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Personnel Training based on Engineering Education Concept

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***Abstract*—This paper preliminary discussed how to improve students' engineering application ability and train applied electrical engineering and automation professionals. The engineering education concept based on CDIO was put forward, and the engineering education training mode, practice teaching reform for training content was further discussed. In this paper, the training model, practical teaching reform and Implementation plan were given in detail. Then the operation experiences for several years provided the beneficial attempt for cultivating engineering application talents.**

Keywords—CDIO; engineering application; personnel training; practical teaching

I. INTRODUCTION

As China joins the "Washington Agreement", engineering education is becoming the direction of engineering reform. To cultivate the concept of engineering education will become the country's economic construction needs of the source of engineering and technical personnel. At present, the shortage of engineering talent and the quality of engineering education has become a common problem facing the whole world. In order to cultivate more high-quality engineering talents, improve the quality of engineering education and enhance international competitiveness, all countries have carried out engineering education reform, to meet the needs of the state for talent. CDIO is in this context better training mode.

II. PROJECT EDUCATION IDEA OF CDIO

CDIO represents Conceive, Design, Implement and Operate [1]. Joined the CDIO cooperation program, continue to develop and improve the CDIO teaching model. It is the product development to the product life cycle as the carrier, so that students take the initiative, practice, the organic connection between courses to learn engineering, is concentrated reflection of "learning by doing" and "project-based education and learning." As an innovative tool for engineering education reform, the CDIO framework provides student-oriented education that emphasizes the development of Conceive-Design-Implement-Operate real-world systems and product [2,3].The aim is to learn engineering theory and practice. Since 2000, the CDIO model has achieved remarkable results since the implementation of dozens of universities, led by MIT in the world [3]. The goal of implementing CDIO is to equip students with a deep knowledge and technical basis; to cultivate students to lead new products, processes and systems to innovate and operate, and accordingly to develop students' personal and interpersonal skills as well as mastery skills of products, processes, and systems; Let students understand the importance of future research and strategic value, R&D process must take into account the social responsibility and sustainable development. The implementation of CDIO has four themes, one curriculum reform, to industrial demand-oriented, to complete the project to set the course, arrange teaching programs and CDIO skills education; the second is to improve the level of teaching, teachers' positions clearly put forward the requirements of engineers; and third, the laboratory construction, to provide students with the best practice environment; the last is to improve the evaluation system, focusing on practical ability examination, including CDIO skills assessment, innovative skills assessment and project evaluation.

III. TRAINING MODEL OF ENGINEERING EDUCATION BASED ON CDIO

The Electrical Engineering and Automation of Beihua University in 2008 got the title of national characteristic professionalism, in 2015 became the provincial engineering certified experimental specialty. It has been at the forefront in the field of engineering education, training a large number of engineering talents. However, with the continuous development and widening of electrical information technology, the quality of talent for the society is also getting higher and higher. After research, our training objectives are adjusted to not only the students to train technical personnel in the field of electrical engineering, master the professional needs of the professional level of knowledge; but also to cultivate students with a certain spirit of innovation, with strong teamwork skill and so on, with the overall quality of high-quality applied talents. Therefore, our CDIO engineering education training model includes three aspects: the curriculum, teaching, laboratory. The ability training program aiming at ability training is formulated, and the curriculum teaching and practice teaching are improved. The relation among them is shown in figure 1.

