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Innovation and Practice of Programmable Logic Controller Course Based on OBE

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Abstract: *Focusing on the core goal of creating students' value through education, give full play to the advantages of the training mode of applied talents, and carry out the curriculum reform practice of programmable logic controller (PLC) with the concept of OBE engineering education. Based on the curriculum training objectives, this paper deeply analyzes the connotation of innovative practice, and realizes the cultivation of core competence and core literacy of new engineering talents in the engineering context through mixed education and teaching reform, one-stop curriculum resource construction and centered on curriculum and stepped experimental practice projects. Build a multi-level innovative practice training system based on horizontal projects, guided by in class and extracurricular practice, guaranteed by students' professional community training, encouraged by the selection of school competitions, supported by open laboratories, and driven by graduation design and China intelligent manufacturing challenge.*

Keywords: *Programmable Logic Controller, OBE, Mixed Education and Teaching, New Engineering*

1. Main teaching problems to be solved

1.1. Integration of industry and education

At present, due to the limitation of curriculum content and class hours in the curriculum system of colleges and universities, the professional ability, engineering professional ability and sustainable development ability required for the cultivation of new engineering talents are insufficient in depth and breadth. At the same time, the subject vision is not broad enough, the inside information is insufficient, and the humanistic quality is often missing. Through the step-by-step experimental practice project of the curriculum, the professional community training integrated with the curriculum practice project, and the collaborative education of closely related science and technology competitions, horizontal projects and completed design, students' professional core competence and core quality are continuously improved. With the goal of cultivating professional talents required by new engineering as the goal, curriculum experimental practice projects are organically integrated with science and technology competition projects and enterprise horizontal projects, and the diversified collaborative education mode of "curriculum competition enterprise" is deepened. Solve the problem of insufficient depth and breadth of the training of innovative practical ability by the curriculum experimental practice project, and can not be effectively connected with the training of new engineering talents with the ability to solve complex engineering problems.

1.2. Practice project leading

Taking the cultivation of students' innovative and practical ability as the goal, the stepped experimental and practical projects and real enterprise project cases are developed, which solves the problems that the traditional curriculum teaching mode adheres to the knowledge standard and cannot guarantee the knowledge transfer, innovation and engineering practical ability cultivation. At the same time, the cultivation of students' ability to practice gradually is ignored, and the lack of students' ability to practice gradually is also ignored. According to the students' individual learning results and learning expectations, teaching students according to their aptitude develops the ladder experimental practice teaching of basic experiments, improving practical projects and comprehensive practical projects with the main line of cultivating ability, so as to cultivate students' practical ability step by step.

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1.3. Outcome based education

Taking output as the guidance and students as the center, we can solve the problem that the traditional curriculum teaching and learning scene is fixed and knowledge transfer is the center, which fails to reflect the student development as the center, which affects students' learning efficiency, autonomous learning and in-depth learning. The traditional curriculum teaching fails to design the curriculum from the core competence quality matching the industry needs and professional training objectives, and the curriculum teaching completely depends on the classroom. The teaching mode is limited by time and space, and fails to give full play to the students' subjective initiative. At the same time, students can not choose to study according to themselves. Through the "one-station" learning resource platform, semi virtual simulation remote real machine practice project platform and hybrid teaching, we can carry out independent learning and in-depth learning, carry out self personalized development design, and create practical achievements and high-quality resource output.

2. Practical ways to solve teaching problems

Taking curriculum construction as the center, curriculum practice projects promote the development of students' professional community training, and professional community construction promotes the development of discipline competition. Discipline competition leads the reform and innovation of curriculum practice teaching. Discipline competition, as the test method of curriculum teaching reform and the extension of teaching activities, constructs professional community, discipline competition. The "four-in-one" whole process multi-dimensional innovative practical talent training system of new engineering jointly built by open experiments.

2.1. Output orientation

With the development of students as the goal, the curriculum optimization design and hybrid curriculum reform practice based on the concept of OBE engineering education. According to the OBE engineering education concept, a result oriented teaching mode is designed. Based on the core competence and quality matching the needs of social industry and professional training objectives, reverse design is carried out to determine the training objectives of the course [1].Based on CDIO Engineering Education Mode, the curriculum system and teaching methods are optimized, and the curriculum knowledge management center of "one-station" learning resource platform is established to create an open, free and complete curriculum ecology[2].Deepen the construction of course content, take engineering projects and horizontal projects as the teaching situation, take practical projects as the carrier, realize problem resonance, emotional resonance and wisdom symbiosis through cooperative exploration, stimulate students' interest in learning professional knowledge and desire for knowledge, and realize the cultivation of knowledge transfer ability.The hybrid teaching mode, which is student-centered and combines Online Autonomous Learning with vivid and interesting face-to-face teaching in class, cultivates students' autonomous learning ability and in-depth learning ability, and realizes basic professional ability, engineering professional ability and sustainable development core ability literacy.

2.2. Practice leading

Taking the curriculum practice project as the platform, establish the curriculum teaching reform practice of achievement driven mode under the concept of engineering education. Take students as the center, grasp students' development level, rebuild teaching carrier, stimulate students' desire for knowledge driven by project results, and realize the internalization of knowledge and skill training into ability training, so as to effectively help them master professional knowledge and realize ability transfer. Encourage and create conditions to guide students to use professional community training, big innovation projects and discipline competitions to carry out innovation and entrepreneurship practice, so as to build a bridge between theory and practice. According to the type of "learning results", design diversified teaching carriers to promote the "Engineering" of teaching content; Develop step-by-step experimental practice projects, and gradually cultivate students' innovative consciousness, improve students' literacy and improve students' engineering practice ability [3].

