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## **RESEARCH ON APPLICATION- ORIENTED ELECTROMECHANICAL TALENTS' TRAINING MODE UNDER BACKGROUND OF "INTERNET+ MADE IN CHINA 2025" PROMOTION PLAN**

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### **Abstract**

*China's economic and social development and the popularization of higher education have led to the development of applied undergraduate education. Innovative and applied undergraduate talents training mode has become an important task to implement quality engineering and improve teaching quality of undergraduate course. Based on the "Internet+ Made in China 2025" Promotion plan sponsored by National Center for Schooling Development Program, this paper explores the Key problem of how to increase the comprehensive application ability and occupational suitability in Application- Oriented Colleges and Universities wherein the education model, college- Enterprise cooperation platform, Platform of practice teaching and curricular system have been further discussed by focusing on the Reformation of theoretical education system, practical teaching system and teaching method. This paper proposed a model of innovative talents training based on college- Enterprise cooperation in electromechanical speciality. Through the construction of modular applied theory teaching system and the practice teaching system based on the cooperation of industry and enterprise to train students' comprehensive application ability*



*and engineering practice ability, to put forward higher requirements of scientific and technological innovation consciousness, and to cultivate the high skilled talents needed for industrial transformation and upgrading. A sharing mechanism of the Intelligent Manufacturing Internship Factory for the full use of practical teaching environment with the advantages of a cross-regional resource sharing has been also proposed.*

### **Keywords**

Electromechanical Major; Application- Oriented education; “Internet+ Made in China 2025”

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## **1. Introduction**

China is now in the important stage of rapid industrial development and transformation period; herein intelligent manufacturing is the development direction of China's manufacturing industry transformation and upgrading. According to the "Made in China 2025" strategy issued by the State Council in May 2015, industrial robots are the core key areas to realize intelligent manufacturing and promote the process of China's modern industrialization. As a typical application of electromechanical integrated system, the complexity and systematization of industrial robots cause the integration between classic knowledge field and subject. How to increase the comprehensive application ability of the related majors and improve occupational suitability in Application- Oriented Colleges and Universities become the key problems. The latest research focused on the cultivation of the engineering talents needed by enterprises under background of national industrial transformation and upgrading. . Guo, F. and Xiao, W. have shown that the key to implement “China-made 2025” strategy is talent. In order to meet the demand of manufacturing development and transformation on applied talents, a new model of innovative talents training has to be developed. Zhang B. analyzed the existing engineering training mode and pointed out the gap between the existing mode and industrial restructuring in 2018. A new argument was putted forward that the cultivation of the applied engineering talents should meet the needs of industrial enterprises and emphasizes the combination of theory and practice. Liu, J. and Yan, G. F. have shown that under the background of “made in china 2025 and Internet +”, in order to meet the new demand for high quality applied talents during the progress of the industrial transformation and upgrading, the innovation of personnel training mode of university-enterprise cooperation is an important task in front of application-oriented undergraduate colleges and universities in 2017 and in 2016 respectively.

May 14, 2016, the National Center for Schooling Development Program and Beijing Huasheng Information Technology Co., Ltd. jointly launched the “Internet+ Made in China 2025” Promotion plan, wherein the selected pilot colleges will build "intelligent manufacturing internship factory" platform. The platform can not only being able to test



students' mastery of the basic principles and theories of professional courses, but also can cultivate students' ability of applying these professional knowledge to carry out engineering design and practical application. It also become the composing parts of the practical teaching environment of electromechanical engineering and provides important hardware conditions for the research and practice of the new type of college- Enterprise cooperation mode. Based on the above, in the process of cultivating the innovative talents adapting to the upgrading of modern manufacturing industry, the pilot colleges and universities should make changes and adjustments in the aspects of education form, talent training mode, educational content, curriculum system and teaching practice, so as to meet the requirements of intelligent manufacturing and industrial upgrading for professional development. In this paper, a model of innovative talents training based on college- Enterprise cooperation in electromechanical specialty is proposed.

## **2. Construction of innovative talents training model based on integration of production and education in electromechanical major**

### **2.1 The target of the new training model**

At present, there are some deep-seated problems in the construction of Mechatronics technology specialty in higher vocational colleges which affect its sustainable and healthy development. It is mainly reflected that there is still a big gap between the quality of talent cultivation and the demand of employment market (Meng, F.Z. & Liu, L.Z. 2012). Therefore, the development of professional talent training model and reconstruct the curriculum system have become of the electrometric major. the key According to the training target of the Application- Oriented technical talents of electromechanical major, the basic ideas of the college- Enterprise cooperation mode is the improvement of the actual production- oriented teaching courses and the enhancement of the university's practical teaching ability by using of professional technical information and production test equipment provided by enterprise. At the same time through the promotion of students' employability, improve the teaching quality. For the enterprise aspect, it can provide the professional staff for the enterprise in the development process. At the same time, it provides practical opportunities for the students to improve the employment competitiveness of students.