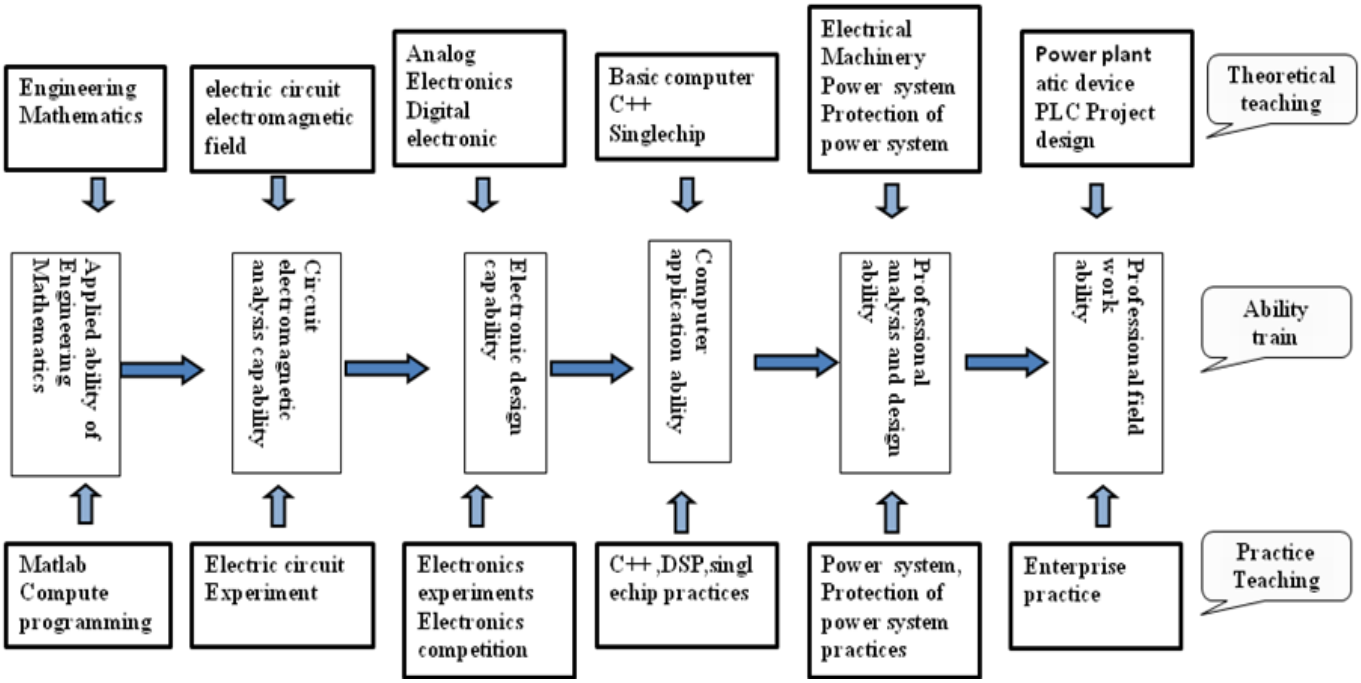

Fig. 1 Block diagram of training program

A. *Curriculum Reform*

Modifying the original order of teaching, teaching methods and content; increased the proportion of design and construction projects in the original curriculum; coordinating and connecting the traditional disciplines; created the challenging experimental courses based on the design, construction and operation of a production system.

B. *Teaching Reform*

Curriculum increases the positive and hands-on learning content; improves the teaching requirements and learning standards, emphasizing the training objectives on the problem statement and solving ability; explores a variety of potential applications of engineering tools and engineering technology; and a series of innovative ways to collect feedback information extensively, then adjust the teaching objectives and teaching content according to the feedback information.

C. *Laboratory Reform*

Providing students with the laboratory, so that students learn "functioning" in the experiment, allowing students to achieve assembly and integration of hardware and software, teachers can also demonstrate in the experimental class for students to learn how to "functioning".

IV. Practice Teaching Reform based on the Project Education Idea of CDIO

Practical teaching of engineering colleges is generally divided into: experimental courses, curriculum design, and graduation practice and design aspects. In these teaching sessions, "lay stress on knowledge, academic and reasoning, and pay little attention on ability, application, and effectiveness" is a common problem in engineering education. Combined social demand in electrical engineering and automation profession, we have increased appropriately the practical aspects, which laid the foundation for cultivating the graduates' adaptability and develop specialty characteristics, thus formed practical teaching model with characteristics of applied electrical information specialty. The decentralized experimental lessons of theory teaching and curriculum design should be highly concentrated, with the establishment of practical teaching link at different levels, in stages, step by step and cycle settings. Comprehensively strengthen the experimental and practical teaching links, the teaching methods of theory-practice-learning theory again-practice again is implemented, it aims to make practice and theoretical learning more closely, practice to promote theoretical study, theory to enrich practical ability.

A. *Curriculum Experiment Reformation*

Reform of the past curriculum experiment to the theme of the curriculum, knowledge points as the core, professional within the curriculum segmentation, there is no overall optimization and unity of the training objectives, which is the shortcoming. The curriculum experiment "plate" set is put forward. The design of the plate experiment is based on the interrelationship of the knowledge points between the professional core curriculum and the corresponding elective courses, emphasizing the experimental conception, design, implementation and operation based on the project. So that the curriculum experiment really play a role in "personal experience and feelings". We design the teaching experiment as a number of specific practical engineering system, each project system has three projects, a project for the project

requirements, put forward the overall training objectives and the need to cultivate the engineering training capacity. Level 2 project for the further division of the engineering subsystem design and analysis; grade 3 project is the specific experimental content and experimental subjects.

B. Course Design Reformation

The traditional curriculum design is generally set according to the main course, in view of our school's professional background; there cannot be so many hours. In accordance with the requirements of personnel training mode, the requirements of the knowledge system and the time limit, we set the curriculum design content as the main line of professional design, through the contents of all courses to complete a complete project design process. The core idea of curriculum design is to encourage students to take active learning and comprehensive study, to carry out academic research activities to promote student learning system construction, model analysis, algorithm comparison, simulation development, scientific results analysis and other skills. In the curriculum design project, teachers only play a guiding role, through lectures, technical seminars, program research and other forms to inspire students' innovative thinking. As in the course of power system analysis, the curriculum design of CDIO mode is used to analyze and calculated system model of the selected research object, and develop the ability to accurately describe the topology of power system, and parameter system of reflecting the system behavior, system behavior by using the logical methods in mathematics [4].

C. Graduation Design Reformation

"Education is to create the value of students," Based on the CDIO mode, the "industry, education and research" combination of graduation design process was reformed. So that students take the initiative, practice and the organic connection between the courses to learn engineering technology. Teaching process to strengthen links with all sectors of society especially the professional and technical industries, according to the implementation of the "industry, education and research," a combination of modes to organize and manage a period of three and a half months of graduation design (including graduation practice) of the teaching process, Established a "three-link" management model. Teachers through cooperation of the model, theory has to be truly integrated with practice. Through the scientific research to make the teachers' own professional quality, practical ability, innovation ability to get exercise and improve, not only enrich the teaching content, and further improve the level of teachers guidance graduation design, and rich subjects for students to carry out graduation design provide the actual engineering design project, so that graduates who are freshly out of school have the opportunity to participate directly in the actual research projects selection, feasibility studies, design and research work, so that students' graduating design from a simple teaching to gradually close integration of the practical production, research work and student employment, thus strengthens students' awareness of understanding the society and serving for the community, so as to improve students' scientific research capability and practical ability radically.

V. CONCLUSION

After several years of efforts, the students of electrical engineering and automation profession, their engineering application ability and innovation awareness, cooperation ability has been improved obviously. Students have the ability and spirit of cooperation to analyze and solve engineering problems, with the use of systematic theoretical knowledge and practical skills, and have the spirit and thinking of autonomous innovation simultaneously. It gets the employers and students to respond well for the employment of students to provide a superior condition. For the further implementation of CDIO engineering education model makes a conscious attempt.

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