

Exploration and Practice on Training Mode of "Production, Teaching, Learning, Research and Application" in Mechatronics under Background of New Engineering

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ABSTRACT

In view of the new development opportunities for mechatronics Engineering under the background of "new engineering", combined with the superior geographical environment of the college in the Guangdong-Hong Kong-Macao Greater Bay Area, and aiming at the problems existing in the current training mode, this paper explores a new training mode centering on "production, teaching, research and application". This model, combined with the needs of new engineering to improve the professional training program, helps the college to integrate and optimize various resources, provide students with a broader platform for competition and scientific research, effectively improve the innovation ability of students' independent learning and independent practice, and achieve zero transition from graduation to employment.

Keywords: *New engineering, "production, teaching, learning, research and application", Mechatronics, training mode.*

1. INTRODUCTION

The construction of "new engineering" aims at first-class talent training, first-class undergraduate education and first-class specialty construction, seizing the opportunity of new technology innovation and new industry development, exerting global influence in the new round of engineering education reform in the world, and realizing the transformation of China from a large country in engineering education to a powerful country in engineering education[1]. Under the background of "new engineering", the major of mechanical and electronic engineering, as an important basis for manufacturing industry, will also usher in a faster and new development opportunity. Mechatronics technology is the basis of manufacturing automation production, is related to the strategic position of the country and reflects the national level of the important symbol, is an important means to improve the quality of manufacturing products and labor productivity[2]. It is an important subject for the construction and development of "new engineering" of mechanical and electrical courses how to meet the needs of talents in the industry and construct a

new system of training mechanical and electrical technical talents in accordance with the characteristics of the historical background[3].

Beijing Institute of Technology, Zhuhai (hereinafter referred to as the institute) has established the major of Mechanical and Electronic Engineering since 2008, which has a stable foundation for professional construction and a good prospect for professional development. Relying on the school's history and rich experience in education and teaching, combined with the current development direction of mechanical and electrical technology, the major of Mechanical and Electronic Engineering continues to optimize the curriculum and practical teaching system, improve talent training programs, and innovate teaching methods. Strengthening laboratory construction, vigorously expanding off-campus practice base, strengthening the training and introduction of professional talents, and forming teaching teams ensure good teaching effects. In the past 5 years, there have been 25 school-level, city-level, province-level and national-level teaching reform, featured teaching materials, high-

quality courses, quality engineering and scientific research projects related to this major.

2. PROBLEMS EXISTING IN CURRENT TRAINING MODE

Under the background of "new engineering", our college takes the initiative to adapt to the development goals of new technology, new economy and new industry, and establishes a talent training mode of mechanical and electrical specialty that meets the requirements of "new engineering" construction and is characterized by "production, teaching, research and application", so as to cultivate diversified and innovative outstanding engineering talents. It mainly overcomes the following problems existing in the current training mode:

- (1) Some students lack interest in study

The basic courses and core courses of mechanical and electrical specialty are abstract and difficult to learn for some application-oriented undergraduate students, with many analytical methods and theoretical, practical and engineering characteristics. Traditional teaching mode is a one-way teaching method based on knowledge dissemination, which lacks interaction and ignores the main role of students in the teaching process. Students often find it difficult to understand through theoretical learning, which makes students fear of the courses and lose their interest in learning, which is not conducive to the mastery of basic knowledge and basic skills.

- (2) Limited platforms for students to participate in competitions and research

Although the institute and majors increase the support for scientific and technological innovation, the scope of funding is still limited, and there are no more channels to cultivate students' innovative and practical ability. Many students intend to apply for science and technology competition, but miss the opportunity due to the lack of teachers' guidance. Some students apply for scientific research projects, lack of equipment and funding support, resulting in slow progress; Although some students can finish the project on time and finish the project, the quality of the completion is not good, and they cannot continue to carry out innovative scientific research activities after the completion of the project, and the continuous innovation training is not enough.