### **2.2 Current Deficiencies**

At present, the application-oriented undergraduates have some inadaptability to the achievement of the above goals in the training mode and teaching system, which are mainly shown in:

(1) There is not a good combination of theory teaching and practice teaching in application-oriented teaching mode, some basic courses and professional basic courses have too many theories and lack the support of actual cases. In particular, compared with research-oriented universities, the basic theory knowledge of the students in application-oriented university is relative weak; especially the ability of mathematics and the ability to analyze with mathematics is relatively weak, so that too much theoretical teaching often leads to the unsatisfactory result.

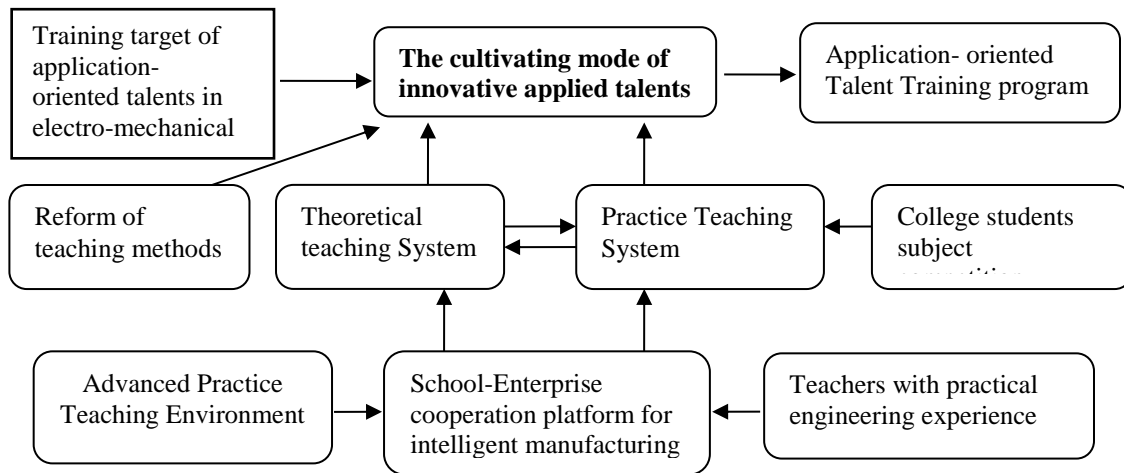
(2) The practice teaching mainly designed for the single course and lacks systematic, comprehensive and innovative design. The basic course lacks the effective experimental practice support. There is almost no practical segments that can stress the combination and comprehensive application of electro-mechanical knowledge. Most of the experiments are mainly validated, students are only passive participation, the content design lacks the cultivation of students' innovative consciousness.

(3) The students' evaluation method is relatively simple, and there is no appraisal system suitable for comprehensive evaluation of engineering application ability and innovation ability.

(4) The teachers lack engineering experience, the practical teaching segment and graduation design lack the participation of the teacher member with enterprise practical experience. Although the pilot university have established the "intelligent manufacturing factory" platform, but the resource sharing mechanism still did not realize, which led to lower utilization of equipment and the shortage of effective communication and improvement of relevant teachers.

### **2.3 Construction of innovative talents training mode for electromechanical speciality**

The innovative talents training mode of electromechanical specialty mainly includes the construction of the theory teaching system and the practical teaching system. According to the training goal of the application-oriented talents of the electromechanical specialty, the target is to build up the theoretical and practical teaching system adapted to the application-oriented undergraduate education, which aim for the basic engineering qualities, such as technology application ability and innovation ability. The concrete construction is as in figure 1.



**Figure 1:** Structure of application-oriented talents training mode of electromechanical specialty

Focus on the construction of intelligent manufacturing, industrial robots, Internet + as the main content of the college-Enterprise cooperative Platform. Relying on the advanced practical teaching environment of the platform and the teachers with practical engineering experience, the training mode of application-Oriented talents with innovativ thinking which oriented by industrial robot application, intelligent control and so on the position in manufacturing industry is to be constructed.