2.3. Integration of enterprises with universities and subject contest

Relying on horizontal projects and under the guidance of discipline competition, the innovative

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practice mode of curriculum centered, professional associations, open laboratories and discipline competition is jointly established. Implement the course combining practical teaching with discipline competition to improve students' engineering practice ability and cultivate innovation ability. Professional associations are equipped with professional teachers with rich engineering experience to build a platform and create an atmosphere to provide strong support for students to carry out innovative engineering practice activities. Organize students to participate in discipline competitions, "promote learning by competition and link courses by competition", and give full play to the guiding role of discipline competitions in new technology and new development and the leading role in the cultivation of innovation ability[4].Discipline competition promotes curriculum teaching reform, integrates the competition content into the process of curriculum project design, makes it complementary to curriculum reform and human training, improves students' practical ability and stimulates students' interest in independent research-based learning ,As shown in Figure 1.

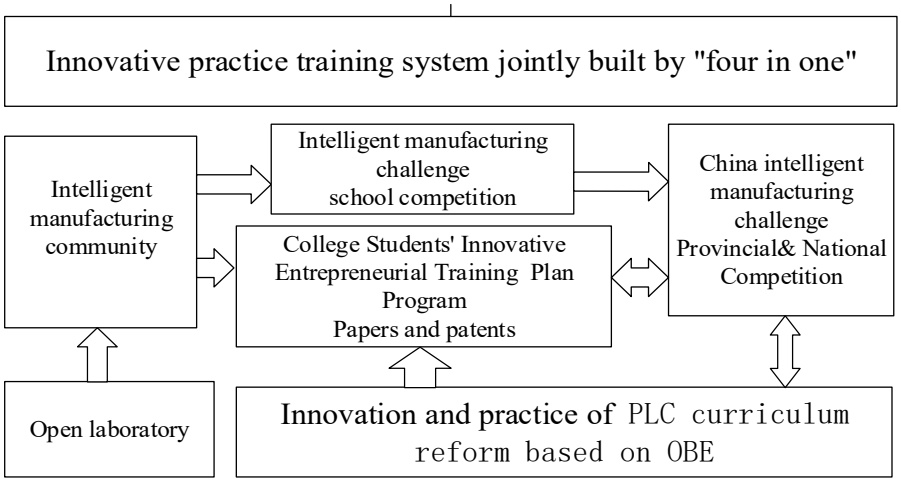

Figure 1: Architecture of innovation practice training system

3. Curriculum reform, practice and innovation

3.1. Train of thought innovation

Based on the OBE concept, student-centered and output oriented, through a series of curriculum reform practice and continuous improvement, this paper puts forward an innovative engineering application-oriented talent training system integrating curriculum construction, innovative design of curriculum practice projects, students' professional associations, discipline competitions and open laboratories. Expand the cultivation and promotion of students' innovative spirit and engineering practice ability to the all-round cultivation process of in class and out of class, professional associations and discipline competitions, courses and their experimental practice teaching projects, and the whole process multi-dimensional integrated innovative practice training system focusing on the cultivation of knowledge and practical ability and aiming at the cultivation of innovative spirit and engineering practice ability [5].

3.2. Method innovation

The achievements focus on the guidance of practical projects, follow the concept of "students are projects and courses are projects", adhere to the basic principle of "core quality is the goal of education, take practical projects as the carrier, take domain knowledge as the basis and take the change of learning methods as the way", and build a "deep learning system with project-based learning as the core" to stimulate students' internal learning motivation, Point to the development of students' core literacy. With the cultivation of innovative spirit as the internal driving force and the cultivation of engineering practical ability as the basic path, build an extracurricular practical teaching management system, and integrate the professional core competence, the social demand for professional talents and the knowledge ability quality structure that professional talents should have, so as to realize the in-depth transformation from teaching to learning and better meet the needs of the industry, Realize the cultivation of applied talents with innovative spirit and engineering practice ability.

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3.3. Practical innovation

Starting from improving students' innovative and practical ability, guide students to take interests and problems as the guide, promote students' personalized development, and explore a new path for the cultivation of new engineering talents. The design of step-by-step practical teaching projects, virtual control objects and semi virtual simulation practice platform for real machine operation of remote landing laboratory has broken through the limitations of time and space, broken the curriculum boundary, integrated and improved, and built an in class / out of class, professional associations / discipline competitions integrated and improved practical teaching system and implement it. Take the cultivation of innovation and entrepreneurship ability as a part of curriculum professional education, normalize students' engineering innovation activities, and develop and establish professional associations. According to the requirements of the new industry and the new economy for the core competence and core quality of electronic and information talents, through the training of professional associations and the organization of discipline competitions, cultivate students to adhere to exploratory learning, guide students to establish knowledge self-confidence, ability self-confidence and quality self-confidence, and promote the comprehensive and coordinated development of students' knowledge, ability and quality, Build a training mode of innovative practical ability to solve complex engineering problems under the background of intelligent manufacturing, so as to provide support for the training of cross compound new engineering talents with both engineering core competence and core quality[6].

4. Conclusion

Student centered, output oriented and "four in one" have constructed a new model for the cultivation of innovation ability and engineering practice ability. Based on the OBE concept, taking students as the center, taking output as the guidance, and combined with the mixed education and teaching reform, a new path for the cultivation of innovative talents aiming at the cultivation of innovative ability and engineering practice ability is put forward. The teaching reform practice of the course and its practical projects has formulated a practical teaching system of "four in one", which is complementary to the training objectives of the course, including student professional associations, subject competitions and open laboratories. From the perspective of innovation and entrepreneurship education, this paper points out the value and significance of cultivating innovative spirit, discusses the methods and ways of cultivating applied talents from the perspective of improving engineering practice ability, and constructs a new training mode of engineering applied talents with innovative spirit.

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