- (3) Need to effectively promote school-enterprise cooperation and resource sharing

The lack of cooperation between colleges and local enterprises leads to the lack of supporting practical resources. Many science and engineering professional laboratories in colleges and universities are unitary, lack of practice base experimental resources. Practical teaching is not simply completed in the software environment simulation, but requires a variety of equipment and tools as well as the conditions of off-

campus enterprises. If there is no corresponding equipment conditions, practical teaching is out of the question, which also limits the cultivation of practical ability.

3. TRAINING MODE OF "PRODUCTION, TEACHING, LEARNING, RESEARCH AND APPLICATION"

3.1. The basic content of training model

The meaning of "production, teaching, learning, research and application" five-in-one talent training mode[4]. "Production" refers to the combination of industry, school-enterprise cooperation, on the basis of close cooperation with enterprises to promote scientific research innovation and talent training. "Teaching" means to set up a high-level team of teachers to guide students in theoretical study and application practice, and constantly improve the teaching system and training programs. "Learning" means to train students' ability to study and solve problems independently. "Research" focuses on cultivating students' scientific research ability. "Application" is to cultivate students' application ability and transform knowledge into productivity. Figure 1 shows the general framework.

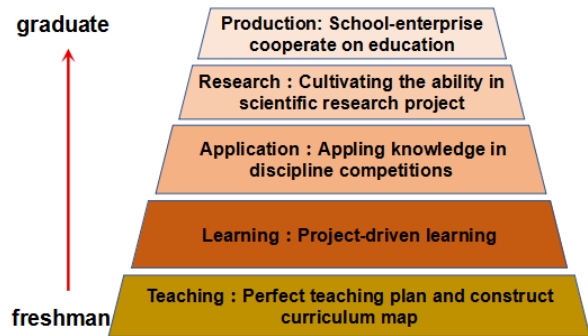


Figure 1 General framework of training mode

3.2. Training goal

The Guangdong-Hong Kong-Macao Greater Bay Area is undergoing the transformation and upgrading of manufacturing industry and industrial integration, so it needs a large number of excellent talents in mechanical and electronic engineering as industry support to promote the scientific innovation and development of the industry[5]. Combined with the new engineering background, the mechanical and electrical engineering major of the institute establishes training objectives centering on "production, teaching, research and application", improves the training program (as shown in Figure 2), and cultivates students with solid professional theories and professional skills, which meets the talent demand of mechanical and electronic engineering major

in The Guangdong-Hong Kong-Macao Greater Bay Area.

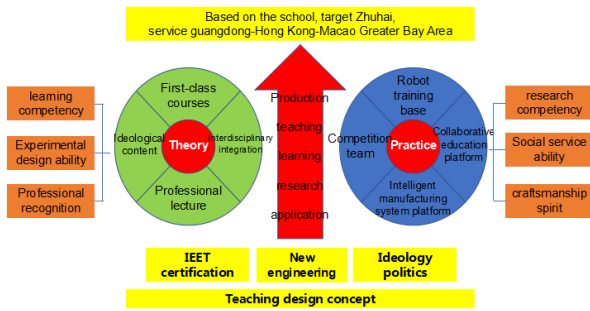


Figure 2 Training goal of mechanical and electrical specialty

3.3. The promotion and optimization of training mode

With reference to the concept and experience of engineering talent cultivation in many universities at home and abroad, the mechanical and electrical major of the institute promotes the optimization plan centering on the five-in-one cultivation mode of "production, teaching, research and application" under the background of new engineering, as shown in Figure 3.