The teaching process should be guided by the practice teaching which is determined by the teachers and students in the teaching activities. We should strengthen the integration of practice teaching and theoretical teaching, improve the proportion of innovative practice, emphasize the guiding role of all kinds of innovation competitions to students and integrate them into the professional practice teaching system. Establish innovative and application-oriented talents training mode with distinctive and professional characteristics. And then develop a training program that conforms to the model above.

### 3. The modular teaching system of theoretical courses

Classroom research is considered a strategic tool for the improvement of training and teaching, the stimulation of meaningful learning and academic achievement, and the development of the students' reading and writing skills (Coimbra, M. N., & Alves, C. D, 2017). In establishing the theory teaching system of application-oriented electromechanical speciality, we should strengthen the degree of participating in the teaching, develop the teaching plan together with the cooperative enterprises, construct the modular and application-oriented foundation courses, set up the core courses, and strengthen the key courses construction.



The goal focuses on the transition from imparting knowledge to capacity-oriented training, from engineering design and research capability to technical application capability. The main task is to develop the ability to solve practical problems by using advanced technology, especially mechatronic technology and industrial robot control technology. The curriculum structure and teaching content system should be established according to the comprehensive and technical application of intelligent manufacturing and industrial robot compared with those according to the subject.

This paper constructs a curriculum system based on the cultivation of application ability, transforms the modular composing mode of "Basic Course", "specialized basic course" and "specialized course" into the module composing mode divided by the professional field and the comprehensive engineering, such as: "Mechanical basic module", "Electrical Principle module" and "Integrated Control application module." Each module constructs the curriculum system and readjusts the courses and credit points based on "application" as the benchmark. For example, the foundation of automatic control theory is the core professional basic courses with strong theoretical nature. It can be rebuilt through the combining of the courses with "Engineering Mathematics", "Automatic Control Principle" and "Control System Simulation". A simple control case and simulation model can be used to simulate and verify the control system composed of mathematical model to avoid the boring mathematical deduction and abstract control system theory explanation.

#### **4. Establishing the practical teaching system adapting to the professional training objectives**

Xia J. G and Jie B have proposed the importance of building a cooperative practice teaching environment based on industry and enterprise in 2010 and in 2008 respectively. According to the training target of the mechanical and electrical specialty, the relevant colleges and universities should rely on the practice teaching environment of college-Enterprise cooperation platform, and focus on strengthening the cultivation of comprehensive application and innovation ability. It is also advocated to jointly develop the talent training plan with enterprise demand as the guidance, to set up the school-enterprise joint and to cultivate the innovative practice teaching system (Gu, C. H., 2013).

##### **4.1 The composition of practical teaching system**

In the course design, we should strengthen the design of the experiment and practice course for professional theory and basic courses, so that students can obtain the support of experiment and practice at the stage of professional basic courses. The goal is to achieve the



full coverage of the practice course from the "professional initial stage", "professional depth Stage", and "employment preparation stage" covering the entire professional learning cycle.

The practical module of electromechanical control system which conforms to the actual production should be developed. The college should strengthen the participation of the Enterprise Tutor and work together with the cooperative enterprise to construct and to determine the practical project and jointly complete the preparation of the practical teaching material. At the same time, the enterprise experts also participate in the guidance of Students' practice, and build practical training projects with actual engineering projects. The teaching content of the enterprise engineer can be based on the industry background of the enterprise teacher and be carried on with centering on the position skill requirement and professional quality of the intelligent manufacturing industry. Students can bring their own experimental projects, can also participate in the teacher's topic, which provide innovative atmosphere of independent research and stimulate the creative ability for students. In the graduation design, the proportion of subjects with real engineering design should be strengthened. Through the design process, the students can better grasp the modern electromechanical system design method and control technology.

The industry skill competition has played a great role in promoting the talent training, and the skill competition is a good support for the construction of the high-end equipment manufacturing industry and education fusion platform (Wen, Y., 2018). It is practical significance to make the training mode, course system and teaching content of Mechatronics technology specialty with setting the skill competition as the goal and combining the teaching reform of mechatronics speciality (Yan, G. F. & Zhang, D. K., 2016). Integrating different kinds of innovation competitions into professional practice teaching system and improving participation of students in different stages. It transforms the innovation activity which is participated only by the high stage student for the improvement into the curriculum-assisted practice activity which can be participated together by the high and the lower grade student. So that the junior students have the opportunity to cultivate expansion, innovative thinking through the participation of innovative practices activities in the professional basic courses stage.

