students, encourage them to improve their ability in their spare time, the teacher after class will develop experimental training courses (with difficulty classification) for students who are interested in robotics courses according to their characteristics. Some students have achieved good results in various grade competitions through learning this course. In the past three years, students who have passed the course system have won the third prize of the National College Students Challenge Cup, the third prize of the National Vocational College Skills Competition, the first prize of the Robot competition of Guangdong Vocational colleges, and other good results, and applied for the relevant topics of the college students' climbing plan. Through these students who played the demonstration roles, the whole class's enthusiasm for learning can be brought into full play.

### 3.4 Establishment of Laboratory Under the Coalition of College and Enterprise

At present, our college has jointly established the Industry 4.0 intelligent manufacturing laboratory with Shenzhen Modebao Technology Co., Ltd. The laboratory will deepen school-industry cooperation, strengthen project management and project practice, and adopt the teaching mode of integration of industry and education. This teaching mode deeply integrates enterprises and schools. The products being produced by industrial enterprises are brought to the classroom for classroom teaching integrating professional theories, practical skills and enterprises' demand for products. Finally, qualified products are produced and put into mass production. This teaching mode should be closely linked with the development of the industry, and the combination of production and education should be implemented through classroom and teaching process. At present, all students majoring in robotics in our college need to have a one-month internship in the laboratory. Through learning in the laboratory, students can understand the technology related to robot production in reality, which help them learn the course to the maximum. In addition, some of our teachers and laboratory engineers jointly develop relevant teaching courses based on engineering practice. Through joint teaching in the laboratory, the engineering practice ability of teachers and students can be improved.

## **IV. TRAINING MODE OF TALENTS IN ROBOT INNOVATION AND ENTREPRENEURSHIP EDUCATION**

Relying on Dongguan Robot Industry Association, the college has in-depth cooperation with Li Qun Automation and other enterprises, and has put forward a solution with a certain theoretical and practical basis that can be replicated and promoted.

4.1 From the Needs of Enterprises, The Problem that the Basic Ability of Students Does not Adapt to the Needs of Industry can be Solved by Strengthening the Collaborative Education Based on Work Practice.

According to the demand for robot technical talents, the current talent training direction has changed from operational technical talent suitable for a single position to the comprehensive talents suitable for the whole process of production and multiple positions. They are required to be able to adapt to different application scenarios for product and production line installation, commissioning, operation, maintenance and service. Dongguan Vocational and Technical College gathers resources from associations and enterprises to carry out the whole process of "college-enterprise cooperation", transforming real projects of enterprises into teaching cases, practical training projects or project courses. In the real application scenarios of enterprises, students' abilities of product technology application analysis, installation and debugging, fault diagnosis and project organization are trained to achieve accurate connection between students' abilities and enterprise needs.

## 4.2 Starting from the Curriculum Reform, the College Carries out Content Upgrading to Guide Students' Ability Cultivation and Solve the Problem of Students' Lack of Motivation in Professional Learning

With the core curriculum reform of professional group as the key breakthrough, the enterprise project is transformed into curriculum cases. With project implementation as the main line, the college has developed two courses, intelligent Cooperative Robot Technology and Application, which involve professional standards, advanced technology and X certificate. The college has compiled 9 new textbooks integrating technical skills with ideological and political elements, and developed 9 vocational qualification standards such as Industrial Robot, which meet the needs of enterprise production practice. Through the above measures, the synchronization of professional teaching content and industrial advanced technology has been realized. Through jointly opening courses with enterprises to enhance learning attraction, carrying out project inquiry learning to enhance learning participation, level by level textual research to promote the advancement of skills, and guiding students to find employment in high-tech enterprises, students' learning motivation can be enhanced.

## V. CONCLUSION

The ability of teachers and students to develop service industry has been continuously enhanced. The team has accumulated more than 160 government "automation transformation" evaluation projects, enterprise entrusted projects, technology promotion projects and other projects, creating output value of more than 800 million yuan for more than 30 enterprises such as Ward Precision, Tianji Robot; The college has cooperated with Dongguan Robot Industry Association and enterprise technician workstation to carry out robot operation and visual inspection training, training 5,000 technicians for the society; Part of the courses are being transformed into the Sino-Thai cooperative international student training program. Some of the technical achievements of the project go abroad with China Airlines, Ward Precision and other enterprises, radiating to countries along the "Belt and Road". The results have contributed to the construction of "Dongguan Capital of Skills and Talents", attracting extensive attention from leaders at all levels, providing reference and solutions for personnel training in higher vocational colleges, and offering demonstration for enhancing industrial adaptability and leadership of vocational education.

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