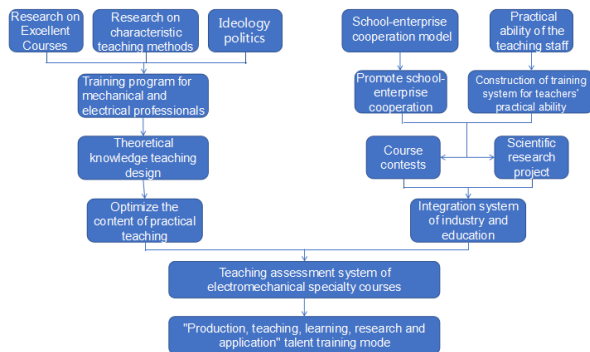


Figure 3 Plan of promotion and optimization

Based on the idea of promoting the optimization plan, the work will start from five aspects of "production, teaching, research and application" :

(1) Teaching: Construct teaching plan and curriculum map

The teaching methods, curriculum system and assessment methods are discussed and analyzed, and the teaching plan and curriculum map that meet the needs of electromechanical talents are constructed.

(2) Learning: Project-driven teaching, solid foundation

Set up characteristic courses, show the characteristics and charm of the professional, knowledge combined with the project to explain. Practical teaching content is divided into course experiment, professional practice and

comprehensive practice, so that students can really solve mechanical and electrical engineering problems in class.

(3) Application: Subject competitions inspire vitality

Regularly hold a wide range of subject competitions to provide a platform for students to innovate and practice, and select talents to participate in higher level provincial or national competitions through the subject competitions on campus, so as to activate students' learning enthusiasm and ideological vitality.

(4) Research: Cultivate the ability of scientific research

Provide a platform for students to apply for science and technology projects, encourage students to participate in teachers' scientific research projects, so as to cultivate students' scientific research ability, and learn to extract scientific research achievements from projects.

(5) Production: School-enterprise cooperation in education

School-enterprise cooperation training is carried out. In-class practice is carried out in combination with enterprise projects. Industrial engineers are hired as electives to carry out practical teaching, and students are introduced into the corresponding enterprises for practical learning through "visiting understanding" and "professional practice".

4. THE EFFECT OF TRAINING MODE

The mechanical and electrical major of the institute has a stable professional construction foundation, and has explored innovative talent training mode under the premise of new engineering. Certain reforms have been completed in the early stage and good results have been achieved. It is mainly reflected in education and teaching, competition and scientific research, school-enterprise cooperation.

4.1. Competition and research

The institute provides experimental sites in teaching buildings, training buildings and other places to guarantee the venues for competitions and scientific research. The institute regularly hold characteristic courses, SCM competition, numerical control competition and so on with a wide range of audiences and low threshold. The institute provides the support of venues and equipment, and professional teachers provide guidance. Through the selection of on-campus competitions, excellent students are organized to participate in a number of high-level and highly recognized competitions such as the National College Student Robot Competition, World Robot Competition, "Jingtian Cup" automatic driving Competition, and "Hetai Cup" SCM Competition, providing a broader stage for students (as shown in Figure 4). Students can

apply for college student innovation and entrepreneurship programs under the guidance of teachers, or join faculty research programs based on their interests.



Figure 4 Participating in the World Robot Competition

4.2. University-enterprise cooperation

The institute will hire enterprise engineers to give lectures and practice teaching after class, and introduce students into the corresponding industry enterprises for practice learning through "visiting and understanding" and "professional practice". Set up an industry-university-research innovation laboratory together with Weisigang Co., LTD. Cooperating with Guangzhou Yueqian, Erzhi Robot and other enterprises to carry out internship, curriculum design and other teaching and research content; Cooperating with Bojie and Zhixin company to implement the school-running mode, this two companies recruit internship students from our college every year. Students can carry out practice, internship or graduation project according to the enterprise project, and excellent interns stay and get employed every year(as shown in Figure 5).



Figure 5 Joint report in graduation project

5. CONCLUSION

In the context of new engineering, the institute integrates the geographical advantages of the Guangdong-Hong Kong-Macao Greater Bay Area[6], adheres to the exploration and practice of "production,

teaching, learning, research and application" training mode, achieves the goals including: forming a certain scale of student practice team; instructing a certain number of students to participate in competitions each year; improving the students' professional quality and ability and cultivating talents in line with the development needs of "new engineering"; the demonstration effect is remarkable, and the social influence and reputation of the institution are improved.

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