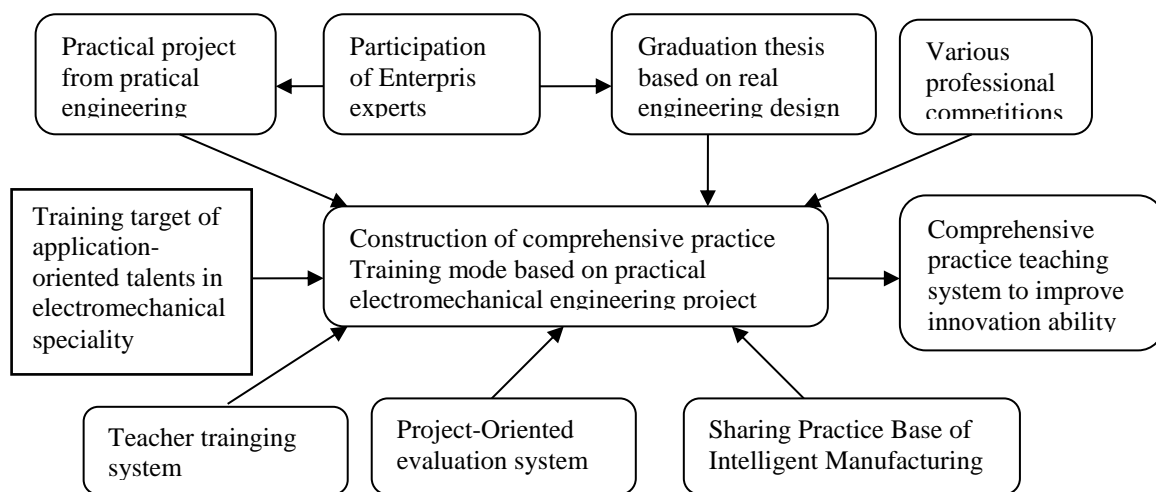
#### **4.2 New evaluation System and Sharing Mechanism**

It's important to explore the setting and evaluation system of the applied technique-oriented universities (Sun C, 2017). In order to cultivate the ability of engineering innovation, it is necessary to change the traditional method of evaluation, and to establish the evaluation system based on innovation ability and comprehensive application ability. We should take the

process and effect of teaching content and training goal as the main means, combine process evaluation and effect evaluation, and make a reasonable and perfect evaluation system and innovation incentive system.

Make full use of the "Intelligent Manufacturing Internship Factory" platform established by "Internet+ Made in China 2025" Promotion plan sponsored by National Center for Schooling Development Program to promote the development of intelligent manufacturing practice sharing base in the Yangtze River delta area. A sharing mechanism is to be established through the integration of industrial robot applications, industrial robot control, intelligent Internet and other majors of intelligent manufacturing in other pilot colleges of "Internet+ Made in China 2025" Promotion plan. Through this sharing mechanism, we can realize the practice resource sharing, joint training for Teachers, joint development of relevant institutes and joint training of students. Finally, it should construct a practical teaching environment with the advantages of a cross-regional resource sharing, practical hardware environment and strong professional teachers.

The concrete construction of practice teaching system method is figured as follows:



**Figure 2:** Schematic diagram of practical teaching system of innovative oriented talents for electro-mechanical specialty

## 5. Conclusion

The cultivation of engineering talents is the foundation of national industrial development. The key to the implementation of the "China Manufacturing 2025" strategy is to have an upgraded version of the talent to adapt to it. New demands for technical and skilled talents' basic, professional and developmental abilities are caused by "Made in China 2025". However, current higher teaching mode can't meet the demands. The basic ideas of cultivate the product design, production management and innovation compound talented person





provide the theoretical basis for the reform and innovation of higher teaching mode under the “Made in China 2025” strategy. Following the basic ideas, the reform and innovation of theoretical and practical teaching system are developed. This paper proposes the construction of the education mode for the innovative and application-oriented talents of electro-mechanical specialty through the reform of education mode and teaching method, relying on "intelligent manufacturing internship factory" and the college-enterprise cooperation platform. In the process of Education, the emphasis is put on the engineering practice, the ability of comprehensive application, and strengthens the application and innovation thinking of the practical project. Through the development of modular curriculum, project-oriented teaching methods and comprehensive evaluation system, make practice learning and innovation thinking to cover the entire teaching process, in which the basic knowledge, personal ability, team ability and engineering innovation ability of the students can also be trained and improved comprehensively. However, the specific evaluation system and creative incentive system design about students' ability training is not involved in this paper.

How the application-oriented engineering colleges verify the effectiveness of teaching model and training program reform under the background of "Made in China 2025" through relevant practice by using their own advantages and together with the specific evaluation system design will be the emphasis of the next research.

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